Gas Distribution
Asset Management Plan
2015 – 2025

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Gas Distribution
Asset Management Plan
2015 – 2025

Executive Summary – Section 1

1 Summary of the Asset Management Plan

1.1 Asset Management at Vector

Asset management is critical for ensuring Vector's gas distribution business provides safe and reliable services, which meet the needs and expectations of consumers, help to achieve the business' commercial and strategic objectives and satisfies its regulatory obligations. Effective planning helps ensure Vector maintains and invests appropriately in its network. Vector's ongoing goal is to achieve a high standard of asset management (with a focus on safety), given its critical nature to the business and consumers, while reflecting the regulatory and economic environment within which it finds itself. It is important to note that gas is not an essential product. There are alternative fuels available in the market. The approach to management of the gas distribution business is therefore different to that of the electricity distribution business.

Vector aims to be:

"New Zealand's first choice for integrated infrastructure solutions that build a better, brighter future"




This Asset Management Plan supports achieving Vector's vision.

1.2 Purpose of the Plan

The purpose of this Asset Management Plan (AMP) is to comply with the requirements set out in the Commerce Commission's Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015). It covers a ten year planning period starting from 1st July 2015.

The AMP accurately represents asset management practices at Vector as well as the forecasted ten year capital and maintenance expenditure on the Vector gas distribution network. The objectives of the AMP are to:

- Demonstrate that safe management processes are in place;
- Inform stakeholders about how Vector intends to manage its gas distribution network based on the information available;
- Demonstrate alignment between gas network asset management and Vector's vision and goals;
- Provide visibility of effective life cycle asset management at Vector;
- Provide visibility of the level of performance of the network;
- Provide guidance of asset management activities to its staff and field service providers;

- Provide visibility of forecast gas distribution network investment programmes and forecast medium-term construction activities to external users of the AMP;
- Demonstrate innovation and efficiency improvements;
- Discuss the impact of regulatory settings on future investment decisions;
- Discuss Vector's view on expected technology and consumer developments and the asset investment strategies to deal with a changing environment; and
- Meet Vector's regulatory obligations under the aforementioned Determination.

From an asset manager perspective the AMP:

- Supports continued efficient improvement in Vector's performance;
- Is essential to Vector's goal to continually improve its asset management practices; and
- Will help Vector achieve its overarching vision.

1.3 Business Operating Environment

1.3.1 Qualification

This AMP represents Vector's current and best view of the ongoing investment, maintenance and operational requirements of its gas network, in the current operating environment.

Vector follows an annual budget process and the implementation of the works programmes may be modified to reflect any changing operational and economic conditions as they exist or are foreseen at the time of finalising the budget, or to accommodate changes in regulatory or customer requirements that may occur from time to time. Any expenditure must be approved through normal internal governance procedures. This AMP does therefore not commit Vector to any of the individual projects or initiatives or the defined timelines described in the plan.

1.3.2 Economic Factors

Economic cycles impact on business activities and hence gas demand particularly in business sectors. For the purposes of this AMP, Vector has assumed that economic growth will resume at relatively modest to low levels in the short to medium term.

1.3.3 Regulatory Factors

Vector's electricity distribution, gas distribution, and gas transmission businesses are subject to price and quality regulation. This regulation is undertaken by the Commerce Commission under Part 4 of the Commerce Act 1986.

The Part 4 regulation can impact on both the opex and capex through the requirement to meet regulated service quality standards. The Commerce Commission's operation of Part 4 can also impact on the ability and incentives to innovate and to invest, including in replacement, upgraded, and new assets; and to improve efficiency and provide services at a quality that reflects consumer demands.

On 28 February 2013 the Commission issued its first default price-quality path ("DPP") decision for gas pipeline businesses, including Vector's distribution services. The regulatory period started on 1 July 2013 and will end on 30 September 2017. For the first assessment period (15 months from 1 July 2013 to 30 September 2014[1]) Vector's maximum allowable revenue (before allowing for pass-through and recoverable costs) was set at $86.6m. (Pass-through and recoverable costs can be covered over and above the maximum allowable revenue.) For the following 3 assessment periods of 12 months Vector is able to increase its maximum allowable annualised revenues by CPI. The DPP also sets quality standards that must be maintained throughout the regulatory period.

1.3.4 Technical Factors

Vector anticipates that Auckland will experience continued population increase and associated growth in business activities and gas demand for the foreseeable future. However, the extent to which this population growth translates into new gas connections varies considerably over years, and network reinforcements are therefore deferred until sufficient certainty of new developments and network demand is obtained.

1.3.5 Legislative requirements

Vector's gas distribution assets have been designed and constructed and are operated in accordance with the following principal Acts, Regulations and industry codes:

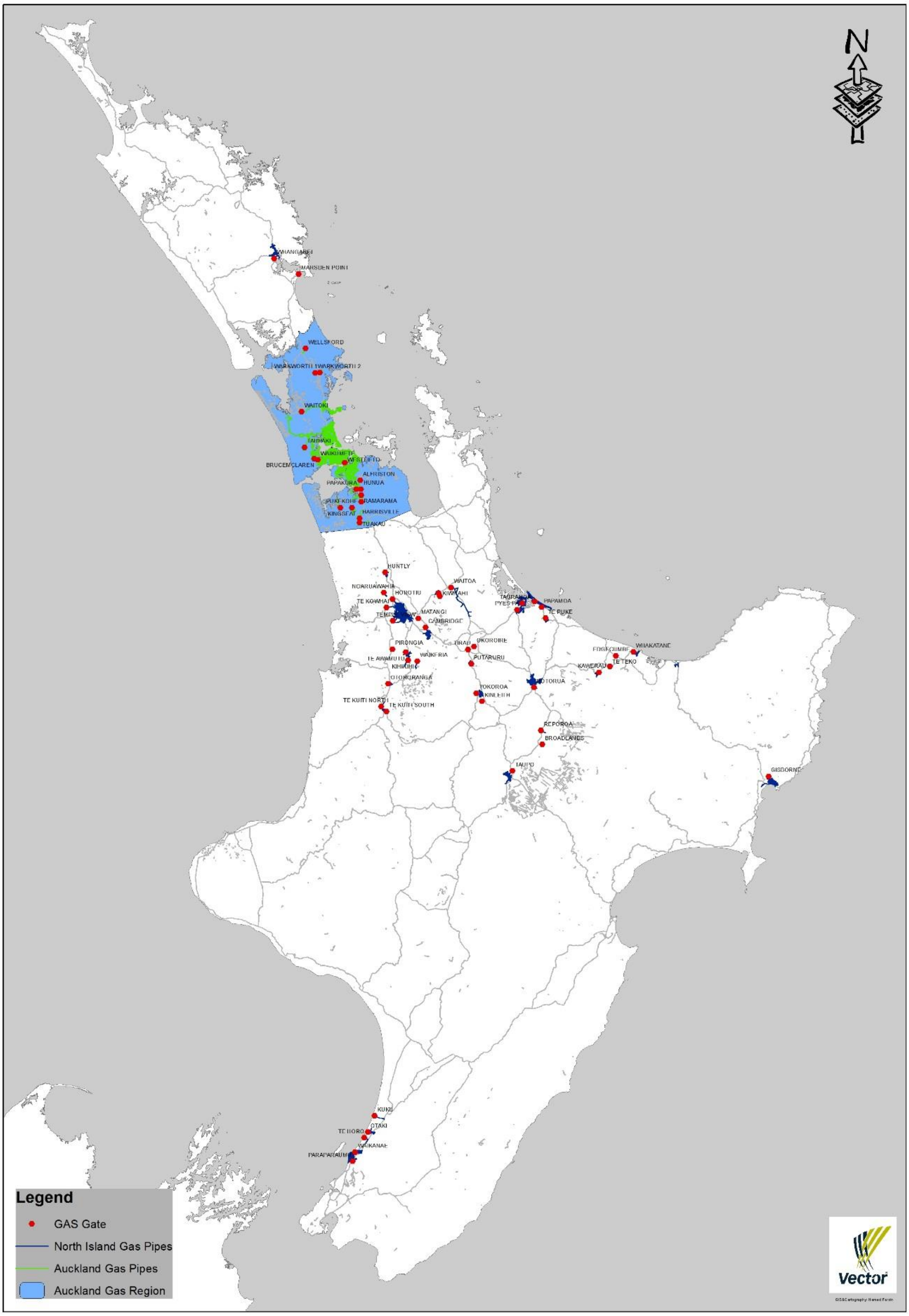
- Gas Act 1992 and Gas Amendment Act;
- Health and Safety in Employment Act ;
- Gas (Safety and Measurement) Regulations;
- Civil Defence and Emergency Management Act;
- Hazardous Substances and New Organisms Act;
- NZS 7901 Electricity and Gas Industries – Safety Management Systems for Public Safety;
- AS/NZS 4645.1 Gas Network Management;
- AS/NZS 2885 Pipelines – Gas and liquid petroleum; and
- NZS 5263 Gas detection and odorisation.

These Acts, Regulations and industry codes include both prescriptive and performance based requirements which have been embedded into Vector's suite of design, construction, maintenance and material specification technical standards.

1.4 Vector's Network

Vector's natural gas distribution network assets are the result of progressive amalgamation, mergers and acquisitions of a number of private and public gas utilities, a process that took place over the last hundred years. Vector provides gas to over 30 towns and cities across the North Island as shown in the map below.

[1] The first assessment period is 15 months to allow the regulatory regime to transition to an October-September regulatory year.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REPOROA
BROADLANDS
TAUPO
EDGECUMBE
WHAKATANE
KAWERAU
TE TEKO
GISBORNE
KUKU
OTAKI
WAIKANAE
Legend
GAS Gate
North Island Gas Pipes
Auckland Gas Pipes
Auckland Gas Region
Vector

A comparison of the key features of the gas distribution network for 2013 and 2014 is presented below (as at 30 June):

Description	2014	2013	Change
Consumers connected[2] (no.)	159,738	156,952	1.8%
System length[3] (km)	10,623	10,479	1.4%
Consumer density (consumer/km)	15	15	0%
Gate stations[4]	64	65	-2%
District regulating stations[5] (DRS)	446	490	-9%
DRS density (system km/DRS)	24	21	11%
DRS utilisation (consumers/DRS)	358	320	12%
Peak load[6] (scmh)	150,486	142,761	5.4%
Gas conveyed[7] (PJ pa)	21.9	21.6	1.6%

Table 1-1 : Key features of Vector's gas distribution networks

1.5 Demand Forecasts

Historical trends show gas demand (and sales volume) is primarily influenced by economic activities in an area, price and availability of substitute fuels (e.g. electricity, fuel oil etc.), marketing effort, population / household growth, socio-economic factors, climate and the investment decisions made by large industrial and commercial gas consumers. In the short-term, gas demand is very sensitive to climatic conditions. A cold snap, for example, could drive up the demand for gas significantly. Conversely, a warm winter could result in a materially lower demand. Hence on a year–by-year basis, demand can vary significantly.

Historical information, after normalising for year-on-year variances, shows a reasonably steady demand trend. The exceptionally high peak demand hours occur due to extreme weather conditions and normally represent only a small percentage of hours in a year.

Based on the available information and using the methodology described in this AMP, the following graph shows the load forecast for Vector's gas distribution networks.

[2] Source: Information Disclosure 2014 (http://vector.co.nz/disclosures/gas-financial-and-network-information)

[3] Source: Vector's Geographic Information System (GIS) as at 30 June. Includes mains and service pipe lengths

[4] Source: Vector's GIS as at 30 June.

[5] ibid, footnote 4. Includes Vector's district regulating stations and street regulators as described in section 3

[6] Calculated by adding the coincident load of each network system for a calendar year. Measured as standard cubic metres per hour (scmh)

[7] ibid, footnote 2

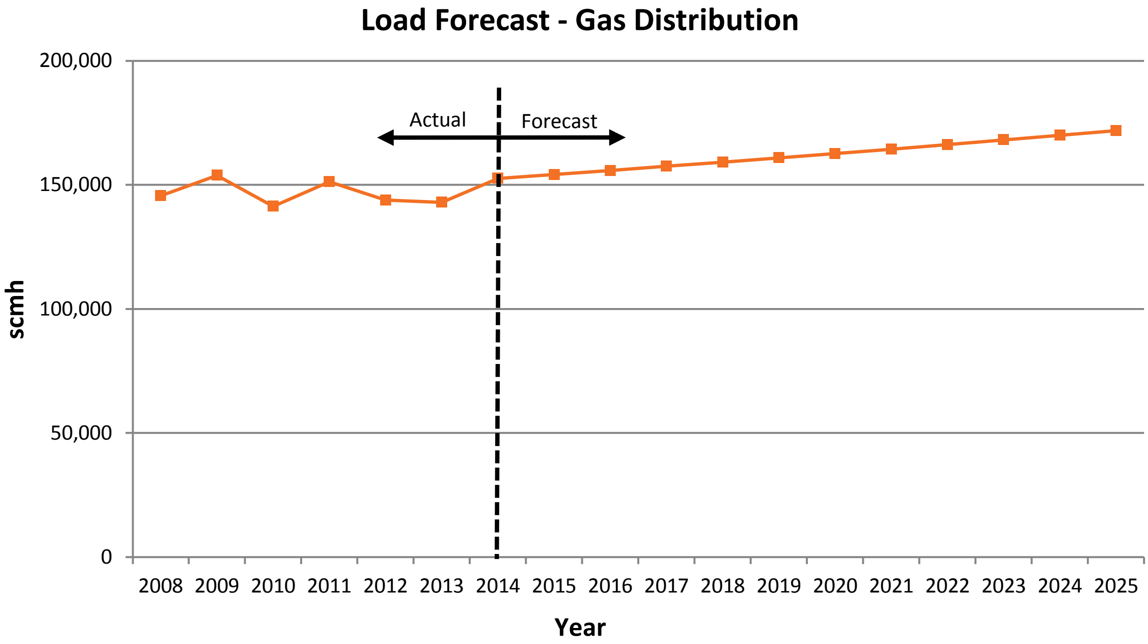


Figure 1-1 : Load forecast for Vectors networks

1.6 Network Development

1.6.1 Planning Criteria

Vector's approach to network development planning is driven by:

- Ensuring the safety of the public, staff and service providers;
- Meeting network capacity and security requirements in an economically efficient manner;
- Striving for least life-cycle cost solutions (optimum asset utilisation) and optimum timing for capex;
- Maximising capex efficiency in a sustainable manner;
- Outcomes that improve asset utilisation take into account the increased risk trade-off;
- Incorporating enhanced risk management strategies and processes into Vector's planning philosophy;
- Continuously striving for innovation and optimisation in network design, and trialling new technology where available and applicable to improve network performance;
- Reference to targets set by industry best practice where economic and practical;
- Ensuring assets are operated within their design rating; and
- Meeting statutory requirements including acceptable pressure levels.

Vector's planning criteria are detailed in Section 5 of this AMP.

1.6.2 Network Development Plan

Vector's primary objectives in network planning are to identify and prevent foreseeable network related security[8], capacity and quality (system pressure) problems in a safe, technically efficient and cost-effective manner. The planning process involves identifying and resolving:

- Supply quality, security or capacity issues that may prevent Vector from delivering its target service levels;
- Adequacy of supply to new developments or areas requiring gas connections;
- The need to relocate assets, when reasonably required by third parties; and
- Supply quality problems can be identified from a wide range of sources including network measurement and monitoring (system pressure), gas flow modelling and customer complaint databases.

Vector's ten-year network development plan is described in Section 5 of the AMP.

This plan details the anticipated gas demand in each geographical region for the next ten years. Based on these demand forecasts and Vector's network planning criteria, various projects are planned (and alternatives considered) to ensure that adequate supply capacity and reliability levels will be maintained. Planning is especially detailed for the first five years of the plan.

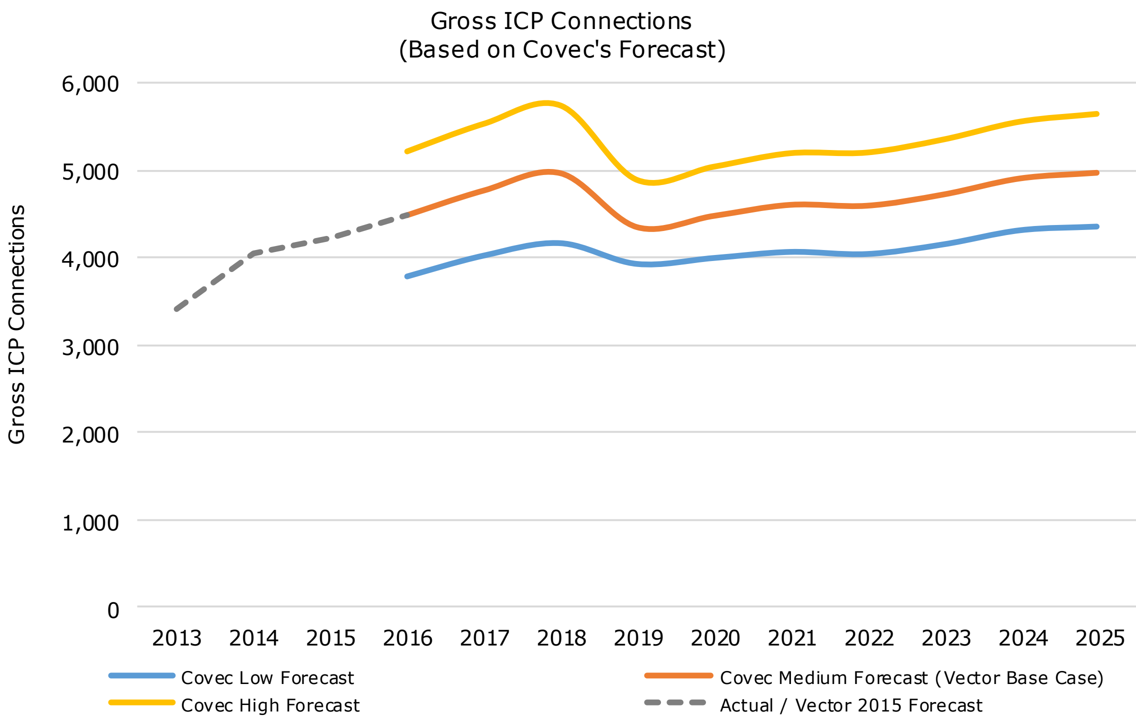
1.6.3 Customer Connections

Last year, Vector commissioned Covec[9] to independently forecast connection rates on the gas distribution network. In its review, Covec verified Vector's own internal information, and identified that the key drivers for the future increase in new connections were primarily linked to the Statistics New Zealand 2013 Census data (such as population growth projections and household size) and GDP growth forecasts (as provided by the RBNZ). Housing growth was also an indicator, but less influential.

Covec's review included three forecast scenarios as shown below. The base case forecasts in this AMP are based on Covec's 'medium' growth forecast.

[8] "Security" as used in a planning context means the security of the gas supply – i.e. the likelihood that supply may be lost.

[9] For a description of the analysis behind Covec's forecast refer to Vectors 2014 Gas Distribution Asset Management Plan Update http://vector.co.nz/disclosures/gas/gas-asset-management



1.6.4 Subdivision Reticulation

The housing shortage in Auckland will continue to drive significant greenfield subdivision activity for the foreseeable future, especially north of Albany. Of note are several large scale developments planned in the Orewa/Wainui/Silverdale areas including an 8000 lot development that lies on the west side of the northern motorway adjacent to the Millwater subdivision, and an additional 4000 lot development that lies on the west side of the northern motorway directly south of the Silverdale motorway interchange.

Outside of the Auckland region, Vector continues to see subdued growth in residential gas connections in most regions across the North Island. However, Vector is working with developers on a number of growth projects, including large scale residential developments requiring gas reticulation currently in build or planning phase in the Taupo, Waikato (Hamilton and Cambridge) and Tauranga areas. In Tauranga, this includes over 600 new residential lots due for completion in the next 3 years in 'The Lakes' project in Pyes Pa and new stages in the 'Palm Springs' development in Papamoa. There are also an estimated 1,000 new lots in scope for development projects in the next 3-5 years in Hamilton North, (North of Borman Rd) due to re-zoning activity and 300 'known' new lots in the Taupo region.

1.7 Service Commitment

Vector contracts with energy retailers for pipeline services, while end users contract with energy retailers for both energy and line services. This is called an interpose arrangement. Vector is committed to providing a high standard of service and a safe, reliable and secure gas supply to the end users.

Vector's supply quality and service standards are explained in detail in Section 4 of this AMP.

1.8 Asset Management Planning

1.8.1 Maintenance Planning Policies and Criteria

Vector's overall philosophy on maintaining network assets is based on four key factors:

- Ensuring the safety of consumers, the public and the network field staff;
- Ensuring reliable and sustainable network operation, in a cost-efficient manner;
- Achieving the optimal trade off between maintenance and replacement costs. That is, replacing assets only when it becomes more expensive to keep them in service. Vector has adopted, where practicable, condition-based assessments rather than age based replacement programmes; and
- Integration (alignment) of asset management practices given Vector is a multi utility asset manager.

Safety is the key consideration in the design, construction and maintenance of Vector's gas networks and accordingly Vector manages its gas distribution networks in accordance with relevant acts, regulations and industry standards. Although Vector strives to maintain the integrity of its gas networks at levels in line with good industry practice, some gas leakage and escapes occur on all utility networks (e.g. gas, water and wastewater services etc), including on Vector's gas networks from time to time. Vector responds immediately when becoming aware of any such event, ensuring the safety of customers and installations. We also closely monitor incident trends and, where warranted, this could be the trigger for network upgrades.

Vector has developed maintenance standards for each major class of assets. The standards form a key part of Vector's schedule for planned maintenance. The purpose of these standards, in conjunction with the schedules of maintenance work, is to ensure assets operate safely and deliver their designed outcomes with regard to life and performance.

Based on these maintenance standards, to ensure that all assets are appropriately inspected and maintained, Vector's maintenance contractors develop an annual maintenance schedule for each class of asset they are responsible for. The asset maintenance schedules are aggregated to form the overall annual maintenance plan which is implemented once it has been approved by Vector. Progress against the plan is monitored monthly.

Maintenance data is being directly fed into Vector's databases, based on the activities of our field services providers (FSPs).

Maintenance works at Vector are categorised in three main categories:

- Preventive maintenance is defined by Vector's standards and is work intended to identify issues before they occur. The frequency of performing the preventive maintenance work (per asset group) is defined in the maintenance standards, flowing through into the contractors' schedule;
- Corrective maintenance work is the work that flows from the preventive activities, site inspections, testing and observations by Vector's FSPs or any party that reports on potential issues relating to our network's conditions or performance; and
- Reactive maintenance work is undertaken following customers' complaints, accidents or any other work that is to rectify damage to the assets caused by unforeseen circumstances.

In addition, Vector also has categories for third party services maintenance and for maintenance management services.

Vector's asset renewal plans are discussed in Section 6. The overall asset-condition of various asset categories is discussed in detail, highlighting areas where upgrades or renewal is required (as well as the process and factors support these decisions). This forms the basis of the ten-year asset renewal programme.

In general Vector replaces assets on a condition-assessment rather than age-basis. We strive to achieve the optimal replacement point where the risk associated with asset failure and the likelihood of this occurring becomes unacceptably high, and it is more economically efficient to replace an asset than to continue to maintain it.

1.9 Risk Management

1.9.1 Risk Management Policies

Managing risk is one of Vector's highest priorities. Risk management is practiced at all levels and parts of the Vector Group and is overseen by the Board Risk and Assurance Committee, the Executive Risk and Assurance Committee and Vector's Chief Risk Officer.

Vector's risk management policy is designed to ensure that material risks to the business are identified, understood, and reported and that controls to avoid or mitigate the effects of these risks are in place. Detailed contingency plans are also in place to assist Vector in managing high impact events.

The consequences and likelihood of failure or non performance, current controls to manage these, and required actions to reduce risks, are all documented, understood and evaluated as part of the asset management function. Risks associated with the assets or operations of the network are evaluated, prioritised and dealt with as part of the network development, asset maintenance, refurbishment and replacement programmes, and work practices.

Asset-related risks are managed by a combination of:

- Reducing the probability of failure through the capital and maintenance work programme and enhanced work practices, including design standards, equipment specification and selection, quality monitoring, heightened contractor and public awareness of the proximity of or potential impact of interfering with assets; and
- Reducing the impact of failure through the application of appropriate network security standards and network architecture, robust contingency planning and performance management of field responses.

The capital and maintenance asset risk management strategies are outlined in the Asset Maintenance and Network Development sections (Section 6 and Section 5, respectively). Vector's contingency and emergency planning is based around procedures for restoring gas supply in the event of a fault on the network, and is detailed in Section 9 of this AMP.

1.9.2 Health and Safety

At Vector, safety is a fundamental value, not merely a priority. Vector's aspiration is everyone home safely every day. Vector's Health and Safety Policies can be found in Section 8 of this AMP. In summary, the policies are developed to ensure safety and wellbeing of its staff, contractors and the public at its work sites and around its assets.

To achieve this Vector will comply with all relevant health and safety legislation, standards and codes of practices; establish procedures to ensure its safety policies are followed; encourage its staff and service providers to participate in activities that will improve their health, safety and wellbeing; and take all practical steps to ensure its field services providers (FSPs) adhere to Vector's health and safety policies and procedures.

The Gas (Safety and Measurement) Regulations came into force on 4 May 2010. A key change for asset owners within the gas and electricity industries is the requirement to operate an accredited safety management system that incorporates process for the safety of the public and public property.

Vector's gas distribution network has been audited against the requirements of NZS7901. Vector has subsequently received certification that the gas distribution networks operate under an accredited safety management system, which incorporates public safety and the protection of public property.

The accreditation is effective for 3 years, with annual monitoring required every year.

1.9.3 Environment

Vector's environmental policy is contained in Section 8 of this AMP. In summary, the policy is developed to monitor and improve Vector's environmental performance and to take preventive action to avoid adverse environmental effects of Vector's operation.

To achieve this Vector will:

- Plan to avoid, remedy or mitigate adverse environment effects of Vector's operations; and
- Focus on responsible energy management and energy efficiency for all Vector's premises, plant and equipment where it is cost effective to do so.

Vector's long term operational objectives with regard to environmental factors are to:

- Utilise fuel as efficiently as practicable;
- Mitigate, where economically feasible, fugitive emissions and in particular greenhouse gas emissions; and
- Work with consumers to maximise energy efficiency.

1.10 Approval of the AMP and Reporting on Progress

Approval of the disclosure AMP will be sought at the May board meeting. This timing is aligned with the regulatory requirement to publish a disclosure AMP.

Progress in implementing Vector's asset management plan is regularly monitored, and progress against its investment plans and asset performance measured through several metrics, including:

- Health, safety and environmental issues;
- Monthly reporting on progress and expenditure on major projects/programmes;
- Reliability performance;
- Performance and utilisation of key assets;
- Progress with risk register actions; and
- Security of supply.

1.11 Financial Forecasts

Table 1-2 and Table 1-3 summarise the capital and operations and maintenance expenditure forecast covering the AMP planning period.

	Financial Year ($000)										
Expenditure description	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
Consumer connection	$16,714	$17,242	$17,016	$15,869	$16,215	$16,408	$16,459	$16,858	$17,243	$17,359	$167,383
System growth	$6,381	$5,033	$3,120	$2,338	$7,718	$5,954	$6,331	$2,767	$1,580	$1,580	$42,802
Asset replacement and renewal	$4,008	$3,550	$2,460	$2,285	$3,270	$3,320	$3,310	$3,310	$3,310	$3,310	$32,133
Asset relocations	$3,974	$4,329	$4,170	$4,219	$4,180	$4,043	$4,043	$4,125	$4,125	$4,125	$41,332
Quality of supply	$530	$120	$385	$213	$80	$80	$175	$80	$80	$80	$1,823
Legislative and regulatory	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other reliability, safety and environment	$690	$690	$0	$0	$0	$0	$0	$0	$0	$0	$1,379
Capital Expenditure on network assets	**$32,296**	**$30,964**	**$27,151**	**$24,923**	**$31,463**	**$29,805**	**$30,318**	**$27,140**	**$26,338**	**$26,454**	**$286,851**
Non Network Assets	$1,322	$1,646	$1,978	$1,563	$1,652	$1,970	$1,760	$1,749	$2,010	$1,891	$17,540
Capital Expenditure on assets	**$33,619**	**$32,609**	**$29,129**	**$26,486**	**$33,115**	**$31,775**	**$32,078**	**$28,888**	**$28,348**	**$28,345**	**$304,391**

* Figures are in 2016 real New Zealand dollars ($'000)

** The forecasts are inclusive of cost of finance and in line with Vector's business practice

Table 1-2 : Capital expenditure forecast

	Financial Year ($000)										
Expenditure description	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
Service interruptions incidents and emergencies	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$40,400
Routine and corrective maintenance and inspection	$4,464	$4,466	$4,468	$4,471	$4,473	$4,475	$4,478	$4,480	$4,483	$4,485	$44,743
Asset replacement and renewal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System operations and network support	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$103,086
Business support	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$5,746
Total Operational Expenditure	**$19,387**	**$19,389**	**$19,392**	**$19,394**	**$19,396**	**$19,399**	**$19,401**	**$19,403**	**$19,406**	**$19,408**	**$193,976**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 1-3 : Total Operational Expenditure Forecast

Gas Distribution Asset Management Plan 2015 – 2025

Background and Objectives – Section 2

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2. Background and Objectives

2.1 Context for Asset Management at Vector

Vector recognises that providing a network that is safe to customers, the public and operators alike is a top priority. This is reflected in Vector's work processes and standards, as well as the safety management system that is continuously being enhanced from the present well developed systems.

Asset management is critical for ensuring Vector's gas distribution business provides safe and reliable services which meet the needs and expectations of consumers, help to achieve the business's commercial and strategic objectives and satisfies its regulatory obligations. Effective planning helps ensure Vector maintains and invests appropriately in its network. Vector's ongoing goal is to ensure good industry practice asset management, given its critical nature to the business and consumers, while reflecting the regulatory and economic environment within which it finds itself.

The Asset Management framework adopted for Vector's gas distribution business is illustrated in Figure 2-1.

This is a generic Asset Management model widely adopted by many types of infrastructure businesses. The framework is superimposed on the environment within which Vector operates.

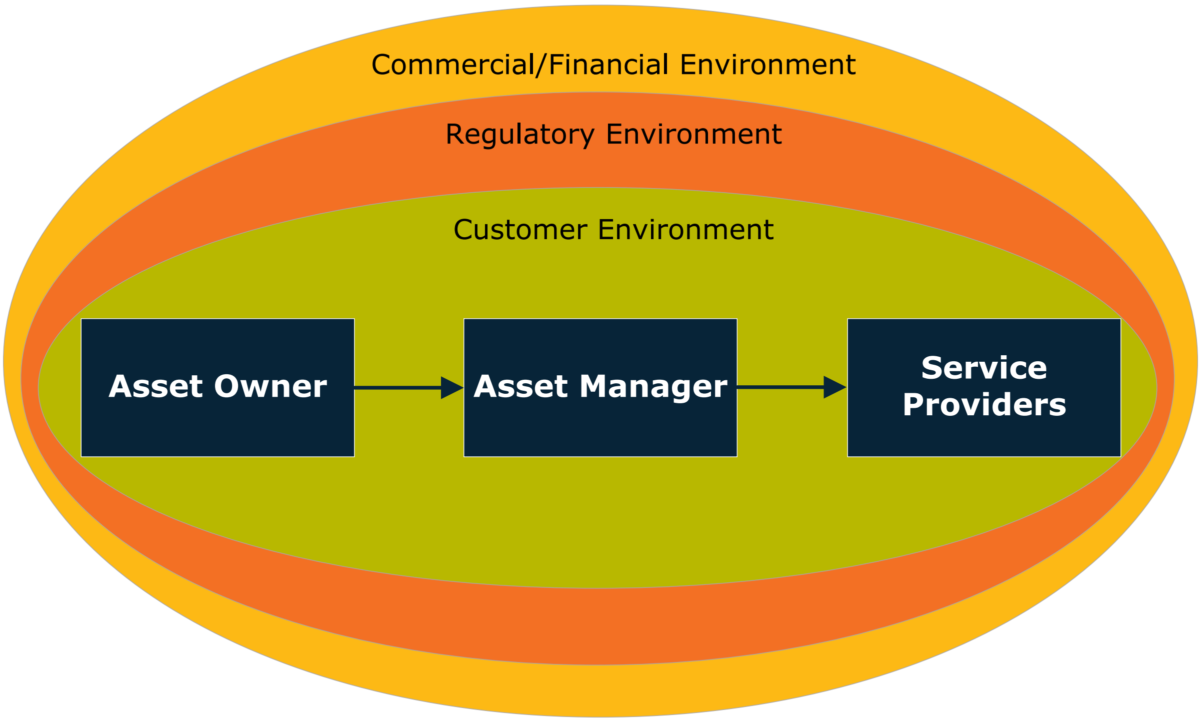

Figure 2-1 : Vector's asset management framework

In this model, the Asset Owner is the highest level of management within Vector that owns the assets, which in this case is the Vector executive, with oversight from the Vector Board. The Asset Owner determines the operating context for the Asset Manager, focusing on corporate governance and goals, and the relationship with regulators and other stakeholders.

The Asset Manager develops the asset management strategy, directs asset risk management, asset investment and asset maintenance planning, and decides where and how asset investment is made in accordance with directions set by the Asset Owner. The Asset Manager sets policies, standards and procedures for service providers to implement. In Vector the Asset Manager function is, broadly, the responsibility of the Networks group.

The Service Providers are responsible for delivering asset investment programmes, to maintain and operate the assets based on the guidelines set by the Asset Manager.

Vector's Service Providers are a combination of the Service Delivery team in the Networks group - capital programmes, network operations and service operations - and the external contractors and consultants supporting them (see Section 2.6 below).

Asset management is strongly influenced by safety and customer needs as well as commercial, financial and regulatory requirements:

- Safety is one of Vector's key priorities. The health and safety policy sets out the directives of Vector's health and safety framework to ensure health and safety considerations are part of all business decisions;
- Customer needs and expectations, along with safety and technical regulations, are the key determinants of network design. Network layout and capacity is designed to ensure contracted or reasonably anticipated customer demand can be met during all normal operating circumstances. Quality of supply levels[1], which relate to the level of redundancy built into a network to avoid or minimise outages under abnormal operating conditions, are based on customer requirements and the value they place on reliability of supply;

  Most direct interaction with customers occurs through the Customer Excellence team in the Networks group. Asset management involves close interaction with the Service Delivery and Customer Excellence groups to assist with understanding and addressing customer technical requirements, consumption forecasts and upcoming developments;
- There are technical and economic regulations relating to how networks are built and operated and how network services are provided and sold. Commercial return on investment is regulated. These regulations directly influence investment decisions;

  Regulatory certainty is critical to the investment framework, given the long-term nature of the assets and the need for gas distribution businesses to have confidence that they can expect to recover their costs of efficient and prudent investment. Importantly, Vector also has to attract capital both locally and from offshore;[2]

  Direct contact with the regulators is generally maintained through the Regulatory Compliance team in the Networks group, which in turn works with the Asset Manager to provide guidance on regulatory issues and requirements;
- Vector takes a commercial approach to investment and therefore has to ensure that it makes optimal investment decisions and implement targeted maintenance programmes in the network, including replacement, upgrades and new assets, while always keeping safety as a priority. This requires demonstration that investment decisions are not only economically efficient, but that realistic alternative options have been investigated to ensure the most beneficial solution – technically and commercially – is applied. This may involve taking a view on likely future technical changes in the energy sector;

  In addition, financial governance has a direct and significant bearing on asset management. Capital allocation and expenditure approvals are carefully managed in accordance with Vector's governance policies. Short and long-term budgeting processes take into account the balance between network needs, construction resources and available funding – requiring careful project prioritisation; and

[1] These are discussed in Section 5 of the AMP (asset management plan).
[2] In Vector's experience, the New Zealand regulatory regime is often cited by capital markets and rating agencies as being uncertain.

Asset management, in particular where expenditure is involved, therefore requires close interaction with the Finance group and the Service Delivery teams.

In the context described above, this Vector AMP has been developed to define and record Vector's asset management policies, responsibilities, targets, investment plans and strategies to deal with the future of the gas distribution network. It describes Vector's asset management policies, responsibilities, targets, investment plans and strategies to provide confidence to its board and regulators that it has considered all options to ensure the gas distribution network is maintained and enhanced to support Vector's commercial investment approach and meet the needs of consumers, while ensuring safe and efficient gas distribution network operations. It also reflects feedback obtained from customers on their requirements for the quality and cost of their gas distribution services, and the manner in which they interact with Vector. The AMP sets out the forward path for Vector's gas distribution network capital investment and maintenance needs and how we intend to address these.

While this AMP's emphasis is on gas distribution network asset management, it is a document used Vector-wide. It supports the achievement of the vision and goals of Vector through maximising the efficiency of asset management activities. Rather than being prepared in isolation by and for the gas distribution business only, the Plan is guided by Vector's overall goals, relies extensively on inputs from all areas within Vector, and one of its key functions is to provide visibility on the asset investment strategies and forecasts to the entire Vector Group.

This AMP is also publicly disclosed to satisfy Vector's regulatory obligation. To satisfy the Information Disclosure requirements, the contents of this AMP are presented in accordance with the requirements stated in the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015).

2.1.1 Relationship between Asset Management and Vector's Strategies and Goals

As indicated above, the Asset Owner determines the operating context for the Asset Manager, focusing on corporate governance, strategies and goals, and the relationship between regulatory issues and other stakeholder requirements. The Asset Manager interprets these strategies and goals and translates the strategic intentions into an asset investment strategy which is supported by a series of asset management policies. These are documented in this AMP. Technical standards, work practices and equipment specifications support the asset management policies, guiding the capital and operational works programmes.

Performance of the network is monitored against a set of performance indicators that are based on realising customer expectations, meeting regulatory requirements and safety obligations and achieving best-practice network operation. Performance monitoring ensures resources are optimally allocated to the appropriate areas.

The diagram in Figure 2-2 illustrates the relationship between Vector's corporate strategies and goals with its asset management policy framework.

Vector's gas distribution network asset management objective is to efficiently and effectively deliver safe and reliable gas distribution network services to customers at a quality commensurate with their technical and economic preferences.

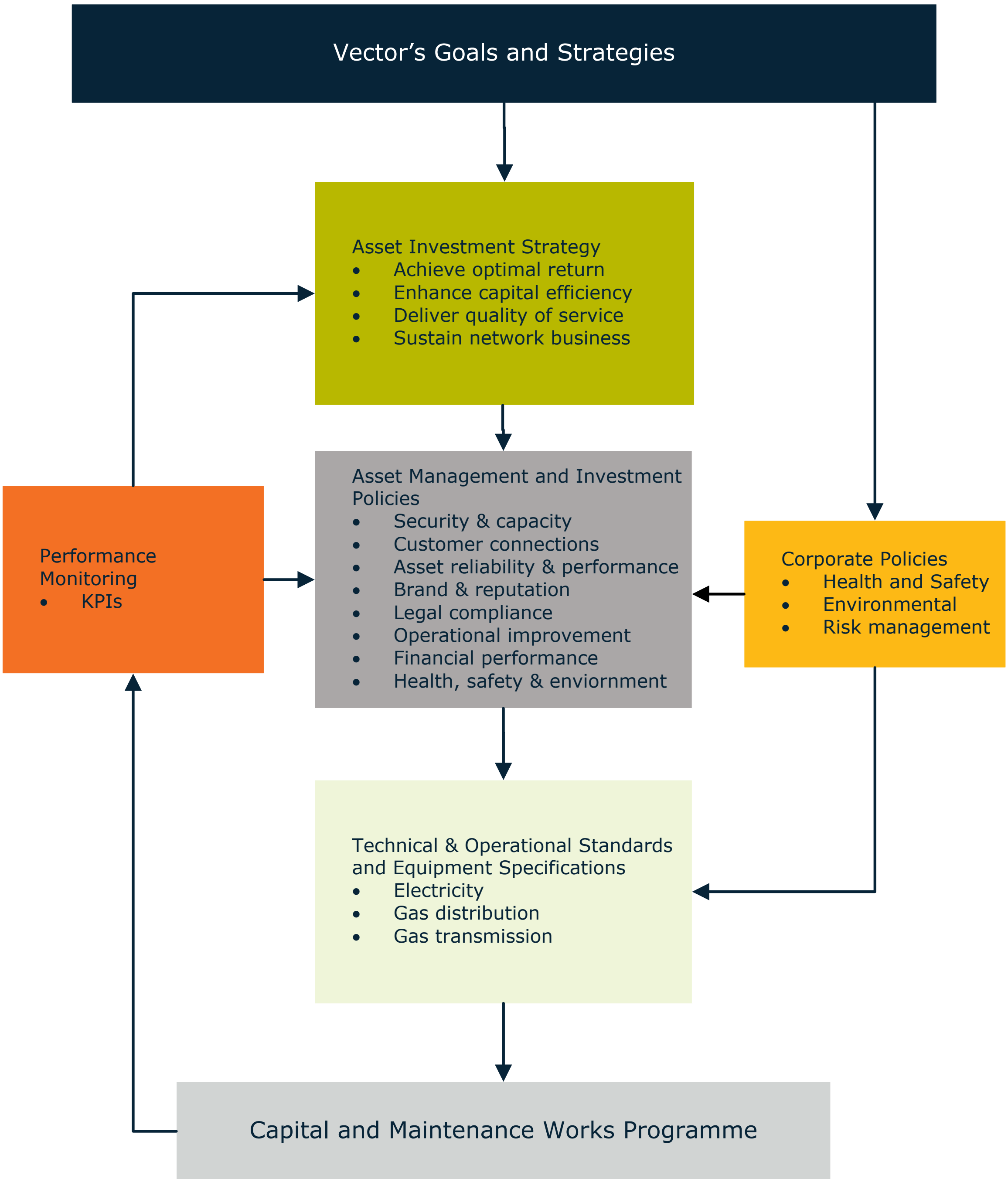

Figure 2-2 : How Vector's asset management strategies and policies relate to the strategic goals

2.2 Planning Period and Approval Date

This AMP covers a ten year planning period, from 1st July 2015 through to 30th June 2025 and was approved by the Board of Directors in May 2015.

The first five years of the AMP is based on detailed analysis of customer, network and asset information and hence provides a relatively high degree of accuracy (to the extent reasonably possible) in the descriptions and forecasts. The capital and maintenance forecasts set out in the AMP, particularly for the first year, are inputs into Vector's annual budgeting cycle.

The latter period of the AMP is based on progressively less certain information and an accordingly less accurate and detailed level of analysis. From year five on, the AMP is only suitable for provisional planning purposes.

2.3 Purpose of the Plan

This AMP has been developed as part of the requirements under Clause 2.6 of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) and covers ten years starting on 1st July 2015. The purposes of this AMP are to:

- Demonstrate that safe management processes are in place;
- Inform stakeholders how Vector intends to manage and expand its gas distribution network based on information available at preparation;
- Demonstrate the impact of regulatory settings on future investment decisions;
- Demonstrate alignment between gas distribution network asset management and Vector's goals and values;
- Demonstrate innovation and efficiency improvements;
- Provide visibility of effective life cycle asset management at Vector;
- Provide visibility of the level of performance of the network;
- Provide guidance of asset management activities to its staff and field service providers;
- Provide visibility of forecasted gas network investment programmes and upcoming medium-term construction programmes to external users of the AMP;
- Discuss Vector's views on expected technology and consumer developments and the asset investment strategies to deal with a changing environment; and
- Meet Vector's regulatory obligation under the aforementioned Determination.

This AMP does not commit Vector to any of the individual projects or initiatives or the defined timelines described in the AMP. Vector follows an annual budget process and the implementation of the works programmes may be modified to reflect any changing operational and economic conditions as they exist or are foreseen at the time of finalising the budget, or to accommodate changes in regulatory or customer requirements that may occur from time to time. Any expenditure must be approved through normal internal governance procedures.

2.3.1 Asset Management in Support of Vector's Vision

Vector's strategic vision is to be:

"New Zealand's first choice for integrated infrastructure solutions that build a better, brighter future"




To support Vector in achieving this vision a number of group goals have been defined as follows:

- Public, employee and contractor safety;
- Vector Customer Index;
- Environmental compliance;
- Business line specific goals, including:
    - Response time to emergencies (RtE) for gas distribution business;
    - Availability of core network for telecommunications;
    - SAIDI for electricity business; and
    - Reliability of smart meters; and
- EBITDA.

These group goals are also used as key performance indicators to assess and award staff performance bonuses.

The manner in which the AMP supports Vector's vision is demonstrated in Figure 2-3.

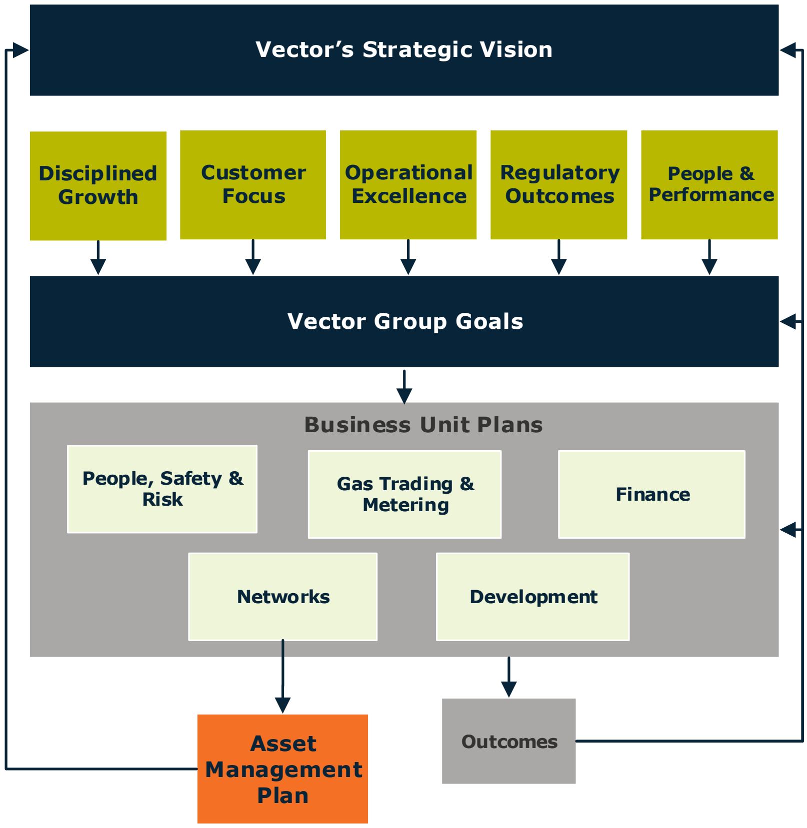

Figure 2-3 : The AMP in support of the overall Vector strategic vision

Table 2-1 below demonstrates how asset management supports Vector to achieve its strategic objectives[3].

[3] The group goals and initiatives are not in any priority order.

Group Goal	Asset Management in support of
Disciplined Growth	• Investigate new technologies and associated opportunities • Optimise capital contributions • Support commercially attractive investments • Innovation and optimal investment efficiency • Economies of scale from long-term view
Customer Focus	• Providing safe and reliable services • Fit-for-purpose network designs • Maintaining appropriate price/quality trade-off • Understanding and reflecting customer needs in designs • Security and reliability levels adapted to customer needs
Operational Excellence	• Safety is a top priority • Full compliance with health, safety and environmental regulations • Needs clearly defined • Understanding risks • Technical excellence • Reliable asset information source • High quality network planning • Effective maintenance planning • Fit-for-purpose network designs • Providing reliable service • Security and reliability levels adapted to customer needs • Easy-to-maintain and operate networks • Investigate new technologies and opportunities offered • Clear prioritisation standards • Clear roles and responsibilities for asset management • Strong, well-documented asset management processes • Clear communication of network standards and designs
Regulatory Outcomes	• Earning the regulatory cost of capital • Meeting regulatory requirements • Detailed five-year expenditure budgets • Strategic scenario planning
People and Performance	• Health and safety, environmental and risk management principles implemented at an asset investment level • Asset management and performance expectations clearly set • Clear roles and responsibilities

Table 2-1 : How asset management supports Vector's group goals

2.3.2 Vector's Vision Driving Asset Management

The previous section indicated how asset management at Vector supports the group's overall vision and goals. Conversely, and very importantly for this AMP, the Vector vision and goals also sets the framework and fundamental parameters for asset management[4]. This is illustrated in Table 2-2.

Group Goal driving	Asset Management
Disciplined Growth	• Keep abreast of technology changes • Seek optimal commercial outcomes in investment decisions • Innovation and capital efficiency • Optimised network solutions

[4] The group goals and initiatives are not in any priority order.

Group Goal driving	Asset Management
	• Optimised investment timing • New product development and investment where economically viable
Customer Focus	• Understanding customer needs and recognising this in decisions • Good project communications • Appropriate price/quality trade-off • Soundly justified investment programme • Fit-for-purpose solutions • Security of supply levels appropriate to customer needs • Keep abreast of technology changes
Operational Excellence	• Effective consideration of HS&E in investment and maintenance decisions • Asset decisions reflects safe networks as top priority • Implement high priority projects only • Appropriate to network environment • Maintain appropriate risk levels • Fit-for-purpose solutions • Easy-to-maintain and operate networks • Consistent project prioritisation • Minimising asset environmental impact • Standardisation • Clear roles and responsibilities • Strong, well-documented asset management processes • High quality asset data management • Clear forward view on upcoming work • Consider service providers' capacity
Regulatory Outcomes	• Respond to regulatory quality incentives (when they are introduced)
People and Performance	• Setting KPIs for the Group and individual performance • Technical training and development • Leadership development

Table 2-2 : How Vector's group goals drive asset management

2.3.3 Key Premise for the AMP

On a practical level, incorporating the Vector values and goals in the asset management strategy determines the fundamental assumptions or premise on which the AMP is based. These assumptions[5], listed in Table 2-3 below, reflect the manner in which the Networks group understands and implements Vector's strategic direction.

Key Premise for the AMP	
Safety will not be compromised	• Safety of the public, staff and contractors is paramount. Safety is a focus across the business. • Current safety regulations place the accountability for public safety on Vector as the owner of the assets. This is not expected to change.[6] • Vector fully complies with New Zealand safety codes, prescribed network operating practices and regulations.

[5] The assumptions are not listed in any priority order.
[6] This does not absolve Vector's service providers from meeting Vector's health & safety obligations, particularly in respect of public safety – Vector requires full compliance with its health and safety policies from all its service providers. Their performance in this regard is audited on a regular basis and managed under performance-based contracts.

Key Premise for the AMP	
The present industry structure remains	• The Vector gas distribution network will continue to operate as a stand-alone, regulated business (not vertically-integrated). Open access of the network will be maintained. • Vector's gas distribution network development will continue broadly in the same direction. The existing network will be maintained in accordance with good industry practice, ensuring that sufficient capacity, at appropriate reliability levels, will be retained to meet the needs of Vector's customers.
Existing Vector gas distribution business operation model remains	• Field services will continue to be outsourced. Adequate resources with the relevant skills will be available to implement the works programme to deliver the service to the required level. (Alternative approaches for field services provision were investigated prior to the current field services contracts being awarded. The commercial model for these contracts is continually tested and refined. Any change to the provisions of the contract requires negotiation with the field services providers.)
Current supply reliability levels remain unchanged	• Under the current regulatory arrangement in New Zealand it is imperative that reliability does not materially deteriorate. Under current price quality regulation Vector will therefore ensure reliability levels are maintained. • Customer survey results indicate Vector's customers in general are satisfied with the quality of service they receive, at the price they pay for the service. There is no material evidence to support increased service levels with the associated price increases.
A deteriorating asset base will be avoided	• In general, assets will be replaced when economic to do so, which is likely to be before they become obsolescent, reach an unacceptable condition, can no longer be maintained or operated, or suffer from poor reliability. In a number of instances (where it is technically and economically optimal and safety is maintained), some assets will be run to failure before being replaced.
Regulatory requirements are met	• Regulatory requirements with regards to information disclosure or required operating standards will be met accurately and efficiently.
A sustainable, long-term focused network will be maintained	• Asset investment levels will be appropriate to support the effective, safe and reliable operation of the network. • Expenditure will be incurred at the economically optimum investment stage without unduly compromising supply security, safety and reliability. • New assets will be good quality and full life-cycle costing will be considered rather than short-term factors only. • Networks will be effectively maintained, adhering to international good industry practice asset management principles. • Avoid over design or building excess assets. • Investments must provide an appropriate commercially sustainable return reflecting their risks.
Existing efficiency, reliability and supply quality levels are generally maintained	• At present there is no regulatory incentive to improve reliability and quality of supply. Incentives to improve efficiency are present within the price path mechanism but are relatively weak and the incentives are uneven over a regulatory period, blunting their effectiveness.
Under normal operating conditions, full required demand will be met	• Assets will not be unduly stressed or used beyond appropriate short or long-term ratings to avoid damage. This is part of maintaining a long term sustainable gas distribution network.
Network security standards (for delivery) will be met	• In exceptional cases breaches may be accepted, as long as this is consciously accepted, explicitly acknowledged and contingency plans prepared to cater for asset failure. The security standards are based on the optimal trade-off between providing an economically efficient network and Vector's best understanding of customer requirements and the price/quality trade-offs they would like to make.
Asset-related risks will be managed to appropriate levels	• Network risks will be clearly understood and will be removed or appropriately controlled – and documented as such.
An excessive future "bow-wave" of asset replacement will be avoided	• Although asset replacement is not age-predicated, there is a strong correlation between age and condition. To avoid future replacement capacity constraints or rapid performance deterioration, age-profiles will be monitored and appropriate advance actions taken.

Key Premise for the AMP	
Quality of asset data and information will continue to improve	• Vector's asset management is highly dependent on the quality of asset information. Its information system and data quality improvement programme will continue for the foreseeable future.

Table 2-3 : Key premises for the AMP

These key premises have a direct and major impact on the quality of service provided by the network, the condition of the assets, the levels of risk accepted and the asset expenditure programmes.

2.4 Asset Management in the Wider Vector Context – Internal Stakeholders

Asset management at Vector is not practised in isolation. It is heavily reliant on inputs from the various parts of Vector, either directly or indirectly. The AMP provides visibility of asset management activities to the rest of Vector, for incorporation into the broader business plans and strategies. This two-way support flow is illustrated in Figure 2-4 and Figure 2-5.

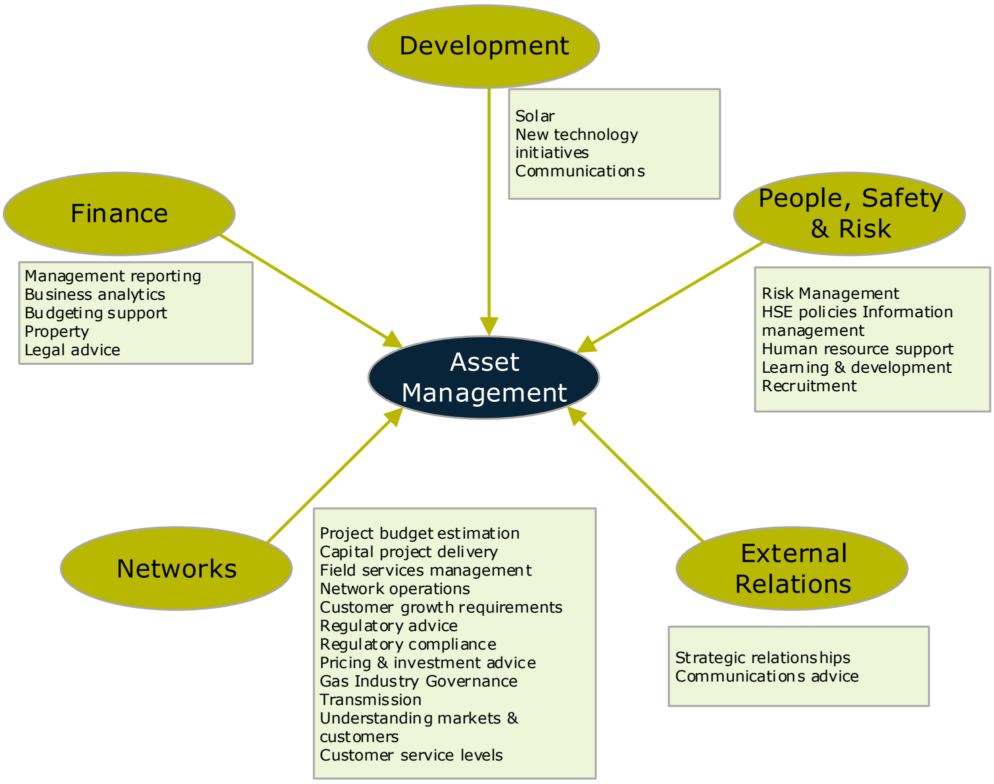

Figure 2-4 : Interaction with the rest of Vector - the flow into asset management

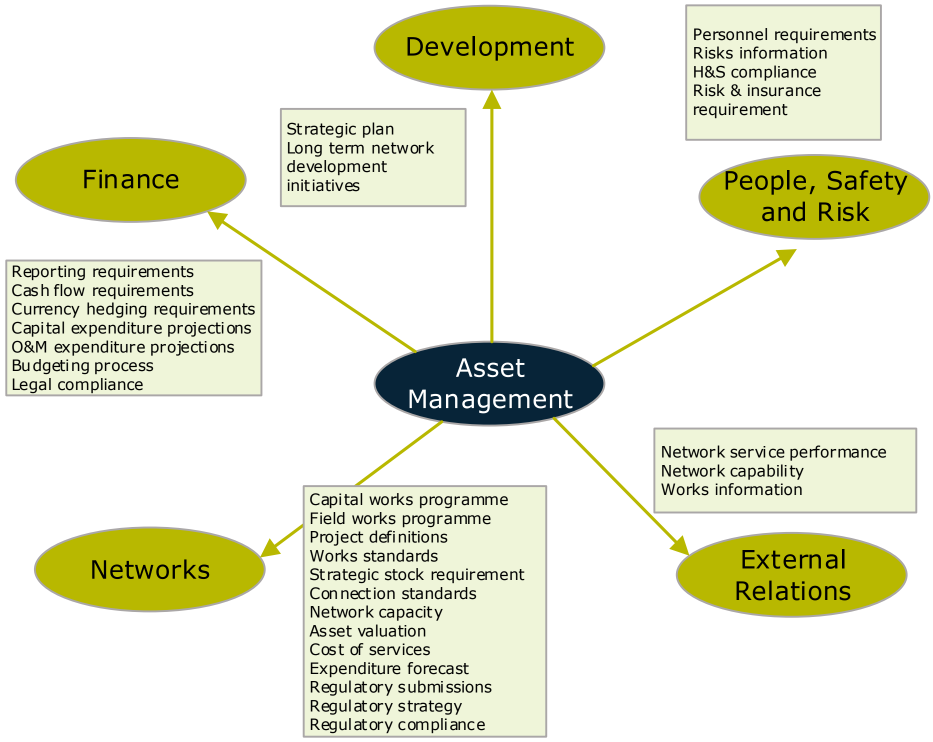

Figure 2-5 : Interaction with the rest of Vector - the flow from asset management

2.4.1 Communication and Business Participation in Preparing the AMP

As part of business-as-usual, there is ongoing close communication and cooperation between the various business units in Vector and the Networks group. This is considered key to the success of Vector.

With respect to the preparation of the AMP, the following action plan has been prepared to guide its development and implementation, and to communicate the strategies and activities to the relevant parties.

Step	Description
1	Inform staff involved in the preparation of the AMP of the evolving information disclosure requirements (what information to be provided) and definitions of terms used to ensure consistency in the presentation of the AMP.
2	Reinforce the asset management strategies (risk assessment, maintenance strategies, network development standards, etc) and how these relate to the corporate goals. This strengthens the focus of the Asset Management Plan on the objectives of the Plan.
3	Information requirements include: • Reiteration of requirements under the previous regime (that are still required under the current regime) that require attention • New or additional (to the previous regime) requirements • Key issues include (but not limited to): o Definition of capex and opex categories o Asset categories and asset classes o Planning period and disclosure year

Step	Description
	○ Price inflation factor ○ Key assumptions ○ Options analysis and justifications for near term projects ○ Service levels targets and performance level ○ Capability to deliver works programme ○ Asset Management Maturity Assessment Tool (AMMAT).
4	Identify data and information requirements.
5	Notify relevant parties of information systems and accounting structure needed to provide the required information in the required format.
6	Inform staff of the structure of the disclosure AMP and the time line for preparing the AMP.
7	Identify the assumptions to be used in preparing the disclosure AMP (demand forecast, cost estimation, escalation, etc.).
8	Assess the deliverability of the works programme (within the next two years). Seek input from project managers and field service providers.
9	Allocate responsibilities for preparation of the AMP.
10	Engage with staff and field service providers to seek input prior to finalising the AMP.
11	Circulate the drafts of the AMP to interested parties (Finance, Risk, IT) within Vector for inputs and comments.
12	Seek staff input / comments on risk assessment and service performance aspects of the AMP.
13	Finalise the AMP taking into account relevant inputs and comments received.
14	Seek comments and approval from executives prior to seeking board approval.
15	Upon approval of the AMP (and associated budgets), organise staff to prepare works programme (including detailed designs, etc) for the next two years and communicate the works programme to staff and service providers.
16	Present highlights of the AMP (asset management strategies and policies, how they support Vector's goals, works programmes, etc) to staff and field services partners involved in asset management activities.
17	Reiterate Vector's aim for achieving capital efficiency (including its goals and past achievements and respective staff KPIs).
18	Monitor project and works programme progress against plan. Monitor expenditure against budget.

Table 2-4 : AMP Action Plan

2.5 Asset Management in the Wider Vector Context – External Stakeholders

Vector has a large number of internal and external stakeholders that have an active interest in how Vector's assets are managed. The essential service nature of the gas distribution service Vector provides, and its importance to the Nation's well-being and economy, creates a keen interest in how Vector conducts its business.

In Figure 1-6, the important external stakeholders to Vector are highlighted. Understanding of how these stakeholders interact with Vector and the requirements or expectations they have of Vector has a major bearing on the manner in which Vector constructs and operates the gas distribution networks.

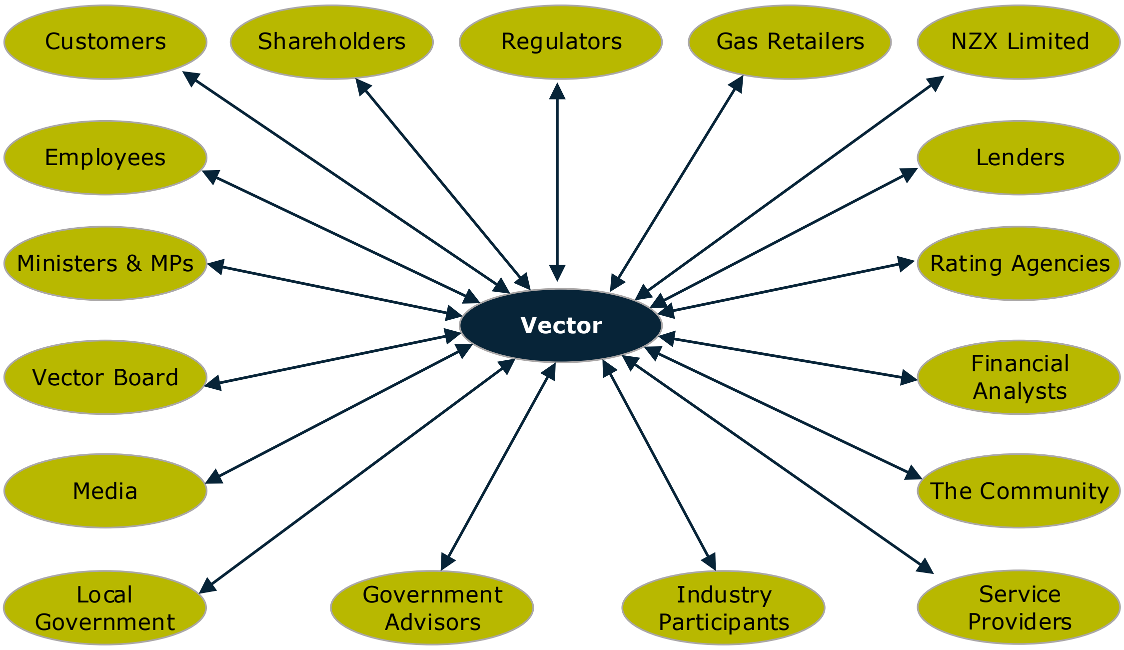

Figure 2-6 : Vector's key external stakeholders

2.5.1 Stakeholder Expectations

Important stakeholder expectations[7] are listed in Table 2-5 below.

Customers (and End-Use Consumers)	
Health and safety	Reliable supply of gas
Quality of supply	Planned outages
Security of supply	Timely response to complaints and queries
Efficiency of operations	Information in fault situations
Reasonable price	Environment
Timely response to outages	Timely connections
Innovation, solution-focus	
Shareholders	
Health and safety	Regulatory and legal compliance
Sustainable growth	Prudent risk management
Sustainable dividend growth	Good reputation
Reliability	Good governance
Confidence in board and management	Clear strategic direction
Accurate forecasts	Return on investment

Retailers

[7] The stakeholders and their expectations are not listed in any order of priority.

Health and safety Reliability of supply Quality of supply Managing any customer issues	Information in fault situations Ease of doing business Good systems and processes
Regulators	
Health and safety Statutory requirements Accurate and timely information	Inputs on specific regulatory issues Input into policy proposals and initiatives Fair and efficient behaviour
Vector Board	
Health, safety and the environment Regulatory and legal compliance Good governance Accurate and timely provision of information Expenditure efficiency	Prudent risk management Security and reliability of supply Return on investment Accurate budgeting
NZX Limited	
Compliance with market rules	Good governance
Financial Analysts/Rating Agencies/Lenders	
Transparency of operations Accurate performance information Clear strategic direction Adhering to the NZSX listing rules Adhering to the NZDX listing rules	Prudent risk management Good governance Accurate forecasts Confidence in board and management
Service Providers	
Safety of the work place Stable work volumes Quality work standards Maintenance standards Clear forward view on workload	Construction standards Innovation Consistent contracts Clearly defined processes Good working relationships
Government Advisors	
Public safety Workplace safety Vector's views on specific policy issues Efficient and equitable markets	Innovation Infrastructure investment Reduction in emissions Accurate and timely provision of information
Ministers and MPs	
Public safety Workplace safety Reliable supply of gas Efficient and equitable markets Industry leadership	Security of supply Investment in infrastructure and technologies Environment Good regulatory outcomes Energy and supply outage management

Local Government	
Public safety Environment Coordination between utilities Sustainable business	Support for economic growth in the area Visual and environmental impact Compliance

Community	
Public safety Good corporate citizenship Gas safety programme	Engagement on community-related issues Improvement in neighbourhood environment Visual and environmental impact
Energy Industry	
Health and safety Leadership Innovation Participation in industry forums	Policy inputs Influencing regulators and government Sharing experience and learning
Gas Transmission	
Effective relationships Ease of doing business Secured source of supply	Well maintained assets at the networks interface Co-ordinated approach to system planning and operational interfaces Sharing experience and learning
Media	
Effective relationship Access to expertise	Information on Vector's operations

Table 2-5 : Stakeholder expectations

Vector ascertains its stakeholders' expectations by, amongst other things:

- Meetings and discussion forums;
- Consumer engagement surveys;
- Engagement with legislative consultation processes;
- Employee surveys (Pulse surveys);
- Annual planning sessions;
- Direct liaison with customers;
- Membership on industry working groups;
- Feedback received via complaints and compliments;
- Investor roadshows and annual general meetings;
- Analyst enquiries and presentations;
- Monitor analyst reports;
- Media enquiries and meetings with media representatives; and
- Monitoring publications and media releases.

Vector accommodates stakeholders' expectations in its asset management practices by, amongst other things:

- Due consideration of the health, safety and environmental impact of Vector's operations;
- Providing a safe and reliable gas distribution network;
- Quality of supply performance meeting consumers' needs and expectations, subject to price / quality trade off;
- Optimisation of capital and operational expenditures (capex and opex);
- Maintaining a sustainable business that caters for consumer growth requirements;

- Comprehensive risk management strategies and contingency planning;
- Compliance with regulatory and legal obligations;
- Security standards reflecting consumers' needs and expectations, subject to price / quality trade off;
- Network growth and development plans;
- Provision of accurate and timely information;
- Development of innovative solutions; and
- Comprehensive asset replacement strategies.

2.5.2 Addressing Conflicts with Stakeholder Interests

In the operation of any large organisation with numerous stakeholders with diverse interests, situations will inevitably arise where not all stakeholder interests can be accommodated, or where conflicting interests exist. From a Vector asset management perspective, these are managed as follows:

- Clearly identifying and analysing stakeholder conflicts (existing or potential);
- Having a clear set of fundamental principles drawing on Vector's vision and goals, on which compromises will normally not be considered (see the list in Section 2.3);
- Effective communication with affected stakeholders to assist them to understand Vector's position; and
- Where Vector fundamentals such as safety are not compromised, seeking an acceptable alternative or commercial solution.

Other aspects considered when assessing aspects impacting on stakeholder interests or resolving conflicts include:

- Health and safety;
- Cost/benefit analysis;
- Central and local government interface and policies;
- Commercial and technical regulation;
- Long-term planning strategy and framework;
- Environmental impacts;
- Societal and community impacts;
- Legal implications;
- Sustainability of solutions (technically and economically);
- Works/projects prioritisation process;
- Security and reliability standards;
- Quality of supply;
- Risks; and
- Work and materials standards and specifications.

At a practical level in relation to asset management, Vector has developed an extensive set of asset management and investment policies, guidelines and standards which implicitly embrace practical solutions to the requirements of stakeholders. These policies and standards provide guidance to the safe operation and maintenance of the gas network assets. At an investment decision level, a project prioritisation matrix (section 9) has been developed to provide guidance on the selection of projects for implementation.

2.6 Asset Management Structure and Responsibilities

This section discusses how gas distribution asset management currently operates at Vector. It is based on a functional rather than organisational structure and therefore discusses how the functions are structured according to the business units within the Vector Group. It does not distinguish between functions undertaken by particular legal entities within the Group.

2.6.1 Vector Senior Level Structure

The Vector senior level structure is provided in Figure 2-7 below. Vector is split into several functional areas, each with a responsible group general manager or chief officer.

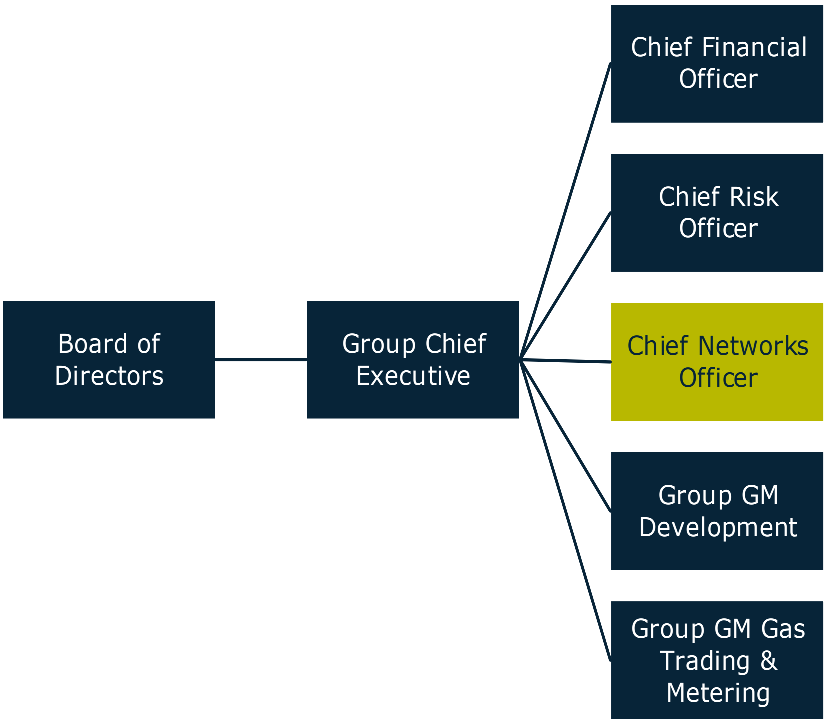

Figure 2-7 : The Vector senior management structure

The primary responsibility for the asset management of the gas distribution network lies with the Chief Networks Officer. The role this business unit plays in asset management is further discussed in Section 2.6.2.

In summary, the responsibilities of the other groups are as follows:

- Finance

  Financial accounting and reporting, budgeting, treasury, management accounting, tax management, legal services, company secretary, corporate development, properties, business analytics and insurance.

- People, Safety & Risk

  Enterprise risk management, health, safety and environmental policies, information & knowledge management, human resources support, training and development, recruitment, personnel performance management, business continuity management, internal audit and internal control, and strategic insurance.

- Development

Corporate initiatives, solar programme, communications strategies, Vector's Fibre and Communications business.

- Gas Trading and Metering

  Wholesale gas business, liquid petroleum gas (LPG) business and metering services.

2.6.2 The Networks Group

The Networks group structure is provided in Figure 2-8 below. The structure of the group is expanded, emphasising the asset management responsibilities.

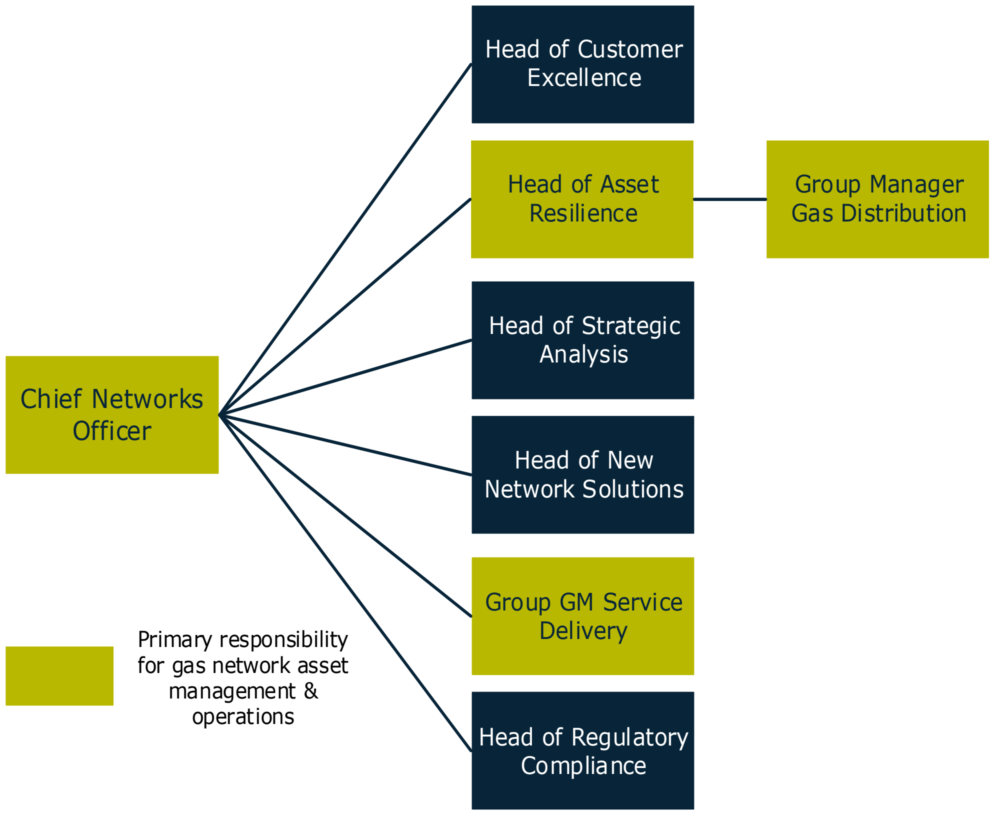

Figure 2-8 : The Networks group management structure supporting the AMP

2.6.2.1 The Asset Resilience Group

As the Asset Manager, the primary responsibility for the management of the gas distribution network and preparation of the AMP lies with the Asset Resilience group. In broad terms, this group is responsible for:

- Setting gas distribution network security standards;
- Supporting Vector's development and implementation of a Safety Management System;
- Ensuring asset investment is efficient and provides an appropriate commercially sustainable return to Vector's shareholders;
- Ensuring the configuration of the gas distribution network is technically and economically efficient, meets customer requirements, and is safe, reliable and practical to operate;
- Planning network developments to cater for increasing gas demand and customer requirements;

- Ensuring the integrity of the existing asset base, through effective renewal, refurbishment and maintenance programmes;
- Preparing detailed engineering design for projects, including engagement of design consultants;
- Keeping abreast of technological and consumption trends, assessing the potential impact thereof and devising strategies to effectively deal with this in the long-term network planning; and
- Maintaining current and accurate information about the extent and performance of the network and assets.

The AMP is the prime document that captures how the above functions are discharged.

2.6.2.2 The Service Delivery Group

In Vector's asset management model, the service provider function is predominantly fulfilled by the Service Delivery (SD) group. In conceptual terms, the Asset Resilience team defines what assets are required, when and where, and how these should be operated and maintained, while the SD group delivers on providing, operating and maintaining the assets.

The SD group has a wide brief but the key functions as far as it relates to asset management, or the provision of the service provider function for the gas distribution network, are illustrated in Figure 2-9 and further expanded below.

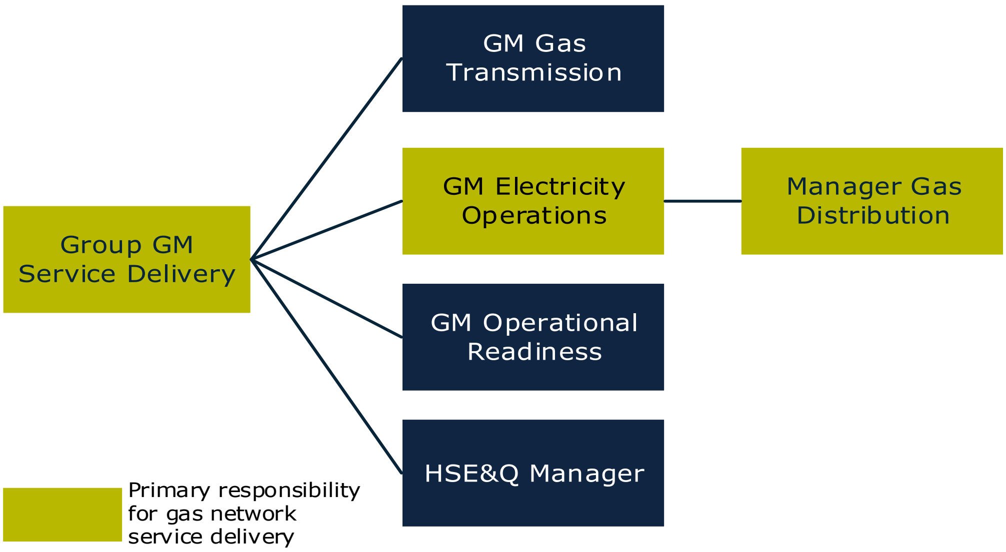

Figure 2-9 : Service Delivery as an asset management service provider

The Operations section is responsible for the maintenance and day-to-day safe operation of the gas distribution network including planning network configuration; managing, reporting and investigating incidents and contingency management.

The Operations section is also responsible for the delivery of infrastructure projects and customer connections including detailed project engineering and cost estimates, as well as project and contract management services. Vector does not have an in-house construction section for the gas distribution network. Construction work is predominantly undertaken by our contracted Service Provider partners (Northpower and Electrix), which were selected through a competitive tender process. In some instances work is also done by other contractors sourced on a competitive tender basis.[8]

The Asset Resilience group manages the overall capital budget and is responsible for setting and controlling this, including obtaining the necessary expenditure approvals through the Vector governance process. After expenditure is approved, SD manages the individual projects and associated expenditure.

The maintenance of the gas distribution network is undertaken in conjunction with Vector's Service Provider partner (Electrix), who was selected through a competitive tender process.

The Operations section interacts with Asset Management in various areas, including:

- Managing the end-to-end project delivery process;
- Work scopes and project briefs;
- Detailed project engineering, including appointment of design consultants;
- Detailed project cost estimation;
- Reporting on project progress;
- Expenditure tracking and forecasting;
- Construction and commissioning standards;
- Project close-out and capturing learning;
- Implementation of asset maintenance policies;
- Providing asset information for Asset Resilience to set maintenance budgets;
- Feedback on asset performance and customer issues; and
- Investigating asset failures.

2.6.3 Asset Management Activities by Other Groups

While the bulk of gas distribution network asset management activities are performed by the Asset Resilience group, supported by the SD group, as noted in Section 2.4 the rest of Vector has many inputs. Most of these inputs are indirectly related to the assets themselves, but there are the following exceptions, where gas-related assets are directly sourced and incorporated by others.

2.6.3.1 External Relations

The External Relations group is responsible for setting and measuring the service experience that customers on Vector's networks should receive for connection, faults repair and other services.

2.6.3.2 Information Technology (part of Corporate Services)

There is increasing overlap in the real-time operation of gas distribution network assets and corporate-wide information technology services. Not only does Asset Management require increasingly sophisticated information systems, but the traditional SCADA/telemetry systems are, over time, becoming less of a stand-alone application with unique requirements and protocols, and more of an integrated IT network application. Increased cyber-security of both SCADA and telemetry has to be provided for.

[8] Works provided by our contracted Service Providers are still managed through a competitive bid process, although it may not be put out to open tender on a project by project basis.

Procurement and implementation of Asset Management and IT support systems, and the core SCADA equipment, is managed by the Information Technology group.

2.6.3.3 Vector Communications (part of Development group)

Vector Communications manages Vector's fibre optic network, for internal and external clients. They provide a major part of the SCADA/Telemetry system – the communication link between the Sky Tower and Vector's offices at Carlton Gore Road in Auckland. Provision of this service is on a strict commercial basis, with the Asset Resilience group treated similar to external clients and charged on the same basis.

2.6.4 Field Service Model

Vector's business model for operating and maintaining its gas distribution network assets is to outsource much of this work to Field Services Providers (FSPs).

After an extensive investigation in 2008/09 it was decided to retain the outsourcing model. Through a competitive process, Vector selected Electrix Ltd as the maintenance contractor for the gas distribution networks. Electrix is responsible for the preventative, corrective and reactive maintenance works of the gas distribution network.

Other outcomes of the review included establishing new key performance indicators (KPIs) and a new framework with guiding principles to manage the working relationships between Vector and the FSP. The objective of the business model is to improve the efficiency and quality of the delivered services to Vector and its customers.

2.7 AMP Approval Process

Approval of the disclosure AMP is sought at the May 2015 board meeting.

This AMP is subject to a rigorous internal review process, initially within the Networks group (the developer of the Plan), and then by the Regulatory, External Relations, Financial and SD groups. Finally, the AMP is reviewed and certified by the board, in accordance with the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) [9].

2.7.1 Alignment with the Vector Budgeting Process

Vector operates under a July to June financial year. This matches with the regulatory year. The Asset Management planning processes and documents form a key input into the budgeting process. These contain detailed, prioritised breakdowns of the gas distribution network expenditure requirements for the next five years, with supporting evaluation for the individual projects or programmes. This is intended to assist the executive with the budget process, clarifying the gas distribution network priorities and also prioritising these along with other business investment needs.[10]

2.7.2 The Expenditure Forecasting Process

In Figure 2-10 the forecast process for capex projects in the AMP is illustrated. This process follows the following steps:

- The overall capital works programme is divided into different work categories. A plan covering the next five-year period is first developed for each work category (based on the asset management criteria for that work);

[9] Schedule 17 of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015)
[10] As with all companies, Vector does not have unlimited cash resources, and competing investment needs and commercial opportunities have to be balanced.

- A works programme is then drawn up and the corresponding capex to implement the works programme is developed. This is an unconstrained estimate;
- The prioritisation process described in Section 9 is then applied to the projects and programmes within the work category. This identifies projects that could be left out from the programmes without undue negative consequences;
- Discussions then take place within the Networks group to ensure the required resources and skills to complete the works programme are available, and appropriate adjustments made prior to the works programme being finalised; and
- An overall prioritisation process is then applied to the combined suite of network projects, to develop the final AMP forecast for combined capex.

As noted before, the accuracy of forecasts further out in the planning period diminishes. The capital forecasts for years six to ten are based on a combination of projects foreseen at this stage and trend analysis for other types of projects. Project prioritisation for this period is indicative only.

A similar process is adopted for the operation and maintenance expenditure forecasts, which are prepared in conjunction with Service Delivery.

2.8 Asset Management Decisions and Project Expenditure Approval

Implementation of the AMP requires decisions to be made by management and staff at all levels, reflecting their functional responsibilities and level of delegated financial authorities (DFAs), as set in accordance with the Vector governance rules. Functional responsibilities define the role of each staff member in Vector. The DFAs specify the level of financial commitment that individuals can make on behalf of Vector.

Investment decisions are budget-based, with the board approving yearly budgets before any commitment can be made. Preliminary project approval is normally given through the annual (one-year) budgeting process, but projects are not individually assessed in detail at this stage. Project-specific capex approval therefore still has to be granted for all projects prior to committing capital, despite these having been included in the approved annual budget. The detailed project approval process has been developed in accordance with the Vector DFA system. The Board is not bound to giving approval to the programmes and projects included in the AMP as the key factors affecting investment may be subject to change.

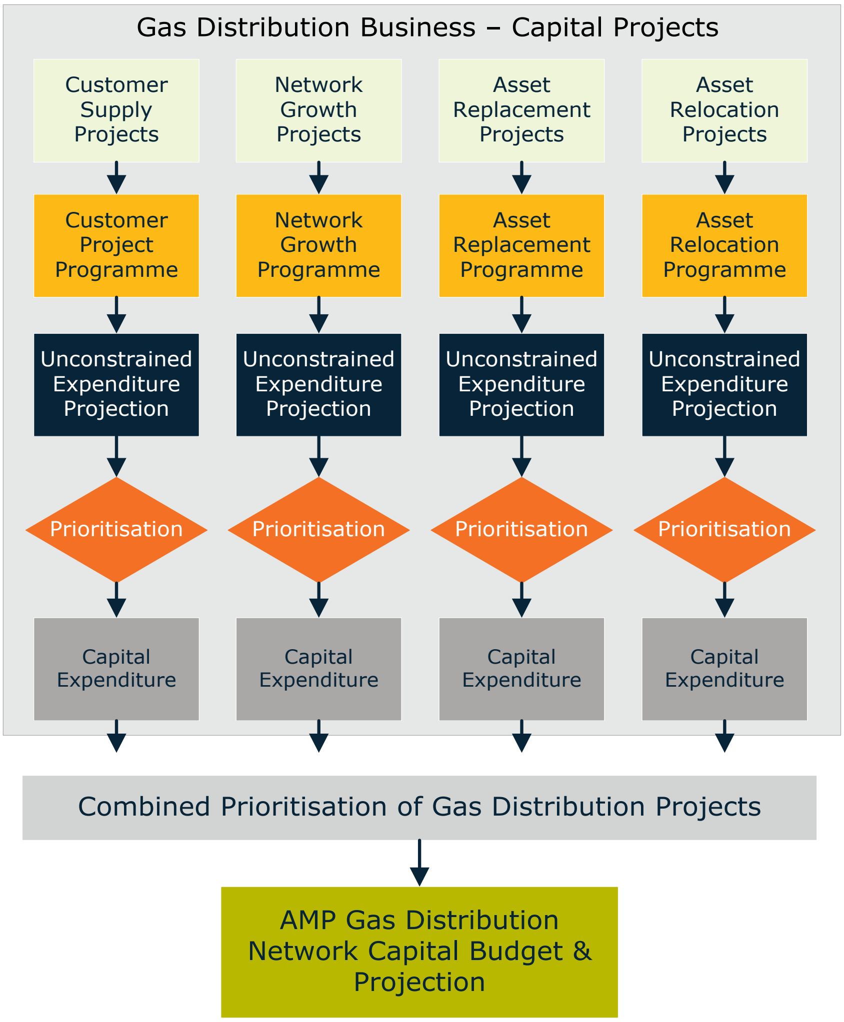

Figure 2-10 : Capex forecasting process adopted for the AMP

Critical unbudgeted investments will be taken to the board for consideration at any stage of the financial year, if supported by a robust business case or arising from an urgent safety, reliability or compliance issue.

Applications for expenditure approval must be supported by formal business cases. Each business case contains information on the expenditure objective, constraints and assumptions, strategic fit, options investigated, project time line, resources required and available, project deliverability, cost benefit analysis, return on investment and risk assessment. This assists Vector management to assess and approve investment applications.

2.9 Progress Reporting

Performance against the annual budgets is closely monitored, with formalised change management procedures in place. Regular reports are sent to the Vector board regarding:

- Health, safety and environmental issues;
- Monthly report on overall expenditure against budget;
- Progress of key capital projects against project programme and budget;
- Response time to emergencies (RTE);

- Progress with risk register actions (the board has a risk committee with a specific focus on risks to the business).

2.10 Asset Management Processes

The diagram in Figure 2-11 shows the high level asset investment process within Vector. This highlights the relationship between the different asset creation and evaluation processes within Vector.

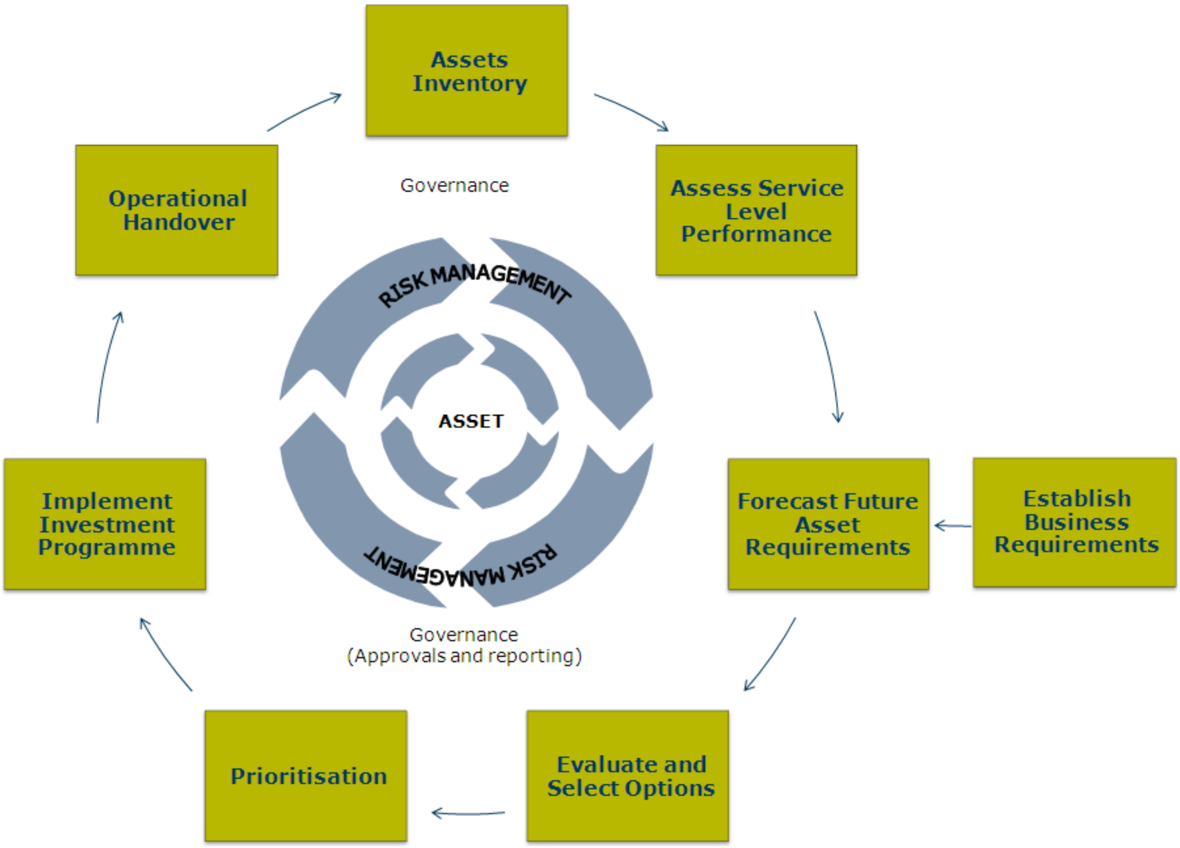

Figure 2-11 : High-level overview of the Vector asset investment process

Assets Inventory

Information on the quantity, age and capability of existing assets is essential to understand and effectively manage the asset base. Information on the existing assets and network configuration is set out in Section 3, Section 5 and Section 6 of this AMP.

The asset register, geographical information system (GIS) and associated databases store cost information and technical characteristics for all assets, including their location, history and performance. The way in which information systems support Asset Management processes is described in Section 7.

Assess Service Level Performance

Information on the performance, utilisation and condition of existing assets and the different parts of the network is needed to forecast future investment, renewal or upgrading requirements and improve service level. This requires ongoing monitoring of asset condition and network performance, the consumption of resources associated with maintaining the assets, and the efficiency and effectiveness with which assets are utilised (including network configuration). Information on the condition and performance of existing assets and on the network configuration is set out in Section 4, Section 5 and Section 6.

Establish Business Requirements

The levels of service required from the gas distribution network are guided by the wider business requirements. These requirements in turn are determined by Vector's operating environment and reflect corporate, community, environmental, financial, legislative, institutional and regulatory factors together with stakeholder expectations.

Section 2 sets out the background and business requirements that drive the AMP. Service levels are described in Section 4, Section 5 and Section 6.

Forecast Future Asset Requirements

The combination of asset condition and performance drivers, load demand and the business requirement drivers form the basis for assessing future asset needs and the resulting network development plans. Section 4, Section 5 and Section 6 discuss this information.

Evaluate and Select Options

Once the future network or asset requirements are established, options for addressing these needs have to be evaluated and potential solutions have to be identified. Decision tools and systems used to support the evaluation of options include network modelling and analysis, effective capital budgeting techniques, optimised renewal modelling, life-cycle costing, risk assessments and geographic information. At the same time, the feasibility of non-network or unconventional solutions to address network requirements is also considered.

Vector broadly categorises asset investment planning in two main streams:

- Network development planning is undertaken to ensure service target levels are met in an environment of increasing load (demand) growth, or increased customer quality expectations. It is based on systematic analysis of maximum demand trends, consumer requests and demographic estimates. Vector's approach to network development planning is set out in Section 5; and
- Asset maintenance and replacement planning is undertaken to ensure assets remain fully functional for their reasonably expected lifespan when operating within design ratings. It also includes activities to prolong asset lives or to enhance asset performance. Maintenance planning addresses both capital investments on renewal or refurbishment, or long, medium and short-term asset maintenance. Vector's approach to maintenance planning is set out in Section 6.

Prioritisation

Prioritisation is a process that ranks all projects identified during the network development and maintenance planning processes. This process ensures only projects that meet Vector's investment thresholds – which encompass safety, commercial and technical considerations - are included in the project programme.

Projects also undergo a second prioritisation process, to compare investment needs across Vector. This is to ensure the best use of available resources on a Vector-wide basis.

The way Vector prioritises gas asset capital investment projects is discussed in Section 5, Section 6 and Section 9.

Implement Investment Programme

Budgets are prepared on a cash-flow basis mirroring expected expenditure based on works programmes. The board approves the overall expenditure on an annual cycle and project expenditure on the larger projects in accordance with DFA governance rules. While most projects are delivered in the financial year, the delivery of larger projects, such as low pressure pipeline replacement, may straddle financial years. Budgetary provision is made in the year expenditure will be incurred.

The implementation of solutions identified as part of the Asset Replacement (Section 6) or Planning Process (Section 5) is managed by SD. This team also manages the maintenance programmes, liaising directly with the Service Providers.

Operational Handover

Once construction and installation is completed, a formal handover process takes place. The process is designed to check the quality of work and equipment meets Vector's standards and the assets are constructed to allow maintenance in accordance with Vector's maintenance standards. It also includes a walkover between the Project Manager, a Service Delivery representative and the asset engineers who take assets over and implement the maintenance regime and the contractors who manage the assets on Vector's behalf. The GIS record is updated with the new assets as well as the asset information system database.

Governance (Approvals and Reporting)

Formal approval (budgets and expenditures) and reporting (progress and risks) processes are in place to satisfy Vector's Corporate Governance requirements.

Risk Management

Risk management underpins all Asset Management business processes and forms an important part in defining project requirements (discussed in Section 8).

2.11 Works Coordination

2.11.1 Internal Coordination

Vector puts a significant effort into coordinating the various activities associated with the delivery of the capital works programme with the objectives of better utilisation of resources, enhancing capital efficiency and delivering improved customer outcomes.

In addition to its gas distribution networks, Vector operates electricity networks, a gas transmission system and a fibre optic telecommunication network. To maximise the synergy benefits that can be achieved from cooperation, and to deliver projects in the most effective, least disruptive manner, effective coordination of capital works between these business units is essential.

2.11.2 External Coordination

As well as internal coordination, new processes have also been put in place to improve coordination between Vector and other utilities, roading authorities, local councils and their service providers. These works coordination processes are focused on maintaining effective communication channels and effective working relationship with external agencies, identifying cost effective future proofing opportunities, minimising disturbance to the public as a result of infrastructure works, streamlining works processes and meeting Vector's regulatory obligations.

It is important for Vector to be cooperative and supportive in its relationships with other agencies. In the past this has resulted in a number of win-win outcomes.

2.12 Other Asset Management Documents and Policies

Vector has a number of other documents used to capture Asset Management policies and procedures. Including all of these in one document would produce an unwieldy, impractical plan. In addition, there are a number of Vector-wide policies that have a direct bearing on asset management.

2.12.1 Other Asset Management Documents

The AMP is supported by a collection of detailed Asset Management documents, guidelines and policies in the following areas (not in any order of priority):

- Asset management and investment;
- Network quality and security;
- Detailed asset maintenance;
- Network design and construction;
- Network equipment;
- Risk management;
- Contracts management;
- Procurement;
- Health and safety;
- Environmental;
- Asset rehabilitation;
- Asset settlement;
- Network contingency plans;
- Network projects quality assurance; and
- Drug and alcohol management.

In addition to the policies, Vector has also developed a suite of work practice standards and guidelines and equipment specifications to guide its service providers in the course of implementing the works programme. These standards, guidelines and specifications can be found on Vector's internal communications website.

2.12.2 Other Vector Policies Affecting Asset Management

Vector has a number of business policies[11] designed to help the business to operate efficiently and effectively. Many of these interact with, or impact on, the Asset Management policies and this AMP.

Business:

- Health and safety policy;
- Environment policy;
- Fraud control policy;
- Preventing workplace bullying and harassment policy;
- Diversity policy;

[11] These policies are not listed in any order of priority.

- Code of conduct and ethics;
- Whistleblower policy;
- Performance and conduct in the workplace policy;
- Privacy policy;
- Risk management policy;
- Business continuity policy;
- Contract management policy;
- Legal compliance policy;
- Protected disclosure policy;
- Remuneration policy;
- Customer credit policy;
- Foreign exchange policy;
- Expense management policy;
- Delegated financial authority policy;
- Drug and Alcohol policy;
- Network WIP (work-in-progress) management policy;
- Network fixed asset creation and disposal policy; and
- Capex policy.

Information Technology:

- Access policies;
- Password and authentication policy;
- Network management policy;
- Internet use policy;
- E-mail policy;
- Access control policy;
- Antivirus policy;
- Communications equipment policy;
- Computer systems and equipment use policy;
- Cyber crime and security incident policy;
- E-commerce policy;
- Firewall policy;
- Hardware management policy;
- Information technology exception policy; and
- Information technology general user policy.

2.13 Review of Vector's Asset Management Practice

2.13.1 Asset Management Maturity Assessment (AMMAT)

In terms of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015), the Commerce Commission requires its Asset Management Maturity Assessment Tool (AMMAT) to be applied by all gas distribution businesses. This tool, which is an extract from the British Standards Institute PAS55 (2008) Asset Management Model, is intended to facilitate a self-reflection on the maturity of asset management at each business and to highlight areas for possible improvement.

To comply with the Information Disclosure Determination 2012 (consolidated in 2015), Vector has applied the AMMAT. Vector's self-assessment was carried out in a workshop setting by the group of middle managers responsible for the various facets of asset management at Vector. The results were reviewed by the senior executives in charge of the Asset Resilience group. The assessment was carried out in accordance with guidelines provided by the Commerce Commission and also the Electricity Engineers' Association (EEA) [12].

The AMMAT is essentially a series of questions against which a business has to assess its maturity level. Maturity is measured on a 5-point scale, defined as follows (by the EEA):

- **Maturity Level 0**

  The elements required by the function are not in place. The organisation is in the process of developing an understanding of the function.

- **Maturity Level 1**

  The organisation has a basic understanding of the function. It is in the process of deciding how the elements of the function will be applied and has started to apply them.

- **Maturity Level 2**

  The organisation has a good understanding of the function. It has decided how the elements of the function will be applied and work is progressing on implementation.

- **Maturity Level 3**

  All elements of the function are in place and are being applied and are integrated. Only minor inconsistencies may exist.

- **Maturity Level 4**

  All processes and approaches go beyond the requirements of PAS 55. The boundaries of asset management development are pushing to develop new concepts and ideas.

As part of the maturity self-assessment, Vector also considered the maturity level it desires to achieve. On all assessment questions, the Vector goal is set at maturity level 3. While achieving level 4 could be desirable in some instances, the cost and effort this would involve is generally considered to exceed the value it would add to Vector's operations.

The result of Vector's self-assessment is provided in Table 2-6 below. More commentary on the response to individual questions is included in Appendix 6.

Question No.	Function	Question	Rating 0	1	2	3	4
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?					

[12] Electricity Engineers' Association, "Guide to Commerce Commission Asset Management Maturity Assessment Tool (AMMAT)", May 2014

Question No.	Function	Question	Rating 0 1 2 3 4
10	Asset management policy	What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders?	
11	Asset management policy	In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship?	
26	Asset management plan(s)	How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems?	
27	Asset management plan(s)	How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery?	
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	
31	Asset management plan(s)	What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)? (Note this is about resources and enabling support)	
33	Contingency planning	What plan(s) and procedure(s) does the organisation have for identifying and responding to incidents and emergency situations and ensuring continuity of critical asset management activities?	
37	Structure, authority and responsibilities	What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)?	
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	
45	Outsourcing of asset management activities	How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)?	
48	Training, awareness and competence	To what extent has an asset management policy been documented, authorised and communicated?	
49	Training, awareness and competence	How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies?	
50	Training, awareness and competence	How does the organization ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience?	
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	
59			

Question No.	Function	Question	Rating 0	1	2	3	4
	Asset Management System documentation	What documentation has the organisation established to describe the main elements of its asset management system and interactions between them?					
62	Information management	What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system?					
63	Information management	How does the organisation maintain its asset management information system(s) and ensure that the data held within it (them) is of the requisite quality and accuracy and is consistent?					
64	Information management	How has the organisation ensured its asset management information system is relevant to its needs?					
69	Risk management process(es)	How has the organisation documented process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle?					
79	Use and maintenence of asset risk information	How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs?					
82	Legal and other requirements	What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system?					
88	Life Cycle Activities	How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities?					
91	Life Cycle Activities	How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance?					
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?					
99	Investigation of asset-related failures, incidents and nonconformities	How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated?					
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?					
109	Corrective & Preventative action	How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance?					
113	Continual Improvement	How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle?					
115							

Question No.	Function	Question	Rating 0 1 2 3 4
	Continual Improvement	How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation?	
		OVERALL RATING	

Table 2-6 : Asset management maturity assessment ratings

At an overall level, Vector's asset management maturity compares well with generally accepted New Zealand asset management standards, and is considered sound, but with scope for further improvement. Two broad areas in particular have been identified where improvement in Vector's asset management could be achieved:

a. Formalising Processes and Documentation

Vector's asset management practices were developed over several decades and help to ensure a high-quality, safe gas supply to its customers. However, formal documentation relating to these practices is somewhat incomplete, or exists in varying formats and degrees of detail. There are also some gaps in documented asset management processes, and no formal, board-approved asset management policy is in place (traditionally it was considered appropriate for the board to sign off on the asset management policy as set out in the Asset Management Plan).

Vector is systematically reviewing and updating asset management documentation and processes. This includes better documentation, improved communication of formal asset management documentation and requirements, documenting the resource and training requirements for asset management and more formally measuring performance against asset management requirements. In addition, a formal asset management policy document is being developed which will be formally approved by the Vector board, and widely communicated to stakeholders.

b. Information Management

Vector owns a number of legacy information systems with data stretching back to early in the 20th century. Consolidating this into an effective, integrated data management system poses an ongoing challenge which Vector is actively addressing. Current improvement initiatives include upgrading the GIS system, consolidating asset performance information into the SAP plant maintenance system and developing asset management reporting systems that will extract information directly from verifiable source data – see section 7 for a discussion.

Associated data quality issues also pose some difficulties, as historical asset data is sometimes inaccurate or incomplete, and the extent of available asset performance information is not fully sufficient for modern asset management practices. Accordingly Vector has several initiatives underway to improve its asset data quality, including the systematic analysis of historical asset records and rectification of data anomalies; to develop processes to cross-check and validate field-information; and to expand the extent of asset performance information being collected in the field.

Vector's progress against the AMMAT will be measured in future AMPs – with the goal to achieve a "3" rating on the bulk of all measures by 2016.

2.14 Cross Reference to the Information Disclosure Requirements

As indicated earlier (section 2.3), one of the key purposes of this disclosure AMP was to also inform internal stakeholders on how Vector intends to manage its asset management activities. As such the order of presentation of this disclosure AMP is somewhat different from that presented in Attachment A of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015).

The following table provides a cross reference between the disclosure requirements and the sub-sections in this AMP.

ID Determination Attachment A	Commerce Commission Disclosure Contents Requirements	AMP Section
3	The AMP must include the following:	
3.1	A summary that provides a brief overview of the contents and highlights information that the *GDB* considers significant	Executive Summary
3.2	Details of the background and objectives of the *GDB*'s asset management and planning processes	2.1 and 2.3
3.3	A purpose statement which:	
	(a) Makes clear the purpose and status of the AMP in the GDB's asset management practices. The purpose statement must also include a statement of the objectives of the asset management and planning processes	2.1 and 2.3
	(b) States the corporate mission or vision as it relates to asset management	2.1 and 2.3
	(c) Identifies the documented plans produced as outputs of the annual business planning process adopted by the *GDB*	2.3 and 2.13
	(d) States how the different documented plans relate to one another, with particular reference to any plans specifically dealing with asset management	2.1, 2.3, 2.8 and 2.13
	(e) Includes a description of the interaction between the objectives of the AMP and other corporate goals, business planning processes, and plans *The purpose statement should be consistent with the GDB's vision and mission statements, and show a clear recognition of stakeholder interest*	2.1, 2.3, 2.8, 2.9, 2.10, 2.11, 2.12 and 2.13
3.4	Details of the AMP planning period, which must cover at least a projected period of 10 years commencing with the disclosure year following the date on which the AMP is disclosed *Good asset management practice recognises the greater accuracy of short-to-medium term planning, and will allow for this in the AMP. The asset management information planning information for the second 5 years of the AMP planning period need not be presented in the same detail as the first 5 years*	2.2
3.5	The date that it was approved by the directors	2.2
3.6	A description of each of the legislative requirements directly affecting management of the assets, and details of:	6.1
(a)	How the GDB meets the requirements; and	

ID Determination Attachment A		Commerce Commission Disclosure Contents Requirements	AMP Section
	(b)	The impact on asset management	
3.7		A description of stakeholder interests (owners, consumers etc) which identifies important stakeholders and indicates:	2.5 and 2.6
	(a)	How the interests of stakeholders are identified	2.5 and 2.6
	(b)	What these interests are	2.5 and 2.6
	(c)	How these interests are accommodated in asset management practices	2.5 and 2.6
	(d)	How conflicting interests are managed	2.5 and 2.6
3.8		A description of the accountabilities and responsibilities for asset management on at least 3 levels, including:	2,1, 2.7, 2.8, 2.9, 2.10 and 2.12
	(a)	Governance—a description of the extent of director approval required for key asset management decisions and the extent to which asset management outcomes are regularly reported to directors	2.1, 2.7, 2.8, 2.9 and 2.10
	(b)	Executive—an indication of how the in-house asset management and planning organisation is structured	2.1 and 2.7
	(c)	Field operations—an overview of how field operations are managed, including a description of the extent to which field work is undertaken in-house and the areas where outsourced contractors are used	2.1, 2.7, 2.9 and 1.12
3.9		All significant assumptions	2.3, 5.2, 5.4 and 9.3
	(a)	Quantified where possible	2.3, 5.2, 5.4 and 9.3
	(b)	Clearly identified in a manner that makes their significance understandable to interested persons, including	2.3, 5.2, 5.4 and 9.3
	(c)	A description of changes proposed where the information is not based on the GDB's existing business	n/a
	(d)	The sources of uncertainty and the potential effect of the uncertainty on the prospective information	5.2, 5.4 and 9.3
	(e)	The price inflator assumptions used to prepare the financial information disclosed in nominal New Zealand dollars in the Report on Forecast Capital Expenditure set out in Schedule 11a and the Report on Forecast Operational Expenditure set out in Schedule 11b	9.5

ID Determination Attachment A		Commerce Commission Disclosure Contents Requirements	AMP Section
3.10		A description of the factors that may lead to a material difference between the prospective information disclosed and the corresponding actual information recorded in future disclosures	5.2, 5.4 and 9.3
3.11		An overview of asset management strategy and delivery *To support the AMMAT disclosure and assist interested persons to assess the maturity of asset management strategy and delivery, the AMP should identify:* (a) How the asset management strategy is consistent with the GDB's other strategy and policies; (b) How the asset strategy takes into account the life cycle of the assets; (c) The link between the asset management strategy and the AMP; (d) Processes that ensure costs, risks and system performance will be effectively controlled when the AMP is implemented.	2.1, 2.3, 2.8, 2.9, 2.10 and 2.11
3.12		An overview of systems and information management data *To support the AMMAT disclosure and assist interested persons to assess the maturity of systems and information management, the AMP should describe:* (a) The processes used to identify asset management data requirements that cover the whole of life cycle of the assets; (b) The systems used to manage asset data and where the data is used, including an overview of the systems to record asset conditions and operation capacity and to monitor the performance of assets; (c) The systems and controls to ensure the quality and accuracy of asset management information; and (d) The extent to which the systems, processes and controls are integrated	7, 7.1, 7.2 and 7.3, 7.5 and 7.6
3.13		A statement covering any limitations in the availability or completeness of asset management data and disclose any initiatives intended to improve the quality of this data *Discussion of the limitations of asset management data is intended to enhance the transparency of the AMP and identify gaps in the asset management system*	7.5 and 7.6
3.14		A description of the processes used within the *GDB* for:	
	(a)	Managing routine asset inspections and network maintenance	6.2
	(b)	Planning and implementing network development projects	5.1, 5.2 and 5.3

ID Determination Attachment A	Commerce Commission Disclosure Contents Requirements	AMP Section
(c)	Measuring network performance	4.7
3.15	An overview of asset management documentation, controls and review processes *To support the AMMAT disclosure and assist interested persons to assess the maturity of asset management documentation, controls and review processes, the AMP should:* *(a) Identify the documentation that describes the key components of the asset management system and the links between the key components;* *(b) Describe the processes developed around documentation, control and review of key components of the asset management system;* *(c) Where the GDB outsources components of the asset management system, the processes and controls that the GDB uses to ensure efficient and cost effective delivery of its asset management strategy;* *(d) Where the GDB outsources components of the asset management system, the systems it uses to retain core asset knowledge in-house; and* *(e) Audit or review procedures undertaken in respect of the asset management system*	7
3.16	An overview of communication and participation processes *To support the AMMAT disclosure and assist interested persons to assess the maturity of asset management documentation, controls and review processes, the AMP should:* *(a) Communicate asset management strategies, objectives, policies and plans to stakeholders involved in the delivery of the asset management requirements, including contractors and consultants; and* *(b) Demonstrate staff engagement in the efficient and cost effective delivery of the asset management requirements*	2.5 and 2.6
3.17	The AMP must present all financial values in constant price New Zealand dollars *except where specified otherwise*	9
3.18	The AMP must be structured and presented in a way that the *GDB* considers will support the purposes of AMP disclosure set out in clause 2.6.2 of the determination	
	Assets covered	
4	The AMP must provide details of the assets covered, including:	
4.1	A map and high-level description of the areas covered by the GDB, including the region(s) covered	3.1

ID Determination Attachment A		Commerce Commission Disclosure Contents Requirements	AMP Section
4.2		A description of the network configuration, including: *if sub-networks exist, the network configuration information should be disclosed for each sub-network*	3.3, 3.6, 3.7 and 5.19
	(a)	A map or maps, with any cross-referenced information contained in an accompanying schedule, showing the physical location of: (i) All main pipes, distinguished by operating pressure (ii) All ICPs that have a significant impact on network operations or asset management priorities, and a description of that impact (iii) All gate stations (iv) All pressure regulation stations	3.2 and 3.9
	(b)	If applicable, the locations where a significant change has occurred since the previous disclosure of the information referred to in sub clause 4.2(a) above, including- (i) A description of the parts of the network that are affected by the change (ii) A description of the nature of the change	n/a
		Service Levels	
5		The AMP must describe the network assets by providing the following information for each asset category:	6.3
5.1		Pressure	6.3
5.2		Description and quantity of assets	6.3
5.3		Age profiles	6.3
5.4		A discussion of the results of formal risk assessments of the assets, further broken down by subcategory as appropriate. Systemic issues leading to the premature replacement of assets or parts of assets should be discussed.	6.3
6.		The asset categories discussed in clause 5 above should include at least the following:	6.3
6.1		Main pipe	6.3
6.2		Service pipe	6.3

ID Determination Attachment A	Commerce Commission Disclosure Contents Requirements	AMP Section
6.3	Stations	6.3
6.4	Line valve	6.3
6.5	Special crossings	6.3
6.6	Monitoring and control systems	6.3
6.7	Cathodic protection systems	6.3
6.8	Assets owned by the GDB but installed at gate stations owned by others.	6.3
7.	The AMP must clearly identify or define a set of performance indicators for which annual performance targets have been defined. The annual performance targets must be consistent with business strategies and asset management objectives and be provided for each year of the AMP planning period. The targets should reflect what is practically achievable given the current network configuration, condition and planned expenditure levels. The targets should be disclosed for each year of the AMP planning period	4.1
8.	Performance indicators for which targets are defined in clause 7 above must include—	
8.1	The DPP requirements required under the price quality path determination applying to the regulatory assessment period in which the next disclosure year falls	4.1
8.2	Consumer oriented indicators that preferably differentiate between different consumer types	4.1
8.3	Indicators of asset performance, asset efficiency and effectiveness, and service efficiency, such as technical and financial performance indicators related to the efficiency of asset utilisation and operation	4.4, 4.5 and 4.6
8.4	The performance indicators disclosed in Schedule 10b of the determination	4.1 and 4.4
9.	The AMP must describe the basis on which the target level for each performance indicator was determined. Justification for target levels of service includes consumer expectations or demands, legislative, regulatory, and other stakeholders' requirements or considerations. The AMP should demonstrate how stakeholder needs were ascertained and translated into service level targets	4.1, 4.2, 4.3 and 4.4
10.	Targets should be compared to historic values where available to provide context and scale to the reader	4.1, 4.2, 4.3 and 4.4

ID Determination Attachment A		Commerce Commission Disclosure Contents Requirements	AMP Section
11		Where forecast expenditure is expected to materially affect performance against a target defined in clause 7 above, the target should be consistent with the expected change in the level of performance *Performance against target must be monitored for disclosure in the Evaluation of Performance section of each subsequent AMP*	n/a
		Network Development Planning	
12.		AMPs must provide a detailed description of network development plans, including—	
12.1		A description of the planning criteria and assumptions for network development;	5.2, 5.3, 5.4 and 5.6
12.2		Planning criteria for network developments should be described logically and succinctly. Where probabilistic or scenario-based planning techniques are used, this should be indicated and the methodology briefly described;	5.2 and 5.4
12.3		The use of standardised designs may lead to improved cost efficiencies. This section should discuss:	3.8
	(a)	The categories of assets and designs that are standardised; and	
	(b)	The approach used to identify standard designs	
12.4		A description of the criteria used to determine the capacity of equipment for different types of assets or different parts of the network *The criteria described should relate to the GDB's philosophy in managing planning risks*	5.3
12.5		A description of the process and criteria used to prioritise network development projects and how these processes and criteria align with the overall corporate goals and vision	9.4
12.6		Details of demand forecasts, the basis on which they are derived, and the specific network locations where constraints are expected due to forecast increases in demand:	
	(a)	Explain the load forecasting methodology and indicate all the factors used in preparing the load estimates;	5.4
	(b)	Provide separate forecasts to at least system level covering at least a minimum five year forecast period. Discuss how uncertain but substantial individual projects/developments that affect load are taken into account in the forecasts, making clear the extent to which these uncertain increases in demand are reflected in the forecasts;	5.4, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14 and 5.15

ID Determination Attachment A		Commerce Commission Disclosure Contents Requirements	AMP Section
	(c)	Identify any network or equipment constraints that may arise due to the anticipated growth in demand during the AMP planning period *The AMP should include a description of the methodology and assumptions used to produce the utilisation and capacity forecasts and a discussion of the limitations of the forecasts, methodology and assumptions. The AMP should also discuss any capacity limitations identified or resolved in years during which an AMP was not disclosed*	5.4, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14 and 5.15
12.7		Analysis of the significant network level development options identified and details of the decisions made to satisfy and meet target levels of service, including:	5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15 and 5.16
	(a)	The reasons for choosing a selected option for projects where decisions have been made;	
	(b)	Alternative options considered for projects that are planned to start in the next five years; and	
	(c)	Consideration of planned innovations that improve efficiencies within the network, such as improved utilisation, extended asset lives, and deferred investment	
12.8		A description and identification of the network development programme and actions to be taken, including associated expenditure projections. The network development plan must include:	5.16
	(a)	A detailed description of the material projects and a summary description of the non-material projects currently underway or planned to start within the next 12 months;	5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15 and 5.16
	(b)	A summary description of the programmes and projects planned for the following four years (where known); and	5.16, 5.17 and 5.18
	(c)	An overview of the material projects being considered for the remainder of the AMP planning period *For projects included in the AMP where decisions have been made, the reasons for choosing the selected option should be stated which should include how target levels of service will be impacted. For other projects planned to start in the next five years, alternative options should be discussed*	5.16 and 5.20
		Lifecycle Asset Management Planning (Maintenance and Renewal)	
13		The AMP must provide a detailed description of the lifecycle asset management processes, including—	6.1 and 6.2
13.1		The key drivers for maintenance planning and assumptions;	6.1 and 6.2

ID Determination Attachment A		Commerce Commission Disclosure Contents Requirements	AMP Section
13.2		Identification of routine and corrective maintenance and inspection policies and programmes and actions to be taken for each asset category, including associated expenditure projections. This must include:	6.3
	(a)	The approach to inspecting and maintaining each category of assets, including a description of the types of inspections, tests and condition monitoring carried out and the intervals at which this is done;	6.3
	(b)	Any systemic problems identified with any particular asset types and the proposed actions to address these problems; and	6.3
	(c)	Budgets for maintenance activities broken down by asset category for the AMP planning period	6.2
13.3		Identification of asset replacement and renewal policies and programmes and actions to be taken for each asset category, including associated expenditure projections. This must include:	6.2, 6.3 and 6.4
	(a)	The processes used to decide when and whether an asset is replaced or refurbished, including a description of the factors on which decisions are based, and consideration of future demands on the network and the optimum use of existing network assets;	
	(b)	A description of innovations that have deferred asset replacements;	
	(c)	A description of the projects currently underway or planned for the next 12 months;	
	(d)	A summary of the projects planned for the following four years (where known); and	
	(e)	An overview of other work being considered for the remainder of the AMP planning period	
13.4		The asset categories discussed in subclasses 13.2 and 13.3 above should include at least the categories in sub clause 6 above	
		Non-Network Development, Maintenance and Renewal	
14		AMPs must provide a summary description of material non-network development, maintenance and renewal plans, including—	7.1 and 7.2
14.1		A description of non-network assets;	7.2

ID Determination Attachment A	Commerce Commission Disclosure Contents Requirements	AMP Section
14.2	Development, maintenance and renewal policies that cover them;	7.4
14.3	A description of material capital expenditure projects (where known) planned for the next five years;	7.4
14.4	A description of material maintenance and renewal projects planned (where known) for the next five years	n/a
	Risk Management	
15	AMPs must provide details of risk policies, assessment, and mitigation, including—	8
15.1	Methods, details and conclusions of risk analysis;	8.2, 5 and 6
15.2	Strategies used to identify areas of the network that are vulnerable to high impact low probability events and a description of the resilience of the network and asset management systems to such events;	5 and 6
15.3	A description of the policies to mitigate or manage the risks of events identified in sub clause 15.2 above; and	8.2
15.4	Details of emergency response and contingency plans *Asset risk management forms a component of a GDB's overall risk management plan or policy, focusing on the risks to assets and maintaining service levels. AMPs should demonstrate how the GDB identifies and assesses asset related risks and describe the main risks within the network. The focus should be on credible low-probability, high-impact risks. Risk evaluation may highlight the need for specific development projects or maintenance programmes. Where this is the case, the resulting projects or actions should be discussed, linking back to the development plan or maintenance programme*	8.4
	Evaluation of performance	
16	AMPs must provide details of performance measurement, evaluation, and improvement, including—	
16.1	A review of progress against plan, both physical and financial; (a) Referring to the most recent disclosures made under sub clause 2.5.1 of the determination, discussing any significant differences and highlighting reasons for substantial variances; (b) Commenting on the progress of development projects against that planned in the previous AMP and provide reasons for substantial variances along with any significant construction or other problems experienced; and (c) Commenting on progress against maintenance initiatives and programmes and discuss the effectiveness of these programmes noted	5, 6 and 9

ID Determination Attachment A	Commerce Commission Disclosure Contents Requirements	AMP Section
16.2	An evaluation and comparison of actual service level performance against targeted performance (a) In particular, comparing the actual and target service level performance for all the targets discussed in the previous AMP under clause 7 above and explain any significant variances	4
16.3	An evaluation and comparison of the results of the asset management maturity assessment disclosed in the Report on Asset Management Maturity set out in Schedule 13 against relevant objectives of the GDB's asset management and planning processes	2.13
16.4	An analysis of gaps identified in sub-clauses 16.2 and 16.3 above. Where significant gaps exist (not caused by one-off factors), the AMP must describe any planned initiatives to address the situation	2.13 and 4
	Capability to Deliver	
17	AMPs must describe the processes used by the GDB to ensure that:	
17.1	The AMP is realistic and the objectives set out in the plan can be achieved	2.8
17.2	The organisation structure and the processes for authorisation and business capabilities will support the implementation of the AMP plans.	2.7, 2.8, 2.9 and 2.12

Table 2-7 : Cross reference between the sub-sections in this AMP and the disclosure requirements referenced in Attachment A of Commerce Commission Decision No. [2015] NZCC 7 - 2015 Amendment to the Gas Distribution Information Disclosure Determination 2012 dated 24 March 2015

Clause 2.6.1 of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) requires Vector to include the following information schedules in this Asset Management Plan:

Information Disclosure Schedule	Title	AMP Appendix
Schedule 11a	Report on Forecast Capital Expenditure	Appendix 1
Schedule 11b	Report on Forecast Operational Expenditure	Appendix 2
Schedule 12a	Report on Asset Condition	Appendix 3

Information Disclosure Schedule	Title	AMP Appendix
Schedule 12b	Report on Forecast Utilisation	Appendix 4
Schedule 12c	Report on Forecast Demand	Appendix 5
Schedule 13	Report on Asset Management Maturity Assessment	Appendix 6

Table 2-8 : Commerce Commission Information Disclosure Schedules included in the AMP

Gas Distribution
Asset Management Plan
2015 – 2025

Assets Covered by this Plan– Section 3

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3 Assets Covered by this Plan

3.1 Distribution Area

Vector's natural gas distribution network assets are the product of the progressive amalgamation, merger and acquisition of a number of private and public gas utilities, a process that has occurred over the last hundred years.

In 2002, Vector acquired UnitedNetworks. Under this arrangement the gas network assets located in Wellington, Palmerston North and Hawkes Bay were sold to Powerco, and Vector retained the natural gas distribution network assets in Auckland.

During 2004/2005, Vector acquired a 66.05% stake in NGC Holdings Ltd from Australian Gas Light (AGL). After listing on the New Zealand Stock Exchange in the same year, Vector successfully acquired the remaining shares in NGC. This acquisition increased Vector's gas distribution network and transmission asset base to supply gas to over 30 towns and cities across the North Island. The map in Figure 3-1 shows the extent of Vector's gas distribution network supply areas.

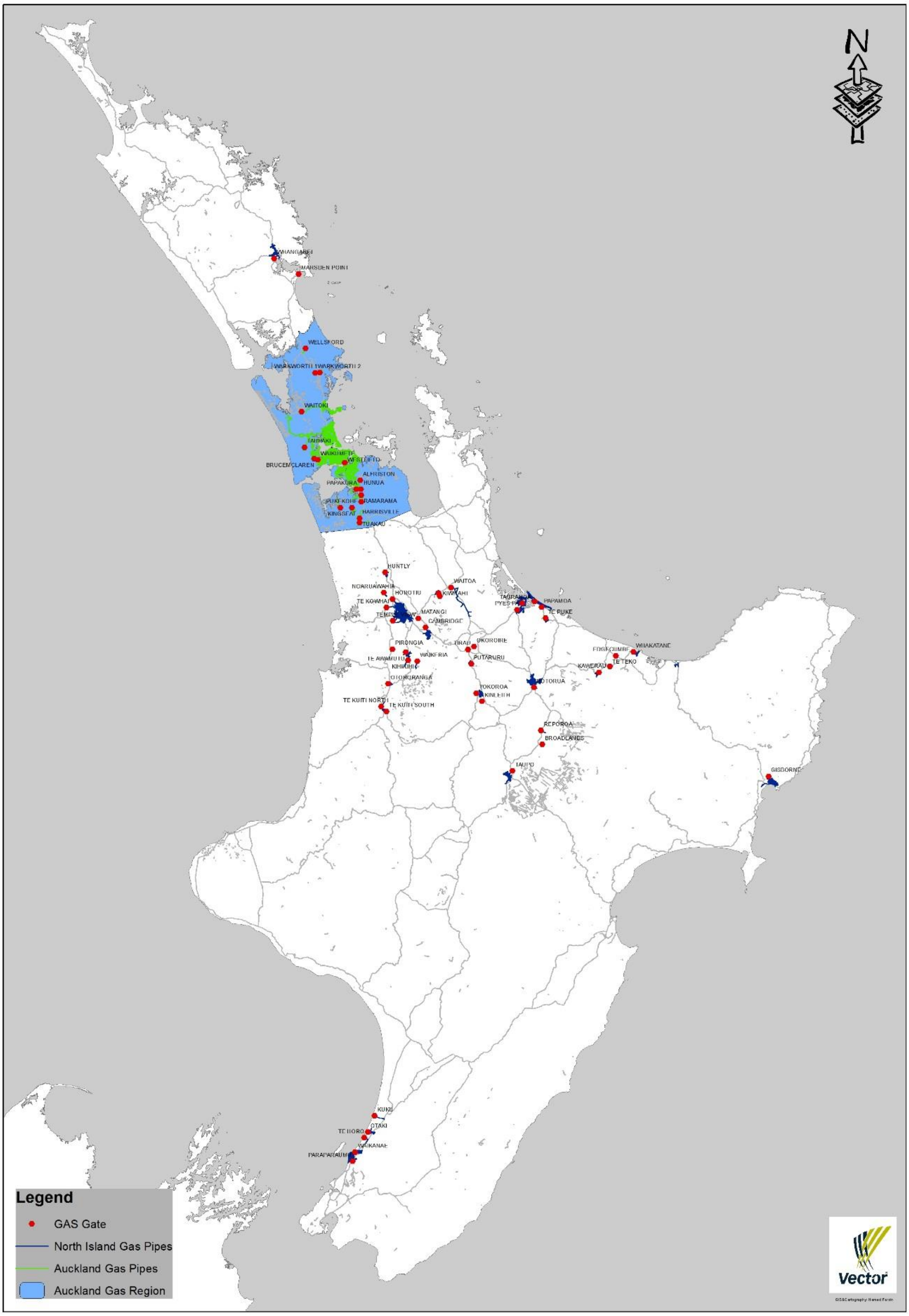

Figure 3-1 : Vector's gas distribution network supply areas

3.2 Major Customer Sites on the Vector Network

Vector has a number of large customer sites at various locations in its network. The following are those customer sites with individual energy demand above 200TJ and which hence have a significant impact on network operations and asset management (collectively they represent approximately 22% and 23% of energy usage and gas demand on the network, respectively):

- ACI Operations
- BOPE Cogeneration Plant
- Whakatane Mill
- CHH Tasman Mill
- BlueScope and Fletcher Steel
- Wallace Corporation
- Reporoa Dairy Factory
- Morrinsville Dairy Factory
- Hautapu Dairy Factory
- NZ Sugar Co Limited
- SCA Hygiene
- Winstone Wallboards Limited
- Yashili

3.3 Key Features

A comparison of the key features of the gas distribution network for 2014 and 2013 is presented below (as at 30 June):

Description	Auckland Region			North Island Region			Total		
	2014	2013	Change	2014	2013	Change	2014	2013	Change
Consumers connected[1] (no.)	94,821	92,843	2.1%	64,917	64,109	1.3%	159,738	156,952	1.8%
System length[2] (km)	5,795	5,713	1.4%	4,827	4,766	1.3%	10,623	10,479	1.4%
Consumer density (consumer/km)	16	16	0.7%	13	13	0.0%	15	15	0%
Gate stations[3]	11	11	0.0%	53	54	-1.9%	64	65	-2%
District regulating stations[4] (DRS)	311	353	-11.9%	135	137	-1.5%	446	490	-9%
DRS density (system km/DRS)	19	16	15.1%	36	35	2.8%	24	21	11%

[1] Source: Information Disclosure 2014 (http://vector.co.nz/disclosures/gas-financial-and-network-information)

[2] Source: Vector's Geographic Information System (GIS) as at 30 June. Includes mains and service pipe lengths

[3] Source: Vector's GIS as at 30 June.

[4] ibid, footnote 3. Includes Vector's district regulating stations and street regulators as described in section 3.7.2

Description	Auckland Region			North Island Region			Total		
	2014	2013	Change	2014	2013	Change	2014	2013	Change
DRS utilisation (consumers/DRS)	305	263	15.9%	481	468	2.8%	358	320	12%
Peak load[5] (scmh)	80,490	75,407	6.7%	69,995	67,354	3.9%	150,486	142,761	5.4%
Gas conveyed[6] (PJ pa)	12.2	12.1	0.5%	9.7	9.4	3.0%	21.9	21.6	1.6%

Table 3-1: Key features of Vector's gas distribution networks

3.4 Load Characteristics

The capacity of an individual pipeline is determined by the operating pressure, the diameter and the allowable pressure difference between inlet and outlet. Meshed distribution networks work on the same principle with the difference that pipelines are interconnected at several points and that such distribution networks can be fed at multiple points.

As the distribution networks expand and demand grows, certain parts of the networks, in particular feeder mains, can develop large pressure drops that constrain delivery in downstream parts of the distribution systems. Each year, Vector prepares network pressure monitoring surveys and carries out distribution network analysis to identify any constraints and to reinforce networks to ensure operating pressures do not become insufficient.

Regulator stations have nominal outlet pressures which supply each discrete pressure system on the distribution network. System pressures in the network drop in accordance with demand and the supply pressure. Under the normal network operating arrangement, Vector's Quality of Supply standard stipulates the pressure at any point on the network shall be no less than 50% of its nominal pressure and no more than 10% above its maximum operating pressure. Further details of Vector's Quality of Supply standard can be found in Section 5.

Pressure drops on each pressure system need to be considered separately, due to the meshed nature of the network and the different characteristics, i.e. mix of residential, commercial and industrial customers, each system exhibits.

Vector uses individual system pressure profiles to illustrate the load characteristics of each network. These are based on system pressure data that Vector collects as part of its system pressure monitoring programme and an understanding of the relationship between pressure and flow.

The typical daily winter[7] pressure profile for residential loads and load profile for commercial/industrial customers are illustrated in Figure 3-2 and Figure 3-3. Residential load typically has two peaks whereas the commercial and industrial load is more consistent for the whole day.

[5] Calculated by adding the coincident load of each network system for a calendar year. Measured as standard cubic metres per hour (scmh)

[6] ibid, footnote 1

[7] The greatest demand on the gas distribution networks occurs during winter

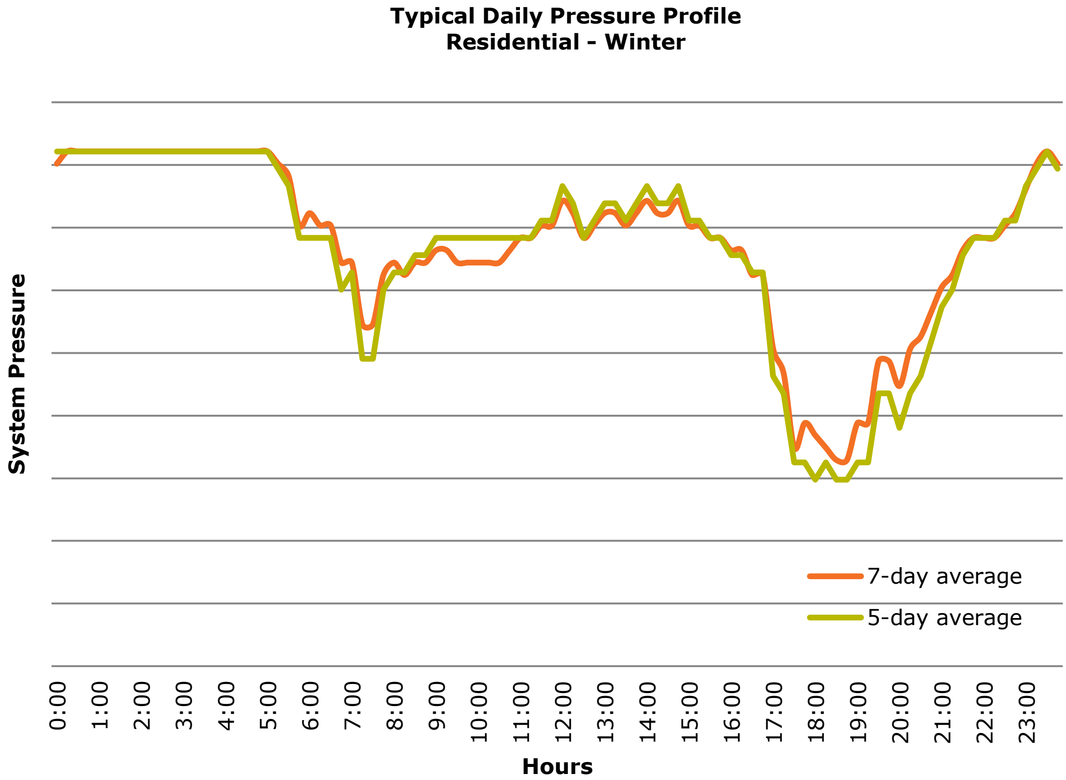

Figure 3-2 : Typical winter system pressure profile for residential customers

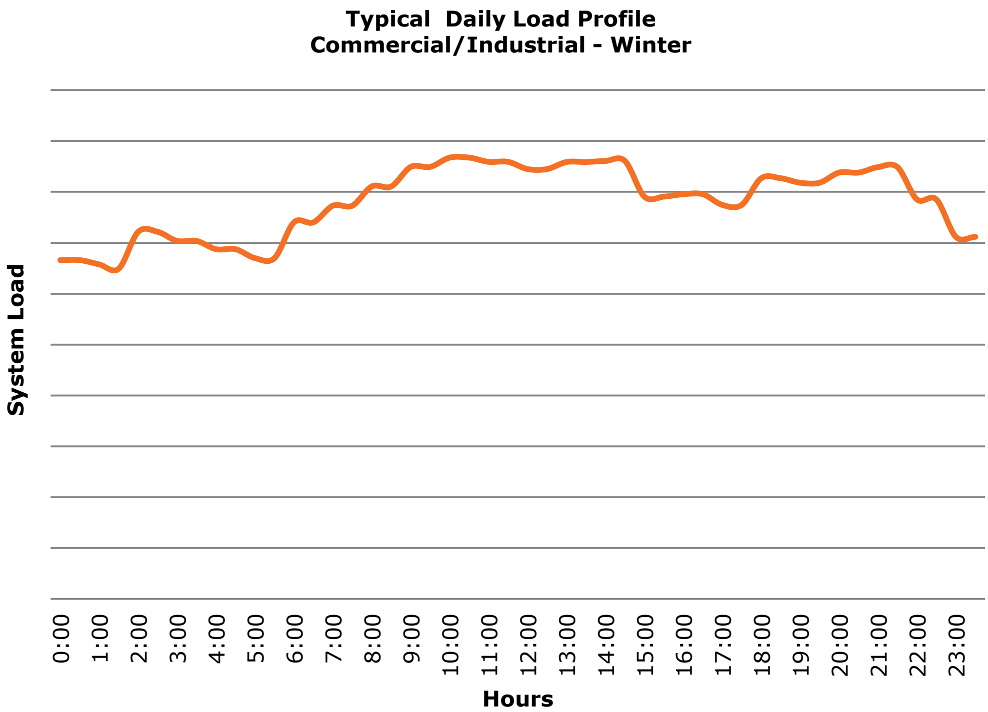

Figure 3-3 : Typical winter load profile for commercial and industrial customers

Demand curves for specific industrial consumers are far more variable – conforming closely to the nature of the customer's business. A typical industrial load curve is therefore not a meaningful concept.

A measure of load diversity is achieved with residential customers providing peaks in the morning and early evening, with the commercial and industrial load filling in the trough between these peaks. The mix of customer types within a distribution network, and their location, influences the size and duration of the peaks.

3.4.1 Peak Demand and Energy Delivered

Historical trends show gas demand (and sales volume) is primarily influenced by economic activities in an area, price and availability of substitute fuels (e.g. electricity, fuel oil etc.), marketing effort, population / household growth, socio-economic factors, climate, and the investment decisions made by large industrial and commercial gas consumers. In the short-term, gas demand is very sensitive to climatic conditions. A cold snap, for example, could drive up the demand for gas significantly. Conversely, a warm winter could result in a materially lower demand. Hence on a year–by-year basis, demand can vary significantly.

Historical information, after normalising for year-on-year variances, shows a reasonably steady demand trend. The exceptionally high peak demand hours occur due to extreme weather conditions and normally represent only a small percentage of hours in a year.

The peak demand[8] on the gas distribution network and the gas conveyed[9] for the past three years is listed in Table 3-2 (the individual demand forecasts for all gate stations on Vector's network are detailed in Section 5) and Table 3-3, respectively[10].

Year	Auckland Region		North Island Region		Total	
	scmh	% change	scmh	% change	scmh	% change
2008/09	77,251	-	76,261	-	153,512	-
2009/10	74,066	-4.1%	66,985	-12.2%	141,051	-8.1%
2010/11	81,769	10.4%	69,241	3.4%	151,010	7.1%
2011/12	75,318	-7.9%	68,302	-1.4%	143,620	-4.9%
2012/13	75,407	0.1%	67,354	-1.4%	142,761	-0.6%
2013/14	80,490	6.7%	69,995	3.9%	150,486	5.4%

Table 3-2: Peak hour demand delivered on the gas distribution network

The values reported above are the coincidental peak demands of all gate stations delivering supply to Vector's gas distribution networks.

[8] The peak demand is calculated by adding the peak load of each network system for a calendar year. Where a network system comprises of more than one gate station or a gate station supplies to more than one network system, the coincident peak load is used.

[9] ibid, footnote 1

[10] The reasons for the variability between the energy delivered and the peak hour demand trends are complex and analysis of this is ongoing. Changes in weather patterns or the timing of gas usage of large industrial consumers has a considerable influence on overall peak gas demand, which partially explains the inconsistent relationship between the annual energy delivered and the total peak hour demand.

Year	Auckland Region		North Island Region		Total	
	PJ	% change	PJ	% change	PJ	% change
2008/09	11.9	-	9.7		21.6	-
2009/10	11.7	-1.7%	9.5	-2.1%	21.2	-1.9%
2010/11	11.8	0.9%	9.3	-2.1%	21.1	-0.5%
2011/12	12.4	5.1%	9.6	3.2%	22.0	4.3%
2012/13	12.1	-2.0%	9.4	-1.7%	21.6	-1.9%
2013/14	12.2	0.5%	9.7	3.0%	21.9	1.6%

Table 3-3: Energy delivered on the gas distribution network

3.5 Distribution System Design

Vector's gas distribution networks are generally relatively young (built in the late 1980s onwards) and are mostly constructed of modern steel and polyethylene materials, operating at significantly higher pressures than the original network. Standard operating pressures within the Intermediate Pressure (IP) and Medium Pressure (MP) bands are however not consistent between the individual networks - a legacy of the different operating standards applied by the previous owners of the separate gas networks; with older parts of the networks having to operate at significantly lower pressures than the new parts. (Vector intends to rationalise/standardise the design and operating pressure ranges in accordance with future planned improvement programmes.)

3.6 Network Configuration

Vector takes bulk gas supply from the High Pressure (HP) transmission systems operating across the North Island. The transmission systems operate at pressures ranging between approximately 50 and 80 bar and typically deliver gas to Vector's distribution systems at IP20, IP10, MP7 and MP4 pressure level (20 bar down to 4 bar).

The IP and higher pressure MP systems tend to be radial in design, whereas the design of the majority of MP and Low Pressure (LP) systems tends to be of a mesh nature, providing back-feed security to large numbers of residential and commercial loads. MP and LP systems are often supplied from multiple district regulator stations (DRSs) thereby further increasing the security of supply.

The overall current architecture of the Vector gas distribution network is shown in Figure 3-4.

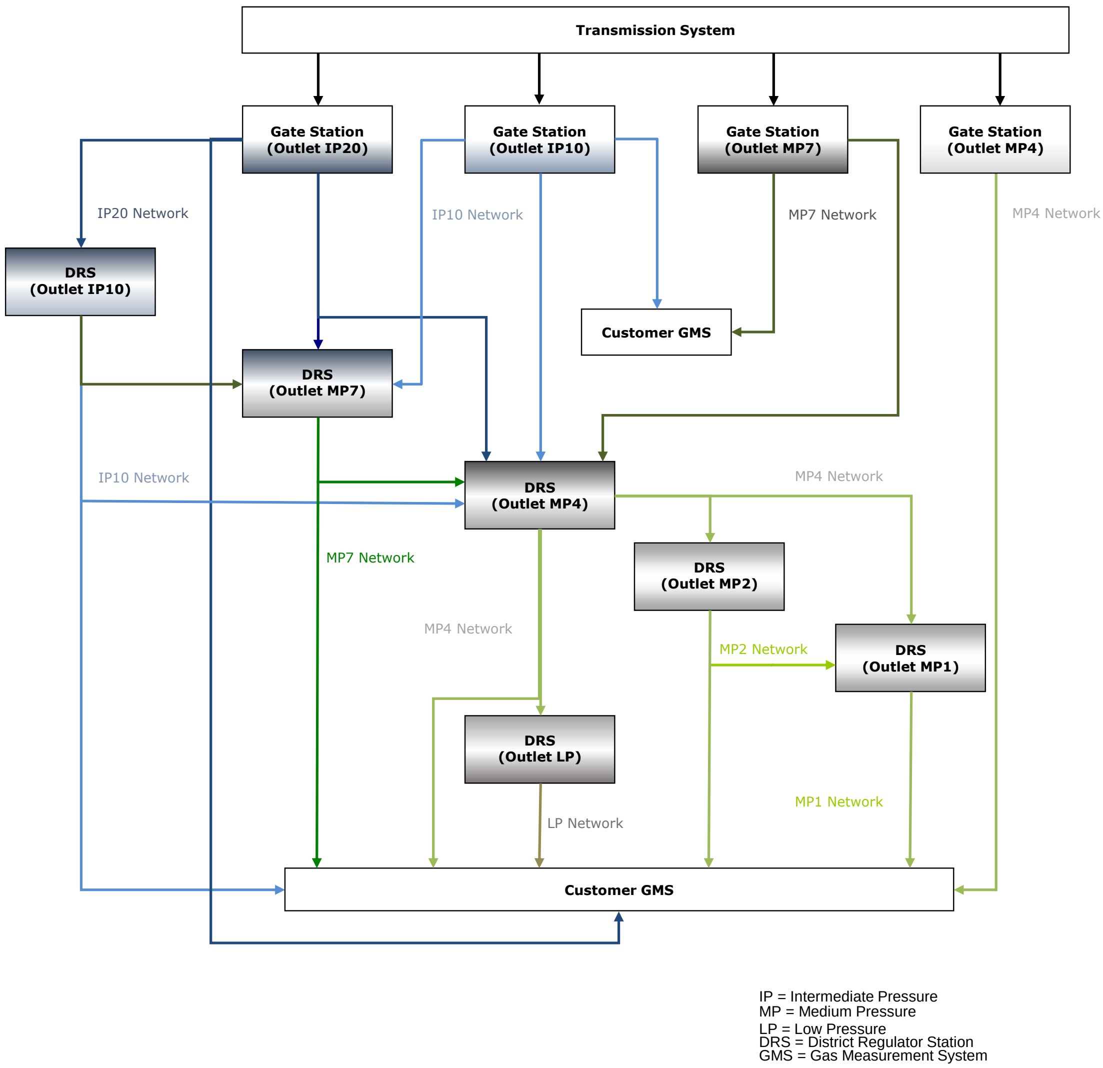

Figure 3-4 : Schematic of Vector's gas distribution network

3.7 Distribution Systems

Distribution networks extend from the outlet valve of the transmission gate station to the inlet valve on a consumer gas measurement system (GMS). Distribution networks broadly contain the following five main categories of assets:

- Distribution pipelines;
- Pressure stations;
- Valves;
- Corrosion protection equipment;
- Telenet/SCADA equipment; and
- Special crossings.

3.7.1 Distribution Pipelines

Vector's distribution networks generally comprise HP, IP, MP and LP systems. Table 3-4 shows the eight pressure levels used by Vector to categorise the gas distribution networks:

Pressure Level	Auckland Region		North Island Region		Total	
	Length (km)	% of Total Network	Length (km)	% of Total Network	Length (km)	% of Total Network
High Pressure (>2,000kPa)	24	0.4%	0	0.0%	24	0.2%
Intermediate Pressure 20 (1,000-2,000kPa)	136	2.3%	101	2.1%	237	2.2%
Intermediate Pressure 10 (700-1,000kPa)	56	1.0%	94	1.9%	150	1.4%
Medium Pressure 7 (420-700kPa)	57	1.0%	32	0.7%	89	0.8%
Medium Pressure 4 (210-420kPa)	5,383	92.9%	4,417	91.5%	9,800	92.3%
Medium Pressure 2 (110-210kPa)	62	1.1%	24	0.5%	86	0.8%
Medium Pressure 1 (7 - 110kPa)	71	1.2%	73	1.5%	144	1.4%
Low Pressure (0 - 7kPa)	6	0.1%	86	1.8%	93	0.9%

Table 3-4: Pressure levels and corresponding asset length[11]

Vector's bulk gas distribution assets are operated in the IP range of 700 to 2,000kPa. The selection of these pressures has, in the majority of cases, historically been justified on an economic basis (consideration of gas volumes, transmission distances, delivery pressures etc). The IP systems are all constructed to a high technical standard of welded steel with all of them being protected against corrosion by Cathodic Protection (CP), using either a system of sacrificial anodes or an impressed current installation.

The IP systems are generally the principal "backbone" systems of the distribution networks with laterals radiating from them to supply adjacent areas. The distribution assets which are used to directly supply gas consumers are constructed mostly of polyethylene and work in the MP range.

LP systems typically operate between 2kPa and 7kPa and represent the oldest parts of the distribution system, supplying residential and small commercial loads. LP systems typically consist of cast iron mains pipelines. (Note: These are progressively being replaced.)

Vector's gas distribution network includes a high pressure system which is integrated into the gas distribution network. The pipeline is a 200mm steel pipeline running from the Henderson Gate Station (North West of Auckland) to Albany on Auckland's North Shore. The pipeline was constructed and is maintained to high pressure standards, and is rated to operate at 4,600kPa, but is currently only operating at 1,900kPa. The higher design pressure was selected to enable the operating pressure to be increased in the future.

Service connections provide the link between the gas mains in the street and the customer's gas meter and are comprised of a service pipe, riser and a meter valve. The outlet connection of the meter valve designates the end of Vector's distribution system. A service regulator is normally fitted downstream of the meter tap to regulate the gas pressure to the consumer meter-set and to downstream appliances / plant (in these cases the regulator is owned by retailers or Gas Measurement System (GMS) owners).

[11] Source: Vector's GIS as at 30 June 2014. Includes mains and service pipe lengths.

3.7.2 Pressure Stations

Pressure stations are those parts of a gas system that link two pressure levels in gas networks through pressure regulators. They are the points of input to a pressure level. Vector has three categories of pressure stations: gate stations, district regulating stations and service regulators.

3.7.2.1 Gate Stations

Where the pressure station is the link between the gas transmission system and a gas distribution network, it is known as a gate station[12]. High pressure equipment (i.e. pressure regulating equipment and custody transfer metering etc) within the gate station is operated by Vector Transmission[13], whereas distribution system equipment (i.e. check metering (where installed) and associated valves and pipework etc) within the gate station is operated as part of Vector's distribution networks.

3.7.2.2 District Regulating Stations

Where the pressure station is the link between two Vector gas pressure networks it is known as a District Regulating Station (DRS). DRSs are used to reduce the operating pressure from higher operating pressure systems to systems with lower operating pressures.

DRSs are strategically located within the distribution network such that a continuous and safe gas supply of gas is delivered to the maximum number of customers. They are primarily used to reduce the higher pressures associated with 'high volume' mains, (i.e. those with an operating pressure of 1,900kPa, 1,000kPa and 700kPa), down to a more economical distribution pressure level of between 200kPa and 420kPa. They are also used to provide a controlled pressure into the low pressure networks. In this case the DRS may be sited to use an IP or MP system as its source, depending upon which is geographically available.

Generally a DRS converts significant volumes of gas from one pressure to another and they are the source of supply to a significant number of consumers. The importance of DRSs in the supply networks means duplicate assets are often provided in order to deliver a reasonable level of security. This duplication also enables maintenance to take place without a loss of supply to customers.

The lower operating pressures provided by the DRS assets allow modern technology and materials to be used to provide a safe, assured and economical gas supply to the areas where customers are situated.

3.7.2.3 Service Regulators

A service regulator is used to regulate the flow of gas (reduce the pressure) to individual customer premises and is typically installed as part of the gas measurement system.

Where for practical reasons a service regulator cannot be installed immediately adjacent the gas meter (i.e. as part of the GMS) it is installed at a location upstream from the GMS and owned and maintained by Vector.

3.7.3 Valves

Distribution system valves are comprised of in-line mains and service valves (to isolate the flow of gas within the system) and blow down valves (to depressurise sections of the system in the event of an emergency). Valve types currently in use include ball valves, plug valves, gate valves and a relatively small number of other valve types.

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[12] An alternative name for a gate station is delivery point.

[13] Vector Transmission is the gas high pressure pipeline operator.

3.7.4 Corrosion Protection Equipment

Below ground steel plant is protected against corrosion by the provision of protective coatings (e.g. high density polyethylene) and the application of impressed current or sacrificial anode Cathodic Protection (CP) systems. Protective coatings are inspected whenever underground plant is exposed. CP test points are monitored on a periodic basis and maintained to ensure that the levels of protection being provided to the underground plant are kept within prescribed maximum and minimum levels.

Above ground steel or metallic plant is protected against corrosion by the provision of paint or other suitable protective coating e.g. wrapping. Periodic inspections are carried out to monitor the condition of protective coatings.

3.7.5 Telemetry Systems

The telemetry systems used by Vector to monitor its gas distribution networks comprise the Telenet Supervisory Control and Data Acquisition (SCADA) system, and the Cello system. The Telenet SCADA system is currently deployed in Auckland and the Cello system is used on other regional networks.

Access to Telenet data is provided via the PI archiving system, and access to the Cello data is provided via a proprietary PMAC database.

The telemetry systems provide remote monitoring and alarming of critical inlet/outlet pressures, temperatures and flow rates, and corrected and uncorrected metering data. The telemetry monitors data at gate stations, DRSs and major gas customer sites, and also provides remote control facilities for the operation of the IP20 valves located at either end of the Auckland Harbour Bridge.

3.7.6 Special Crossings

Special crossings are locations where a section of pipeline is installed above ground in order to cross over a roadway, river or railway etc. The above ground crossing enables the gas distribution pipeline route to negotiate obstacles presented by the presence of a roadway, river or railway etc where a below ground crossing is not practical.

3.8 Justification of Assets

Network assets are created for a number of reasons. While asset investment is often the most effective and convenient means of addressing network issues, Vector also considers other solutions to network issues and applies these where practical and economic. Such alternatives may include network reconfiguration, asset maintenance, or adopting non-network solutions such as adjusting gate station and DRS pressure regulator set points or entering into load management arrangements with customers.

The key factors leading to asset investment at Vector are:

- Health and safety: Where health and safety concerns indicate the need for asset investment, this takes priority;
- New developments: Where new building or urban developments occur, or existing developments are extended, this usually requires investment in network assets;
- Legal and regulatory compliance: Ensuring Vector is not in breach of statutory obligations of a gas distributor or regulatory requirements such as satisfying the gas quality and pressure specifications;
- Capacity: Maintaining sufficient network capacity to supply the needs of consumers is a key driver for asset investment;

- Vector's technical standards: Vector is committed to meeting its Quality of Supply standard (refer Section 5 for details), and any potential breaches of these often indicate a need for asset investment;
- Customer requirements: Assets are often installed at the request of customers (who then contribute to the investment cost) for example to provide higher security of supply levels;
- Replacement: Assets are usually replaced before they have deteriorated to the extent that they pose a safety or reliability risk, or when they have reached the end of their useful lives (where maintenance starts to be more expensive than replacing an asset); and
- Obsolete Assets: When assets become obsolete and can no longer fulfil the basic requirements of a modern, effective network, this will lead to replacement.

Vector's network investment is that of a prudent network company, meeting realistic network growth requirements over a reasonable planning window. Several factors influence how assets are selected and the manner in which they are implemented.

- **Network design standards**

  Vector has developed detailed network supply standards, which sets out the basic requirements for network planning for the gas distribution networks (refer to Section 5 of this AMP for details). These standards define largely the stage at which network reinforcement (i.e. new assets) becomes essential, and the capacity to which new installations should be built.

  To manage supply risk, Vector has put in place a system of operational contingency plans (which are regularly updated).

  Capacity and security are not the only criteria for the design of the distribution network. In Section 5 other planning criteria are also described.

- **Optimising installations**

  When a potential network issue or constraint is identified, project options will be developed and the optimal (usually least life cycle cost) solution will be adopted. The optimal solution may not have the lowest initial capital cost or be the lowest capacity solution.

- **Equipment standardisation**

  To minimise cost in the long-term and to ensure that optimally rated equipment is installed to meet a range of possible situations, Vector has a policy of using standardised equipment on its network. Standardisation helps to reduce design and procurement costs during the establishment phase, increase operational flexibility and makes equipment maintenance more effective. It also allows more effective strategic spares management. For example, we have standardised on pipe sizes for polyethylene pipelines which are designed to operate at a standard pressure of 420kPa. Other examples of standardised asset categories, defined in Vector's material specifications, include district regulator station equipment (such as meters, regulators and filters), valves and telemetry equipment.

- **Customer-specific assets**

  From time to time, Vector builds dedicated assets to supply customers at their request based on agreed commercial terms.

- **Life-cycle considerations**

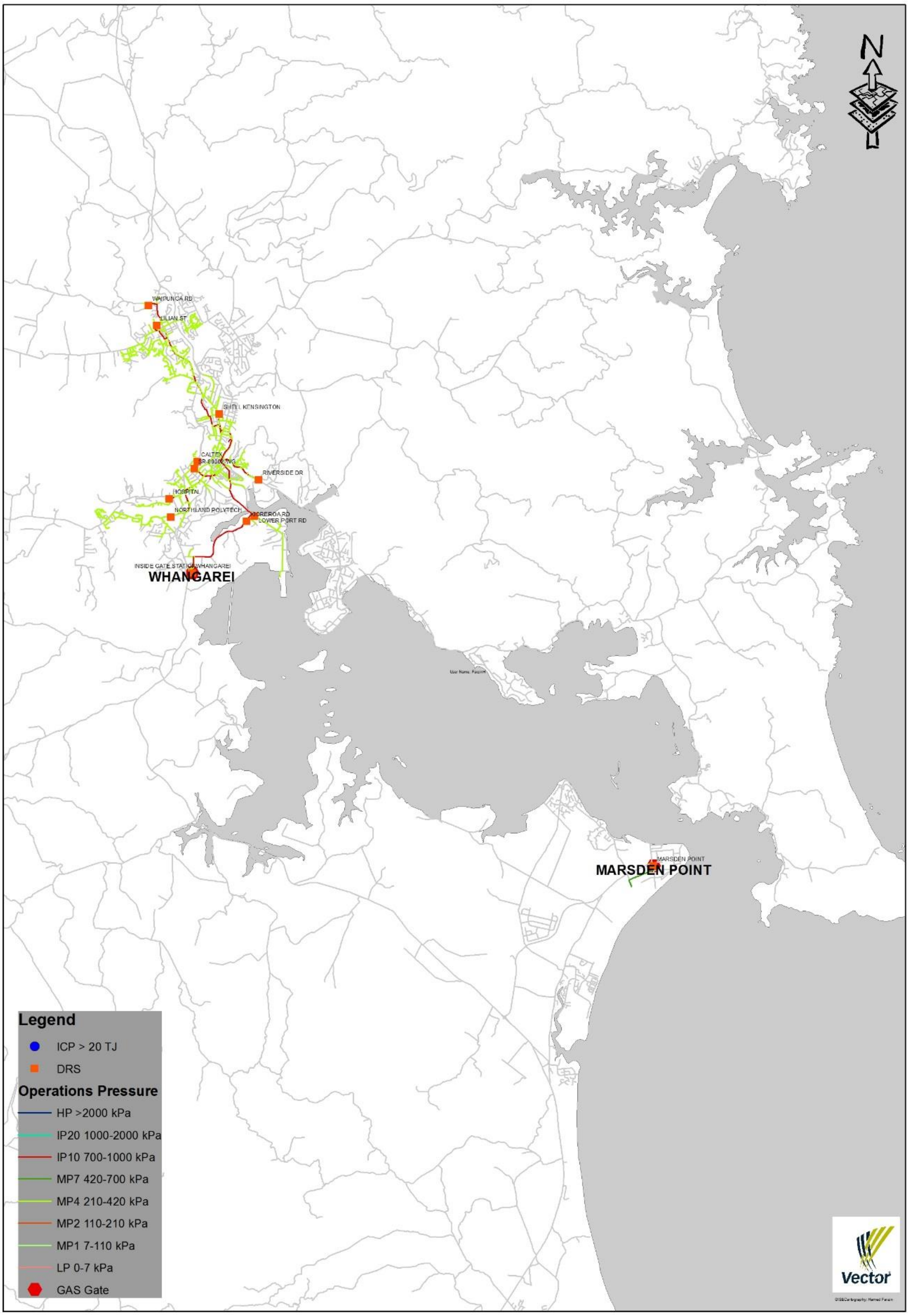
  Vector adopts a life-cycle cost approach to choosing network solutions and assets. This implies that the lowest cost short-term solution may not always be adopted. For example, designing and building district pressure stations to accommodate future telemetry equipment.

- **Historical considerations**

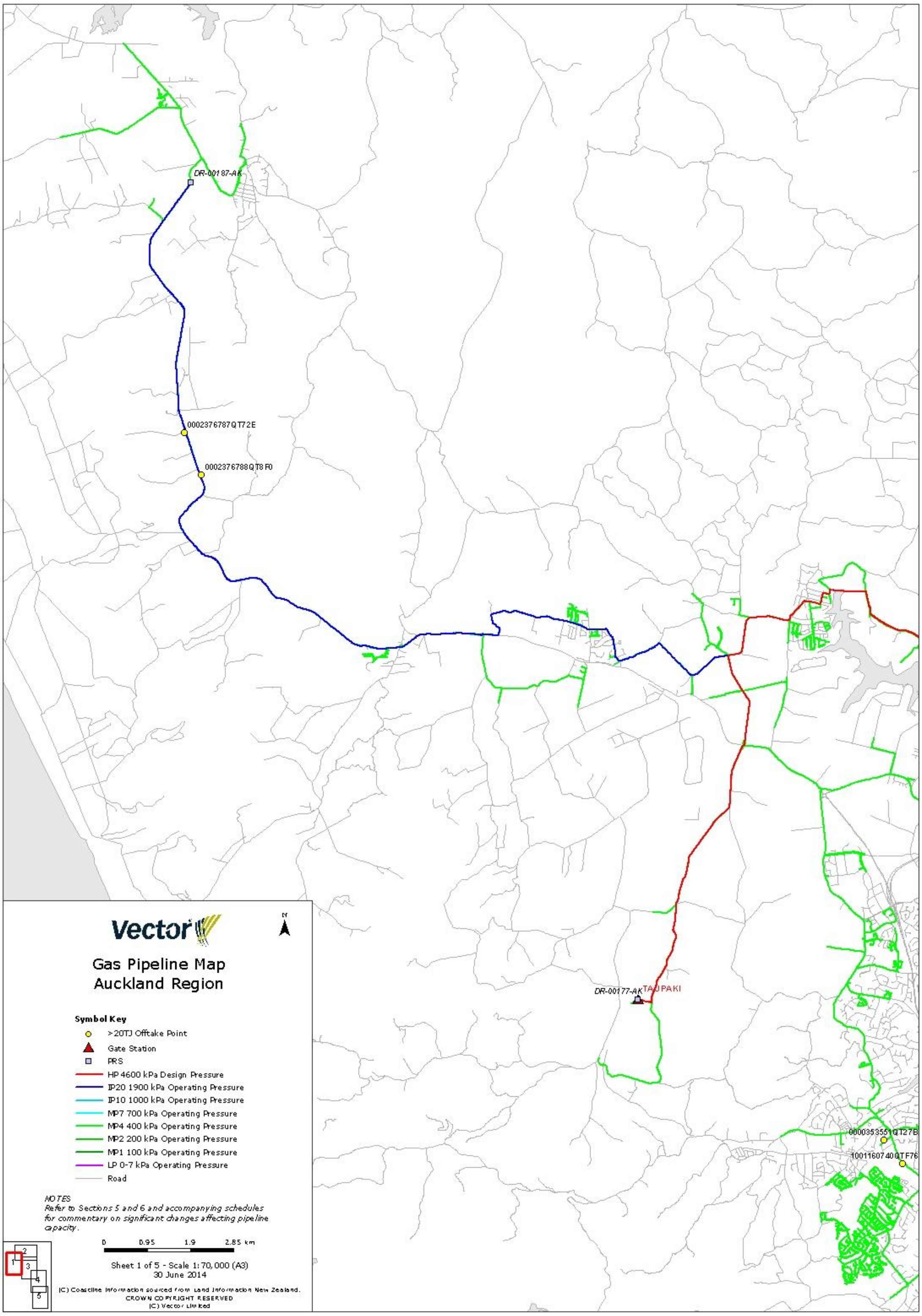
  Load growth, load density and historical network architecture and equipment standards resulted in varying types of assets, states of security and asset condition throughout the network. While historical network architectures and equipment standards converge over-time, replacing well-functioning assets to achieve such alignment in the short-term can generally not be economically justified. However, as assets are replaced or new assets are added to the network, these are designed to comply with the present specifications.

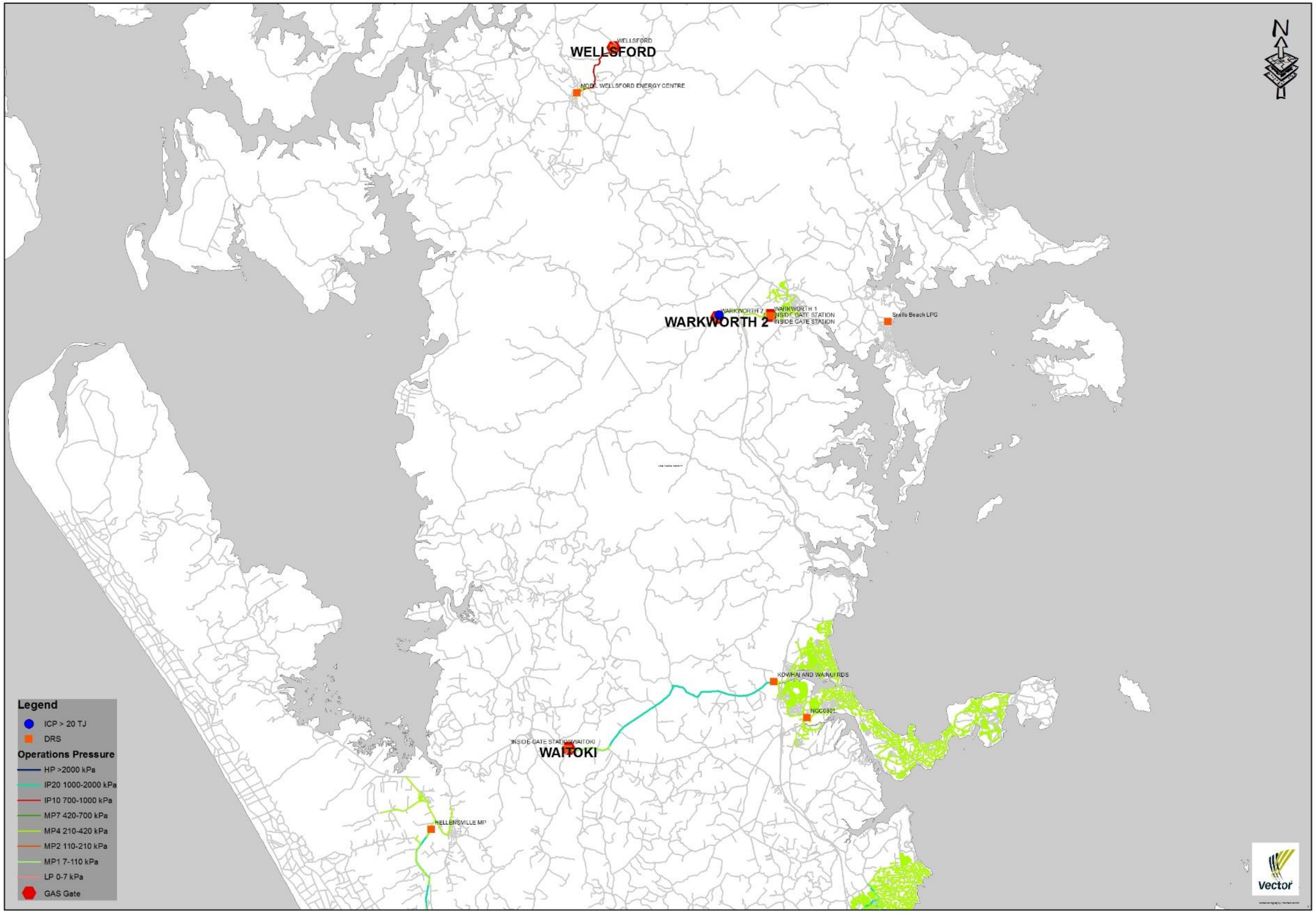
3.9 Gas Distribution Maps

3.9.1 Northland Region



3.9.2 Auckland Region

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WELLSFORD
MOBIL WELLSFORD ENERGY CENTRE
WARKWORTH 2
WARKWORTH 2
WARKWORTH 1
INSIDE GATE STATION
INSIDE GATE STATION
Snells Beach LPG
KOWHAI AND WAINUI RDS
NGC0001
INSIDE GATE STATION WAITOKI
WAITOKI
HELLENSVILLE MP
Legend
ICP > 20 TJ
DRS
Operations Pressure
HP >2000 kPa
IP20 1000-2000 kPa
IP10 700-1000 kPa
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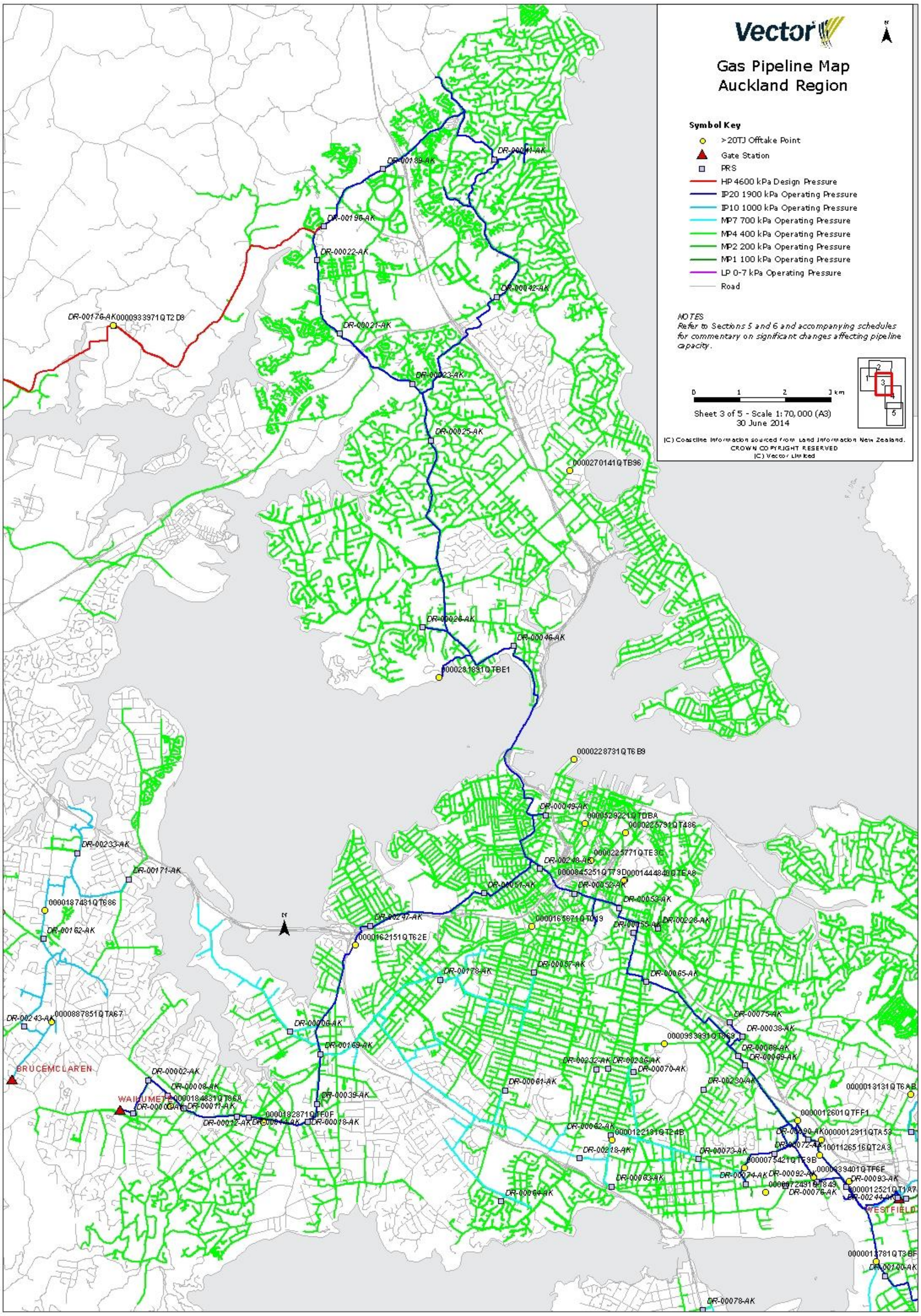
MP4 210-420 kPa
MP2 110-210 kPa
MP1 7-110 kPa
LP 0-7 kPa
GAS Gate
N
Vector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Gas Pipeline Map
Auckland Region
Symbol Key
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Gate Station
PRS
HP 4600 kPa Design Pressure
IP20 1900 kPa Operating Pressure
IP10 1000 kPa Operating Pressure
MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity.
Sheet 3 of 5 - Scale 1:70,000 (A3)
30 June 2014
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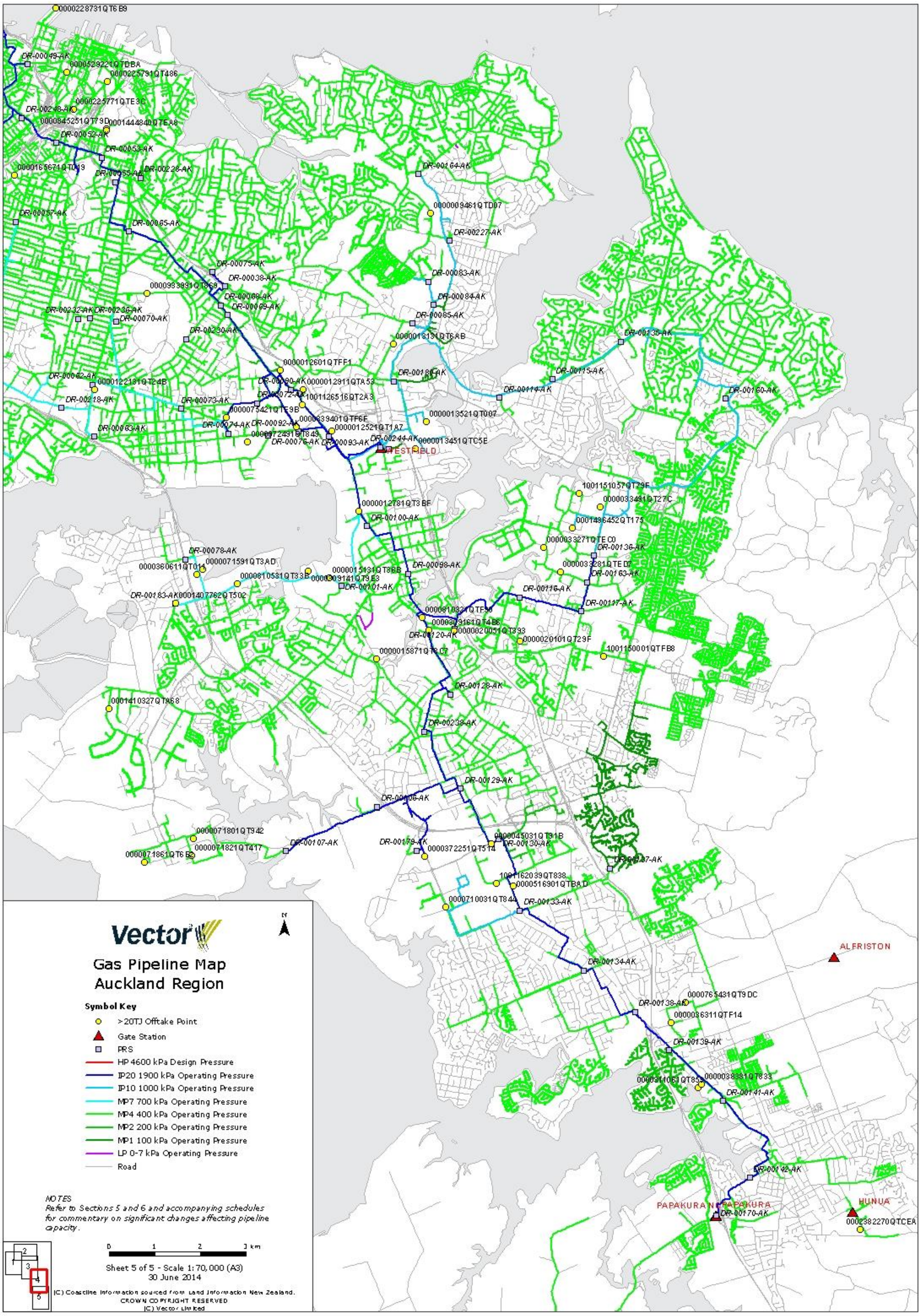
CROWN COPYRIGHT RESERVED
(C) Vector Limited
BRUCEMCLAREN
WAIUMETE
WESTFIELD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MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity.
0 1 2 3 km
Sheet 5 of 5 - Scale 1:70,000 (A3)
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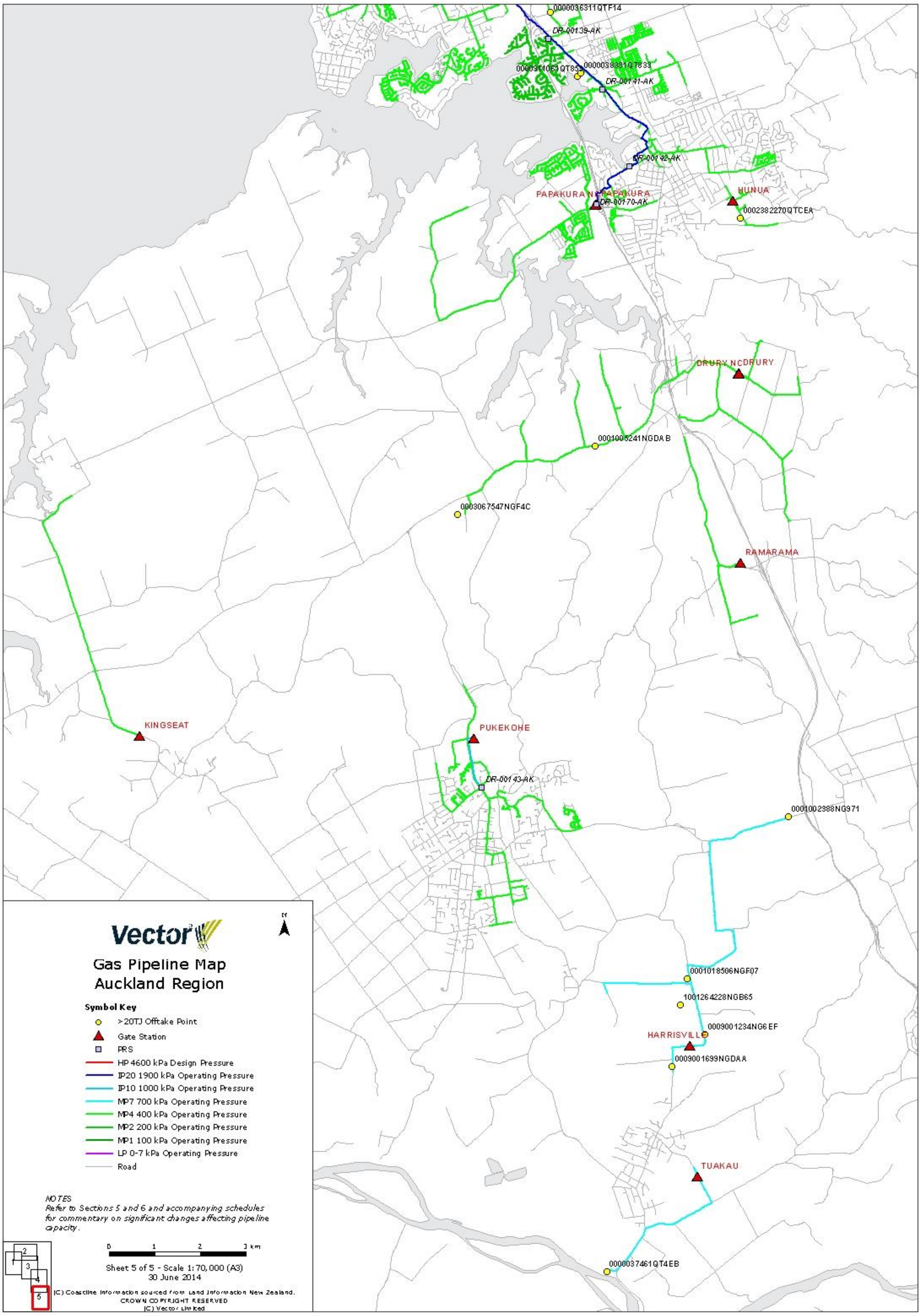
(C) Vector Limited
ALFRISTON
HUNUA
PAPAKURA
WESTFIELD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Gas Pipeline Map
Auckland Region
Symbol Key
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Gate Station
PRS
HP 4600 kPa Design Pressure
IP20 1900 kPa Operating Pressure
IP10 1000 kPa Operating Pressure
MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity.
Sheet 5 of 5 - Scale 1:70,000 (A3)
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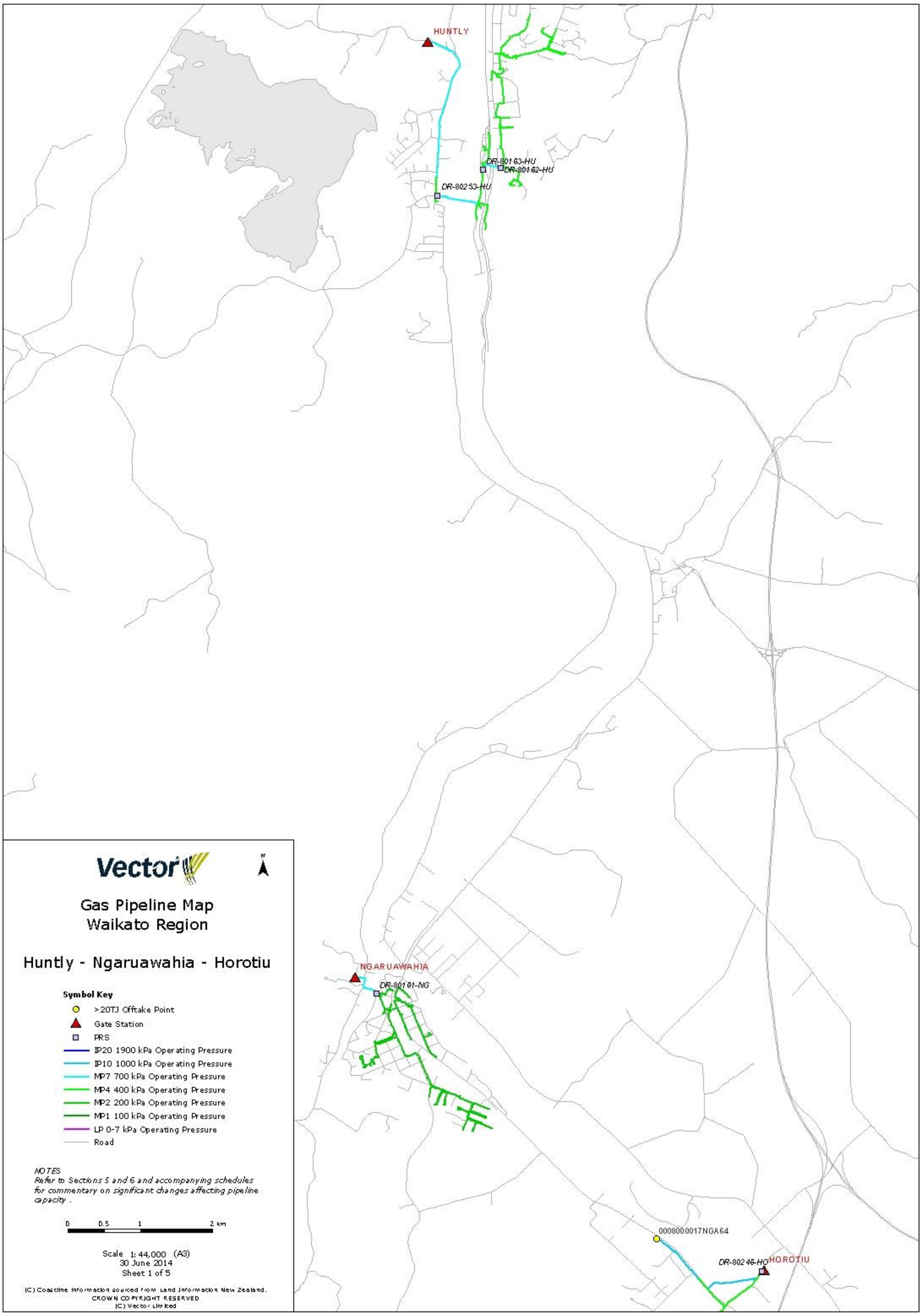
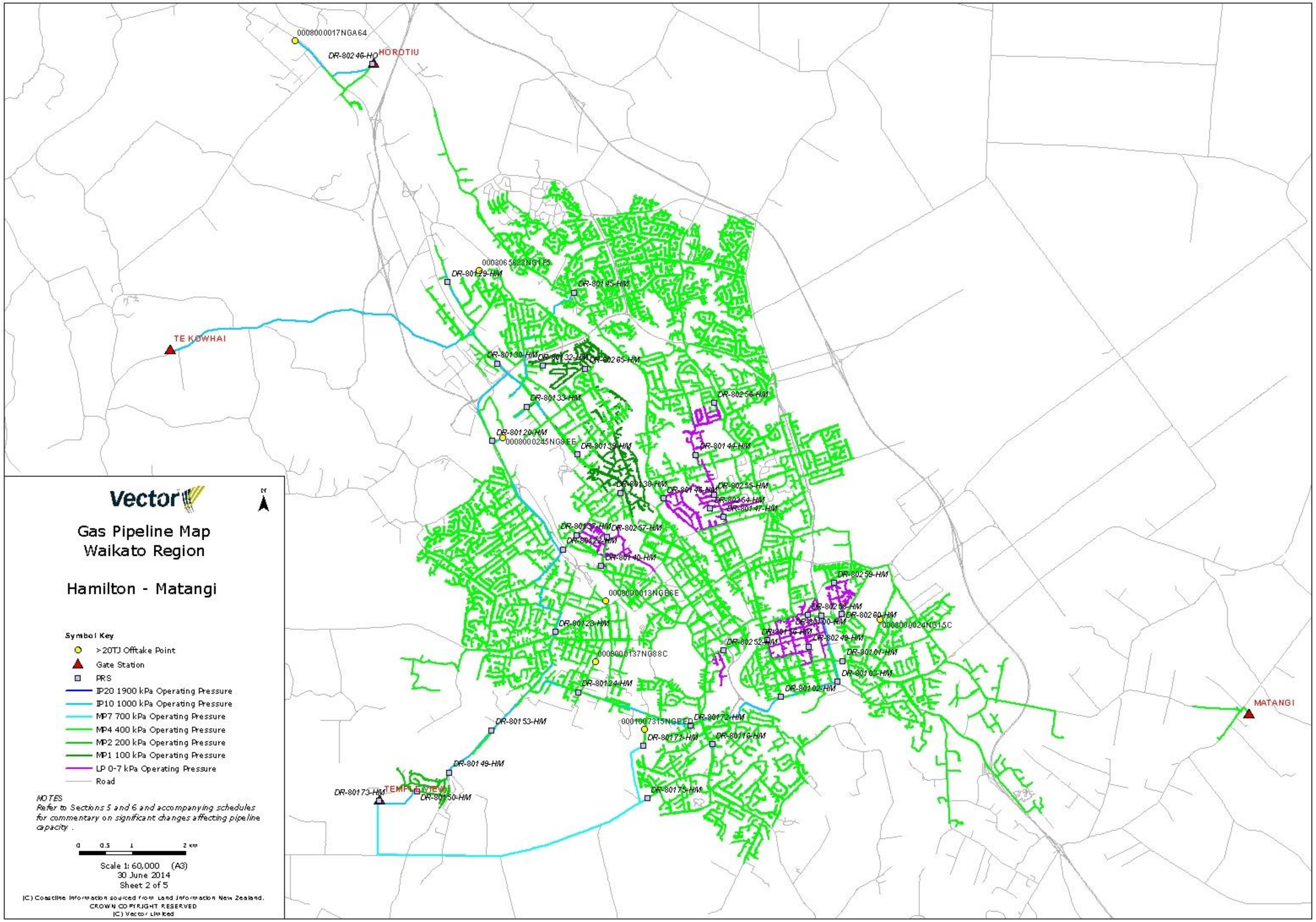
3.9.3 Waikato Region

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Hamilton - Matangi
Symbol Key
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Gate Station
PRS
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IP10 1000 kPa Operating Pressure
MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity .
0 0.5 1 2 km
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30 June 2014
Sheet 2 of 5
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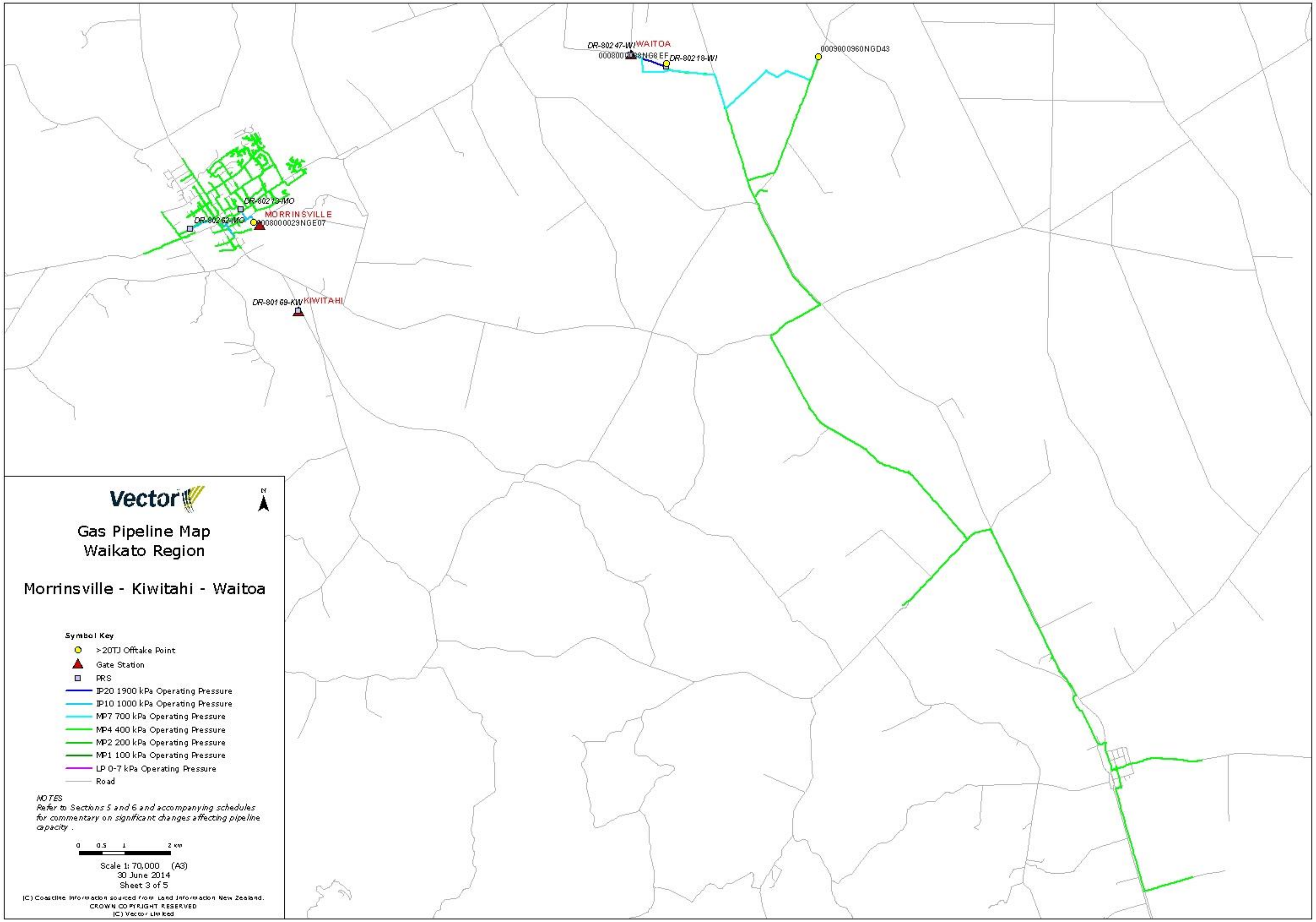
HOROTIU
TE KOWHAI
MATANGI
TEMPLE VIEW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DR-80218-WI
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DR-80213-MO
DR-80262-MO
MORRINSVILLE
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DR-80169-KW
KIWITAHI
Vector
Gas Pipeline Map
Waikato Region
Morrinsville - Kiwitahi - Waitoa
Symbol Key
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Gate Station
PRS
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IP10 1000 kPa Operating Pressure
MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity .
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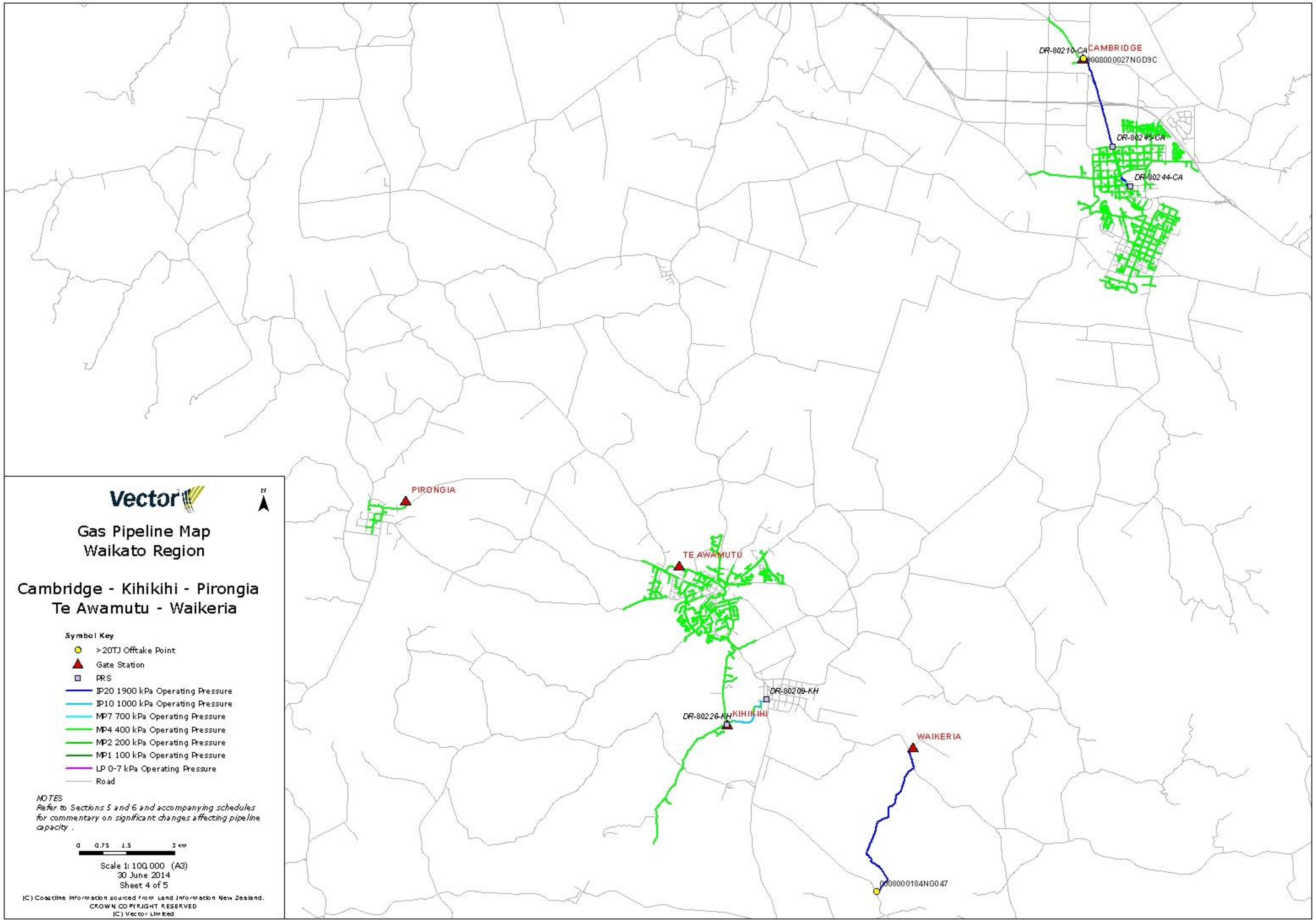
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PIRONGIA
TE AWAMUTU
DR-80209-KH
DR-80226-KH
KIHIKIHI
WAIKERIA
0008000184NG047
Vector
Gas Pipeline Map
Waikato Region
Cambridge - Kihikihi - Pirongia
Te Awamutu - Waikeria
Symbol Key
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Gate Station
PRS
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IP10 1000 kPa Operating Pressure
MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity .
0 0.75 1.5 3 km
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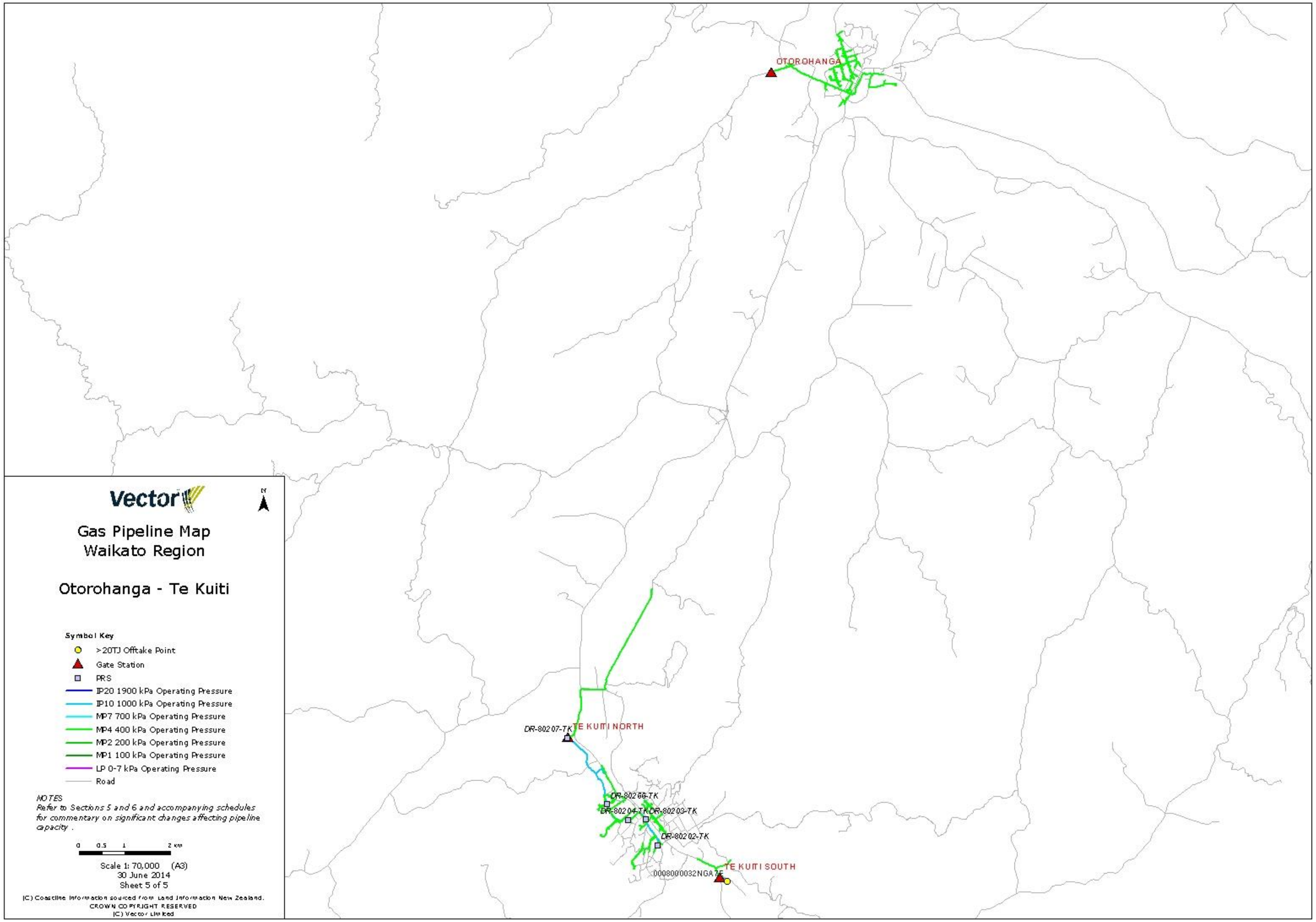
Vector
Gas Pipeline Map
Waikato Region
Otorohanga - Te Kuiti
Symbol Key
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Gate Station
PRS
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MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity .
0 0.5 1 2 km
Scale 1: 70,000 (A3)
30 June 2014
Sheet 5 of 5
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OTOROHANGA
TE KUITI NORTH
DR-80207-TK
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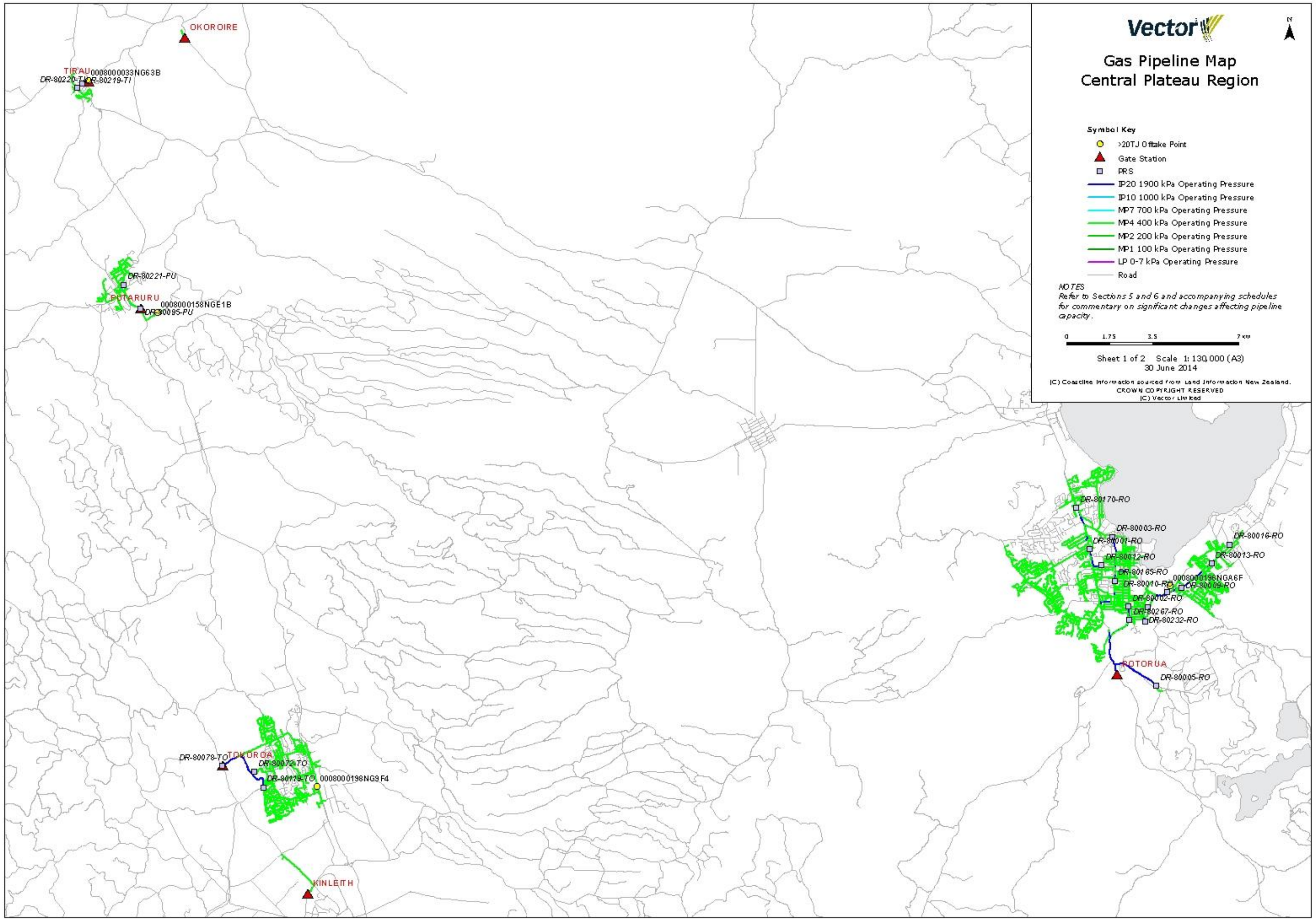
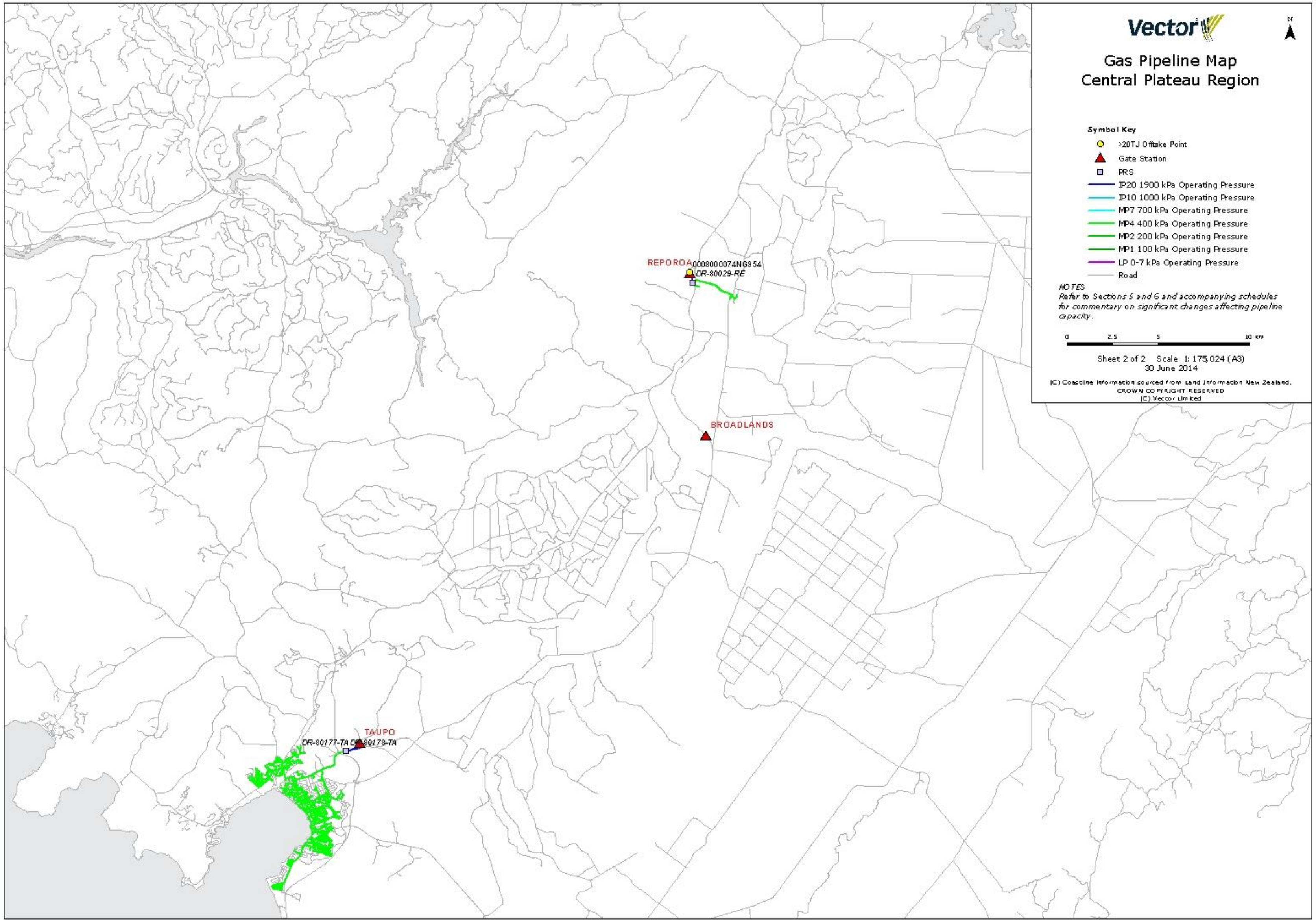
DR-80203-TK
DR-80202-TK
TE KUITI SOUTH
0008000032NGA7E

3.9.4 Central Plateau Region




Vector
N
Gas Pipeline Map
Central Plateau Region
Symbol Key
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Gate Station
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IP10 1000 kPa Operating Pressure
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MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity.
0 2.5 5 10 km
Sheet 2 of 2 Scale 1: 175,024 (A3)
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REPOROA
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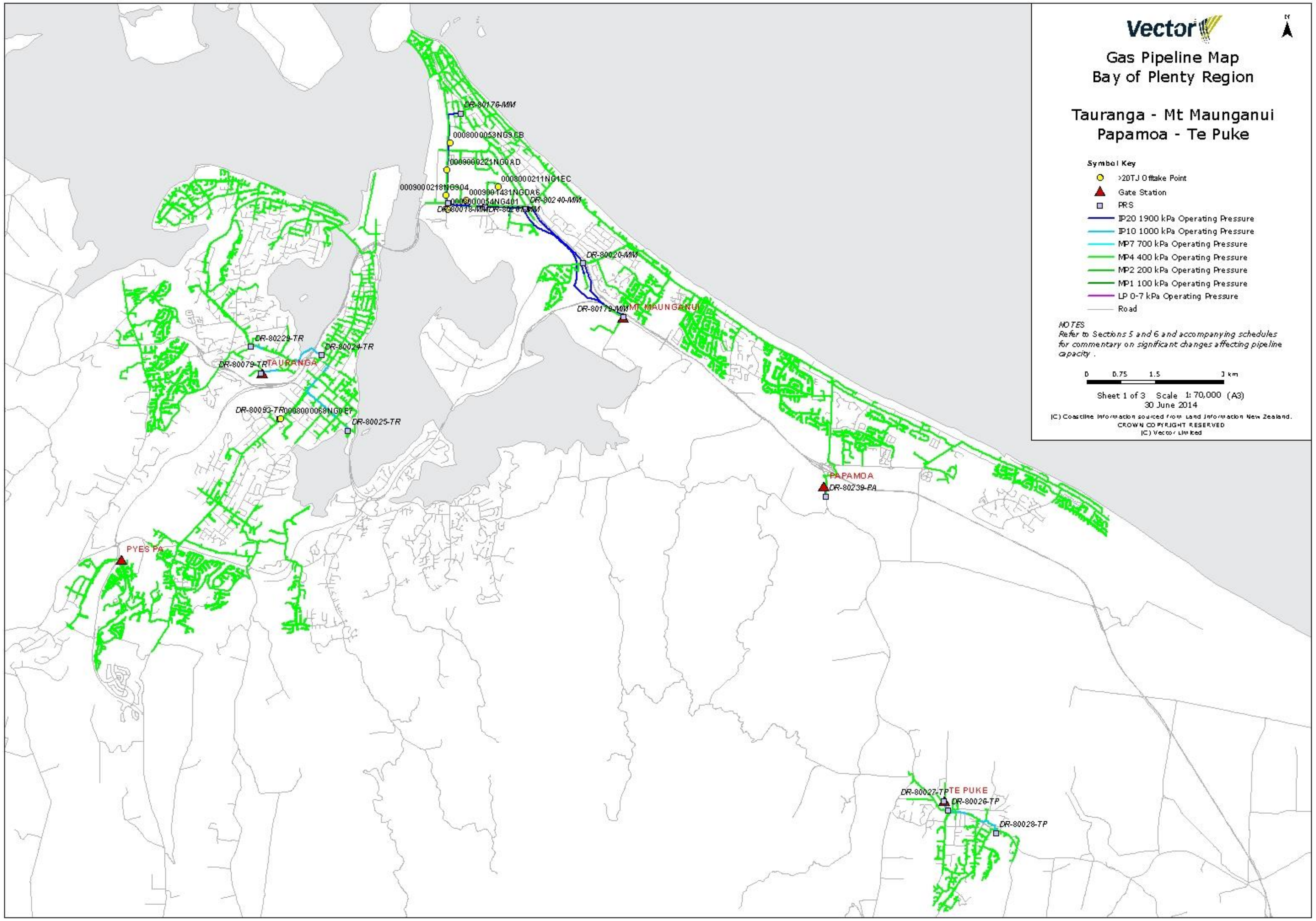
BROADLANDS
TAUPO
DR-80177-TA
80178-TA

3.9.5 Bay of Plenty Region



Vector
Gas Pipeline Map
Bay of Plenty Region
Kawerau - Edgecumbe
Te Teko - Whakatane
Symbol Key
>20TJ Offtake Point
Gate Station
PRS
IP20 1900 kPa Operating Pressure
IP10 1000 kPa Operating Pressure
MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity .
0 0.75 1.5 3 km
Sheet 2 of 3 Scale 1:70,000 (A3)
30 June 2014
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0008000300NGE08
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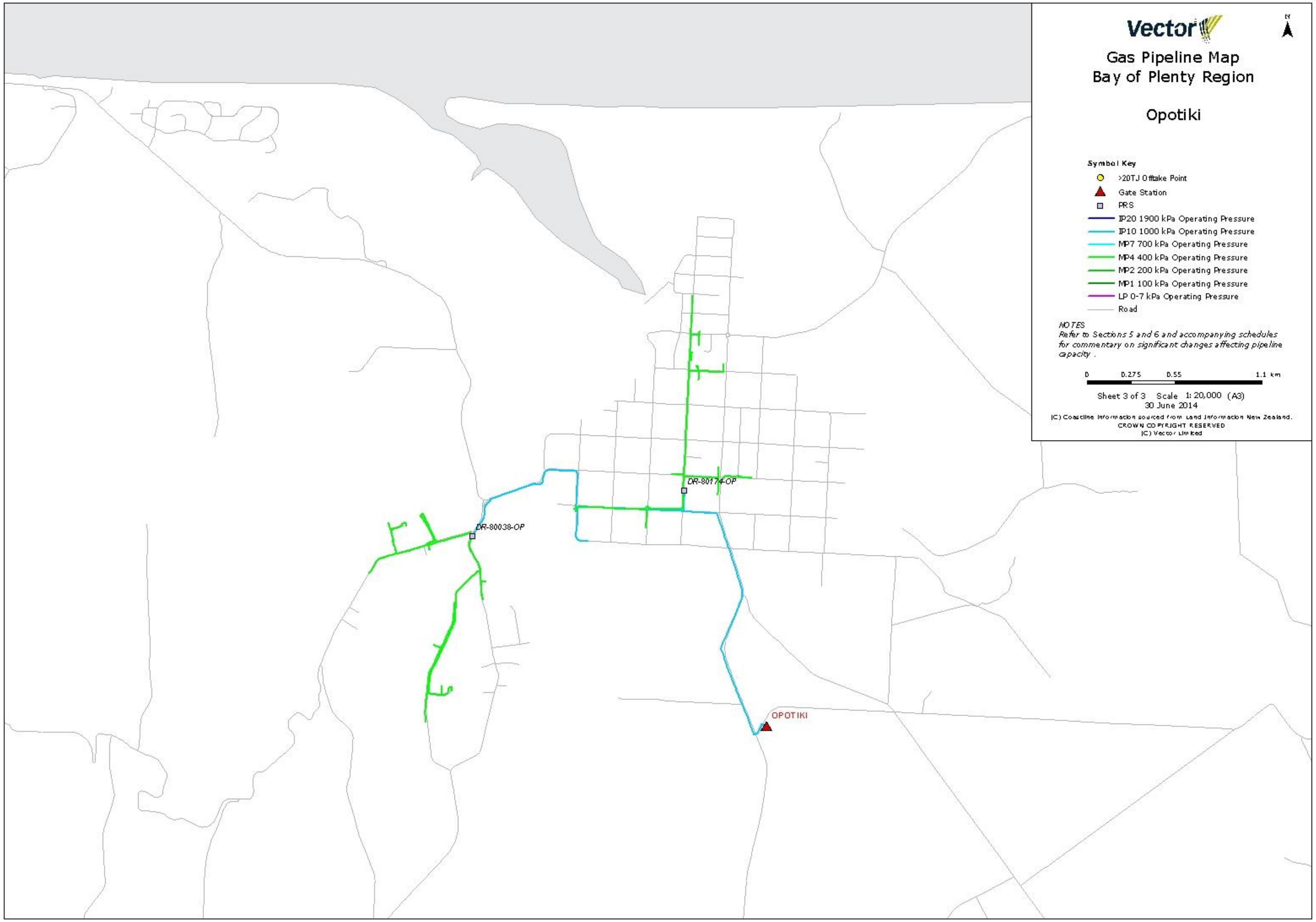
Gas Pipeline Map
Bay of Plenty Region
Opotiki
Symbol Key
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Gate Station
PRS
IP20 1900 kPa Operating Pressure
IP10 1000 kPa Operating Pressure
MP7 700 kPa Operating Pressure
MP4 400 kPa Operating Pressure
MP2 200 kPa Operating Pressure
MP1 100 kPa Operating Pressure
LP 0-7 kPa Operating Pressure
Road
NOTES
Refer to Sections 5 and 6 and accompanying schedules for commentary on significant changes affecting pipeline capacity .
0 0.275 0.55 1.1 km
Sheet 3 of 3 Scale 1: 20,000 (A3)
30 June 2014
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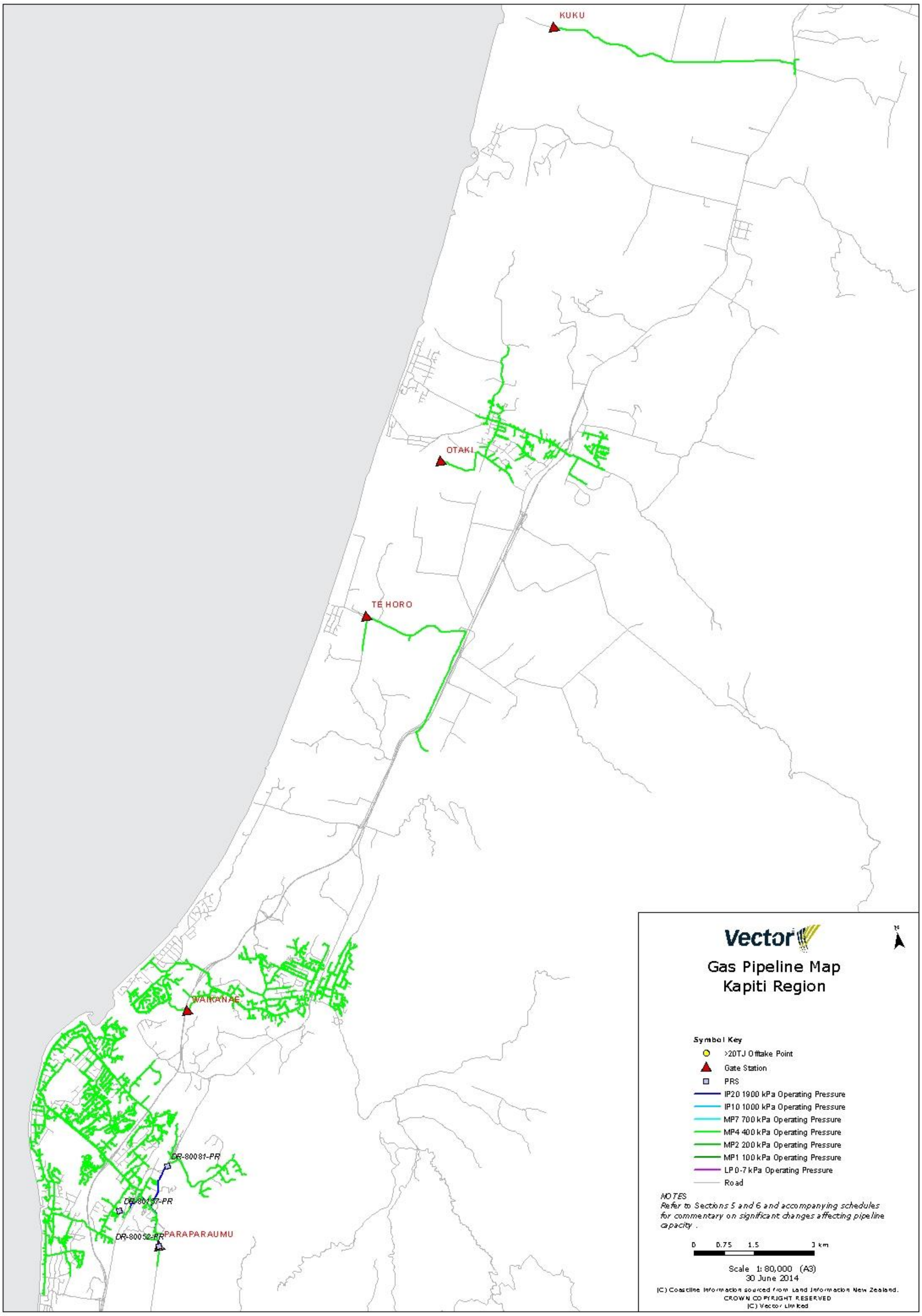
DR-80174-OP
DR-80038-OP
OPOTIKI

3.9.6 Gisborne Region

3.9.7 Kapiti Region



Gas Distribution
Asset Management Plan
2015 – 2025

Service Levels – Section 4

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4 Service Levels

This section describes the gas distribution business performance targets set under Vector's asset management strategy. Performance against these targets is also discussed.

4.1 Consumer Oriented Performance Targets

Vector is committed to providing a high standard of service and a safe, reliable and secure gas supply. This challenge requires effective and efficient network solutions to enable Vector to meet this goal with the optimum investment. As such, Vector recognises that communication is essential in order to improve and understand what services and products Vector's customers like, what they do not like and what they need.

Customers are widely consulted and are able to provide feedback about their expectations through a variety of contact points:

- Call centre representatives;
- Customer service team representatives;
- Operations and project representatives;
- Service provider/contracting representatives;
- Customer service feedback surveys;
- Customer engagement surveys;
- Social media and websites; and
- Dedicated account management for very large customers.

4.1.1 Customer Expectations

Keeping engaged and aligned with changing customer expectations is fundamental to optimal asset investment and asset management practices.

Customer performance targets are normally established through taking into account customer needs on a qualitative basis, due to the complexity and informational requirements of quantifying customer requirements, and relating them to network performance.

At present there is no evidence from the Vector customer-base to support increased (or reduced) levels of supply reliability, especially where these would require increased network charges to recover the additional costs. In the absence of other drivers, Vector's quality targets therefore coincide with the Commerce Commission's regulatory quality targets[1].

4.1.2 Customer Feedback

Vector obtains feedback from regular customer experience surveys, through which we contact a sample of customers[2] who have recently had a gas connection completed, or have reported a gas fault or issue through Vector's fault response process.

The key survey results are reported as follows:

[1] The regulatory threshold target is defined in the Commerce Commission Gas Distribution Services Default Price-Quality Path Determination 2013 dated 28 February 2013 (http://www.comcom.govt.nz/assets/Gas/Gas-Default-Price-Quality-Path/Initial-DPP-for-GPB/2013-NZCC-4-Gas-Distribution-Services-Default-Price-Quality-Path-Determination-28-February-2013-.PDF)

[2] The sample size for the customer surveys vary each year but typically ranges between 620 to 820 for gas connections and 330 to 380 for gas faults. Surveys are conducted on an ongoing monthly basis with reporting at quarterly intervals for connections and 6 monthly for faults.

- The overall customer satisfaction of getting gas installed for residential and commercial customers; and
- The overall customer satisfaction with Vector's gas fault response process for residential and commercial customers.

Individual customers have different and diverse needs and expectations when requesting fault response and connecting gas at their property. For some, the initial contact and professionalism is a key consideration. For others, the method and level of disruption has real consequences. All aspects of the customer experience are reported through the detailed survey responses.

The results of these surveys provide a basis for setting Vector's customer service levels for connections and fault response activities, and guide continuous process and service improvements. The average rating score is expressed as a percentage.

Results for the overall gas connection and fault response performance are summarised in the following charts.

The decline in residential customer satisfaction in 2013/14 Q1 was a result of a number of administration process and personnel changes. A full review of the connections process was initiated and a number of improvements were made to the connections process, including improved customer information and job scheduling, a new fast track pricing option for customers and an improvement in the reinstatement process.

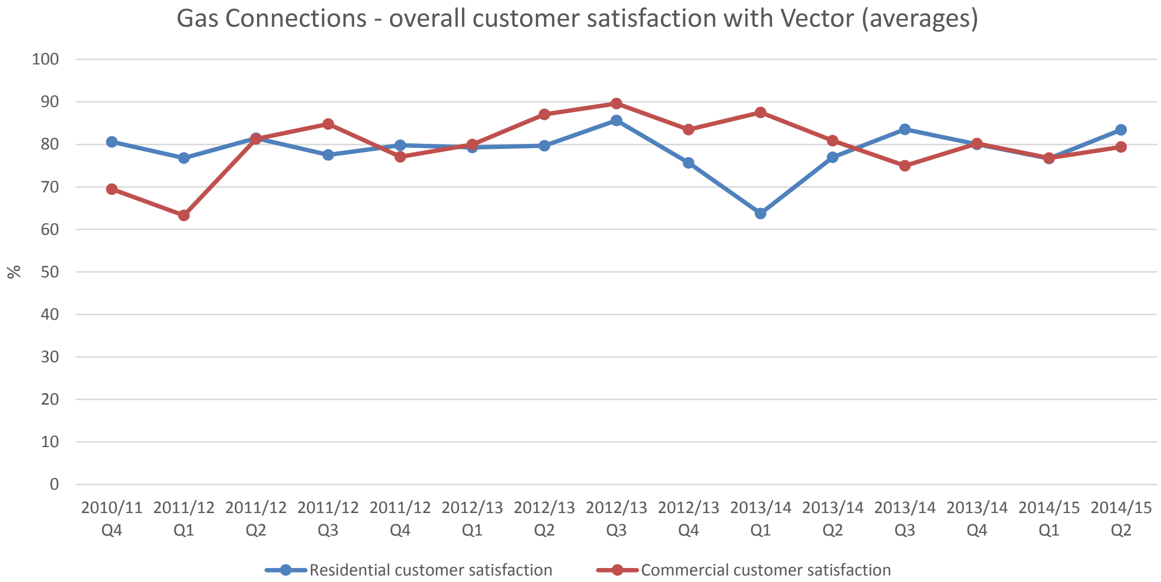

Figure 4-1 Residential and commercial customers' overall satisfaction with Vector through the connections process

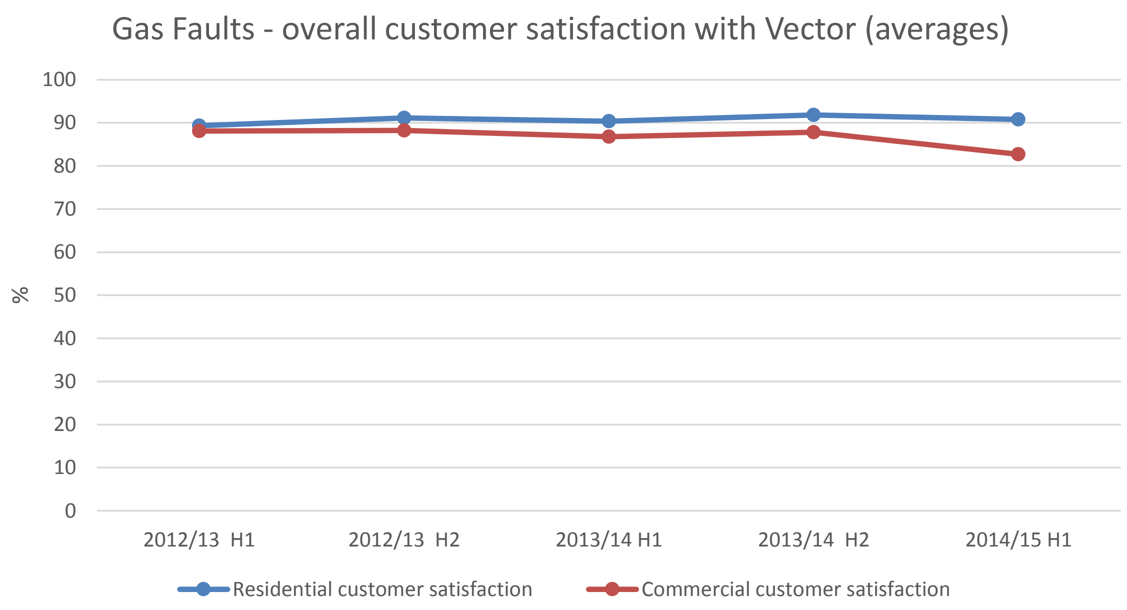

Figure 4-2 : Residential and commercial customers' overall satisfaction with Vector's fault response process

4.1.3 Customer Complaints

Although Vector seeks to provide a high standard of service and a safe and reliable gas supply, there may be times when customers have concerns with their service. In these instances Vector's customer services team takes appropriate actions to manage these concerns, including:

- Logging all reported complaints in relation to the distribution network;
- Coordinating closely with all appropriate areas of the business in resolving the complaints; and
- Improving the customer experience, where appropriate and reasonable.

If the cause for concern or complaint is not immediately resolved, it is logged as a formal complaint with Vector's customer services team. The customer services team is responsible for complaint resolution, identifying trends and raising issues with the appropriate business units in order to implement permanent solutions and prevent recurrence, where appropriate.

Vector adheres to a formal complaint resolution process. Vector's preference is for proactive, consultative and direct engagement with customers via the customer services team. Vector's formal complaint process is as follows:

- Acknowledgement of receipt of the complaint by Vector;
- Providing the customer with an update and/or working to resolve the complaint; and
- If the complaint is not resolved within the stated timeframe, informing the customer of the reason for the delay and working towards resolution.

If Vector has not resolved the complaint within the timeframes specified by the Electricity and Gas Complaints Commission (EGCC, see below), or to the customer's satisfaction, then Vector notifies the customer of the option of taking the complaint to the EGCC.

The number of complaints performance indicator is calculated from the sum of complaints acknowledged divided by the average total number of customers.

For the year ending 30 June 2014, Vector's total number of complaints per customer was 0.0011, beating Vector's 2014 target of 0.0013. Table 4-1 shows the comparison of the average complaints per customer for the previous two years.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Number of complaints per consumer				0.0010	0.0011	0.0013

Table 4-1 : Historical response for customer complaints

Vector's target number of complaints for the next 10 years is (less than) 0.0013 complaints per customer.

4.1.4 Response Time to Emergencies

Targets and measures for Vector's response time to emergencies[3] (RTE) are recorded and reported as follows.

For the year ending 30 June 2014, Vector's RTE within one hour, three hours and telephone call response time was 91.2%, 100% and 91.7%, respectively, as shown in Table 4-2.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Proportion of RTE within one hour	88.6%	92.7%	93.8%	93.1%	91.2%	80%
Proportion of RTE within three hours	100%	100%	100%	100%	100%	100%
Number of telephone calls to emergency numbers answered within 30 seconds				93.2%	91.7%	90%

Table 4-2 : Historical performance of RTE and telephone response times

Vector's target proportion of RTE within one and three hours is 80% and 100%, respectively, which is higher than or equal to the limits set by the Commerce Commission[4].

Vector's target response to answering all emergency telephone calls within 30 seconds for the next 10 years is (higher than) 90%.

4.2 Health, Safety and Environment

Vector's policy and overall approach to Health, Safety and Environment (HS&E) is described in Section 8.

In addition to the specific performance measures relating to HS&E that have been implemented by Vector's Field Service Providers (FSPs), Vector monitors gas-related public safety incidents and incidents arising from its employees. These incidents are reviewed

---

[3] An "emergency" is defined as one of the following events: an unplanned escape and/or ignition of gas that requires the active involvement of any emergencies service (i.e. fire service, ambulance); or an unplanned disruption in the supply of gas that affects more than five customers; or the need to evacuate premises as the result of escape or ignition of gas.

[4] The regulatory threshold target is defined in the Commerce Commission Gas Distribution Services Default Price-Quality Path Determination 2013 dated 28 February 2013 (http://www.comcom.govt.nz/assets/Gas/Gas-Default-Price-Quality-Path/Initial-DPP-for-GPB/2013-NZCC-4-Gas-Distribution-Services-Default-Price-Quality-Path-Determination-28-February-2013-.PDF)

monthly to ensure lessons are captured and where appropriate, corrective actions are implemented.

Figure 4-3 below shows the long-term trend in lost time injuries at Vector (including Vector staff and FSPs) over the last four years. The figures include both electricity and gas network activities.

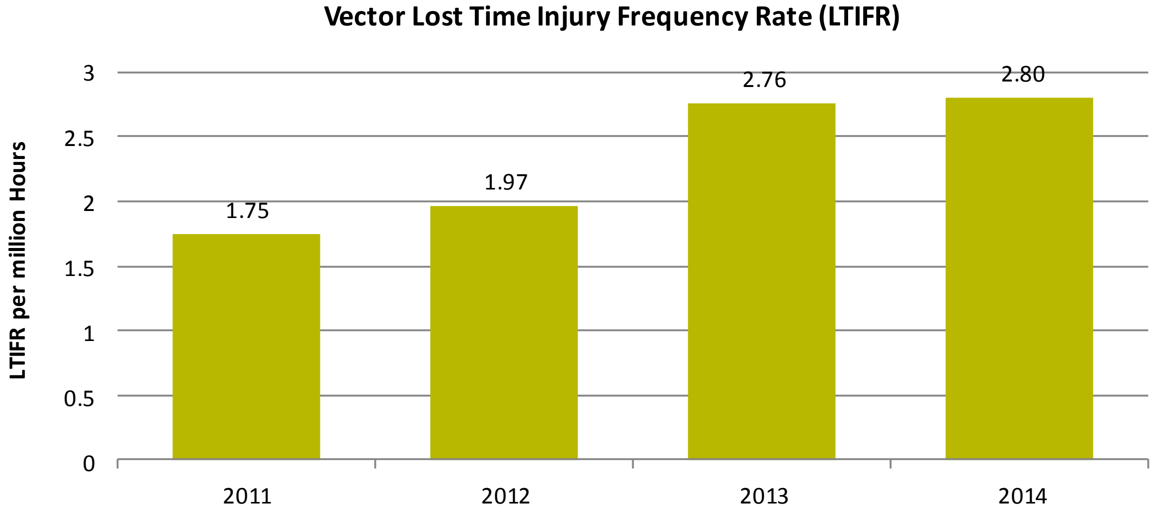

Figure 4-3 : Lost time injuries at Vector (including the electricity networks)

Vector continually seeks to explore innovative ways to improve its overall health and safety performance. Vector is in the process of implementing its Loss Control programme which is based on an understanding of human factors and the implementation of practical tools and techniques to reduce loss, whether that loss is related to health and safety or quality. Results of this programme will be reported on in future asset management plans.

Environmental incidents are also reported, recorded and investigated with any learnings and improvements shared with the FSPs at the safety leadership forum.

Vector Target

Vector's aspiration is everyone home safely every day.

Vector's environmental target is full compliance with all requirements from local and regional councils, and to have no prosecutions based on breaches of environmental regulations or requirements.

To progress towards Vector's aspirational goal, Vector is:

- Continuing to place a strong focus on ensuring hazards, wherever possible, are eliminated during the asset design phase;
- Ensuring policies and procedures are in place that assist the workforce to deliver the right action at the right time; and
- Ensuring focus on personal behaviours to encourage an individual and team safety culture.

4.3 Supply Reliability

Supply reliability is the outcome of how often the gas supply gets interrupted, and how long it takes to restore supply once interrupted. In the context of average network supply reliability, the following nationally recognised measures are recorded and reported:

- SAIDI unplanned (System Average Interruption Duration Index) - the length of unplanned time in minutes that the average customer spends without supply over a year, measured in customer minutes per 1000 customers;
- SAIDI planned - the length of planned time in minutes that the average customer spends without supply over a year, measured in customer minutes per 1000 customers;
- SAIFI unplanned – (System Average Interruption Frequency Index) - the number of unplanned supply interruptions which the average customer experiences over a year, measured in customer interruptions per 1000 customers;
- SAIFI planned - the number of planned supply interruptions which the average customer experiences over a year, measured in customer interruptions per 1000 customers;
- CAIDI unplanned (Customer Average Interruption Duration Index) – the average length of an unplanned outage that a customer would experience (SAIDI / SAIFI);
- Outage events - the number of unplanned interruptions that affect more than five customers; and
- Outage events caused by third party damage - the number of unplanned interruptions that affect more than five customers which has been caused by third party damage.

4.3.1 SAIDI Unplanned

SAIDI unplanned measures the total unplanned time, on average, that a customer could expect to be without gas over the reporting period. It is a measure of unplanned interruptions, including third party damage and excludes interruptions directly resulting from unplanned interruptions on the transmission system. It is calculated by dividing the product of the number of interrupted customers and the duration of the interruption (in minutes), by the total number of customers connected to the network and further dividing by 1000.

SAIDI unplanned is driven by a combination of factors. These include the number of faults on the network, the number of customers affected by each fault, and the time taken to restore supply. These in turn are affected by external factors e.g. third party damages, the network design and construction standards, equipment standards, management and performance of field staff and condition of the network assets.

A significant influence on SAIDI (and SAIFI) unplanned is the damage caused to the gas network by non-Vector contractors conducting works not directly related to the gas network. Third party interference damage is a major cause of system interruptions. Though not all events caused by third party works result in interrupted gas supplies, they are potential safety hazards and could project a negative public image of natural gas (and of Vector).

Performance

For the year ending 30 June 2014, Vector's SAIDI unplanned performance was 2200 minutes per 1000 customers, above Vector's 2014 target of 853.

The majority of Vector's unplanned SAIDI is caused by third party damage or equipment failure. Significant increases in SAIDI unplanned during the 2010 to 2014 period include:

- In April 2012, 67 customers lost supply in Whangaparaoa for 550 minutes due to a district regulator station failure; and
- In November 2014, 546 customers lost supply in Hamilton for 8 hours due to third party damage to a mains pipeline.

Table 4-3 shows the comparison of SAIDI unplanned for the previous five years.

Financial Year	2010	2011	2012	2013	2014	2014 Target
SAIDI unplanned (minutes per 1000 customers)	340	680	990	730	2200	853

Table 4-3 : Historical performance for SAIDI unplanned

4.3.2 SAIDI Planned

SAIDI planned measures the total planned time, on average, a customer could expect to be without gas over the reporting period resulting from planned outages. It is calculated by dividing the product of the number of interrupted customers and the duration of the planned interruption (in minutes), by the total number of customers connected to the network.

SAIDI planned is driven by the number of planned activities on the network, such as pipeline replacement or retailer gas meter relocates, the number of customers affected by each fault, and the time taken to restore supply. These in turn are affected by the network design and construction standards, equipment standards, management and performance of field staff and condition of the network assets.

Performance

For the year ending 30 June 2014, Vector's SAIDI planned performance was 2460 minutes per 1000 customer, below Vector's 2014 target of 5800. Table 4-4 shows the comparison of SAIDI planned for the previous 5 years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
SAIDI planned (minutes per 1000 customers)	1202	6000	5600	4360	2460	5800

Table 4-4 : Historical performance for SAIDI planned

4.3.3 SAIFI Unplanned

SAIFI unplanned measures the average number of unplanned interruptions that a customer could expect over the reporting period, including those due to third party damage, but excluding those directly resulting from interruptions of the transmission system. SAIFI unplanned is calculated by dividing the total number of unplanned interruptions on the network in the relevant year by the total number of customers connected to the network and further dividing by 1000.

Performance

For the year ending 30 June 2014, Vector's SAIFI unplanned performance was 8.29 interruptions per 1000 customers, above Vector's 2014 target of 5.0. Table 4-5 shows the comparison of SAIFI unplanned for the previous five years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
SAIFI unplanned (interruptions per 1000 customers)	3.4	5.5	6.5	6.03	8.29	5

Table 4-5 : Historical performance for SAIFI unplanned

4.3.4 SAIFI Planned

SAIFI planned measures the average number of planned interruptions that a customer could expect over the reporting period. SAIFI planned is calculated by dividing the total number of planned interruptions on the network in the relevant year by the total number of customers connected to the network.

Performance

For the year ending 30 June 2014, Vector's SAIFI planned performance was 13.4 interruptions per 1000 customers, above Vector's 2014 target of 9. Table 4-6 shows the comparison of SAIFI planned for the previous 5 years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
SAIFI planned (interruptions per 1000 customers)	3.0	16.0	17.0	16.8	13.4	9

Table 4-6 : Historical performance for SAIFI planned

4.3.5 CAIDI Unplanned

CAIDI unplanned measures the average outage duration of an unplanned interruption of supply per customer who experienced an interruption in the reporting period.

CAIDI unplanned is the sum of the duration of each unplanned (excluding transmission) interruption, divided by the total number of unplanned (excluding transmission) interruptions.

Performance

For the year ending 30 June 2014, Vector's CAIDI unplanned performance was 270 minutes per interruption, above Vector's 2014 target of 157. Table 4-7 shows the comparison of CAIDI planned for the previous five years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
CAIDI unplanned (minutes per interruption)	100	120	150	121	270	157

Table 4-7 : Historical performance for CAIDI unplanned

4.3.6 Outage Events

Outage events are a count of the number of unplanned interruptions which affect more than five customers.

Performance

For the year ending 30 June 2014, Vector's outage events performance was 10 events, slightly above Vector's 2014 target of 9. The outage events caused by third party damage was 7 events, below Vector's 2014 target of 8. Table 4-8 below shows the comparison of outage events (including those caused by third party events) for the previous five years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Outage events (events)	5	8	21	13	10	9
Outage events caused by third party damage (events)	5	5	18	10	7	8

Table 4-8 : Historical performance for outage events

4.3.7 Targets

Table 4-9 shows the supply reliability targets for the next 10 years.

Financial Year	2015	2016	2017	2018	2019	+5 yrs[5]
SAIDI unplanned (minutes per 1000 customers)	988	988	988	988	988	988
SAIDI planned (minutes per 1000 customer)	3924	3924	3924	3924	3924	3924
SAIFI unplanned (interruptions per 1000 customers)	5.9	5.9	5.9	5.9	5.9	5.9
SAIFI planned (interruptions per 1000 customer)	13	13	13	13	13	13
CAIDI unplanned (minutes per interruption)	152	152	152	152	152	152
Outage events	11	11	11	11	11	11
Outage events caused by third party damage	9	9	9	9	9	9

Table 4-9 : Vector's supply reliability targets

4.4 System Condition and Integrity

Vector's strategic goal is to ensure system condition and integrity performance targets are achieved in accordance with the Commerce Commission's regulatory thresholds and customer expectations. In the context of average network system condition and integrity, the following measures are recorded and reported:

- Satisfactory scheduled odour tests;
- Satisfactory scheduled odorant concentration tests;
- Public reported escapes;
- Third party damage events;

[5] Targets are calculated by Vector using the actual performance results from years 2010 to 2014.

- Leakage survey; and
- Poor pressure due to network causes.

4.4.1 Odorisation

The purpose of this measure is to ensure the odorant levels of gas conveyed through Vector's gas networks are maintained in accordance with the requirements of the Gas Regulations 1993 and the New Zealand standard NZS 5263 Gas detection and odorisation.

Monitoring the proportion of satisfactory scheduled odour and concentration levels enables Vector to measure the level of gas odour in the gas and identify when any corrective action is required. Vector uses two measures for odorisation compliance:

- Satisfactory scheduled odour tests; and
- Satisfactory odorant concentration tests.

The satisfactory odour level test measure is calculated as a percentage of satisfactory odour level tests divided by the total number of scheduled odour level tests carried out. Satisfactory means the odour test result is at or below 0.9% gas-in-air.

The satisfactory odorant concentration test measure is calculated as a percentage of satisfactory odorant concentration tests divided by the total number of scheduled odorant concentration tests carried out. Satisfactory means the odorant concentration test result is no less than 3 mg/m^3.

Performance

For the year ending 30 June 2014, Vector's percentage level of satisfactory scheduled odour and odorant concentration tests was 100%, above Vector's 2014 target of 98%. Table 4-10 shows the comparison of the percentage level of satisfactory scheduled odour and odorant concentration tests for the previous 5 years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Satisfactory scheduled odour tests	97%	99%	100%	100%	100%	98%
Satisfactory odorant concentration tests	99%	100%	100%	100%	100%	99%

Table 4-10 : Historical performance for odour and odorant concentration tests

4.4.2 Public Reported Escapes

Vector uses Public Reported Escapes (PRE) as its primary technical network service quality measure for operational purposes. It is a critical safety measure and a reliable indicator of the condition of the network. This measure is impacted by a number of factors, including the effectiveness of renewal strategies, the condition and composition of assets, the level of odorant added (which increases the likelihood of PREs), and the extent and effectiveness of leakage surveys.

PRE is calculated by dividing the total number of confirmed public reported escapes of gas on the network (including mains, service pipes, valves, and pressure stations) in the relevant year by the total length of network (mains and services) and further dividing by 1000.

The monitoring of public reported escapes, the determination of their causes and the implementation of programmes directed at reducing them is internationally recognised as being fundamental to improving the safety and reliability of gas networks.

Performance

For the year ending 30 June 2014, Vector's PRE performance was 46.0 PRE per 1000 km of system, below Vector's 2014 target of (less than) 125. Table 4-11 below shows the comparison of PRE for the previous five years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Public reported escapes (events per 1000km)	57.9	55.7	59.6	45.8	46.0	125

Table 4-11 : Historical performance for PRE

4.4.3 Third Party Damage Events

Third Party Damage (TPD) events to networks are a significant cause of gas escapes and customer supply interruptions. The levels of third party interference damage provide some indication of the network operator's level of success in communicating awareness to those who control and/or are directly engaged in any activities that put gas networks at risk. As described in Section 6, Vector has a number of strategies, such as public safety awareness communications programmes, which are designed to increase public and contractor awareness and reduce the number of third party incidents.

TPD events are calculated by dividing the total number of TPD events on the network in the relevant year by the total length of network (mains and services) and further dividing by 1000.

Performance

For the year ending 30 June 2014, Vector's TPD event performance was 60.8 TPD events per 1000km of system, below Vector's 2014 target of (less than) 67. Table 4-12 shows the comparison of TPD for the previous five years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Third party damage (events per 1000km)	45.0	47.6	53.0	57.3	60.8	67

Table 4-12 : Historical performance for TPD events

4.4.4 Leakage Survey

Leakage surveys are a pro-active maintenance strategy that attempts to locate gas leaks in the network. Leaks detected by system surveys are a clear indicator of the condition of the network and the effectiveness of maintenance strategies. As described in Section 6, renewal strategies play an important role in improving the condition of the gas distribution network and reducing the number of leaks. Vector surveys different parts of its network every year, taking five years to complete an entire network survey. It is therefore not meaningful to compare leak data on a yearly basis; a five year rolling average should be applied to any analysis of overall network condition.

Leak survey is calculated by adding up the number of leaks detected by routine survey and dividing this number into the total length of pipeline and further multiplying by 1000.

Performance

For the year ending 30 June 2014, Vector's leak survey performance was 0.9 leaks per 1000km of system, below Vector's 2014 target of (less than) 10. Table 4-13 shows the comparison of leaks detected by survey for the previous five years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Leakage surveys (leaks per 1000km)	1.87	1.07	1.74	1.3	0.9	10

Table 4-13 : Historical performance for leakage survey

4.4.5 Poor Pressure Due to Network Causes

Poor pressure due to network causes is a count of the number of unplanned incidents where delivery pressure drops below contracted delivery requirements.

Performance

For the year ending 30 June 2014, Vector's poor pressure performance was 6 events, below Vector's 2014 target of (less than) 23 events per annum. Table 4-14 shows the comparison of poor pressure events due to network causes for the previous five years against Vector's target.

Financial Year	2010	2011	2012	2013	2014	2014 Target
Poor pressure due to network causes	3	0	1	3	6	23

Table 4-14 : Historical performance for poor pressure due to network causes

4.4.6 Targets

Table 4-15 shows the system condition and integrity targets for the next 10 years:

Financial Year	2015	2016	2017	2018	2019	+5 yrs[6]
Satisfactory scheduled odour tests	99%	99%	99%	99%	99%	99%
Satisfactory scheduled odorant concentration tests[7]	99%	99%	99%	99%	99%	99%
Public reported escapes per 1000km	53	53	53	53	53	53
Third party damage events per 1000km[8]	67	67	67	67	67	67
Leak survey per 1000km	1.4	1.4	1.4	1.4	1.4	1.4
Poor pressure due to network causes	3	3	3	3	3	3

[6] Targets are calculated by Vector using the actual performance results from years 2010 to 2014.

[7] Targets are calculated by Vector using the actual performance results from years 2008 to 2012.

[8] The third party damage events target is calculated using historical performance and has been adjusted due to the expected level of road corroder activity affecting Vector's assets. Refer to section 6 for further details.

Table 4-15 : System condition and integrity targets

4.5 Asset Utilisation

Asset utilisation in Vector's gas distribution network is defined as the ratio between the peak demand conveyed by an asset (such as a pipeline or a DRS) and the capacity of the asset. It is a measure of what an asset is actually delivering against what it is capable of delivering. Vector has chosen to monitor asset utilisation using a profile approach instead of a single average or median figure as this gives a more holistic picture of the network.

In the case of pipeline utilisation, Vector determines the capacity of an individual pipeline or system by modelling the relationship between the nominal and minimum operating pressures, the diameter and the allowable pressure difference between inlet and outlet network pressures. Using this information, Vector is able to use system pressures as a proxy for pipeline utilisation. Section 5 provides further details on Vector's quality of supply criteria used to calculate pipeline utilisation levels and Schedule 12b Report on Forecast Utilisation specified in Appendix 4.

4.6 Network Security

Vector defines "security" as the ability to supply network load following a fault (or more than one fault) and can be categorised deterministically, or probabilistically.

Deterministic security operates in discrete levels, typically defined as having sufficient capacity to supply customers following a single fault ("N-1") or two faults ("N-2"). Probabilistic security takes into account load curves and the likelihood of faults, allowing for intermediate security levels between the discrete levels set by deterministic practices.

For Vector's gas distribution network, deterministic criteria are used to gauge the adequacy of the network security levels. Shortcomings form the basis of further investigations to determine whether security enhancements are economic (refer to Section 5 for further details).

4.7 Works Performance Measures

4.7.1 Capital Works Delivery

Capital work is scheduled physically and financially from the time a project is in its proposal stage. Each project is split into a number of stage gates that state deliverables from defining the solution, through to final commissioning and close out.

Once a project has passed the solution defining stages and reaches the delivery stage, the physical and financial forecasts are reviewed and re-set as required. Project deliverables are then reviewed against forecasts.

Monthly forecasts are compiled for the whole programme of work and circulated at the executive level. Actual against forecast is also tracked as part of the executive dashboard metrics.

Monthly reporting is designed to provide a "no surprises" environment, where projects with time or budget issues are highlighted at an early stage.

4.7.2 Field Operations Performance Assessment

A performance scheme has been agreed with Vector's FSPs that is intended to:

- Measure the performance of the FSPs through the establishment of KPIs and PI (performance indicators) that provide appropriate incentives to deliver the required performance;

- Drive continuous improvement and efficiencies through the annual review of the indicators and the criteria for those indicators.

For each indicator there is a "meet" or "not met" performance incentive level. KPIs and PIs have been established for Vector's FSPs in the following areas, which are described in more detail below:

- Network performance;
- Delivery and quality of works;
- Health, safety, environmental and people;
- Cost management and efficiency; and
- Information quality.

4.7.2.1 Network Performance

The network performance indicators comprise of three measures. Table 4-16 describes the achievement criteria (meet) targets assigned to each network performance indicator.

Indicator	Description	Achievement Criteria
		Meet
KPI	Respond to emergency events	80% in <60 minutes 100% in <170 minutes
PI	Number of unplanned interruptions	<=50 per month

Table 4-16 : Vector's FSPs network performance targets

4.7.2.2 Delivery and Quality of Works

The PI for delivery and quality of works requires assessment of:

- Completion of all reactive, corrective, and planned maintenance works to the agreed plans within the agreed timeframes;
- Customer connections from customer initiation within the target periods defined below, or to the schedule agreed with the customer;
- Completing Vector initiated network projects within the agreed schedule; and
- Completion of works compliant to industry construction standards, Vector's network standards, national and local codes of practice, resource consents and other conditions without the need for corrective rework.

Vector Target

Customer connections targets:

- For gas connections, provide the quotation back to the customer within five business days of the application being made, and complete the installation within ten business days of the customer accepting the quote and all road access approvals, or on date agreed with the customer; and
- Complete the project within the timeframe agreed with the customer.

Third Party Services:

- Issue Maps;
- Third party educational awareness training; and

- Complete on-site stand-overs and issue close approach consents.

4.7.2.3 Health, Safety, Environmental, and People (for FSPs)

Health and safety management is a core element of Vector's strategic objective of operational excellence. Vector is continuing to work with its FSPs and contracting partners to identify effective ways to further improve the safety of its gas distribution networks.

4.7.2.4 Customer Experience

This is rated in terms of keeping appointment times, resolving any customer issues to ensure complaints are not made to the EGCC (taking into account adverse weather that may have affected Vector's ability to perform) and implementing behaviour-based customer service training to the agreed plan.

4.7.2.5 Cost Management and Efficiency

The cost management and efficiency PI is based on the accuracy and timeliness of invoicing, and the accuracy of information provided to assist Vector with third party damage claims. There is also a target to deliver annual productivity improvements through developing and implementing initiatives that drive efficiencies in either Vector's or the FSP's business.

4.7.2.6 Information Quality

Finally, the information quality PI is determined by assessing the accuracy, completeness and timeliness of updates to Vector's information systems, before, during and after the completion of works. Special consideration is given to safety or other significant incidents caused by any network assets not being shown in the correct location in GIS.

Vector Target

The target times for updating Vector's information systems are:

Information type	Target
Services	15 business days after livening
Subdivisions	15 business days after livening
Faulted asset repairs	15 business days after livening
Asset replacements	15 business days after replacement
Fault data	15 business day after fault resolution

Table 4-17 : Vector's FSP information quality targets

4.8 Process for Recording Reactive Fault Information

Vector's FSPs undertake data capture activities within the gas distribution network. The FSPs manage data in accordance with Vector's requirements as defined in the Vector standard GNS-0081 (standard for Gas Distribution Network Reliability, Integrity and Consumer Service).

Gas distribution network performance and consumer service data is captured using two methods:

- Electronically via hand-held tablets in the field. Data from the hand-held tablets is automatically uploaded into Vector's Customer Management System (CMS); and

- Remotely entered (external to Vector) directly into Vector's CMS, with hard copy paper records scanned and entered as an attachment. This approach is used only if the electronic data capture systems are not available.

Data entered in Vector's CMS by one of the above methods is then quality checked by the FSP for accuracy, prior to undergoing additional quality assurance checks by Vector personnel. Data is then extracted from Vector's CMS and the required information is generated for reporting purposes.

The following system integrity and reliability metrics are extracted from the CMS database for disclosure reporting:

- Response Time to Emergencies
- SAIDI Unplanned
- SAIDI Planned
- SAIFI Unplanned
- SAIFI Planned
- CAIDI Unplanned
- CAIDI Planned
- Interruptions by Class
- Outage Events
- Outage Events Caused by Third Party Damage
- Public Reported Escapes
- Third Party Damage Events
- Leakage Survey
- Poor Pressure Due to Network Causes
- Emergency Telephone Calls answered within 30 Seconds
- Product Control – Non Compliance Odour Tests
- Number of Complaints

Figure 4-4 shows how the reactive fault information is recorded and checked for completeness.

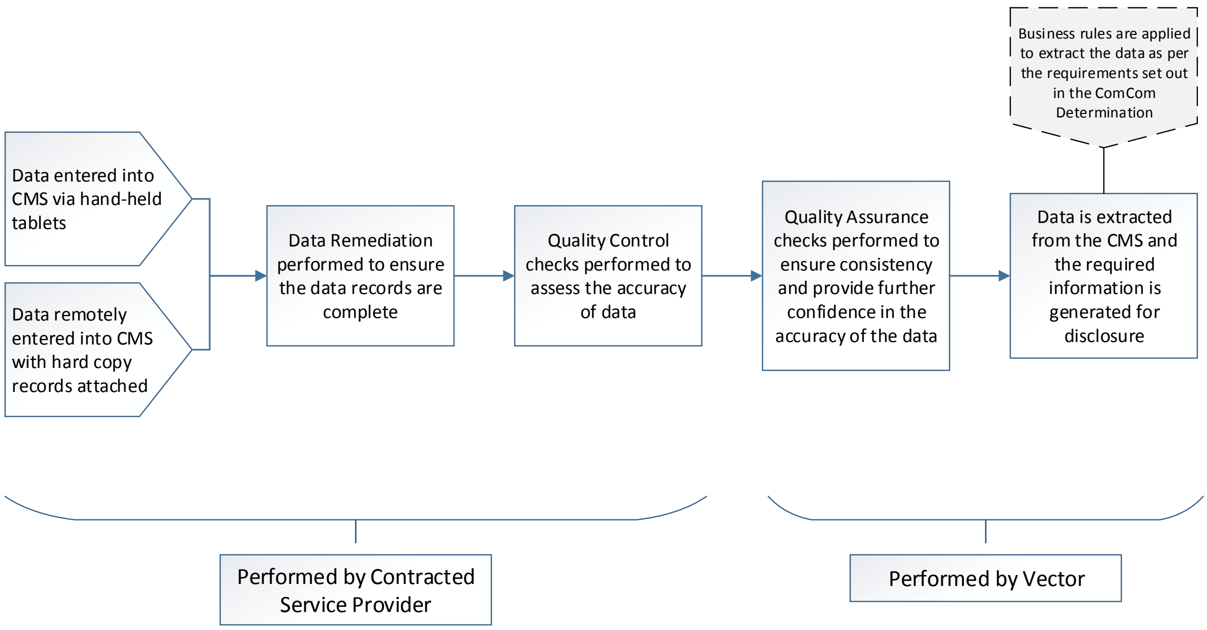

Figure 4-4 : Process for capture and QA of reactive fault information

Gas Distribution Asset Management Plan 2015 – 2025

Network Development Planning– Section 5

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5 Network Development Planning

Network development refers to growth initiatives which:

- Extend the Vector gas distribution network to developing areas;
- Increase the capacity or supply levels of the existing network to cater for load growth or changing consumer demand;
- Provide new customer connections; or
- Address the relocation of existing services when required as a result of the activities of other utilities, requiring authorities[1] or customers.

5.1 Network Development Processes

Vector's network development process involves the modelling and planning of the gas distribution network, capital budgeting, prioritising the solutions programme and implementing the planning solutions.

5.1.1 Network Planning Process

Vector's primary objectives in network planning are to identify and prevent foreseeable network related security[2], capacity and quality (system pressure) problems in a safe, technically efficient and cost-effective manner. The planning process involves identifying and resolving:

- Supply quality, security or capacity issues that may prevent Vector from delivering its target service levels;
- Adequacy of supply to new developments or areas requiring gas connections;
- The need to relocate assets, when reasonably required by third parties; and
- Supply quality problems which can be identified from a wide range of sources, including network measurement and monitoring (system pressure), gas flow modelling and customer complaint databases.

The diagram in Figure 5-1 shows the high level planning and programme implementation processes.

Knowledge of asset capacity and capability, together with an accurate demand forecast, enables an accurate assessment of the network's ability to deliver the required level of security and service. Input data comprising past demand trends, anticipated customer growth, technology trends, demographics, population growth, and industry trends are used to produce the demand forecast.

[1] The main requiring authorities are local authorities, Kiwi Rail and NZTA.

[2] "Security" as used in a planning context means the security of the gas supply – i.e. the likelihood that supply may be lost.

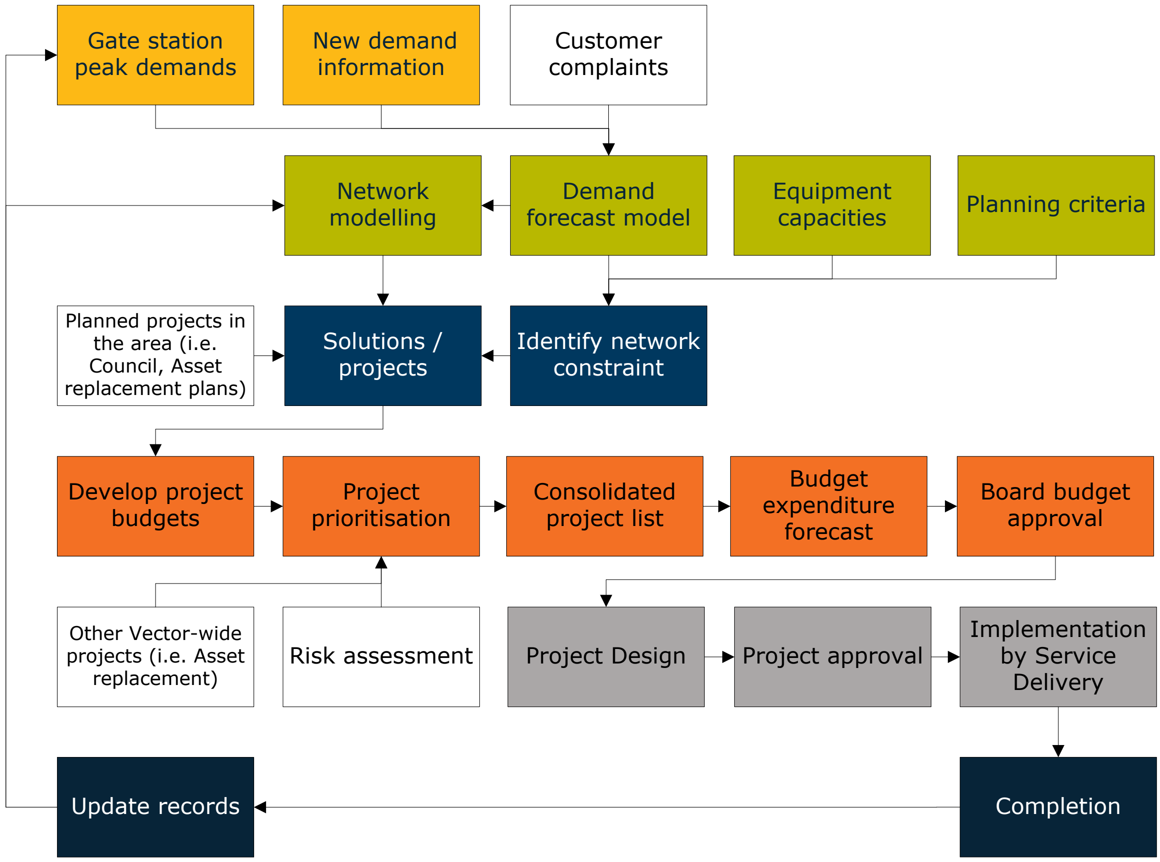

Figure 5-1 : Network development and implementation process

5.1.2 Project Implementation

An effective delivery of the capital works programme, based on an end-to-end delivery process has been established. The process tracks each project from conceptual design through to site construction and commissioning.

5.2 Planning Criteria and Assumptions

Network development planning is concerned with delivering network performance based on the availability of reserve capacity to a level of risk acceptable to the board, or as agreed with customers. Vector has a number of key policies, standards and guidelines underpinning its network planning approach. These policies, standards and guidelines cover the following areas:

- **Quality of supply standard:** Vector's quality of supply standard specifies the minimum levels of network pressure (including levels of redundancy) to ensure an appropriate level of supply service. Vector has adopted a 1-in-20 year winter incidence (i.e. severity) level, to ensure that distribution capacity shortfalls do not occur at an unacceptably high frequency;
- **Service level:** Established as part of the Use of Network Agreement with retailers and customers;
- **Technical standards:** Ensure optimum asset life and performance is achieved. They ensure that capital cost, asset ratings, maintenance costs and expected life are optimised to achieve lowest overall cost for Vector. Standardisation also reduces

design costs and minimises spare equipment holding costs, leading to lower overall project costs; and

- **Network parameters:** Including acceptable operating pressure levels, pipe sizes, flow rates, etc., providing an appropriate operating framework for the network. These will generally be aligned with industry norms.

These policies, standards and guidelines are based on the following principles:

- All network assets will be operated within acceptable standards;
- The design and operation of the network will not present a safety risk to staff, contractors, customers or the public;
- The network is designed to meet statutory requirements including acceptable pressure levels;
- Customers' reasonable gas supply requirements will be met.[3] In addition, the network is designed to include a prudent capacity margin to cater for foreseeable medium term load growth;
- Equipment is purchased and installed in accordance with network standards to ensure optimal asset life and performance; and
- Network investment will provide an appropriate commercial return for the business.

5.2.1 Quality of Supply

Vector recognises the importance of supply quality to its customers. The networks are designed to a supply quality level that ensures most modern gas-driven equipment can operate effectively. Strategies have been adopted to monitor and manage the impact of quality on the network. These include installation of pressure and flow monitoring equipment at gate stations, district pressure stations and customer sites and the application of modelling software and tools to predict the impact of supply quality on customers.

Vector has considered several factors in determining the quality of supply applicable to its gas distribution network. These include the degree of redundancy in different circumstances and supply pressure criteria which, when put together, build the over-arching quality of supply criteria.

Due to historical practices of predecessor organisations, Vector's gas distribution networks have been developed based on different criteria. Steps have been taken to progressively align the different criteria towards a single set of quality of supply and security criteria across all regions.

One of the long-term network development drivers is to increase asset utilisation, while retaining acceptable level of supply and security risks. This can be achieved through a combination of knowledge of the capability of network assets, and accurate network operating information (demand, pressure, etc.).

5.2.1.1 Supply Pressure Criteria

The capacity of an individual pipeline is determined by the operating pressure, the diameter and the allowable pressure difference between inlet and outlet. Meshed distribution systems work on the same principle, except that the pipelines are interconnected and that such distribution systems can be fed at multiple points.

Regulator stations have nominal outlet pressures which supply each discrete pressure system. As the distribution systems expand and demand grows, certain parts of the distribution systems, mostly particular feeder mains, can develop large pressure drops,

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[3] This includes customers with non standard requirements, where special contractual arrangements apply.

thus constraining downstream parts of the distribution systems. Vector therefore prepares regular system pressure monitoring surveys and distribution system analyses to identify such constraints and to reinforce distribution systems before operating pressures become insufficient.

The utilisation of a pipeline system can be inferred by examining pipeline pressures. It therefore follows that 'utilisation' may be used as a proxy measure to establish the acceptable operating limits for pipeline pressures.

Figure 5-2 below illustrates the relationship between gas flow (utilisation) and pressure drop for a typical gas pipeline.

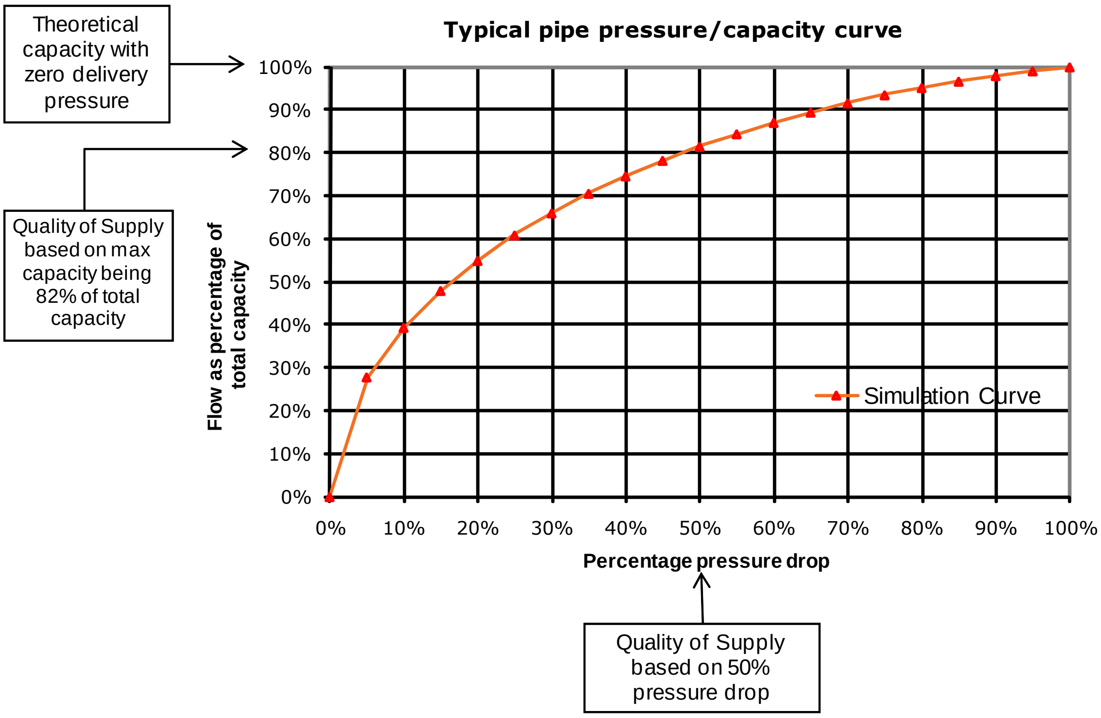

Figure 5-2 : Relationship of pressure and capacity

Examination of the above diagram shows that for a pressure drop of 50%, a pipeline system is delivering 82% of its gas delivery potential (and from an operation perspective is operating at its maximum utilisation level). It is important to note that each pressure system needs to be considered when examining pressure drops. This is due to the meshed nature of the network and the different characteristics each pressure system exhibits, i.e. mix of residential, commercial and industrial customers. The following sections describe the key points of Vector's quality of supply criteria.

a. Standard Operating Pressures

Vector has determined that under standard operating arrangements, pressure at any point on the network shall be no less than 50% of its Nominal Operating Pressure (NOP) and no more than 110% of its NOP[4].

b. Non-Standard Operating Pressures

In some cases non-standard minimum network pressures are used as a result of network configuration, cost efficiency or special agreements with customers. Vector's quality of supply criteria provides the minimum operating pressures that apply at the critical locations where non-standard conditions apply.

[4] Vector's standard operating pressures are in line with international practice.

c. Contingency Conditions

During contingency conditions, network pressures may drop below those experienced during standard and non-standard operating conditions. In these situations, maintaining network pressure depends on the type of fault and the network configuration. Contingency provisions such as customer load shedding are used to maintain network pressure to the end users. Upon loss of a critical element in the supply chain, the following minimum network pressures shall be maintained using contingency provisions:

- Intermediate pressure (IP) networks shall be operating at no less than 40% of NOP;
- Medium pressure (MP) networks shall be operating at no less than 30% of NOP;
- In Auckland, low pressure networks shall be operating at no less than 1.2kPa; and
- In other areas, low pressure networks shall be operating at no less than 3kPa.

Note: Under contingency situations, networks are isolated to maintain safety to customers and the public.

5.3 Planning Methodology

As noted previously, the network planning process involves identifying and resolving:

- Upcoming supply quality, security or capacity issues that may prevent Vector from delivering its target service levels;
- Adequacy of supply to new developments or areas requiring gas connections; and
- The need to relocate assets when reasonably required by third parties.

In all cases, effective design requires consideration of the forecast planning demand, the capacity of equipment and the impact of the environment in which the equipment will operate.

The demand forecast model is aimed at providing an accurate picture of future demand growth (or decline) so investment decisions can be made with confidence. When used in conjunction with equipment ratings, it is possible to plan for the required quality of supply margins within the network. The quality of supply criteria is defined to reflect the levels of acceptable supply risk to Vector and its customers. This ensures that network investments are made on a consistent basis.The methodology used to assess equipment rating reflects the capacity of the equipment under field conditions, independent of the manner in which demand forecasts and quality of supply standards are developed.

5.3.1 Network and Asset Capacity

To enable the capacity of the delivery points (pressure systems) to be assessed, it is necessary to a have a reliable assessment of the capacities of the major network components. Major components include:

- Pipelines;
- Gate stations; and
- District regulating stations (DRS).

Determining the capacities of these network components requires a detailed assessment of each sub-component within the component. For example, in assessing the capacity of a DRS, ratings of the filter, meter, regulator and other accessories are also assessed to ensure the sub-component with the lowest rating – which determines the overall asset rating - is identified.

The following paragraphs describe how the capacities of the network components are assessed. In all cases, asset capacities are assessed at normal full-load ratings.

5.3.1.1 Pipelines

The analysis of pipeline capacity is complex due to the various pipeline types and network configurations. As mentioned beforehand[5], pipeline capacity can be determined by examining the relationship between system pressures, pipe diameter and the allowable minimum operating pressure (MinOP).

To help in determining the capacity of a pipeline or group of pipelines (pressure system), Vector uses the network modelling tool "SynerGi[6]", a product of GL Noble Denton. SynerGi is designed to model the gas network flow, pressure profile and capacity margins. This software tool is used 1) to determine the minimum pressure a pipeline system can sustain under load conditions, 2) for scenario analysis when considering development options, and 3) to assess the impact of changes to network operating parameters (such as increasing or reducing operating pressure in certain parts of the network) and to assess network risk.

5.3.1.2 Gate Stations

Vector takes its gas supply from the transmission system via gate stations (which are also operated and maintained by Vector[7]).

Gate station capacity is designed to meet the 10 year forecast load requirements at the station, based on minimum design inlet pressure and design outlet pressure and current load projections.

From a gas distribution perspective, there is a need to obtain a better understanding of the design capacity of most gate stations. Constraints at a gate station can impact on distribution investment decisions. Improved knowledge of the gate station capacities and constraints will lead to improved decisionmaking by offering a wider range of investment solutions.

5.3.1.3 District Regulating Stations

The purpose of a District Regulating Station (DRS) is to control the pressure in the downstream mains pipeline to which it is connected. Also, a DRS is designed with sufficient capacity to supply the 10 year forecast load, based on minimum design inlet pressure and design outlet pressure, and current load projections.

Vector's gas network distribution quality of supply criteria is based on maintaining an adequate supply pressure across the network.

5.3.2 Project Prioritisation

The planning process results in a list of network projects and non-network solutions. These projects, along with other proposed projects for different asset investment purposes (e.g. asset replacement, customer connections, etc) are prioritised based on a risk matrix to obtain a pair-wise comparison (see Section 9). The risk matrix looks at operational, health and safety, environmental, legal, financial, reputational and regulatory risk factors to develop a "project necessity" rating or priority rating for the project.

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[5] Section 5.2.

[6] SynerGi is the product name provided by GL Noble Denton for gas network modelling and analysis. It features advanced pipeline simulation software along with the ease and familiarity of a windows-based operating system. Licensing add-on modules can extend SynerGEE's functionality. Currently, Vector has two server licences that can run both steady state and unsteady state modules.

[7] Note that the gas transmission asset management or asset details are separately disclosed in Vector's Gas Transmission AMP.

The resulting list of projects becomes an input for the capital works programme. For network growth projects, the project priority is generally in the following order (from high to low):

- Avoiding quality of supply breaches that could lead to unsafe situations;
- Enhancing network efficiency (including works programme synergy); and
- Implementation of long-term development opportunities.

Refer to Section 9 for further details on project prioritisation.

5.4 Demand Forecasting

5.4.1 Demand Forecasting Methodology

A spreadsheet-based model has been developed for gas demand forecasting. The model covers the winter forecasts for the next 10 years.

Time-series analysis is used to develop a demand forecast at each gate station. Historical monthly flow data is summarised into a quarterly peak flow value. Input into the time-series was taken as the maximum flow of each quarter (Jan-Mar as Q1, Apr-Jun as Q2, etc). Some gate stations are equipped with two or three meters resulting in multiple meter readings. At these sites, the flows were either summed or the maximum value was used. Zero, anomalous or incomplete data has been excluded. In some cases[8], data was not available, and in these cases, Vector relies on its system pressure monitoring programmes to assess the demand on the network.

The time-series quarterly values are analysed for several factors: long-term trend, business cycle effects, seasonality, and unexplained, random variation. Because it is usually very difficult to isolate the business cycle effects, the method described here assumes the trend component has both long-term average and cyclical effects. The multiplicative model calculates the value using the formula:

Value = Trend x Seasonal x Random

The process of analysing time-series comprises two stages. The first stage is called 'decomposition' by applying moving averages to eliminate the irregular and seasonal variation in the data and identifying the long-run growth trend within the time-series. Secondly, historical flow data is seasonally adjusted and the trend of the adjusted quarterly flow values is extrapolated[9] and multiplied by an appropriate seasonal index to obtain the forecasted long-term gas demand at each gate station.

Using actual gate station flow data and providing the results of the updated time series analysis allows the demand forecasts to be developed using maximum values for year 0, and derived values for years during the planning period.

Where a gas network is supplied from two (or more) gate stations, the timing of the network peak gas flow may not coincide with either of the gates stations' flows[10]. In such cases, a co-incidence factor is calculated and applied to the growth trend. It is expressed as the maximum peak flow into the network divided by the sum of the individual peak flows of the two gate stations. Examples of these networks include Central Auckland, Hamilton, Te Awamutu, Mt Maunganui and Tauranga.

[8] Gate station flow data for Papakura (non Auckland), Wellsford, Broadlands, Oakleigh, Matangi, Okoroire Springs, Te Rapa, Kuku and Te Horo is unavailable due to these gate stations having no transmission metering capability.

[9] The extrapolation uses a linear trend except where the trend results in negative values. In these cases, a zero load growth has been applied.

[10] The coincident and non-coincident demand is the same for gas distribution networks with a single gate station supply.

Similarly, a co-incident factor is also applied where two network systems are supplied by one gate station. These networks include the Auckland and North Island networks in Drury and Whangaparaoa, respectively.

5.4.2 Customer Connections

Last year, Vector commissioned Covec[11] to independently forecast connection rates on the gas distribution network. In its review, Covec verified Vector's own internal information, and identified that the key drivers for the future increase in new connections were primarily linked to the Statistics New Zealand 2013 Census data (such as population growth projections and household size) and GDP growth forecasts (as provided by the RBNZ). Housing growth was also an indicator, but less influential.

Covec's review included three forecast scenarios as shown in Figure 5-3. The base case forecasts in this AMP are based on Covec's 'medium' growth forecast.

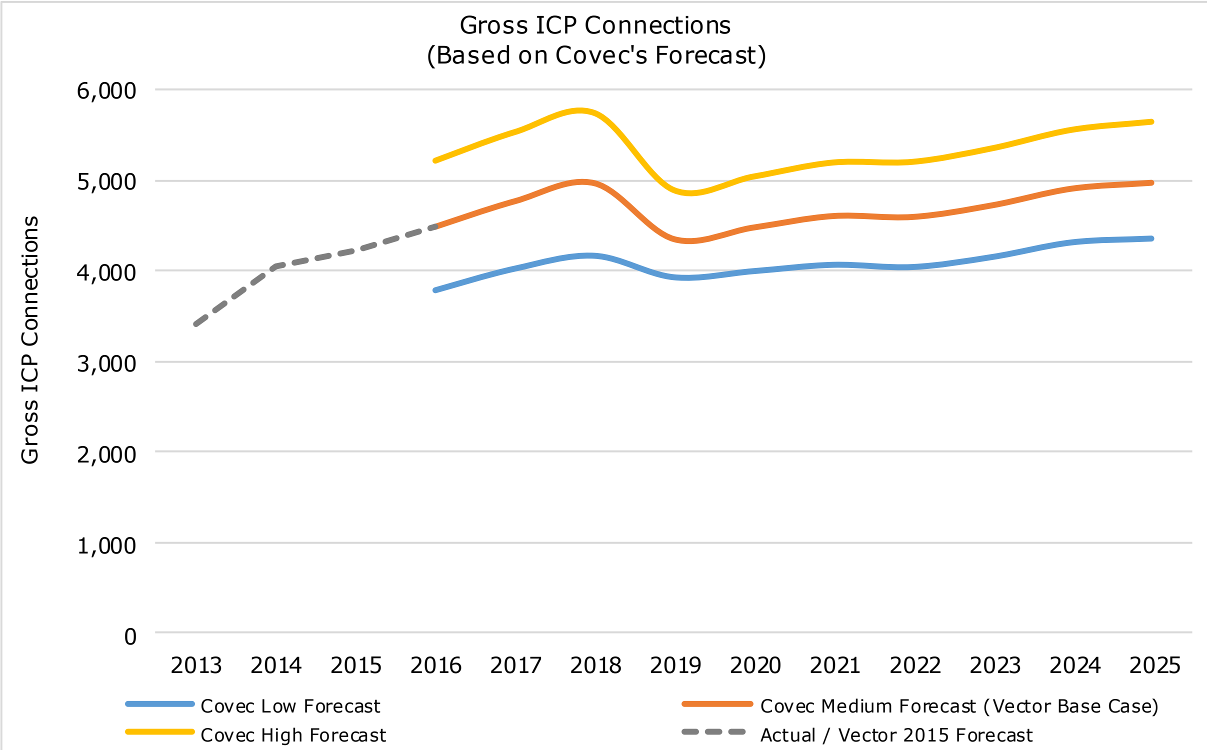

Figure 5-3 : Forecast gross gas connections based on Covec's growth forecasts

5.4.3 Subdivision Reticulation

Over the past year, there has been an increase in the number of residential gas subdivisions where electricity and gas are jointly reticulated (namely within the Auckland network area). This is due to improvements in Vector's processes along with the developers being more aware of the value in reticulating gas and electricity at the same time.

General market conditions indicate an increasing number of enquiries from developers reflecting the widely reported housing shortage in Auckland. It is anticipated that the level of enquiries will increase as developers look to address this demand for residential

[11] For a description of the analysis behind Covec's forecast refer to Vectors 2014 Gas Distribution Asset Management Plan Update http://vector.co.nz/disclosures/gas/gas-asset-management

properties with customer appealing energy solutions, such as gas hot water and appliances.

The North Island subdivision market has also shown signs of an upturn; however as the gas network is not complimented by an electricity network, gas reticulation is in direct competition with electricity rather than being complimentary. Additionally, the gas market in the North Island is increasingly competitive.

Vector is anticipating an increase in subdivision reticulation activity; new connections are forecast to continue in line with growth in new subdivisions, with a 'bow wave' of activity expected in 2 -3 years' time as the majority of lots being developed in Auckland Special Housing Area's come to market. Given the fragile global economic environment and focus on the energy sector, a prudent approach to forecasting new gas connections is appropriate.

Current uptake of gas connections in residential reticulated subdivisions sits at 60%.

Table 5-1 shows Vector's gross forecast customer connections in the residential and commercial markets.

Gross Customer Connections	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total connections	4,496	4,772	4,966	4,363	4,488	4,612	4,602	4,728	4,907	4,971

Table 5-1 : Gross customer connections forecast

* Figures are in 2016 real New Zealand dollars ($'000);

Table 5-4 and * Figures are in 2016 real New Zealand dollars ($'000);

Table 5-5 provide Vector's connection expenditure forecasts for the Auckland and North Island regions respectively for the next 10 years.

5.4.4 Large Development Projects

Vector, as a requiring authority, receives early notification of resource consent applications. This allows Vector to keep abreast of imminent projects and commence early discussions with developers and consultants about proposed gas supply needs. For larger projects, in particular, the earlier planning commences, the more ability Vector has to optimise designs, obtain optimal procurement rates and maximise potential benefits arising from the synergy of these projects.

The additional loads expected from development projects are captured in the demand forecast, based on a best estimate of when this will be experienced, and hence the optimal point at which network augmentation will be required. Regular re-forecasting allows the timing of the individual projects to be re-evaluated and to adjust the forecasts accordingly.

In high growth areas, network augmentation may be brought forward somewhat, to ensure a larger network capacity buffer that allows for unexpected load increases or unexpected delays in the delivery of solutions.

5.4.5 Planning Under Uncertainty

A number of precautions are taken to mitigate the risks of making long-term investments in an uncertain environment. Apart from normal business risk avoidance measures, specific actions taken to mitigate the risks associated with investing in networks include the following.

- **Act prudently:** Make small incremental investments and defer large investments for as long as reasonably possible (replace DRS components rather than entire DRS). The small investments must, however, conform to the long-term investment plan for a region and not lead to future asset stranding.
- **Multiple planning timeframes:** Produce plans based on near, medium and long-term views. The near term plan is the most accurate and generally captures load growth for the next three years. This timeframe identifies short-term growth patterns, mainly leveraging off historical trends. It generally allows sufficient time for planning, approval and network construction to be implemented ahead of changing network demand.

  The medium-term plan covers the next ten years, and anticipates regional development trends such as land rezoning, new transport routes and larger infrastructure projects. The medium-term plan also captures behavioural changes such as the adoption of new technologies or global trends (eg. impact of climate change on consumer behaviour, energy conservation, etc).

  The Auckland Council has published a draft "Auckland Plan" to guide the development of the city in the next twenty to thirty years to accommodate the anticipated "medium" population growth to two million people by 2031. The "Auckland Plan" will supersede the Regional Growth Strategy (RGS) when it is formalised. A preliminary assessment of the "Auckland Plan" indicated that it is very similar in approach to the RGS with intense developments within the region's urban limits and concentrated growth along transport corridors. A detailed assessment will be made when the "Auckland Plan" is formalised.

  The long-term plan looks at growth patterns within the region at the end of the current asset lifecycle, around 40 years out. A top-down approach is used to predict probable network loads within the region, from which the requirement for pressure system upgrades or new gate stations and DRSs are identified. The objective is less about developing accurate load forecasts and more about providing a long-term development plan, identifying likely future network requirements.
- **Review significant replacement projects:** For large network assets, rather than replace existing end-of-life assets with the modern equivalent, a review is carried out to confirm the continued need for the assets, as well as the optimal size and network configuration that will meet Vector's needs for the next asset lifecycle.

5.4.6 Load Forecasts

Based on the available information and using the methodology described earlier, Figure 5-4 shows the load forecast for Vector's gas distribution networks in the Auckland and North Island pricing regions. Table 5-2 shows the projected annual and total growth rates at each of Vector's existing gate stations, which are applied in Vector's network models[12].

[12] Vector's network models are updated on a rolling 3 yearly cycle.

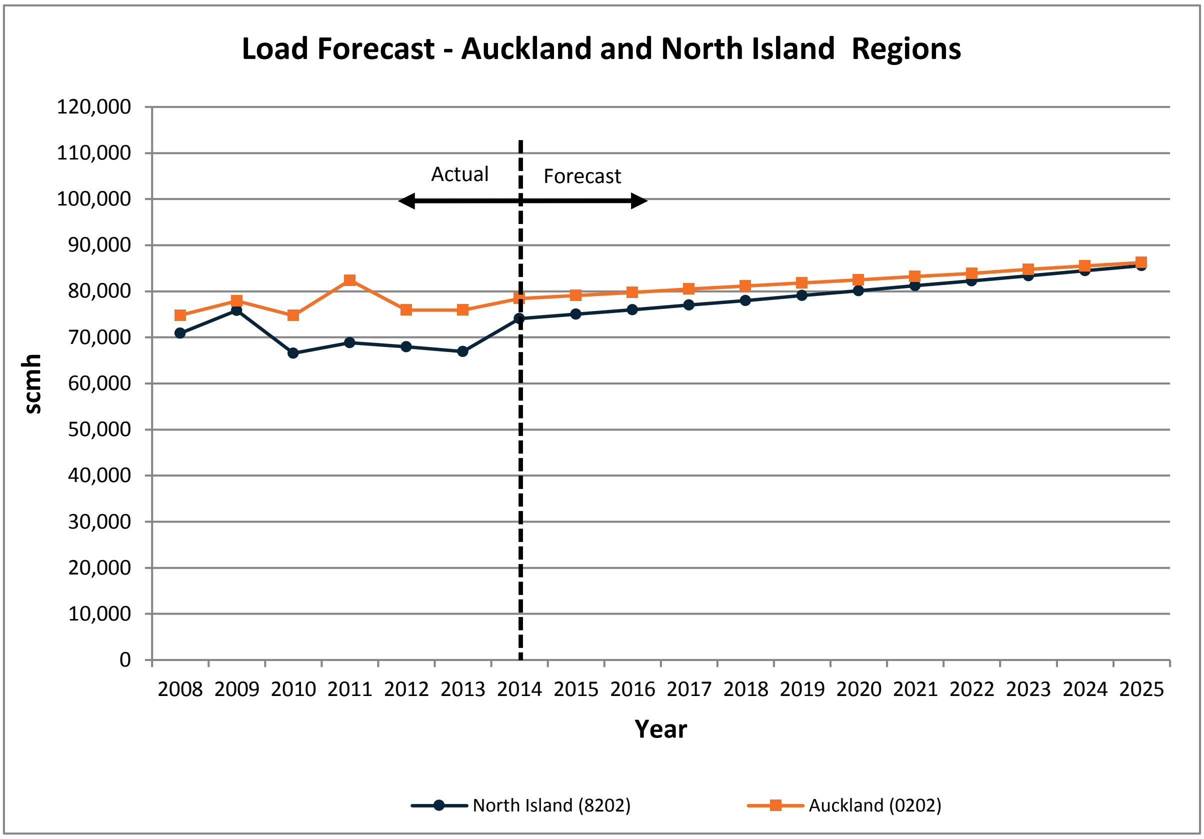

Figure 5-4 : Load forecast for Vector networks in Auckland and North Island pricing regions

Region	Network system	Gate station / Network system	2009 Actual	2010 Actual	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Forecast	2016 Forecast	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	Annual growth	Total growth
Northland	Marsden Point	Marsden Point Gate Station	218	207	198	168	211	199	207	207	207	207	207	207	207	207	207	207	207	0.4%	4.0%
Northland	Oakleigh	Oakleigh Gate Station	No data																		
Auckland	Wellsford	Wellsford Gate Station	No data																		
Northland	Whangarei	Whangarei Gate Station	1,659	1,028	1,066	984	954	978	1,037	1,028	1,028	1,028	1,028	1,028	1,028	1,028	1,028	1,028	1,028	0.5%	5.1%
Auckland	Alfriston	Alfriston Gate Station	203	194	157	140	141	156	194	194	194	194	194	194	194	194	194	194	194	2.0%	24.0%
Auckland	Auckland Central	Papakura Gate Station (GS0006)	21,700	19,444	23,844	20,203	18,632	18,836	20,247	20,419	20,591	20,763	20,936	21,108	21,280	21,453	21,681	21,866	22,052	1.4%	17.1%
Auckland	Auckland Central	Westfield Gate Station	41,044	43,303	49,938	48,431	42,982	45,227	45,090	45,474	45,858	46,242	46,625	47,009	47,393	47,776	48,285	48,698	49,110	0.8%	8.6%
Auckland	Auckland Central	Bruce McLaren Gate Station	1,982	1,908	1,989	2,142	2,063	2,266	1,987	2,004	2,021	2,037	2,054	2,071	2,088	2,105	2,128	2,146	2,164	0.0%	0.0%
Auckland	Auckland Central	Henderson Gate Station	10,646	10,635	11,274	10,802	11,657	11,726	11,074	11,168	11,262	11,357	11,451	11,545	11,639	11,734	11,859	11,960	12,061	0.3%	2.9%
Auckland	Auckland Central	Central Auckland Network System (non co-incident)	75,372	75,290	87,045	81,578	75,334	78,056	78,398	79,065	79,732	80,399	81,066	81,734	82,401	83,068	83,952	84,670	85,387	0.8%	9.4%
Auckland	Auckland Central	Auckland Central Network System (co-incident)	74,187	70,946	78,660	71,933	72,319	75,482	75,105	75,744	76,383	77,022	77,662	78,301	78,940	79,579	80,426	81,114	81,801	0.7%	8.4%
Auckland	Drury CT	Drury CT Network System	377	373	367	368	315	369	373	373	373	373	373	373	373	373	373	373	373	0.1%	1.2%
Auckland	Drury NC	Drury NC Network System	2,051	1,594	1,960	1,877	1,809	2,009	2,422	2,501	2,579	2,657	2,735	2,813	2,891	2,969	3,074	3,158	3,242	4.4%	61.4%
Auckland	Drury CT & Drury NC	Drury Gate Station (non co-incident)	2,428	1,967	2,327	2,246	2,123	2,378	2,716	2,778	2,842	2,906	2,971	3,037	3,103	3,170	3,256	3,326	3,397	3.3%	42.8%
Auckland	Drury CT & Drury NC	Drury Gate Station (Co-incident)	2,316	1,786	2,248	2,141	2,053	2,330	2,479	2,537	2,595	2,653	2,713	2,772	2,833	2,894	2,973	3,037	3,101	2.6%	33.1%
Auckland	Hunua	Hunua (Vector) Gate Station	803	858	804	801	771	851	858	858	858	858	858	858	858	858	858	858	858	0.1%	0.8%
Auckland	Kingseat	Kingseat Gate Station	27	22	22	19	3	4	22	22	22	22	22	22	22	22	22	22	22	17.3%	478.9 %
Auckland	Pukekohe	Pukekohe Gate Station	394	358	375	626	565	432	404	405	406	406	407	408	409	410	411	412	413	0.0%	0.0%
Auckland	Ramarama	Ramarama Gate Station	248	250	257	255	253	322	258	261	264	267	271	274	277	280	284	287	290	0.0%	0.0%
Auckland	Tuakau	Tuakau Gate Station	1,389	1,438	1,494	1,544	1,356	1,499	1,531	1,556	1,581	1,606	1,630	1,655	1,680	1,705	1,730	1,755	1,779	1.6%	18.7%
Auckland	Tuakau	Tuakau Gate Station No.2						3,243												0.0%	0.0%
Auckland	Warkworth	Warkworth Gate Station	2,018	1,899	1,901	1,871	2,016	2,203	2,330	2,417	2,504	2,590	2,677	2,763	2,850	2,937	3,025	3,112	3,199	3.4%	45.2%
Auckland	Whangaparaoa CT	Whangaparaoa CT Network System	291	318	256	224	204	422	356	369	381	394	406	419	431	444	461	475	488	1.3%	15.8%
Auckland	Whangaparaoa NC	Whangaparaoa NC Network System	1,163	969	1,223	1,344	1,251	1,230	1,325	1,372	1,419	1,465	1,512	1,559	1,605	1,652	1,717	1,767	1,818	3.6%	47.9%
Auckland	Whangaparaoa CT & NC	Waitoki Gate Station (non co-incident)	1,454	1,287	1,479	1,568	1,455	1,651	1,679	1,739	1,798	1,857	1,916	1,975	2,034	2,093	2,175	2,240	2,304	3.1%	39.5%
Auckland	Whangaparaoa CT & Whangaparaoa NC	Waitoki Gate Station (co-incident)	1,319	1,191	1,332	1,452	1,409	1,327	1,550	1,605	1,659	1,714	1,768	1,823	1,878	1,932	2,008	2,067	2,126	4.4%	60.3%
Auckland	Papakura	Papakura Gate Station (GS1002)	No data																		

Region	Network system	Gate station / Network system	2009 Actual	2010 Actual	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Forecast	2016 Forecast	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	Annual growth	Total growth
Auckland	Harrisville	Harrisville Gate Station	3,156	3,114	2,972	3,068	3,588	3,343	4,714	4,953	5,192	5,432	5,671	5,910	6,150	6,389	6,628	6,867	7,107	7.1%	112.6 %
Waikato	Cambridge	Cambridge Network System (excl. load of Hautapu DF)	1,054	1,084	1,037	985	1,002	1,144	1,084	1,084	1,084	1,084	1,084	1,084	1,084	1,093	1,091	1,100	1,109	0.0%	0.0%
Waikato	Cambridge	Cambridge (Hautapu DF)	2,279	2,425	2,419	2,448	2,537	2,872	2,425	2,443	2,471	2,499	2,528	2,556	2,584	2,612	2,608	2,629	2,650	0.0%	0.0%
Waikato	Cambridge	Cambridge Gate Station (non co-incident)	3,333	3,509	3,456	3,433	3,539	4,016	3,509	3,509	3,509	3,545	3,585	3,625	3,665	3,706	3,699	3,729	3,758	0.0%	0.0%
Waikato	Cambridge	Cambridge Gate Station (co-incident)	2,681	2,951	2,928	3,047	3,063	3,201	2,951	2,951	2,951	2,953	2,986	3,020	3,053	3,087	3,082	3,106	3,131	0.0%	0.0%
Waikato	Hamilton	Hamilton - Te Kowhai Gate Station	6,720	5,169	5,509	4,978	5,693	5,043	6,015	6,095	6,174	6,254	6,334	6,414	6,493	6,573	6,653	6,733	6,812	2.8%	35.1%
Waikato	Hamilton	Hamilton - Temple View Gate Station	9,140	9,064	9,557	9,698	9,268	13,150	10,547	10,687	10,827	10,967	11,107	11,247	11,386	11,526	11,666	11,806	11,946	0.0%	0.0%
Waikato	Hamilton	Hamilton Network System (non co-incident)	15,860	14,233	15,066	14,676	14,961	18,193	16,562	16,782	17,001	17,221	17,441	17,660	17,880	18,099	18,319	18,539	18,758	0.3%	3.1%
Waikato	Hamilton	Hamilton Network System (co-incident)	15,329	13,987	14,829	14,676	14,363	15,489	16,281	16,496	16,712	16,928	17,144	17,360	17,576	17,792	18,008	18,223	18,439	1.6%	19.0%
Waikato	Horotiu	Horotiu Gate Station	1,189	1,044	960	983	971	1,028	1,290	1,309	1,329	1,348	1,367	1,387	1,406	1,425	1,445	1,464	1,483	3.4%	44.4%
Waikato	Huntly	Huntly Gate Station	661	547	679	581	491	558	547	547	547	547	547	547	547	547	547	547	547	0.0%	0.0%
Waikato	Kiwitahi	Kiwitahi Gate Station	130	144	156	154	153	165	144	144	144	144	144	144	144	144	144	144	144	0.0%	0.0%
Waikato	Matangi	Matangi Gate Station	No data																		
Waikato	Morrinsville	Morrinsville Gate Station	563	515	447	459	477	442	584	588	591	595	599	603	607	611	615	619	623	3.2%	40.8%
Waikato	Ngaruawahia	Ngaruawahia Gate Station	79	64	68	67	67	63	82	84	87	89	91	94	96	98	101	103	106	4.8%	67.9%
Waikato	Otorohanga	Otorohanga Gate Station	168	174	156	163	152	131	174	174	174	174	174	174	174	174	174	174	174	2.6%	32.7%
Waikato	Pirongia	Pirongia Gate Station	25	29	27	30	27	27	32	33	34	34	35	36	37	38	39	39	40	3.6%	47.5%
Waikato	Te Awamutu	Te Awamutu North - No.2 Gate Station	690	631	487	613	439	470	631	631	631	631	631	631	631	631	631	631	631	2.7%	34.4%
Waikato	Te Awamutu	Kihikihi Gate Station	1,294	1,229	653	692	800	748	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	4.6%	64.2%
Waikato	Te Awamutu	Te Awamutu Network System (non co-incident)	1,984	1,860	1,140	1,304	1,239	1,218	1,860	1,860	1,860	1,860	1,860	1,860	1,860	1,860	1,860	1,860	1,860	3.9%	52.7%
Waikato	Te Awamutu	Te Awamutu Network System (co-incident)	1,369	1,229	1,067	1,276	1,105	1,124	1,229	1,229	1,236	1,243	1,249	1,256	1,263	1,270	1,276	1,283	1,290	1.3%	14.8%
Waikato	Te Kuiti North	Te Kuiti North Gate Station	294	368	291	241	317	196	368	368	368	368	368	368	368	368	368	368	368	5.9%	87.6%
Waikato	Te Kuiti South	Te Kuiti South Gate Station	925	910	910	933	968	996	910	910	910	910	910	910	910	910	910	910	910	0.0%	0.0%
Waikato	Te Rapa	Te Rapa (Inactive distribution network)	No data																		

Region	Network system	Gate station / Network system	2009 Actual	2010 Actual	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Forecast	2016 Forecast	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	Annual growth	Total growth
Waikato	Waikeria	Waikeria Gate Station	223	256	401	206	197	217	282	289	297	305	312	320	328	335	343	351	358	4.7%	65.4%
Waikato	Waitoa	Waitoa Gate Station	2,009	2,004	2,082	2,119	1,892	1,936	2,314	2,377	2,440	2,504	2,567	2,630	2,693	2,757	2,820	2,883	2,946	3.9%	52.2%
Central Plateau	Rainbow Mountain	Rainbow Mountain Gate Station	936																		
Central Plateau	Reporoa	Reporoa Gate Station	2,734	2,715	2,762	2,646	2,568	2,607	2,793	2,759	2,725	2,715	2,715	2,715	2,715	2,715	2,715	2,715	2,715	0.4%	4.1%
Central Plateau	Rotorua	Rotorua Gate Station	3,765	3,547	3,763	3,587	3,417	3,438	3,629	3,609	3,588	3,567	3,547	3,547	3,547	3,547	3,547	3,547	3,547	0.3%	3.2%
Central Plateau	Taupo	Taupo Gate Station	1,294	1,228	1,246	1,186	1,176	1,178	1,494	1,539	1,584	1,629	1,674	1,718	1,763	1,808	1,853	1,897	1,942	4.7%	64.9%
Central Plateau	Kinleith	Kinleith Gate Station	235	242	261	252	265	299	258	259	261	262	264	265	267	268	270	271	273	0.0%	0.0%
Central Plateau	Okoroire Springs	Okoroire Springs Gate Station	No data																		
Central Plateau	Putaruru	Putaruru Gate Station	560	531	505	507	504	482	589	579	570	560	550	541	531	531	531	531	531	0.9%	10.1%
Central Plateau	Tirau	Tirau Gate Station	57	57	56	55	48	60	75	79	82	86	89	93	96	100	103	107	110	5.7%	84.8%
Central Plateau	Tokoroa	Tokoroa Gate Station	868	812	805	803	849	860	812	812	812	812	812	812	812	812	812	812	812	0.0%	0.0%
Bay of Plenty	Edgecumbe	Edgecumbe MP4 Pressure System	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	0.0%	0.0%
Bay of Plenty	Edgecumbe	Edgecumbe IP20 Pressure System	6,022	5,769	5,987	5,903	5,743	6,282	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	0.0%	0.0%
Bay of Plenty	Edgecumbe	Edgecumbe Gate Station (non-co-incident)	6,032	5,779	5,997	5,913	5,753	6,292	5,779	5,779	5,779	5,779	5,779	5,779	5,779	5,779	5,779	5,779	5,779	0.0%	0.0%
Bay of Plenty	Edgecumbe	Edgecumbe Gate Station (co-incident)	6,022	5,769	5,991	5,903	5,743	6,282	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	5,769	0.0%	0.0%
Bay of Plenty	Kawerau	Kawerau Network System (excl. loads of ex-Caxton & ex-Tasman)	162	139	134	141	137	137	139	139	139	139	139	139	139	139	139	139	139	0.1%	1.3%
Bay of Plenty	Kawerau	Kawerau (ex-Caxton) (20TJ site in IP network)	3,834	2,282	1,172	779	792	779	2,282	2,282	2,282	2,282	2,282	2,282	2,282	2,282	2,282	2,282	2,282	10.3%	192.9 %
Bay of Plenty	Kawerau	Kawerau (ex-Tasman) (20TJ site in IP network)	3,044	1,940	2,033	2,067	2,076	2,067	2,012	2,010	2,008	2,006	2,003	2,001	1,999	1,997	1,997	1,995	1,994	0.0%	0.0%
Bay of Plenty	Kawerau	Kawerau Gate Station (non-co-incident)	7,040	4,361	3,339	2,986	3,006	2,984	4,361	4,361	4,361	4,361	4,361	4,361	4,361	4,361	4,361	4,361	4,361	3.5%	46.2%
Bay of Plenty	Kawerau	Kawerau Gate Station (co-incident)	6,944	4,056	3,207	2,732	2,797	2,728	4,056	4,056	4,056	4,056	4,056	4,056	4,056	4,056	4,056	4,056	4,056	3.7%	48.7%
Bay of Plenty	Mt Maunganui	Mt Maunganui Gate Station	2,960	2,677	3,195	3,087	3,124	3,118	2,677	2,677	2,677	2,677	2,677	2,677	2,677	2,677	2,677	2,677	2,677	0.0%	0.0%
Bay of Plenty	Mt Maunganui	Papamoa Gate Station	866	831	867	792	776	790	1,298	1,363	1,427	1,492	1,556	1,620	1,685	1,749	1,813	1,878	1,942	8.5%	145.8 %
Bay of Plenty	Mt Maunganui	Mt Maunganui Network System (non co-incident)	3,826	3,508	4,062	3,879	3,900	3,908	3,975	4,040	4,104	4,169	4,233	4,297	4,362	4,426	4,490	4,555	4,619	1.5%	18.2%
Bay of Plenty	Mt Maunganui	Mt Maunganui Network System (co-incident)	3,457	3,190	3,795	3,624	3,480	3,567	3,614	3,672	3,731	3,789	3,848	3,906	3,965	4,023	4,082	4,140	4,199	1.5%	17.7%
Bay of Plenty	Opotiki	Opotiki Gate Station	223	125	163	210	150	156	214	215	215	216	216	216	217	217	218	218	219	3.1%	40.1%

Region	Network system	Gate station / Network system	2009 Actual	2010 Actual	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Forecast	2016 Forecast	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	Annual growth	Total growth
Bay of Plenty	Tauranga	Tauranga Station	2,260	1,967	2,051	1,745	1,740	1,781	2,275	2,305	2,335	2,365	2,396	2,426	2,456	2,486	2,517	2,547	2,577	3.4%	44.7%
Bay of Plenty	Tauranga	Pyes Pa Station	307	290	787	777	537	702	335	340	344	349	353	358	362	367	371	375	380	0.0%	0.0%
Bay of Plenty	Tauranga	Tauranga Network System (non co-incident)	2,567	2,257	2,838	2,522	2,278	2,483	2,610	2,645	2,680	2,714	2,749	2,783	2,818	2,852	2,888	2,922	2,957	1.6%	19.1%
Bay of Plenty	Tauranga	Tauranga Network System (co-incident)	2,567	2,257	2,305	2,254	2,241	2,345	2,610	2,645	2,680	2,714	2,749	2,783	2,818	2,852	2,888	2,922	2,957	2.1%	26.1%
Bay of Plenty	Te Puke	Te Puke Gate Station	466	439	400	456	416	439	658	697	736	775	814	853	892	931	970	1,009	1,048	8.2%	138.9 %
Bay of Plenty	Te Teko	Te Teko Gate Station	33						33	33	33	33	33	33	33	33	33	33	33		
Bay of Plenty	Whakatane	Whakatane Network System	557	533	573	540	592	540	533	533	533	533	533	533	533	533	533	533	533	0.0%	0.0%
Bay of Plenty	Whakatane	Whakatane (20TJ site - CHH)	3,938	2,851	3,072	3,241	3,324	3,710	2,851	2,851	2,851	2,851	2,851	2,851	2,851	2,851	2,851	2,851	2,851	0.0%	0.0%
Bay of Plenty	Whakatane	Whakatane Gate Station (non co-incident)	4,495	3,384	3,645	3,781	3,916	4,250	3,384	3,384	3,384	3,384	3,384	3,384	3,384	3,384	3,384	3,384	3,384	0.0%	0.0%
Bay of Plenty	Whakatane	Whakatane Gate Station (co-incident)	4,133	3,061	3,190	3,410	3,351	3,993	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	0.0%	0.0%
Gisborne	Gisborne	Gisborne Gate Station	3,218	3,111	2,961	3,489	2,829	3,297	3,333	3,358	3,384	3,409	3,435	3,460	3,485	3,511	3,536	3,562	3,587	0.8%	8.8%
Kapiti	Kuku	Kuku Gate Station	No data																		
Kapiti	Otaki	Otaki Gate Station	247	272	274	270	276	251	321	328	335	342	349	356	364	371	378	385	392	4.1%	56.4%
Kapiti	Paraparaum u	Paraparaumu Gate Station	1,520	1,485	1,710	1,493	1,551	1,485	1,766	1,814	1,863	1,911	1,960	2,008	2,056	2,105	2,157	2,206	2,255	3.9%	51.9%
Kapiti	Te Horo	Te Horo Gate Station	No data																		
Kapiti	Waikanae	Waikanae Gate Station	651	641	1,129	807	603	577	722	738	753	769	784	800	816	831	849	865	881	3.9%	52.7%

Table 5-2 : Peak demand projection for the gate stations and network systems (in scmh)

5.5 Network Monitoring

Pressure monitoring is undertaken as part of ongoing pressure monitoring programmes. These programmes are designed to provide the necessary system performance data that would enable network modelling analysis to be carried out.

Various methods are utilised to collect the required network performance data, including:

- Manually downloaded or remotely downloaded (e.g. Cello units) portable electronic dataloggers;
- Telemetry data from gate stations, district regulating stations (DRS) or other Telenet installation;
- Gas customer time-of-use data obtained directly or indirectly from retailer gas measurement systems;
- Gas transmission SCADA system data; and
- Isolated readings obtained during peak loading conditions.

The Telenet SCADA system is mainly deployed in the Auckland region[13], and the Cello system on the North Island regions. Section 6 provides functional and physical descriptions of these systems.

5.6 Network Modelling

Most of Vector's network planning models have been created using data extracted from the GIS and billing systems. These models have been converted for use using the network modelling software Synergi.

Network models are validated by comparing the performance of the computer model to the actual physical performance of the gas distribution network. Where the computer model and actual network performance differs, the computer model is adjusted to reflect the actual conditions recorded from Vector's system pressure surveys[14] and SCADA information.

The total system flow for each network model is then scaled to align with the actual peak flow. This alignment is applied evenly across the network by adjusting the existing loads in the model. This becomes the base model for the network or pressure system.

The network modelling process is an important but time consuming process. Vector has a programme in place to update its network models on a three–yearly cycle.

5.7 Network Development Efficiencies

Significant efficiencies can often be incorporated in growth solutions that could allow conventional network investment to be considerably deferred without compromising capacity or quality of supply. In evaluating possible solutions, the following processes are undertaken to ensure an optimal investment decision:

- Review the asset capacity rating for currency and accuracy of data;
- Consider installing system pressure data loggers to validate actual (rather than theoretical) system pressure data;

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[13] One Telenet site has been installed at a DRS in the Mt Maunganui network system.

[14] System pressure survey is the process for capturing actual system pressure data and is performed during winter to ensure the system peak flow is considered as far as possible. The underlying assumption is that when the network is operating under its most onerous conditions, the network pressure will be at a minimum.

- Consider possible load transfer to alternative pipelines or DRSs (adjusting gate station and DRS regulator settings sometimes allows load diversity);
- Look for load diversity opportunities (mixing commercial and residential loads sometimes allows load diversity);
- Remove capacity constraints caused by individual asset components, to improve the overall capacity of a pipeline;
- Develop short-term solutions that could evolve into longer-term solutions without asset stranding; and
- Leverage off other projects to gain synergies, e.g. asset replacement, road re-alignment or new road construction activities.

5.8 Network Development Programme – Northland Region

Northland is New Zealand's least urbanised region, with only some 50% of the population of 149,600 living in urban areas. Of the towns in this region, Whangarei is the largest, with a population of 48,700. Seven other centres have populations of over 1,000: Kaitaia, Dargaville, Kaikohe, Paihia, Kerikeri, Taipa-Mangonui, and Kawakawa. The population is largely concentrated along the region's east coast.

5.8.1 Load Forecasts

The load forecast for the Northland region for the next 10 years is shown in Figure 5-5.

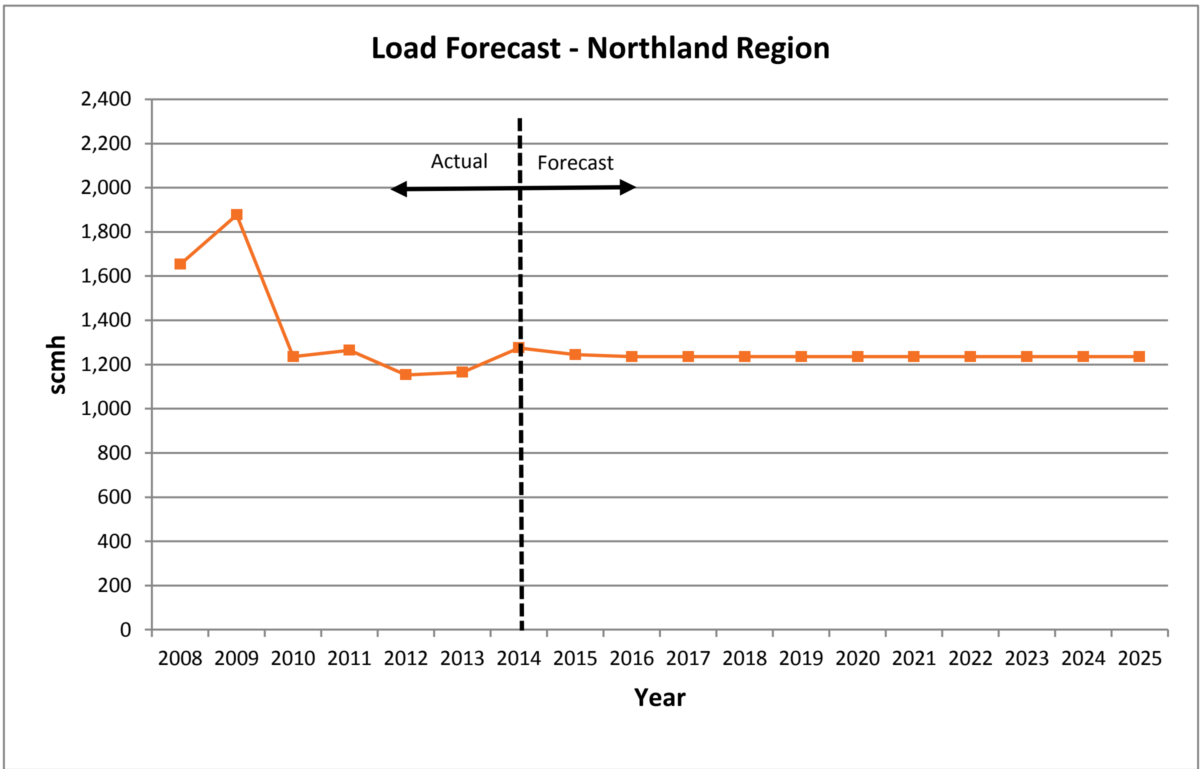


Figure 5-5 : Load forecast for Northland region

5.8.2 Whangarei Network System

The Whangarei system is supplied from the gas transmission system at one gate station, located in South Whangarei. The Whangarei network system consists of one IP pressure system, five MP4 pressure system and 11 DRSs.

5.8.2.1 Consumer Growth and Demand Forecast

About 1,210 consumers are connected to the Whangarei network system, most of whom are residential customers. Around 16% are commercial/industrial gas users, eg. a hospital and bakeries.

5.8.2.2 Gate Stations

The Whangarei network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.8.2.3 District Regulating Stations

The Whangarei network system feeds 13 DRSs. The load forecast for each DRS is not anticipated to exceed the station capacity during the planning period. It is worth noting that some DRSs in the Whangarei network include low pressure filters.

The following DRSs are planned to be upgraded during the planning period:

- DR-80090-WG in FY2016 (refer to section 6);
- DR-80067-WG, DR-80086-WG, DR-80096-WG, DR-80097-WG, DR-80231-WG and DR-80241-WG will be upgraded as part of the Whangarei IP10 uprating project in FY2023.

Whangarei IP10

The Whangarei IP10 pipeline receives gas from one gate station and provides the back-bone supply to the greater part of Whangarei. The IP10 network is capable of operating up to 1,700kPa, but is currently operating at 1,150kPa. This is due to the low pressure filters installed in some DRSs.

The Whangarei IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 1,659scmh resulting in a MinOP of 800kPa (80% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,895scmh, resulting in a MinOP of 670kPa (67% of the NOP). However, several residential subdivisions proposed in Whangarei North (i.e. at the extremity of the Whangarei IP10 pressure system) may result in the system pressure at the extremities of the network dropping below Vector's minimum pressure criteria.

To address this issue, retesting the IP10 pipeline and up-rating the NOP from 1,000kPa to 1,850kPa is scheduled to be completed in FY2023.

Union East Street MP4

The Union East Street MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 348scmh resulting in a MinOP of 344kPa (86% of the NOP). Total forecast planning demand during the planning period is estimated to be 398scmh, resulting in a MinOP of 342kPa (86% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Pipiwai Road MP4

The Pipiwai Road MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 32scmh resulting in a MinOP of 350kPa (88% of the NOP). Total forecast planning demand during the planning period is estimated to be 37scmh, resulting in a MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Riverside MP4

This pressure system was merged with the Whangarei West MP4 and the Whangarei North MP4 pressure systems in FY2015.

Whangarei North MP4

This pressure system was merged with the Whangarei West MP4 and the Riverside MP4 pressure systems in FY2015.

Whangarei West MP4

This pressure system was merged with Whangarei North MP4 and Riverside MP4 pressure systems in FY2015.

Whangarei MP4

The Whangarei MP4 pressure system is the amalgamation of the Whangarei North MP4, Whangarei West MP4 and Riverside MP4 pressure systems, completed in FY2015.

The Whangarei MP4 pressure system operates at a NOP of 400kPa.

Dyer Street MP4

The Dyer Street MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 4scmh resulting in a MinOP of 350kPa (88% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Port Whangarei MP4

The Port Whangarei MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 8scmh resulting in a MinOP of 350kPa (88% of the NOP). Total forecast planning demand during the planning period is estimated to be 9scmh, resulting in a MinOP of 350kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

A proposal to connect this pressure system into the Riverside MP4 pressure system by constructing approximately 1,100 metres of 80mm MP4 PE pipeline in Port Road to DR-80096-WG has been reviewed and is not required during the planning period.

Woodhill North MP4

This pressure system was merged with Whangarei West MP4 pressure system in FY2013.

5.8.3 Oakleigh Network System

The Oakleigh network system has been decommissioned.

5.8.4 Marsden Point Network System

The Marsden Point network system is supplied from the transmission system at one gate station, located in Mair Road. This network system consists of one MP7 pressure system and is supplying gas to one industrial consumer.

5.8.4.1 Gate Stations

The Marsden Point network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.8.4.2 Consumer Growth and Demand Forecast

The Marsden Point network system supplies gas to one industrial consumer located in Rama Road. It is expected that future gas demand will be driven by the growth of potential industrial activities in the area while residential demand will be minimal.

Demand growth is anticipated to be relatively flat over the planning period. However, the area of Marsden Point, One Tree Point and Ruakaka is undergoing substantial development which may result in higher load growth rate in the future.

5.8.4.3 District Regulating Stations

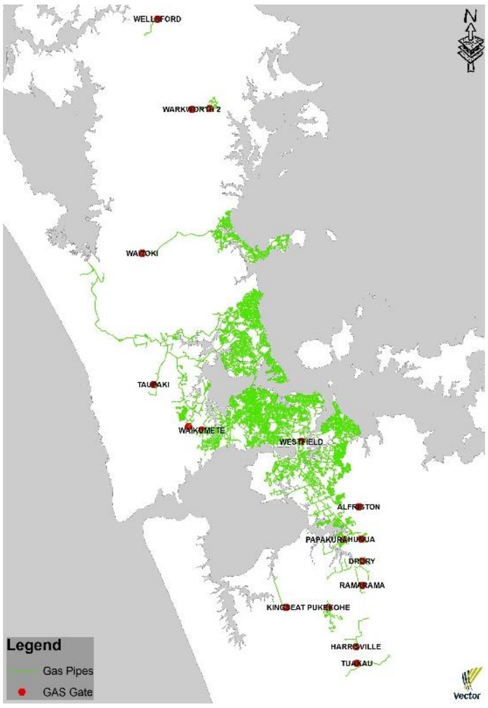
No DRSs are installed in the Marsden Point network system.

5.8.4.4 Pressure Systems

Marsden Point MP7 Pressure System

The Marsden Point MP7 pressure system operates at a NOP of 700kPa. The maximum flow into the system in the base year was 218scmh resulting in a MinOP of 594kPa (85% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 594kPa (85% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9 Network Development Programme – Auckland Region



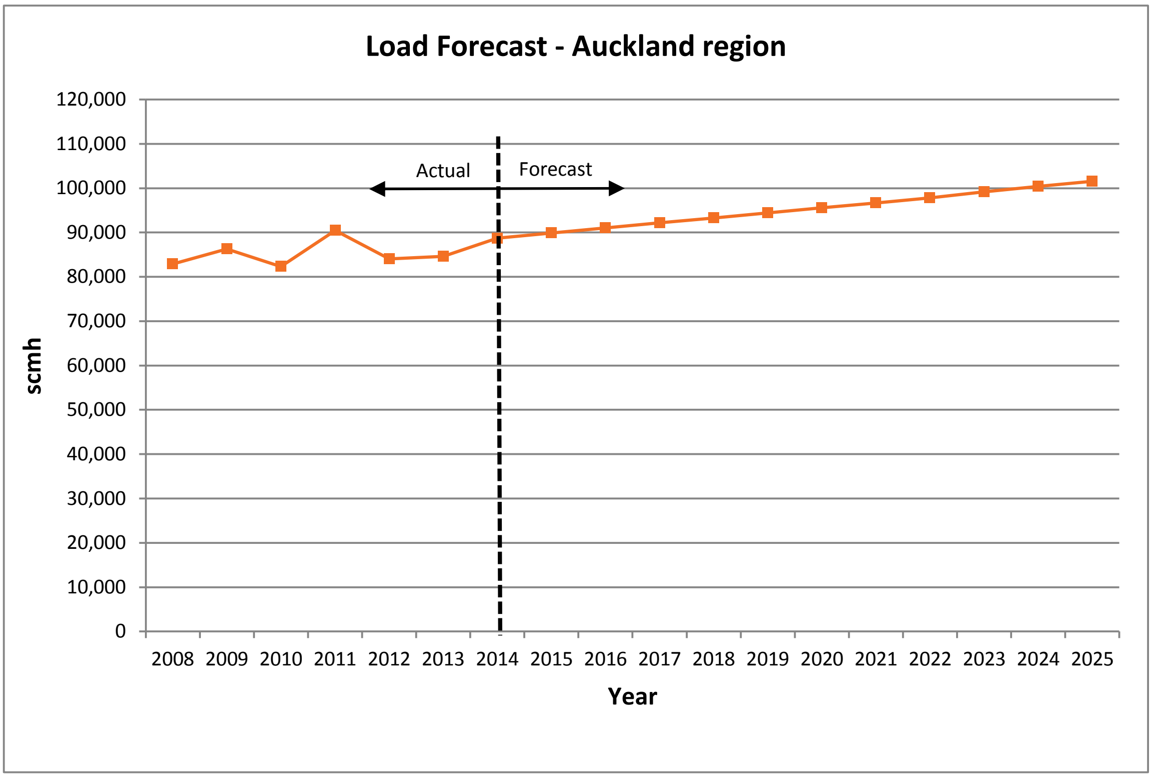
Auckland is New Zealand's largest city with a current population of 1.5 million (about 32% of New Zealand's population). This is expected to grow to around 2.2 million by 2041. Auckland's contribution to the country's Gross Domestic Product (GDP) is over 35%, the most of any region or city[15].

The Auckland Council, the region's governing body, was created and became operational in November 2010. It oversees all of Auckland from Wellsford in the north and Pukekohe in the south and is responsible for planning, development, operations and services in the region.

This section of the development plan describes the assets associated with the Auckland assets in the Auckland region.

5.9.1 Load Forecasts

The load forecast for the Auckland region for the next 10 years is shown in Figure 5-6.



[15] Information refers to the "Auckland Council Annual Report 2011/2012", http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/reports/annual_report/Documents/annualreport20112012vol1.pdf

Figure 5-6 : Load forecast for the Auckland region

5.9.2 Alfriston Network System

The Alfriston network system is supplied from the transmission system at one gate station located in Phillip Road, southeast of Alfriston. This network system comprises one MP4 pressure system.

5.9.2.1 Consumer Growth and Demand Forecast

The Alfriston network system supplies one industrial consumer in Philip Road.

5.9.2.2 Gate Stations

The Alfriston network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.2.3 District Regulating Stations

No DRS is installed in the Alfriston network system.

5.9.2.4 Pressure Systems

Alfriston MP4

The Alfriston MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 156scmh resulting in a MinOP of 389kPa (97% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9.3 Auckland Central Network System

The Auckland Central network system is supplied from the transmission system at five gate stations. This network system consists of one IP20 pressure system, three IP10 pressure systems, two MP7 pressure systems, eighteen MP4 pressure systems, five MP2 pressure systems, four MP1 pressure systems and 100 DRSs.

5.9.3.1 Consumer Growth and Demand Forecast

A total of 90,392 consumers are connected to the Auckland Central network system, around 6% or 5,569 of whom are commercial/industrial gas users. The Auckland Central network system is Vector's largest network system in terms of the number of connections.

The Auckland region has a population of around 1.5 million. Latest population projections released by Statistics New Zealand suggest that the Auckland regional population could increase to 2.2 million by 2041[16].

Some parts of Auckland are projected to experience greater population growth than others. The Waitemata and Upper Harbour local board areas are projected to experience relatively high rates of growth at 88.9% and 85.6%, respectively (over 20 years). The actual numbers are relatively small, however, and the Howick local board, currently the largest population in the region, is projected to have the largest numerical increase - an extra 77,700 more people by 2031, an increase of 65% on 2006 numbers[17].

Auckland is projected to account for 60% of New Zealand's population growth, and the region would be home to 38% of New Zealand's population in 2031, compared with 33%

[16] ibid footnote 15.

[17] Ibid.

in 2006. Within the region, the highest growth rates between 2006 and 2031 are expected to be in the Manukau and Rodney districts, at 1.7%[18].

It is expected that future gas demand will be driven by the population growth and potential industrial and commercial activities in Auckland. At present, examples of some large known development projects within the region include:

- Northern Strategic Growth Area (NorSGA), Westgate Town Centre and Northside Drive subdivision in Westgate;
- Subdivision development in Long Bay;
- Subdivision developments in Albany;
- Subdivision developments in Flat Bush and Flat Bush Town Centre;
- Subdivision developments in Takanini;
- Stonefield subdivision development in Mt Wellington;
- Tamaki Housing Project (Housing New Zealand) in Tamaki;
- Auckland International Airport Limited - The Landing Precinct Expansion; and
- Auckland Waterfront re-development, eg. Wynyard Quarter.

5.9.3.2 Gate Stations

The Auckland Central network system takes supply from the following five gate stations:

- Taupaki;
- Bruce McLaren;
- Waikumete;
- Westfield; and
- Papakura.

The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.3.3 District Regulating Stations

The Auckland Central network system has 99 DRSs which supply gas to two IP10 pressure systems, two MP7 pressure systems, eighteen MP4 pressure systems, five MP2 pressure systems and four MP1 pressure systems.

The following DRSs are planned to be upgraded during the planning period:

- DR-00183-AK in FY2016 due to insufficient capacity;
- DR-00136-AK in FY2016 in conjunction with a roading realignment project;
- DR-00179-AK in FY2017 due to insufficient capacity (refer Wattle Downs MP4 below);
- DR-00049-AK in FY2017 (refer Central Auckland MP4 below);
- DR-00163-AK in FY2018 due to insufficient capacity;
- DR-00095-AK or DR-00244-AK in FY2022 (refer East Auckland IP10 below).

5.9.3.4 Pressure Systems

Auckland IP20

The Auckland IP20 pressure system operates at a NOP of 1,900kPa and provides supply to the greater part of metropolitan Auckland. It transports gas to the urban areas of

[18] Ibid.

Manukau, Auckland, North Shore and Waitakere and receives supply from four gate stations: Papakura, Westfield, Waikumete and Taupaki.

In 2014, Vector commissioned a new gate station in Waikumete, Glen Eden. The completion of this reinforcement solution provides a new 1,850kPa supply point at Waikumete.

Total forecast planning demand during the planning period is estimated to be 81,801scmh, resulting in a modelled MinOP of 839kPa (44% of the NOP) and the system pressure falling below the MinOP criteria. System pressure failure would occur at DR-00136-AK, resulting in the IP10 East Auckland system pressure falling below the MinOP criteria. To address this system pressure issue, the following reinforcement options are planned:

- Elevate the operating pressure at the Westfield gate station to 1,850kPa (refer to East Auckland IP10 section for more details).
- Construct a 200mm IP20 pipeline along Gilbert Ave and Alexander Crescent (refer to East Auckland IP10 section for more details).
- These reinforcement options result in a MinOP pressure of 1,136kPa (60% of the NOP) at the end of the planning period.

Note: System pressure at NZ Sugar is anticipated to fall to 822kPa (43% of the NOP) with the above reinforcement in place. This is a result of the short length of the 25mm nominal service pipe currently in place. Resolving this constraint will be investigated during the planning period.

Bruce McLaren IP10

The Bruce McLaren IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 1,974scmh, resulting in a MinOP of 1,014kPa (100% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,589scmh, resulting in a MinOP of 924kPa (92% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Manurewa IP10

The Manurewa IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 598scmh resulting in a MinOP of 994kPa (99% of the NOP). Total forecast planning demand during the planning period is estimated to be 784scmh, resulting in a MinOP of 991kPa (99% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

East Auckland IP10

The East Auckland IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 7,796scmh resulting in a MinOP of 705kPa (64% of the NOP). Total forecast planning demand for 2016 is estimated to be 9,403scmh, which would result in the MinOP falling below the minimum pressure criteria.

The following reinforcement option will be investigated in 2016:

- Elevate the operating pressure at the Westfield gate station to 1,850kPa (the original set point prior to system reconfiguration of the gas transmission gate station pressure setting changes in 2008). This reinforcement option would result in a modelled MinOP pressure of 619kPa (62% of the NOP) in 2016.

Total forecast planning demand during the planning period is estimated to be 10,222scmh, resulting in the MinOP again likely to fall below the minimum pressure criteria. The following reinforcement is planned:

- Construct a 200mm IP20 pipeline along Gilbert Ave and Alexander Crescent (approximately 1,000 metres) to DR-00116-AK. This reinforcement would results in a modelled MinOP pressure of 564kPa (56% of the NOP) in 2021.

A preliminary study has been undertaken regarding the provision of gas supply to a housing development project in East Tamaki. This project involves a Housing New Zealand led proposal to develop the Tamaki region, increasing dwellings from 5,000 to 10,000 and population from 17,000 to approximately 25,000 - 27,000 over the next 15-20 years.

Modelling work has confirmed that the East Auckland IP10 pressure system will require reinforcement if the housing project goes ahead. The following IP reinforcements are planned and will be subject to further study once more information is available.

- Construct approximately 3km of 180mm PE100 (operating pressure 875 kPa) IP10 gas main from DR-00244-AK at Westfield gate station along Mt Wellington Highway, Ellerslie-Panmure Highway to DR-00085-AK, and upgrade the capacity of DR-00244-AK located at the Westfield gate station; or
- Construct approximately 3km of 150mm IP20 steel pipeline from Westfield gate station along Mt Wellington Highway, Ellerslie-Panmure Highway to DR-00085-AK. Upgrade the capacity of DR-00085-AK and construct an IP20 to IP10/MP4 supply.

Central Auckland MP7

The Central Auckland MP7 pressure system operates at a NOP of 700kPa and supplies gas to the southern suburbs of central Auckland City. The maximum flow into the system in the base year was 4,844scmh, resulting in a MinOP of 620kPa (89% of the NOP).

Total forecast planning demand during the planning period is estimated to be 6,351scmh, which would result in a MinOP of 591kPa (84% of the NOP). No further constraints have therefore been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period (after the initial reinforcement).

The long-term network solution for the Central Auckland MP7 network is to elevate the NOP of the pipeline to 1,000kPa.

South Auckland MP7

The South Auckland MP7 pressure system operates at a NOP of 700kPa and supplies gas to an industrial area east of Mt Mangere. The maximum flow into the system in the base year was 4,228scmh resulting in a MinOP of 620kPa (89% of the NOP). Total forecast planning demand during the planning period is estimated to be 5,544scmh, which would result in a MinOP of 556kPa (79% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

In the long-term, it is proposed that the South Auckland MP7 network NOP be elevated to 1,000kPa.

Central Auckland MP4

The Central Auckland MP4 pressure system operates at a NOP of 400kPa and supplies gas to the Auckland central area bounded by the suburbs of Hillsborough, Avondale, St Heliers, and includes the Auckland and Newmarket central business districts.

The Central Auckland MP4 system has been merged with the Main Highway MP4, Station Road (19) MP4, Station Road MP4 and Onehunga MP4 pressure systems. This is a result of the implementation of the Sandringham, Mt Roskill, Epsom and Penrose LP pipeline replacement projects which were completed in FY2014.

The maximum flow into the system in the base year was 42,217scmh, resulting in a MinOP of 259kPa (65% of the NOP). Total forecast planning demand during the planning period is estimated to be 45,763scmh, resulting in a MinOP of 231kPa (58% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

To support future growth opportunities and enhance network security, the following projects are planned:

- Construct a new DRS (or upgrade DR-00049-AK) to supply the Auckland CBD.
- Construct approximately 30 metres of 32mm PE MP4 pipeline link in Ruskin Street between 9 and 14 Ruskin Street, Parnell;
- Construct approximately 730 metres of 50mm MP4 PE pipeline link in Motions Road, Pt Chevalier; and
- Construct approximately 1,000 metres of 100mm PE MP4 pipeline link in Kohimarama Rd between Whytehead Crescent and Kepa Road, Kohimarama.

Auckland Airport MP4

The Airport MP4 system provides supply to the Auckland International Airport and domestic terminal complex and is currently supplied with natural gas via a single MP4 pipeline, running from the western end of Puhinui Road and over the Pukaki Creek bridge crossing. The MP4 supply is fed from DR-00107-AK located to the east of the Pukaki Creek bridge crossing, and is comprised predominantly of 100mm diameter pipe with a section of 150mm diameter pipe across Pukaki Creek.

The pipeline crossing the Pukaki Creek is owned by Auckland International Airport Limited (AIAL). Vector is contracted to maintain and operate the pipeline.

The Auckland Airport complex currently includes a number of sizable commercial loads and with the planned expansion of the airport complex, significant additional loads are forecast for the medium term. Potential for additional loads has been identified within the Airport complex and north of the Auckland airport development near the intersection of Ihumatao Road and George Bolt Memorial Drive, and The Landing Precinct Expansion off Landing Drive.

The Auckland Airport MP4 system operates at a nominal pressure of 400kPa. The maximum flow into the system in the base year was 2,165scmh, resulting in a minimum system pressure of 211kPa (53% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,458scmh, which would result in the MinOP falling below the minimum pressure criteria. The following reinforcements are planned:

- Construct approximately 300 metres of 100mm PE MP4 pipeline in Ray Emery Drive.
- Construct approximately 180 metres of 100mm PE MP4 pipeline in Tom Pearce Drive.
- Construct approximately 360 metres of 100mm PE MP4 pipeline in Puhinui Road.

Mangere MP4

The Mangere MP4 pressure system was merged into the East Auckland MP4 pressure system following the completion of the Otahuhu and Papatoetoe LP pipeline replacement projects.

From a network development perspective, recent studies show that the Mangere MP4 system has the potential to provide a second supply to the Auckland International Airport complex. The following MP4 gas main link between the Mangere MP4 system and the Airport MP4 system is planned:

- Construct approximately 1.9km of 100mm PE MP4 pipeline from Westney Road along George Bolt Memorial Drive to Tom Pearce Drive.

Mangere Bridge MP4

The Mangere Bridge MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 15scmh resulting in a MinOP of 400kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Fairburn Road MP4

The Fairburn Road MP4 pressure system was merged into the East Auckland MP4 pressure system following the completion of the Otahuhu and Papatoetoe LP pipeline replacement projects.

Glendene MP4

The Glendene MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 117scmh, resulting in a MinOP of 398kPa (99% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Herd Road MP4

The Herd Road MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 5scmh resulting in a MinOP of 400kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Hingaia Road MP4

The Hingaia Road MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 13scmh, resulting in a MinOP of 399kPa (99% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Holloway Place MP4

The Holloway Place MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 793scmh, resulting in a MinOP of 396kPa (99% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Main Highway MP4

The Main Highway MP4 pressure system was merged into the Central Auckland MP4 pressure system following completion of the Penrose LP pipeline replacement project in FY2014.

Manurewa North MP4

The Manurewa North MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 3,211scmh, resulting in a MinOP of 231kPa (58% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Manurewa South MP4

The Manurewa South MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 687scmh, resulting in a MinOP of 390kPa (98%

of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

North Harbour MP4

The North harbour MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 477scmh, resulting in a MinOP of 393kPa (98% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Investigation of a proposal to construct approximately 180 metres of 100mm PE MP4 pipeline (including a 25 metre bridge crossing) from SH17 to The Avenue, Albany Village has been undertaken. The proposal is planned to be completed during the planning period and will link the North Harbour MP4 pressure system with the North Shore MP4 pressure system. This project will improve the security of supply to the North Harbour MP4 pressure system.

North Shore MP4

The North Shore MP4 pressure system operates at a NOP of 400kPa and supplies gas to the North Shore area bounded by the suburbs of Beachhaven, Devonport and Torbay. The maximum flow into the system in the base year was 13,880scmh, resulting in a MinOP of 207kPa (52% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

To support future growth opportunities and enhance network security, the following projects are planned:

- Install a DRS (IP20/MP4) at the junction of East Coast Road and Glenvar Road, Glenvar;
- Install 200mm PVC duct in conjunction with the SH16 upgrade (future proof) along Royal Road Bridge;
- Construct approximately 2,500 metres of 100mm PE MP4 pipeline from East Coast Road along Glenvar Road to Long Bay development, Long Bay;
- Construct approximately 225 metres of 50mm PE MP4 pipeline from Appleby Road along Albany Highway to house number 286, North Harbour;
- Construct 150mm PVC duct in Northside Drive bridge in conjunction with NorSGA development; and
- Construct approximately 3,800 metres of 100mm PE MP4 pipeline from East Coast Road along Okura River Road and Vaughans Road to Long Bay development, Long Bay.
- Construct approximately 750 metres of 100mm PE MP4 pipeline from Northcroft Street along Lake Road to Cameron Street, Takapuna; and
- Construct a 50mm PE MP4 pipeline (road crossing) at the junction of Albert Road and Victoria Road, Devonport.

Nuplex MP4

The Nuplex MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 358scmh, resulting in a MinOP of 400kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Onehunga MP4

The Onehunga MP4 pressure system was merged into the Central Auckland MP4 pressure system following completion of the Three Kings and Penrose LP pipeline replacement projects in FY2014.

Pakuranga MP4

The Pakuranga MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 16scmh, resulting in a MinOP of 400kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Papakura MP4

The Papakura MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 122scmh, resulting in a MinOP of 371kPa (93% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Puhinui Crematorium MP4

The Puhinui Crematorium MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 38scmh, resulting in a MinOP of 399kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

East Auckland MP4

The East Auckland MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 19,183scmh, resulting in a MinOP of 262kPa (66% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

To support future growth opportunities and enhance network security, the following projects are planned:

- Construct approximately 2,000 metres of 100mm PE MP4 pipeline in Kirkbride Road (from Ascot Road) to the existing 100mm PE MP4 main in Massey Road, Mangere;
- Construct 150mm and 200mm PVC ducts in George Bolt Memorial Drive and Kirkbride Road intersections, in conjunction with the SH20A upgrade project;
- Construct approximately 400 metres of 100mm PE MP4 pipeline in Harris Road from Cryers Road to Ti Rakau Drive, Pakuranga;
- Construct approximately 190 metres of 100mm PE MP4 pipeline in Pakuranga Road to the intersection of Bucklands Beach Road, Highland Park; and
- Construct approximately 330 metres of 100mm PE MP4 in Smales Road between 18 and 40 Smales Road, East Tamaki.

The East Auckland MP4 pressure system has has been merged with the Mangere MP4 and Fairburn MP4 pressure systems. This is due to the completion of the Otahuhu LP and Papatoetoe LP pipeline replacement projects. Further modelling of the merged pressure systems will be completed in FY2016.

Station Road (19) MP4

The Station Road (19) MP4 pressure system was merged into the Central Auckland MP4 pressure system following the completion of the Penrose LP pipeline replacement project in FY2014.

Station Road MP4

The Station Road MP4 pressure system was merged into the Central Auckland MP4 pressure system following the completion of the Penrose LP pipeline replacement project in FY2014.

Te Atatu MP4

The Te Atatu MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 412scmh, resulting in a MinOP of 386kPa (97% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Universal Drive MP4

The Universal Drive MP4 pressure system[19] operates at a NOP of 400kPa. The maximum flow into the system in the base year was 84scmh, resulting in a MinOP of 395kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Wattle Downs MP4

The Wattle Downs MP4 system supplies gas to the suburbs of Manurewa and Mahia Park areas at a NOP of 400kPa. The maximum flow into the system in the base year was 804scmh resulting in a MinOP of 353kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Recent information indicates that the gas demand in the Wiri area will increase significantly over the next couple of years. To address this, the capacity of two of the three DRSs supplying this system will need increasing. The upgrade of DR-00134-AK is planned for FY2016 and DR-00179-AK is planned for FY2017.

The Wattle Downs MP4 system now includes the Wiri MP4 system after the completion of 100 mm MP4 PE pipeline laid in Roscommon Road.

Westfield MP4

In FY2012, a new DRS was constructed inside the Westfield gate station to replace DR-00095-AK, which use to supply both the Westfield MP4 and the East Auckland IP10 pressure systems. Approximately 260 metres of 100mm PE MP4 pipeline in Vestey Road was also completed as part of the DRS replacement project enabling the decommissioning of the entire DR-00095-AK. The completed MP4 link now joins the Westfield MP4 and the East Auckland MP4 pressure systems. The Westfield MP4 pressure system has now been merged to East Auckland MP4 pressure system, following completion of the DR-00095-AK rebuild project.

Wiri MP4

The Wiri MP4 pressure system was merged with the Wattle Downs MP4 pressure system after completion of the MP4 link at Roscommon Road.

Broadway Park MP2

[19] The Universal MP4 pressure system now includes the Paramount MP4 pressure system and is supplied by DR-00233-AK.

The Broadway Park MP2 pressure system operates at a NOP of 200kPa. The maximum flow into the system in the base year was 39scmh, resulting in a MinOP of 200kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Conifer Grove MP2

The Conifer Grove MP2 pressure system operates at a NOP of 200kPa. The maximum flow into the system in the base year was 239scmh, resulting in a MinOP of 165kPa (82% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Landsford Crescent MP2

The Landsford Crescent MP2 pressure system operates at a NOP of 200kPa. The maximum flow into the system in the base year was 58scmh, resulting in a MinOP of 199kPa (99% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Manukau MP2

The Manukau MP2 pressure system operates at a NOP of 200kPa. The maximum flow into the system in the base year was 270scmh, resulting in a MinOP of 147kPa (74% of the NOP). Total forecast planning demand during the planning period is estimated to be 355scmh, resulting in a MinOP of 106kPa (53% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Penrose MP2

The Penrose MP2 pressure system operates at a NOP of 200kPa. The maximum flow into the system in the base year was 1163scmh, resulting in a MinOP of 103kPa (52% of the NOP). Total forecast planning demand during the planning period is estimated to be 1260scmh, resulting in a MinOP of 87kPa (44% of the NOP), therefore falling below the minimum system pressure criteria. To address this issue, the following reinforcements are planned:

- Increase the outlet pressure of the two DRS's from 180kPa to 200kPa.

Monahan Road MP1

The Monahan MP1 pressure system operates at a NOP of 35kPa. The maximum flow into the system in the base year was 58scmh, resulting in a MinOP of 28kPa (80% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Panmure MP1

The Panmure MP1 pressure system operates at a NOP of 35kPa. The maximum flow into the system in the base year was 38scmh, resulting in a MinOP of 34kPa (97% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Totara Heights MP1

The Totara Heights MP1 pressure system operates at a NOP of 105kPa. The maximum flow into the system in the base year was 387scmh, resulting in a MinOP of 79kPa (75% of the NOP). Total forecast planning demand during the planning period is estimated to be 507scmh, resulting in a MinOP of 64kPa (61% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Waipuna Road MP1

The Waipuna Road MP1 pressure system operates at a NOP of 35kPa. The maximum flow into the system in the base year was 102scmh, resulting in a MinOP of 29kPa (86% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9.3.5 Development Plans

The following reinforcement options will be investigated during the planning period:

- Link the Papakura MP4 and Hingaia MP4 pressure systems:

5.9.4 Drury Network System

The Drury network system is supplied from the transmission system at one gate station located in Waihoehoe Road. This network system consists of one MP4 pressure system.

5.9.4.1 Consumer Growth and Demand Forecast

A total of 31 consumers are connected to the Drury network system. Residential consumers comprise more than half of the customer base with the remaining being industrial and commercial users.

In general, it is expected that future gas demand will be driven by the growth of potential commercial/industrial activities[20] in the area, while residential demand is expected to be moderate.

5.9.4.2 Gate Stations

The Drury network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.4.3 District Regulating Stations

No DRS is installed in the Drury network system.

5.9.4.4 Pressure Systems

Drury CT MP4

The Drury CT MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 369scmh, resulting in a MinOP of 348kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

A capacity request was recently processed for the development of a new business area next to the Drury quarry. The results of modelling analysis indicate that the existing network capacity of Drury CT MP4 pressure system can deliver a maximum of approximately 1,000 scmh of gas for this development.

Drury NC MP4

[20] Vector has been notified of a major business development which is planned to be constructed adjacent to the Drury quarry in 2015.

The Drury NC MP4 pressure system operates at a NOP of 400kPa[21]. The maximum flow into the system in the base year was 2,051scmh, resulting in a MinOP of 298kPa (72% of the NOP). Total forecast planning demand during the planning period is estimated to be 3,735scmh, which would result in a MinOP of 151kPa (38% of the NOP), therefore falling below the minimum system pressure criteria. To address this issue, the following reinforcements are planned:

- Increase the outlet pressure of the Drury gate station from 350kPa to 400kPa (or as far as technically viable when the gate station is upgraded by Vector Gas Transmission); and
- Construct approximately 1,700 metres of 160mm PE MP4 from Drury gate station along Waihoehoe Road, Flanagan Road and Great South Road to the junction of Firth Street.

5.9.4.5 Development Plans

The following reinforcement options will be investigated during the planning period:

- Link the Drury CT MP4 and Drury NC MP4:
- Install an IP10/MP4 DRS at the junction of Paerata Road and Butcher Road, Paerata; and
- Construct approximately 5.4km of 160mm PE MP4 gas main from Tuhimata Road along Paerata Road and Karaka Road to Gellert Road, Paerata.

5.9.5 Harrisville Network System

The Harrisville network system is supplied from the transmission system at one gate station located in Harrisville Road. This network system consists of one MP7 pressure system.

5.9.5.1 Consumer Growth and Demand Forecast

There are six consumers connected to the Harrisville network system. The consumers comprise five industrial/commercial users and one residential consumer.

Over the last two years, several enquiries have been made from potential industrial users within the Harrisville network system. However, growth is limited and subject to the upgrade of the Harrisville gate station. In addition, this network system is approaching its capacity and will require reinforcement in the future.

It is expected that future gas demand will be driven by the growth of potential industrial activities in the area while residential demand is anticipated to be minimal. Two new industrial connections with a total load of 385scmh, located in Harrisville and Jamieson Roads, have been processed recently.

5.9.5.2 Gate Stations

The Harrisville network system is fed from one gate station. The capacity of the gate station is constrained by the heating equipment located within the gate station. To address this, Vector Gas Transmission has commenced construction of a new gate station in Harrisville Road, located about 1 km from the exisitng gate station. The new gate station will reinforce the Harrisville MP7 pressure system and is due to be completed in May 2015. The existing gate station is to be decommissioned and removed. The gate station winter peak demand statistics are summarised in Table 5-2.

[21] Due to legacy practices, the current operating pressure of the Drury NC MP4 pressure system is 350kPa.

5.9.5.3 District Regulating Stations

No DRS is installed in the Harrisville network system.

5.9.5.4 Pressure Systems

Harrisville MP7

The Harrisville MP7 pressure system operates at a NOP of 700kPa. The maximum flow into the system in the base year was 3,156scmh, resulting in a MinOP of 480kPa (69% of the NOP). Total forecast planning demand during the planning period is estimated to be 6,405scmh, which would result in a MinOP of 231kPa (33% of the NOP), therefore falling below the minimum system pressure criteria.

The following reinforcement options will be investigated in 2016, in conjunction with current construction the new gate station:

- Elevate the Harrisville gate station outlet pressure from 550kPa to 650kPa (request has been made to Vector Gas Transmission at the design stage of the station upgrade project); and
- Install approximately 2,000 metres of 160mm MP7 PE pipeline along Jericho Road between Harrisville Road and 182 Jericho Road.

5.9.5.5 Development Plans

A study into the benefits of connecting the Harrisville MP7 pressure system to the Tuakau MP7 pressure system was completed in 2013. The results indicated that there was no real benefit from joining these two pressure systems.

5.9.6 Hunua Network System

The Hunua network system is supplied from the transmission system at one gate station located in Hunua Road. This network system consists of one MP4 pressure system.

5.9.6.1 Consumer Growth and Demand Forecast

The Hunua network system supplies a total of four large commercial/industrial consumers.

5.9.6.2 Gate Stations

The Hunua network system is fed from one gate station. This gate station also supplies gas to Nova's gas distribution system and Greymouth Petroleum's transmission pipeline. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.6.3 District Regulating Stations

No DRS is installed in the Hunua network system.

5.9.6.4 Pressure Systems

Hunua MP4

The Hunua MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 851scmh, resulting in a MinOP of 348kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9.6.5 Development Plans

Vector Gas Transmission is currently investigating the upgrade of the Hunua gate station which may result in a new supply pressure of 340kPa.

Network modelling indicates that it may be possible to interconnect the Hunua MP4 pressure system into the Manurewa South MP4 pressure system. However, based on the proposed pressure setting of Hunua gate station, the potential benefit of interconnecting these two pressure systems will be marginal due to significant pressure drop at the eastern end of the combined pressure system.

To link the two pressure systems, a new 350 metre MP4 100mm PE pipeline from Calvert Street along Hunua Road to Settlement Road in Papakura is required.

5.9.7 Kingseat Network System

The Kingseat network system is supplied from the transmission system at one gate station located in Kingseat Road. This network system consists of one MP4 pressure system.

5.9.7.1 Consumer Growth and Demand Forecast

The Kingseat network system supplies five residential consumers and one commercial gas user. Kingseat's population[22] in 2006 was 669 and is expected to increase by 136%, to 1,009 in 2021.

5.9.7.2 Gate Stations

The Kingseat network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.7.3 District Regulating Stations

No DRS is installed in the Kingseat network system.

5.9.7.4 Pressure Systems

Kingseat MP4

The Kingseat system south of Auckland consists of approximately 6km of 100mm steel and PE pipe operating at 400kPa. It was originally designed to supply gas to the Kingseat Hospital which was situated at the end of the pipeline. The hospital has since closed and there are no known significant emerging loads in the region. The system now only supplies a small amount of domestic load.

The Kingseat MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 4scmh, resulting in a MinOP of 287kPa (72% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Due to limitations of the gate station regulator equipment, Vector Gas Transmission requested to reduce the outlet supply pressure setting to 270kPa. It has been agreed that the proposed pressure setting is considered as a temporary solution and will be restored as and when new regulator equipment is upgraded.

[22] Growth Projection, May 2009, Franklin District Council, http://www.franklin.govt.nz/LinkClick.aspx?fileticket=w%2fKmP3epp6s%3d&tabid=747

5.9.8 Pukekohe Network System

The Pukekohe network system is supplied from the transmission system at one gate station located in Butcher Road. This network system comprises one IP10 pressure system, MP4 pressure system and one DRS.

5.9.8.1 Consumer Growth and Demand Forecast

The Pukekohe network system has approximately 195 consumers. The customers comprise about three quarters residential and the remaining quarter, a mix of commercial/industrial gas users. In 2012, gas supply to a new industrial customer at Crown Road in Paerata was committed and resulted in an increase in system peak demand.

Pukekohe's population in 2006 was 17,068 and is expected to increase by 51%, to 25,831 in 2021. The number of households is estimated to grow by 61%, from 5,912 in 2006 to 9,507 in 2021[23].

According to a recent growth strategy implementation report[24], an action plan is proposed to promote the intensification of residential and business development in Pukekohe, particularly in and around the town centre. The Pukekohe South growth area is identified for residential development. The report also addresses a plan for business growth in the wider Paerata and North Pukekohe areas. In terms of network development, the potential gas supply to these growth areas can be reticulated from either the Pukekohe or Drury NC network systems.

It is expected that future gas demand will be driven by the growth of population and potential industrial activities in Pukekohe. Total demand forecast for 2023 is anticipated to increase slightly over the planning period.

5.9.8.2 Gate Stations

The Pukekohe network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.8.3 District Regulating Stations

The Pukekohe network system has one DRS which supplies gas to the Pukekohe MP4 pressure system.

5.9.8.4 Pressure Systems

Pukekohe IP10

The Pukekohe IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 432scmh, resulting in a MinOP of 982kPa (98% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Pukekohe MP4

The Pukekohe MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 432scmh, resulting in a MinOP of 389kPa (97% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

[23] Pukekohe Futures: A Franklin District Growth Strategy Implementation Report, August 2010

[24] Ibid footnote 23.

5.9.8.5 Development Plans

Refer to Drury NC MP4 pressure system commentary in section 5.9.4.

5.9.9 Ramarama Network System

The Ramarama network system is supplied from the transmission system at one gate station located near Ararimu Road. This network system consists of one MP4 pressure system.

5.9.9.1 Consumer Growth and Demand Forecast

The Ramarama network system supplies gas to one small commercial customer and two large industrial consumers.

5.9.9.2 Gate Stations

The Ramarama network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.9.3 District Regulating Stations

No DRS is installed in the Ramarama network system.

5.9.9.4 Pressure Systems

Ramarama MP4

The Ramarama MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 322scmh, resulting in a MinOP of 322kPa (81% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9.9.5 Development Plans

A study to investigate the benefits of integrating the Drury CT MP4 and Ramarama MP4 pressure systems has been completed. It was concluded that the benefit of deferring the upgrade of the Drury gate station by linking the Drury CT MP4 and Ramarama MP4 pressure systems is not material. The study found that no savings will be achieved because the network integration would then require an upgrade of the Ramarama gate station.

5.9.10 Tuakau Network System

The Tuakau network system is supplied from the transmission system at one gate station located in Bollard Road. This network system consists of one IP20 pressure system, one MP7 pressure system and one DRS.

5.9.10.1 Consumer Growth and Demand Forecast

The Tuakau network system supplies a total of 12 consumers comprising 7 residential and 6 commercial/industrial gas users.

Over the past two years, Vector has received several requests for gas from existing and potential customers. However, these growth opportunities have been limited by the potential capacity constraints of the Tuakau gate station which has since been upgraded (see Section 5.9.10.2 for more details).

In 2014, a new IP20 pipeline was commissioned to provide gas to a major new industrial consumer. Further development is expected from the area of land in the vicinity of the Tuakau gate station which is now being developed as a business and industrial park.

5.9.10.2 Gate Stations

The Tuakau network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.10.3 District Regulating Stations

A new DRS has been installed in the Tuakau network system to provide gas supplies to the current Tuakau MP7 pressure system.

5.9.10.4 Pressure Systems

Pokeno IP20

The Pokeno IP20 system is a new pressure system that consists of a single pipeline operating at a NOP of 1,900kPa. The pipeline was commissioned in 2014 to provide gas to a new major consumer in Tuakau. No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Tuakau MP7

The Tuakau MP7 system consists of a single pipeline operating at a NOP of 700kPa that is dominated by a large industrial customer.

The Tuakau MP7 pressure system operates at a NOP of 700kPa. The maximum flow into the system in the base year was 1,499scmh, resulting in a MinOP of 659kPa (94% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9.11 Whangaparaoa Network System

The Whangaparaoa network system is supplied from the transmission system from one gate station located in Kahikatea Flat Road. This network system comprises one IP20 pressure system, two MP4 pressure systems and one DRS.

5.9.11.1 Consumer Growth and Demand Forecast

The Whangaparaoa network system supplies gas to about 3,226 consumers in the suburbs of Orewa, Silverdale and Whangaparaoa Peninsula, the vast majority of whom are residential consumers. Only around 3% are commercial/industrial gas users.

Hibiscus Coast had a population of 39,042 at the 2006 Census and is projected to grow to 55,737 in 2021 by a 43% increase[25]. It is made up of 14 Census Area Units (CAUs), which are grouped into three main parts - Orewa, Silverdale and Whangaparaoa Peninsula.

Orewa is a residential and business hub, serving as the town centre of the Hibiscus Coast. Silverdale is the main industrial centre. Growth in the residential, commercial and industrial sectors in the area is expected in the next few years. Although the Hibiscus Coast is a distinct urban area, separate from the North Shore, its population has strong links with the North Shore and other parts of greater Auckland for work, services, schooling and sport[26].

It is expected that future gas demand will be mainly driven by the growth of population in all areas of the Hibiscus Coast and potential industrial/commercial activities in the Silverdale area.

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[25] Supra Note 38

[26] Planning Rodney – Support Document, 2008, http://www.rodney.govt.nz/DistrictTownPlanning/Documents/Planning_Rodney/Support%20Doc%2018%20Oct%2008.pdf

5.9.11.2 Gate Stations

The Waitoki network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.11.3 District Regulating Stations

The network system has two DRSs which supply gas to two MP4 pressure systems.

5.9.11.4 Pressure Systems

Waitoki IP20

The Waitoki IP20 system supplies gas to the suburbs of Silverdale, Orewa and Whangaparaoa. The network is supplied from a single gate station located west of Silverdale and operates at a NOP of 1,900kPa, which was up-rated from a NOP of 1,000kPa in 2012.

Based on a previously analysed NOP of 1,000kPa, the maximum flow into the system in the base year was 1,319scmh, resulting in a MinOP of 876kPa (88% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,968scmh, resulting in a MinOP of 849kPa (85% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Little Manly MP4

The Little Manly MP4 supplies gas to 11 consumers in Tiri Road and Walbrook Road. Gas is supplied from the 50mm PE MP4 main located in Tiri Road of the Whangaparaoa NC MP4 pressure system.

The Little Manly MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 5scmh, resulting in a MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Whangaparaoa CT MP4

The Whangaparaoa CT MP4 system takes gas from the interconnection point in Wainui Road and supplies gas to Silverdale, Orewa and the Whangaparaoa Peninsula at a nominal pressure of 400kPa.

The maximum flow into the system in the base year was 422scmh, resulting in a minimum system pressure of 371kPa (93% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Whangaparaoa NC MP4

The Whangaparaoa NC MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 1,316scmh, resulting in a MinOP of 366kPa (92% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,964scmh, resulting in a MinOP of 332kPa (83% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

The following security enhancements are being considered:

- Construct approximately 600 metres of 80mm PE MP4 pipeline and approximately 700 metres of 100mm PE MP4 pipeline in Gulf Harbour Drive; or

- Interconnect the stranded Auckland asset at the end of the Whangaparaoa Peninsula into the Whangaparaoa MP4 pressure system.

Waitoki MP4

The Waitoki MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 3scmh, resulting in a MinOP of 400kPa (100% of the NOP). Total forecast planning demand during the planning period is estimated to be 4scmh, resulting in a MinOP of 400kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9.11.5 Development Plans

The following reinforcement options will be investigated during the planning period:

- Link the Whangaparaoa CT MP4 and Whangaparaoa NC MP4.

5.9.12 Warkworth Network System

The Warkworth network system is supplied from the transmission system at two gate stations, one located at the east end of Woodcocks Road and another at the west end of Woodcocks Road. This network system consists of one MP4 pressure system and one DRS.

5.9.12.1 Consumer Growth and Demand Forecast

About 258 consumers are connected to the Warkworth network system, most of whom are residential consumers. Only around 14% are commercial/industrial consumers, including a large industrial consumer in Woodcocks Road.

Warkworth's population in 2006 was 3,273. According to the Auckland Council's population projections, Warkworth's population is expected to increase to 6,067 in 2021[27].

A recent economic report[28] discusses the future use of land decisions in Warkworth and provides an overview of Warkworth's business sector by the Auckland Council. The report anticpates baseline (business as usual) growth in the industrial sector and a high demand for land in Warkworth's office and retail sectors. In both cases, a substantial increase in demand in expected.[29]

5.9.12.2 Gate Stations

The Warkworth network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.9.12.3 District Regulating Stations

The Warkworth network system has one DRS which supplies gas to Warkworth MP4 pressure system.

5.9.12.4 Pressure Systems

Warkworth MP4

[27] Supra Footnote **Error! Bookmark not defined.**

[28] Warkworth Business Land Needs, Covec Ltd (prepared for Rodney District Council), July 2010, http://www.rodney.govt.nz/YourCouncil/meetings/Documents/Agendas%20and%20Minutes%20for%202010/October/Item_2_Appendix_6_19_Oct_Warkworth_Business_Land_Needs_29_July_2010_FINAL.pdf

[29] Ibid., for further details, refer to the conclusions and recommendations of the report

The Warkworth MP4 pressure system operates at a NOP of 400kPa and is supplied from a single gate station located west of Warkworth and DR-80075-WW.

In 2007, a significant increase in load at Southern Paprika resulted in the Warkworth gate station being relocated further west, adjacent to the transmission pipeline and involved an additional 160mm PE MP4 system reinforcement. The redundant section of transmission pipeline[30] between the two gate stations now operates at 1,400kPa and supplies DR-80075-WW (located at the gate station site at the west end of Woodcocks Road). Formal transfer of the gas transmission pipeline to operate as a gas distribution pipeline is underway and expected to be completed in FY2016.

The maximum flow into the system in the base year was 2,018scmh, resulting in a MinOP of 336kPa (84% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,511scmh, resulting in a MinOP of 330kPa (83% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.9.13 Wellsford Network System

The Wellsford network system is supplied from the transmission system at one gate station, located in the northeast of Wellsford. This network system consists of one IP pressure system and one MP4 pressure system.

5.9.13.1 Consumer Growth and Demand Forecast

The Wellsford network system has a total of 24 consumers, comprising an even mix of residential and commercial/industrial premises.

Wellsford has a population of 1,665 people which is anticipated to grow to 1,736 in year 2021[31]. Demand for gas has been fairly flat over past few years. Very limited growth is anticipated within the planning period.

5.9.13.2 Gate Stations

Flow data for the Wellsford gate station is not available and Vector has no plans at this stage to collect this information.

5.9.13.3 District Regulating Stations

The Wellsford network system has one DRS which supplies gas to Wellsford MP4 pressure system.

5.9.13.4 Pressure Systems

Wellsford IP20

The Wellsford IP20 pressure system is supplied from a single gate station located North West of Wellsford with a NOP of 1,900kPa. The IP20 network is capable of operating up to 1,900kPa, but is currently operating at 1,200kPa. The maximum flow into the system in the base year was 9scmh resulting in a MinOP of 1200kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

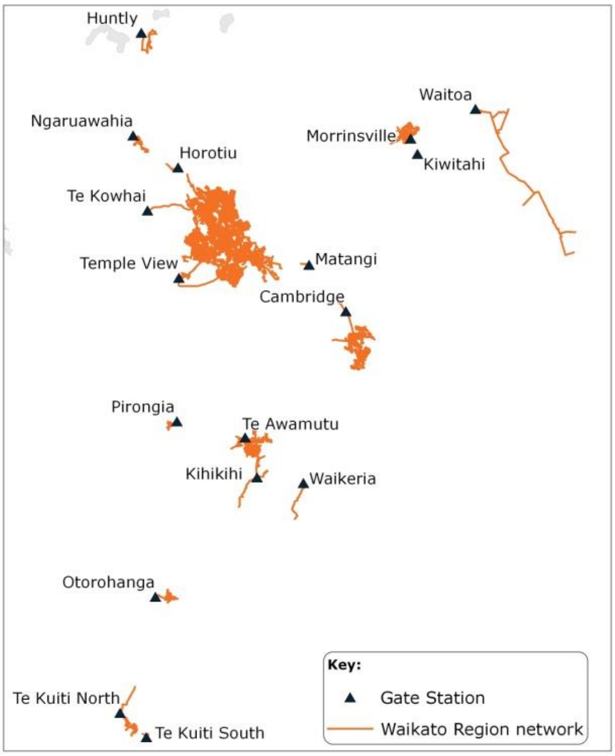
Wellsford MP4

[30] The Warkworth 432 transmission pipeline (part) is a coated steel pipeline with a diameter of 50mm and is 3.6km long.

[31] Population projections by Ward, Main Urban Area and Planning Area Unit , August 2009, http://www.rodney.govt.nz/AboutRodney/Documents/Rodney_District_Population_Projections_Aug2009.pdf

The Wellsford MP4 pressure system is supplied from DR-80056-WE located in Mobil Wellsford Energy Centre and operates at a NOP of 400kPa. The maximum flow into the system in the base year was 9scmh resulting in a MinOP of 349kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10 Network Development Programme – Waikato Region



The Waikato is the fourth largest region in New Zealand, covering 25,000 square kilometres. It stretches from the Bombay Hills and Port Waikato in the north down to the Kaimai Ranges and Mt Ruapehu in the south, and from Mokau on the west coast across to the Coromandel Peninsula in the east.

The Waikato region is comprised one city (Hamilton) and 11 districts (Franklin, Hauraki, Matamata-Piako, Otorohanga, Rotorua, South Waikato, Taupo, Thames-Coromandel, Waikato, Waipa and Waitomo), four of which lie across the regional boundary.

5.10.1 Load Forecasts

The load forecast for the Waikato region for the next ten years is shown in Figure 5-7.

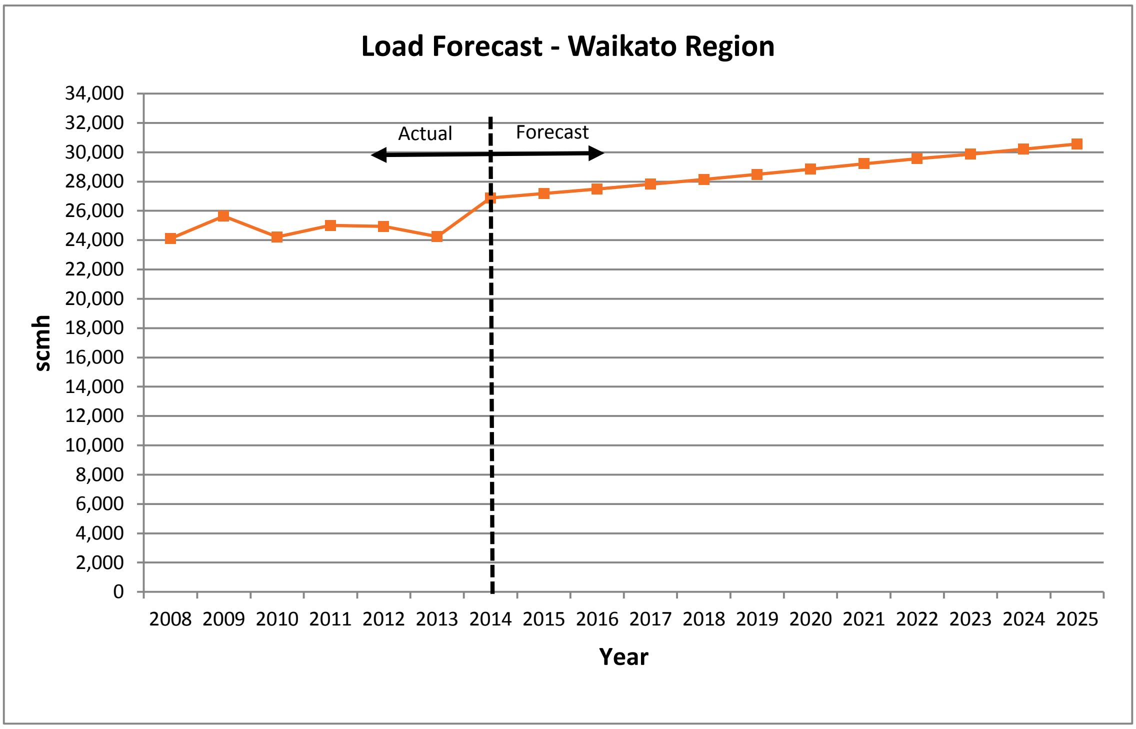


Figure 5-7 : Load forecast for Waikato region

5.10.2 Huntly Network System

The Huntly network system is supplied from the transmission system at one gate station located in Hetherington Road. This network system comprises one MP7 pressure system, three MP4 pressure systems and three DRSs.

5.10.2.1 Consumer Growth and Demand Forecast

About 110 consumers are connected to the Huntly network system, 69% of whom are residential consumers. The rest are either commercial or industrial users.

Huntly's population in 2006 was 6,915 and is projected to increase by 29%, to 8,940 in 2021[32]. With respect to land use, Huntly will continue allocating land for aggregate and coal[33] use in the Waikato region.

It is expected that future gas demand will be driven by the growth of population and potential industrial activities in Huntly. Demand growth is anticipated to be relatively flat over the planning period.

5.10.2.2 Gate Stations

The Huntly network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.2.3 District Regulating Stations

The Huntly network system has three DRSs which supply gas to three MP4 pressure systems.

5.10.2.4 Pressure Systems

Huntly MP7

The Huntly MP7 pressure system operates at a NOP of 700kPa. The maximum flow into the system in the base year was 661scmh, resulting in a MinOP of 683kPa (98% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Huntly East MP4

The Huntly East MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 359scmh, resulting in a MinOP of 345kPa (86% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Huntly Central MP4

The Huntly East MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 295scmh, resulting in a MinOP of 261kPa (65% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Harris St MP4

The Harris St MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 4scmh, resulting in a MinOP of 350kPa (88% of the NOP).

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[32] Growth Strategy and Implementation Plan Summary 2009 – Future Proof, Waikato District Council, http://www.waikatodistrict.govt.nz/CMSFiles/56/5699a8aa-326c-4e96-af79-79ac9d1aa53a.pdf

[33] Ibid.

Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.3 Ngaruawahia Network System

The Ngaruawahia network system is supplied from the transmission system from one gate station located in Brownlee Avenue. This network system comprises one MP7 pressure system, one MP4 pressure system and one DRS.

The Ngaruawahia MP7 pressure system is designed to operate at IP20 (MAOP 1,820kPa) but is currently operating at a lower pressure of 450kPa. The purpose of the lower operating pressure is to improve the accuracy of the transmission gate station meter and to minimise the effects of odorant fade in this network system.

5.10.3.1 Consumer Growth and Demand Forecast

About 158 consumers are connected to the Ngaruawahia network system. They consumers are predominately residential consumers; only around 4% are commercial/industrial gas users.

Ngaruawahia's population in 2006 was 5,120 and is projected to increase by 63%, to 8,340 in 2021[34].

It is expected that future gas demand will be driven primarily by the population growth with limited growth in the commercial/industrial sector.

5.10.3.2 Gate Stations

The Ngaruawahia network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.3.3 District Regulating Stations

The Ngaruawahia network system has one DRS which supplies gas to Ngaruawahia MP2 pressure system.

5.10.3.4 Pressure Systems

Ngaruawahia MP7

The Ngaruawahia MP7 pressure system operates at a NOP of 700kPa (currently operating at lower pressure of 450kPa). The maximum flow into the system in the base year was 79scmh, resulting in a MinOP of 423kPa (60% of the NOP). Total forecast planning demand during the planning period is estimated to be 84scmh, resulting in a MinOP of 422kPa (60% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Ngaruawahia MP2

The Ngaruawahia MP2 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 79scmh, resulting in a MinOP of 348kPa (87% of the NOP). Total forecast planning demand during the planning period is estimated to be 84scmh, resulting in a MinOP of 347kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

[34] Supra Note 38

5.10.4 Horotiu Network System

The Horotiu network system is supplied from the transmission system at one gate station located in Horotiu Bridge Road. This network system comprises one IP10 pressure system, one MP4 pressure system and one DRS.

5.10.4.1 Consumer Growth and Demand Forecast

A total of 6 gas consumers are connected to the Horotiu network system. They comprise 4 large commercial/industrial consumers and 2 residential consumers.

Horotiu's population in 2006 was 700 and is projected to increase by 43%, to 1,000 in 2021[35].

With respect to industrial land use, northern Horotiu will continue allocating land for dairy industry, logistics, warehousing and meat processing[36] in the Waikato region in the long term. In the short term, the Northgate Business Park, a 103-hectare industrial park in Horotiu, is being developed.

It is expected that future gas demand will be driven by the growth of potential industrial activities in the area while residential demand will be minimal.

5.10.4.2 Gate Stations

The Horotiu network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.4.3 District Regulating Stations

The Horotiu network system has one DRS which supplies gas to the Horotiu MP4 pressure system.

5.10.4.4 Pressure Systems

Horotiu IP10

The Horotiu IP10 pressure system has been designed and constructed with an MAOP of 1,900kPa and currently operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 1,189scmh, resulting in a MinOP of 1,056kPa (100% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,193scmh, resulting in a MinOP of 1,039kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Horotiu MP4

The Horotiu MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 230scmh, resulting in a MinOP of 332kPa (83% of the NOP). Total forecast planning demand during the planning period is estimated to be 366scmh, which would result in a MinOP of 307kPa (77% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.4.5 Development Plans

To support industrial and business growth in Horotiu, especially the development of Northgate Business Park, the following projects are planned:

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[35] Supra Note 38

[36] Supra Note 38

- Up-rate the Horotiu IP10 to IP20 pressure system;
- Install a new IP20/MP4 DRS opposite to #5 Washer Road at SH1;
- Extend approximately 350 metres of 100mm PE MP4 from the new DRS to the junction of Horotiu Bridge Road and SH1; and
- Construct approximately 560 metres of 100mm PE MP4 along Horotiu Bridge Road between Washer Road and SH1.

5.10.5 Hamilton Network System

The Hamilton network system is supplied from the transmission system at two gate stations, located at Te Kowhai in the North West and Temple View in the South West of Hamilton. The Hamilton network system comprises one IP10 pressure system, one MP7 pressure system, three MP4 pressure systems, one MP2 pressure system, three MP1 pressure system, five LP pressure systems and 38 DRS's.

5.10.5.1 Consumer Growth and Demand Forecast

A total of 27,845 consumers are connected to the Hamilton network system. They are predominatly residential consumers; only around 4% are commercial/industrial gas users.

The population of Hamilton is projected to increase significantly from 134,400 in 2006[37] to 166,500 in 2019[38]. By 2051, it is expected to increase to 242,000[39]. Residential growth in the next ten years is anticipated to occur in the northern (Rotokaui and Rototuna) and southern (Peacock) parts of Hamilton[40].

According to the Rotokaui Structure Plan[41] released by the Hamilton City Council, the development area is anticipated to drive high growth in industrial and commercial loads over the planning period.

5.10.5.2 Gate Stations

The Hamilton network system has two gate stations (Temple View and Te Kowhai). Vector takes an IP10 supply from both stations at a NOP of 1,000kPa. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.5.3 District Regulating Stations

The Hamilton network system consists of 38 DRSs.

The following DRSs are planned to be upgraded during the planning period:

- DR-80103-HM in FY2016 (refer section 6);
- DR-80139-HM in FY2016 (refer section 6);
- DR-80100-HM in FY2017 (refer section 6);
- DR-80129-HM in FY2017 (refer section 6);

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[37] 2006 census data.

[38] Hamilton City Council's 2009-19 Long-term Council Community Plan (http://hamilton.co.nz/file/fileid/18541).

[39] Refer footnote number 44.

[40] Refer Rotokaui Structure Plan, Rototuna Structure Plan and Peacock Structure Plan in http://www.hamilton.co.nz/our-council/council-publications/districtplans/proposeddistrictplan/chapter3/Pages/default.aspx

[41] The Rotokauri Structure Plan provides for urban growth with an estimated total population of between 16,000 and 20,000 people. Stage 1 development has commenced and comprises 280ha of industrial land, employment areas, and a neighbourhood centre. See http://www.hamilton.co.nz/our-council/council-publications/districtplans/proposeddistrictplan/chapter3/Pages/3-6-Rotokauri.aspx

- DR-80133-HM in FY2017 (proposed ugrade as part of Hamilton IP10 uprating project);
- DR-80145-HM in FY2017 (proposed upgrade as part of the Hamilton IP10 uprating project); and
- DR-80101-HM in FY2018 (refer section 6).

5.10.5.4 Pressure Systems

Hamilton IP10

The Hamilton IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 15,329scmh, resulting in a MinOP of 781kPa at DR-80100-HM (78% of the NOP). Total forecast planning demand during the planning period is estimated to be 17,576scmh, which would result in the MinOP falling below the minimum pressure criteria.

In order to maintain supply pressure quality, a number of options for reinforcement of the Hamilton IP10 pressure system (particularly the southern lateral near the University of Waikato) have been investigated. Amongst the options considered the following five warrant further assessment:

1. Upgrading the existing IP pipeline from Te Kowhai gate station to Avalon Drive from 1,200kPa to 1,900kPa.
2. Construct a new 150mm IP pipeline link from either DR-80145-HM or DR-80139-HM to DR-80100-HM.
3. Construct a new 150mm IP pipeline operating at 1,900kPa from Temple View gate station to the hospital or University area.
4. Construct a new 100mm IP pipeline from Matangi Gate Station to DR-80101-HM.
5. Construct a new 150mm IP pipeline from Horotiu Gate Station to DR-80145-HM.

Option (1) would provide an increase in pressure at the southern lateral of between 50kPa to 100kPa, depending on the regulator set pressure between the 1,900kPa and 1,200kPa systems at Avalon Drive. This would provide only a short-term improvement.

All other options have a higher capital cost due to the type of construction required. Options (2) and (3) provide the greatest capacity and security of supply advantage. Options (4) and (5) will result in major gate station upgrades and require consultation with Vector Gas Transmission with regards to the feasibility of these two options.

Hamilton MP7

The Hamilton MP7 pressure system operates at a NOP of 700kPa and feeds gas to DR-80171-HM, DR-80172-HM and DR-80175-HM. The maximum flow into the system in the base year was 1,424scmh, resulting in a MinOP of 644kPa (92% of the NOP).

Total forecast planning demand for 2016 is estimated to be 1,850scmh, which would result in a MinOP of 641kPa (92% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Hamilton West MP4

The Hamilton West MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 3,169scmh, resulting in a MinOP of 228kPa (57% of the NOP). Total forecast planning demand during the planning period is estimated to be 3,943scmh, resulting in the MinOP falling below the minimum pressure criteria. The following reinforcements are planned:

- Install approximately 150 metres of 50mm PE MP4 in Avalon Drive from #27 Avalon Drive to #1 Livingstone Avenue; and

- Install approximately 100 metres of 50mm PE MP4 from #23 Roy Street to #26 Livingstone Avenue.

To support the growth of residential and industrial demand in Rotokauri, a new DRS is proposed below:

- Install a new IP10/MP4 DRS at a location in Te Kowhai Road between Exelby Road and Ruffell Road.
- DR-80123-HM supplies more than 60% of the total load. If DR-80123-HM failed, suburbs south of Grandview Road and north of Killarney Road / Tuhikaramea Road will fall below the minimum pressure criteria.

Pukete MP4

The MP4 Pukete pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 2,813scmh, resulting in a MinOP of 214kPa (54% of the NOP). Total forecast planning demand during the planning period is estimated to be 3,502scmh, resulting in the MinOP falling below the minimum pressure criteria.

The following reinforcements are planned:

- Construct approximately 650 metres of 80mm PE MP4 pipeline loop in Te Rapa Road from DR-80139-HM to Mahana Road; and
- Construct approximately 180 metres of 50mm PE MP4 in Te Papa Road from Bryant Road to #558 Te Rapa Road.

Contingency scenario analysis of the MP4 Pukete system suggests that if DR-80133-HM failed, supply south of Mears Road (apart from the connections in Te Papa Road) would be lost. Whilst DR-80129-HM provides significant load in the area, if it failed, DR-80130-HM would be able to supply adequate back up pressure. The only customer impacted is the Hamilton Waste Water Treatment Plant where metering pressure would drop below the specific minimum design pressure of 300kPa. However, the reduction in metering pressure is not anticipated to impact the operation of the treatment plant.

Hamilton MP4

The Hamilton MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 10,473scmh resulting in a MinOP of 229kPa (57% of the NOP). Total forecast planning demand during the planning period is estimated to be 15,845scmh, resulting in the MinOP falling below the minimum pressure criteria. Industrial and residential growth is expected to occur north of the network system which is solely supplied by DR-80145-HM. However, reinforcement of the system pressure is expected in the south east area, mainly supplied by DR-80103-HM, DR-80101-HM and DR-80100-HM. The following reinforcements are planned during the planning period:

- Construct approximately 400 metres of 100mm PE MP4 in Cambridge Road from the outlet of DR-80101-HM to Hillcrest Road and tie into the existing 80mm steel; and
- Construct approximately 50 metres of 50mm PE MP4 at the intersection of Boundary Road and Heaphy Terrace and tie into the existing gas mains.

To support growth opportunities in the Rototuna area in Hamilton North, the following enhancement project is planned:

- Construct approximately 2,100 metres of 80mm PE MP4 in Gordonton Road between Wairere Drive and Thomas Road.

Contingency scenario analysis of the Hamilton MP4 pressure system suggests that DR-80145-HM is the only DRS at present supplying Hamilton North. Failure of this DRS would result in a significant loss of supply in the area. A reinforcement proposal to construct approximately 2,500 metres of 100mm PE MP4 to link DR-80130-HM to River Road (river crossing) is being considered.

Temple View MP2

The Temple View MP2 pressure system operates at a NOP of 200kPa. No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Tuhikaramea Road MP1

The Tuhikaramea Road MP1 pressure system operates at a NOP of 100kPa. No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Hamilton MP1

The Hamilton MP1 pressure system has been split into two separate pressure systems. They are known as Hamilton North MP1 pressure system and Hamilton South MP1 pressure system.

Hamilton North MP1

The Hamilton North MP1 system operates at a NOP of 80kPa. The pressure system is located in northern St Andrews and comprises about one third of the former Hamilton MP1 pressure system. The pipeline replacement programme was completed in September 2014 and modelling for this pressure system is yet to be completed.

Hamilton South MP1

The Hamilton South MP1 system operates at a NOP of 80kPa. The pressure system is located in Beerescourt and comprises about one third of the former Hamilton MP1 pressure system. The pipeline replacement programme was completed in September 2014 and modelling for this pressure system is yet to be completed .

Fairfield LP

The Fairfield LP pressure system operates at a NOP of 5kPa. As a result of the recently completed pipeline replacement programme, the Fairfield LP pressure system is about half of its orginal size. Network modelling for this pressure system is yet to be completed.

Frankton LP

The Frankton LP pressure system operates at a NOP of 5kPa. As a result of the recently completed pipeline replacement programme the Frankton LP pressure system is about half of its former size. Network modelling for this pressure system is yet to be completed.

Hamilton West LP

The Hamilton West LP pressure system operates at a NOP of 5kPa. As a result of the recently completed pipeline replacement programme the Hamilton West LP pressure system has reduced slightly and is now supplied by a new DRS. Network modelling for this pressure system is yet to be completed.

Hamilton East LP

The Hamilton East LP pressure system operates at a NOP of 5kPa. As a result of the recently completed pipeline replacement programme the Hamilton East LP pressure system is about two thirds of its former size. Modelling over a winter period has yet to occur.

Cameron Rd LP

The Cameron Rd LP pressure system operates at a NOP of 5kPa. Cameron Rd LP pressure system was formed as a result of the recently completed pipeline replacement programme from a section of the Hamilton East LP pressure system. Modelling over a winter period has yet to occur.

5.10.6 Matangi Network System

The Matangi network system is supplied from the transmission system from one gate station located in Tauwhare Road. This network system comprises one MP4 pressure system.

5.10.6.1 Consumer Growth and Demand Forecast

The Matangi network system supplies 37 residential consumers.

Matangi's population in 2006 was 350 and is projected to increase by 86%, to 650 in 2021[42].

It is expected that future gas demand will be driven by population growth with limited growth expected in the commercial/industrial sector.

5.10.6.2 Gate Stations

Flow data for the Matangi gate station is not available and Vector does not intend to collect this information at this point in time.

5.10.6.3 District Regulating Stations

No DRS is installed in the Matangi network system.

5.10.6.4 Pressure Systems

Matangi MP4

The Matangi MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 11scmh, resulting in a MinOP of 350kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.7 Morrinsville Network System

The Morrinsville network system is supplied from the transmission system from one gate station located in the south of Morrinsville. This network system consists of one IP10 pressure system, one MP4 pressure system and two DRSs.

[42] Supra Note 38

5.10.7.1 Consumer Growth and Demand Forecast

About 710 consumers are connected to the Morrinsville network system. They are predominately residential consumers; only around 7% are commercial consumers and there is one industrial gas user.

The population in Morrinsville in 2006 was 6,800 and is projected to increase by 13%, to 7,700 in 2021[43]. It is expected that future gas demand will be driven by population growth and potential commercial and industrial activities in Morrinsville.

5.10.7.2 Gate Stations

The Morrinsville network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.7.3 District Regulating Stations

The Morrinsville network system has two DRSs which supply gas to Morrinsville MP4 pressure system.

The following DRSs are planned to be upgraded in the planning period:

- DR-80213-MO in FY2017 (refer section 6).

5.10.7.4 Pressure Systems

Morrinsville IP10

The Morrinsville IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 563scmh, resulting in a MinOP of 934kPa (93% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 934kPa (93% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Morrinsville MP4

The Morrinsville MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 430scmh, resulting in a MinOP of 336kPa (84% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 336kPa (84% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Morrinsville West MP4

The Morrinsville West MP4 pressure system was merged with the Morrinsville MP4 system in FY2014.

5.10.8 Kiwitahi Network System

The Kiwitahi network system is supplied from the transmission system from one gate station located in Morrinsville-Walton Road. This network system comprises one MP4 pressure system.

[43] Supra Note 38

5.10.8.1 Consumer Growth and Demand Forecast

The Kiwitahi network system supplies one large commercial consumer and one large industrial gas user.

5.10.8.2 Gate Stations

The Kiwitahi network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.8.3 District Regulating Stations

The Kiwitahi network system has one DRS which supplies gas to Kiwitahi MP4 pressure systems.

5.10.8.4 Pressure Systems

Kiwitahi MP4

The Kiwitahi MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 130scmh, resulting in a MinOP of 309kPa (77% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 309kPa (77% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.9 Waitoa Network System

The Waitoa network system is supplied from the transmission system from one gate station located in Wood Road. This network system consists of one IP20 pressure system, one MP7 pressure system, one MP4 pressure system and two DRSs.

5.10.9.1 Consumer Growth and Demand Forecast

A total of 46 consumers are connected to the Waitoa network system comprising 30 residential consumers and 14 commercial/industrial gas users. At system peak, the total gas demand from five major gas users takes 95% of the system total flow rate.

It is expected that future gas demand will be driven by the growth of potential industrial activities in the area while residential demand will be minimal.

5.10.9.2 Gate Stations

The Waitoa network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.9.3 District Regulating Stations

The Waitoa network system has two DRSs, one of which supplies gas to the Waitoa MP7 pressure system and another one supplies gas to the Waitoa MP4 pressure system.

5.10.9.4 Pressure Systems

Waitoa IP20

The Waitoa IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 2,009scmh, resulting in a MinOP of 1,357kPa (71% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,860scmh, resulting in a MinOP of 1,405kPa (74% of the NOP, based on the MP4 reinforcement models during the planning period). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Waitoa MP7

The Waitoa MP7 pressure system operates at a NOP of 700kPa and supplies gas to Inghams in Waihekau Road. The maximum flow into the system in the base year was 307scmh, resulting in a MinOP of 643kPa (92% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,292scmh, resulting in a MinOP of 613kPa (88% of the NOP, based on the MP4 reinforcement models during the planning period). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Waitoa MP4

The Waitoa MP4 pressure system operates at a NOP of 400kPa and supplies gas to four large industrial consumers. The maximum flow into the system in the base year was 1,746scmh, resulting in a MinOP of 137kPa (34% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,423scmh, resulting in the MinOP falling below the minimum pressure criteria.

In order to maintain supply pressure quality, the following system reinforcements are planned:

- Extend approximately 5,000 metres of 160mm MP7 PE pipeline from the existing Waitoa MP7 pressure system to connect to a proposed MP7/MP4 DRS in Ngarua;
- Install a DRS (MP7/MP4) at Ngarua;
- Extend approximately 5,200 metres of 160mm MP7 PE pipeline to the south of Waitoa and relocate a proposed new DRS to a new location to the end of the MP7 network; and
- Relocate the above DRS installation further south to a new location.

5.10.10 Cambridge Network System

The Cambridge network is supplied from the transmission system from one gate station and consists of one IP20 pressure system, two MP4 pressure systems and three DRSs.

5.10.10.1 Consumer Growth and Demand Forecast

There are currently 1,915 consumers connected to the Cambridge network system. They are predominatey residential consumers; only around 5% are commercial/industrial gas users, including two large industrial consumers.

In 2006, Cambridge's residential population was 13,225, which is projected to increase to 17,500 by the year of 2021[44]. Over the next ten years, growth is anticipated from residential development in Cambridge North and industrial activity at Hautapu.

The Waipa District Council has approved future residential development for Cambridge North where new dwellings are expected to be between 2,200 and 2,950. It is also proposed that land to the east of Victoria Road will provide for a neighbourhood centre (providing for circa 3000 square metres local commercial land use)[45].

[44] See Growth Strategy & Implementation Plan 2009, www.futureproof.org.nz

[45] See Cambridge Town Concept Plan Draft, October 2009, http://www.waipa2050.co.nz/UserFiles/File/town%20concept%20plans/19th%20october%202009%20update%20files/Cambridge%20Town%20Plan%20Report%20web.pdf

5.10.10.2 Gate Stations

The Cambridge network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.10.3 District Regulating Stations

The Cambridge network system consists of three DRSs.

5.10.10.4 Pressure Systems

Cambridge IP20

The Cambridge IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 1,867scmh, resulting in a MinOP of 1,154kPa (61% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,026scmh, resulting in a MinOP of 1,032kPa (54% of the NOP).

However, recent analysis of the potential load growth in Cambridge suggests that the system pressure will fall below the MinOP criteria during the planning period. Recently, Vector accepted a gas supply to a 280 lot residential subdivision in St Kilda Road which will be developed in various stages over the next five years. In addition, a couple of enquiries with considerable load requirements from prospective customers were received and have been processed recently. Gas demand is estimated to increase significantly over the next couple of years; hence, capacity constraints on the Cambridge IP20 are expected.

In order to meet the growth requirements in Cambridge, the following reinforcement options have been investigated:

IP20 pipeline option:

- Elevate the Harrisville gate station outlet pressure 1,800kPa (under investigation);
- Construct approximately 3,400 metres of 80mm IP20 steel pipeline from the Cambridge gate station along Zig Zag Road into Swayne Road; and
- Install a DRS (IP20/MP4) at 79 Swayne Road.

MP7 pipeline option:

- Construct approximately 4,050 metres of 110mm PE MP7 from the Cambridge gate station along Zig Zag Road and Watkins Road to the junction of St Kilda Road;
- Construct approximately 1,400 metres of 110mm PE MP7 in Swayne Road between Zig Zag Road and #79 Swayne Road; and
- Install two MP7/MP4 DRS at 79 Swayne Road and at the junction of Watkins Road and St Kilda Road.

From the options considered, the IP20 pipeline reinforcements have been selected and included in the 10 year planning period.

Cambridge MP4

The Cambridge MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 1,052scmh, resulting in a MinOP of 308kPa (77% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,142scmh, resulting in a MinOP of 301kPa (75% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Bruntwood MP4

The Bruntwood MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 2scmh, resulting in a MinOP of 350kPa (88% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.11 Te Awamutu Network System

The Te Awamutu network system is supplied from the transmission system from two gate stations, located at Te Awamutu and Kihikihi. The Te Awamutu network system consists of one IP10 pressure system, two MP4 pressure systems and two DRSs.

5.10.11.1 Consumer Growth and Demand Forecast

Te Awamutu network system supplies about 1,386 consumers, around 54% of whom are commercial/industrial gas users.

5.10.11.2 Gate Stations

The Te Awamutu network system has two gate stations (Te Awamutu and Kihikihi). Vector takes an MP4 supply from Te Awamutu gate station and IP10 supply from Kihikihi gate station at a NOP of 400kPa and 1,000kPa, respectively. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.11.3 District Regulating Stations

The Te Awamutu network system has two DRSs which supply gas to the Te Awamutu MP4 pressure system and the Kihikihi MP4 pressure system.

5.10.11.4 Pressure Systems

Kihikihi IP10

The Kihikihi IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 679scmh, resulting in a MinOP of 770kPa (77% of the NOP). Total forecast planning demand during the planning period is estimated to be 754scmh, resulting in a MinOP of 765kPa (77% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Te Awamutu MP4

The Te Awamutu MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 536scmh, resulting in a MinOP of 312kPa (78% of the NOP). Total forecast planning demand during the planning period is estimated to be 573scmh, resulting in a MinOP of 299kPa (75% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Kihikihi MP4

The Kihikihi MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 153scmh, resulting in a MinOP of 344kPa (86% of the NOP). Total forecast planning demand during the planning period is estimated to be 181scmh, resulting in a MinOP of 342kPa (86% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.12 Waikeria Network System

The Waikeria network system is supplied from the transmission system from one gate station located in Higham Road. This network system comprises one IP20 pressure system currently supplying gas to one large customer at the end of the system.

5.10.12.1 Consumer Growth and Demand Forecast

The Waikeria network system supplies only one large commercial consumer.

5.10.12.2 Gate Stations

The Waikeria network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.12.3 District Regulating Stations

No DRS is installed in the Waikeria network system.

5.10.12.4 Pressure Systems

Waikeria IP20

The Waikeria IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 223scmh, resulting in a MinOP of 1,761kPa (93% of the NOP). Total forecast planning demand during the planning period is estimated to be 540scmh, resulting in a MinOP of 1,581kPa (83% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.13 Pirongia Network System

The Pirongia network system is supplied from the transmission system from one gate station located in Pirongia Road. This network system comprises one MP4 pressure system.

5.10.13.1 Consumer Growth and Demand Forecast

A total of 50 consumers are connected to the Pirongia network system comprising 47 residential consumers and 3 small commercial gas users.

5.10.13.2 Gate Stations

The Pirongia network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.13.3 District Regulating Stations

No DRS is installed in the Pirongia network system.

5.10.13.4 Pressure Systems

Pirongia MP4

The Pirongia MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 20scmh, resulting in a MinOP of 317kPa (79% of the

NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.14 Otorohanga Network System

The Otorohanga network system is supplied from the transmission system from one gate station located in Waitomo Valley Road. This network system comprises one MP4 pressure system.

5.10.14.1 Consumer Growth and Demand Forecast

About 180 consumers are connected to the Otorohanga network system. They are mainly residential consumers; around 21% are commercial/industrial gas users.

5.10.14.2 Gate Stations

The Otorohanga network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.14.3 District Regulating Stations

No DRS is installed in the Otorohanga network system.

5.10.14.4 Pressure Systems

Otorohanga MP4

The Otorohanga MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 168scmh, resulting in a MinOP of 315kPa (78% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 315kPa (78% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.15 Te Kuiti North Network System

The Te Kuiti North network system is supplied from the transmission system from one gate station located in the northwest of Te Kuiti. This network system consists of one IP10 pressure system, three MP4 pressure systems and five DRSs.

5.10.15.1 Consumer Growth and Demand Forecast

A total of 152 consumers are connected to the Te Kuiti North network system. They are mainly residential consumers; around 23% are commercial/industrial gas users.

5.10.15.2 Gate Stations

The Te Kuiti North network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.10.15.3 District Regulating Stations

The Te Kuiti North network system has five DRSs which supply gas to three MP4 pressure systems.

The following DRSs are planned to be upgraded during the planning period:

- DR-80203-TK in FY2016 (refer section 6).

5.10.15.4 Pressure Systems

Te Kuiti North IP10

The Te Kuiti North IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 294scmh, resulting in a MinOP of 894kPa (89% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 894kPa (89% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Hangatiki East Road MP4

The Hangatiki East Road MP4 pressure system operates at a NOP of 400kPa and is fed from a DRS inside the Te Kuiti North gate station. The maximum flow into the system in the base year was 116scmh, resulting in a MinOP of 331kPa (83% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 331kPa (83% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Seddon St MP4

The Seddon Street MP4 pressure system operates at a NOP of 400kPa and is supplied from one DRS. The maximum flow into the system in the base year was 8scmh, resulting in a MinOP of 350kPa (88% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Te Kuiti MP4

The Te Kuiti MP4 pressure system operates at a NOP of 400kPa and supplies Te Kuiti town via three DRSs. The maximum flow into the system in the base year was 170scmh, resulting in a MinOP of 349kPa (87% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 349kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.10.15.5 Development Plans

A recent study of the Te Kuiti network system has confirmed that by downrating the pressure of a section of pipeline in the Te Kuiti IP10 pressure system, DR-80202-TK and DR-80204-TK can be removed. This avoids future upgrade work and allows the Seddon Road and Te Kuiti MP4 pressure systems to be merged together. This work is planned to be completed in FY2016.

5.10.16 Te Kuiti South Network System

The Te Kuiti South network system is supplied from the transmission system from one gate station located in SH30 near Beros Road. This network system consists of one MP4 pressure system.

5.10.16.1 Consumer Growth and Demand Forecast

A total of 7 consumers are connected to the Te Kuiti South network system comprising 2 residential consumers and 5 commercial/industrial gas users.

It is expected that future gas demand will be driven mainly by industrial users with minimal residential growth.

5.10.16.2 Gate Stations

The Te Kuiti South network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

There is an industrial consumer located adjacent to the Te Kuiti South gate station from which gas is directly fed to this factory. The gas flow into Te Kuiti South pressure system is the difference between the flows recorded by the gate station meter and the industrial consumer's GMS.

5.10.16.3 District Regulating Stations

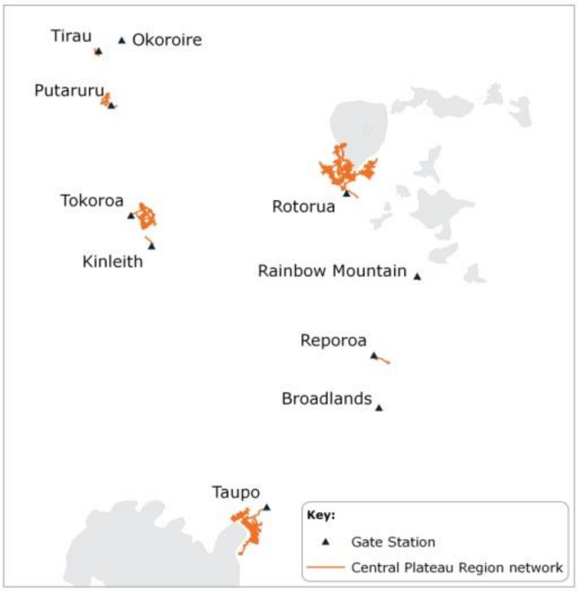
No DRS is installed in the Te Kuiti South network system.

5.10.16.4 Pressure Systems

Te Kuiti South MP4

The Te Kuiti South MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 875scmh, resulting in a MinOP of 338kPa (82% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,184scmh, resulting in a MinOP of 310kPa (78% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11 Network Development Programme – Central Plateau Region



The Central Plateau is an extensive area of high but level country whose underlying rocks and soils are of volcanic origin; hence, it is sometimes referred to as the Volcanic Plateau. It lies in the central part of the North Island extending from Ruapehu and Lake Taupo in the south towards the Bay of Plenty in the north-east.

5.11.1 Load Forecasts

The load forecast for the Central Plateau region for the next ten years is shown in Figure 5-8.

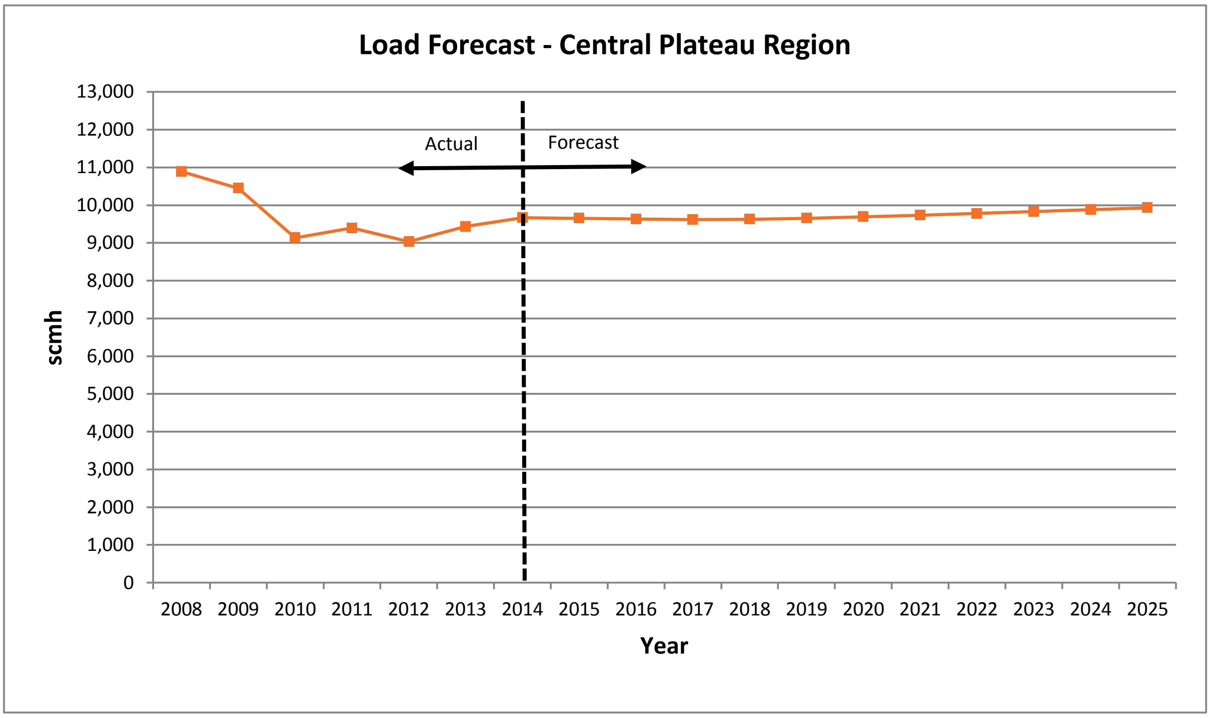


Figure 5-8 : Load forecast for Central Plateau region

5.11.2 Okoroire Network System

The Okoroire network system is supplied from the transmission system from one gate station located in Somerville Road. This network system comprises one MP4 pressure system.

5.11.2.1 Consumer Growth and Demand Forecast

The Okoroire network system supplies one residential consumer and one large commercial gas user. Gas demand is not anticipated to change within the planning period.

5.11.2.2 Gate Stations

Flow data for the Okoroire gate station is not available and collecting this information is not intended at this point in time.

5.11.2.3 District Regulating Stations

No DRS is installed in the Okoroire network system.

5.11.2.4 Pressure Systems

Okoroire MP4

The Okoroire MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 8scmh, resulting in a MinOP of 300kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11.3 Tirau Network System

The Tirau network system is supplied from the transmission system from one gate station located in Okoroire Road. This network system consists of one IP10 pressure system, one MP4 pressure system and two DRSs.

5.11.3.1 Consumer Growth and Demand Forecast

A total of 76 consumers are connected to the Tirau network system, comprising 59 residential consumers and 17 commercial/industrial gas users.

5.11.3.2 Gate Stations

The Tirau network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.11.3.3 District Regulating Stations

The Tirau network system has two DRSs which supply gas to the Tirau MP4 pressure system.

5.11.3.4 Pressure Systems

Tirau IP10

The Tirau IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 57scmh, resulting in a MinOP of 1,006kPa (100% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 1,006kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Tirau MP4

The Tirau MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year results in a MinOP of 349kPa (87% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 349kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11.4 Putaruru Network System

The Putaruru network system is supplied from the transmission system from one gate station located in Bridge Street. This network system consists of one IP10 pressure system, one MP4 pressure system and two DRSs.

5.11.4.1 Consumer Growth and Demand Forecast

There are 350 consumers connected to the Putaruru network system with around 11% of commercial/industrial gas users.

5.11.4.2 Gate Stations

The Putaruru network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.11.4.3 District Regulating Stations

The Putaruru network system has two DRSs which supply gas to the Putaruru MP4 pressure system.

5.11.4.4 Pressure Systems

Putaruru IP10

The Putaruru IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 560scmh resulting in a MinOP of 948kPa (95% of the NOP). Total forecast planning demand during the planning period is estimated to be 873scmh, resulting in a MinOP of 940kPa (94% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Putaruru MP4

The Putaruru MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 560scmh resulting in a MinOP of 325kPa (81% of the NOP). Total forecast planning demand during the planning period is estimated to be 873scmh, resulting in a MinOP of 291kPa (73% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11.5 Kinleith Network System

The Kinleith network system is supplied from the transmission system from one gate station located near the junction of Old Taupo Road and Kinleith Road. This network system consists of one MP4 pressure system.

5.11.5.1 Consumer Growth and Demand Forecast

The Kinleith network system supplies 5 residential consumers and 2 large industrial gas users.

5.11.5.2 Gate Stations

The Kinleith network system is fed from one gate station. The gate station that supplies the Kinleith MP4 is located in the same site as the supply to Kinleith Mills. The gate station winter peak demand statistics are summarised in Table 5-2.

5.11.5.3 District Regulating Stations

No DRS is installed in the Kinleith network system.

5.11.5.4 Pressure Systems

Kinleith MP4

The Kinleith MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 235scmh, resulting in a MinOP of 267kPa (67% of the NOP). Total forecast planning demand during the planning period is estimated to be 354scmh, resulting in a MinOP of 199kPa (49% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11.6 Tokoroa Network System

The Tokoroa network system is supplied from the transmission system from one gate station located in Baird Road near Old Taupo Road. This network system consists of one IP20 pressure system, one MP4 pressure system and three DRSs.

5.11.6.1 Consumer Growth and Demand Forecast

About 1,025 consumers are connected to the Tokoroa network system. They are mainly residential consumers; only 11% are commercial/industrial gas users.

Demand growth is forecast to be relatively flat during the planning period. However, Vector has noted that gas demand may increase as a result of a new development at the Tokoroa Industrial Park in Browning Street.

5.11.6.2 Gate Stations

The Tokoroa network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.11.6.3 District Regulating Stations

The Tokoroa network system has three DRSs which supply gas to the Tokoroa MP4 pressure system.

5.11.6.4 Pressure Systems

Tokoroa IP20 (previously IP10)

The Tokoroa IP10 pressure system was upgraded to an IP20 pressure system in FY2013 and is currently operating at a NOP of 1,900kPa. The maximum flow into the system in the base year was 869scmh resulting in a MinOP of 1,563kPa (82% of the NOP).

The pressure up-rating of the Tokoroa IP10 pressure system from 1,000kPa to 1,900kPa resulted in a 62% increase in capacity. With this reinforcement now in place, no further constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Tokoroa MP4

The Tokoroa MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system results in a MinOP of 267kPa (67% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11.7 Rotorua Network System

The Rotorua network system is supplied from the transmission system from one gate station located in the south of Rotorua in SH5. This network system consists of one IP20 pressure system, four MP4 pressure systems and 14 DRSs.

5.11.7.1 Consumer Growth and Demand Forecast

About 3,968 consumers are connected to the Rotorua network system. They are predominately residential consumers; only around 10% are commercial/industrial gas users.

Rotorua's population was 68,100 at the 2006 Census. The population is forecast to reach 71,986 in 2021 and 75,359 by 2051[46].

Household occupancy is forecast to trend down from 3 people per occupied dwelling in 2001 to 2.67 in 2021, and 2.6 in 2051. The number of households is anticipated to increase from 26,493 in 2006 to 29,988 in 2021, and continue to grow to 32,058 in 2051[47].

The eastern suburbs show continued growth through to 2021 whilst the city experiences a reduction in population numbers. It is also believed that Hamurana, Ngongotaha and northern planning units will experience steady growth[48].

To support the growth of the industrial and commercial activities, the Rotorua District Council forecasts that an additional 44 hectares of industrial/employment land will be needed by 2021 and a further 29 hectares by 2051, while an additional 8 hectares of retail/commercial land will be needed by 2021 and a further 5 hectares by 2051[49].

It is expected that future gas demand will be driven by the growth of potential commercial/industrial activities in Rotorua.

5.11.7.2 Gate Stations

The Rotorua network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.11.7.3 District Regulating Stations

The Rotorua network system has 14 DRSs which supply gas to four MP4 pressure systems.

In addition, two further DRSs in the Rotorua East MP4 pressure system and potentially up to three DRSs in the Rotorua MP4 pressure system can be decommissioned. A cost-benefit analysis will be completed in FY2016.

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[46] Rotorua District Council Ten Year Plan 2009-2019 Part A (About Rotorua District), http://www.rdc.govt.nz/YourCouncil/CouncilDocuments/AnnTYPs/~/media/RDC/Files/CouncilDocuments/Plans/TYP0919/PartA/V1_PartA_About%20Rotorua%20District.ashx

[47] Ibid.

[48] Ibid.

[49] Ibid.

The planned upgrade of DR-80004-RO (a sole DRS that supplies the Tihiotonga MP4 pressure system) was avoided by constructing a section of MP4 PE pipeline along Hemo Road (SH5) to link the Tihiotonga MP4 and Rotorua MP4 pressure systems.

The following DRSs are planned to be upgraded during the planning period:

- DR-80003-RO in FY2017 (refer section 6);
- DR-80232-RO in FY2017 (refer section 6).

5.11.7.4 Pressure Systems

Rotorua IP20

The Rotorua IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 3,765scmh, resulting in a MinOP of 1,268kPa (67% of the NOP). Total forecast planning demand during the planning period is estimated to be 4,008scmh, resulting in a MinOP of 1,201kPa (63% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Tihiotonga MP4

The Tihiotonga MP4 pressure system was merged with Rotorua MP4 system in FY2013. Network modelling of this pressure system is yet to be completed.

Rotorua East MP4

The Rotorua East MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 497scmh, resulting in a MinOP of 283kPa (70% of the NOP). Total forecast planning demand during the planning period is estimated to be 530scmh, resulting in a MinOP of 276kPa (69% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

FRI MP4

The FRI MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 281scmh, resulting in a 233MinOP of kPa (58% of the NOP). Total forecast planning demand during the planning period is estimated to be 299scmh, resulting in a MinOP of 216kPa (54% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Rotorua MP4

The Rotorua MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 2,476scmh, resulting in a MinOP of 303kPa (76% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,638scmh, resulting in a MinOP of 297kPa (74% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Waipa MP4 Pressure System

The Waipa MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 209scmh, resulting in a MinOP of 334kPa (84% of the NOP). Total forecast planning demand during the planning period is estimated to be 222scmh, resulting in a MinOP of 332kPa (83% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11.8 Rainbow Mountain Network System

The Rainbow Mountain network system was decommissioned in 2014.

5.11.9 Reporoa Network System

The Reporoa network system is supplied from the transmission system from one gate station located in Parekarangi. This network system consists of one IP20 pressure system, one MP4 pressure system and one DRS.

5.11.9.1 Consumer Growth and Demand Forecast

A total of 24 consumers are connected to the Reporoa network system comprising 16 residential consumers and 8 commercial consumers and one large industrial gas user. At system peak, the large industrial user demands more than 99% of the total network system flow.

5.11.9.2 Gate Stations

The Reporoa network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

There is an industrial consumer supplied directly from the Reporoa gate station, i.e. not connected to the IP20 network. For modelling accuracy, the load from the industrial user is deducted from the total gate station flow when modelling the Reporoa network system.

5.11.9.3 District Regulating Stations

The Reporoa network system has one DRS which supplies gas to the Reporoa MP4 pressure system.

5.11.9.4 Pressure Systems

Reporoa IP20

The Reporoa IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 2,734scmh, resulting in a MinOP of 1,425kPa (75% of the NOP). Total forecast planning demand during the planning period is estimated to be 4,596scmh, resulting in a MinOP of 1,420kPa (75% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Reporoa MP4

The Reporoa MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 18scmh, resulting in a MinOP of 349kPa (87% of the NOP). Total forecast planning demand during the planning period is estimated to be 31scmh, resulting in a MinOP of 347kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.11.10 Taupo Network System

The Taupo network system is supplied from the transmission system from one gate station located in Rakaunui Road. This network system consists of one IP20 pressure system, one MP4 pressure system and two DRSs.

5.11.10.1 Consumer Growth and Demand Forecast

About 2,137 consumers are connected to the Taupo network system. They are predominately residential consumers; only around 10% are commercial/industrial gas users.

Taupo's district's population in 2010 was 34,000. Population has increased at a rate of 1.8% since the 2006 Census year. Growth projections show that Taupo's population is anticipated to reach around 35,000 by 2021, before stabilising from that point over the following decade[50].

The estimated number of houses in Taupo in March 2010 was 19,061. Latest Statistics NZ projections indicate household/dwelling numbers in Taupo will increase 14% over the 2010-2031 period[51].

Significant residential subdivision developments are anticipated in the Wharewaka East (980 units) and Eastern Urban Land (2,200 units) areas, located south of Taupo. With respect to industrial land use, the Taupo District Council has identified three industrial growth areas: Centennial/Rakaunui Road, Broadlands Road & State Highway 5 and the Taupo airport land, which will promote industrial activity[52].

Over the next ten years, a major residential subdivision and a diverse range of industrial activities are anticipated to drive the increase in gas usage in the Taupo district.

5.11.10.2 Gate Stations

The Taupo network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.11.10.3 District Regulating Stations

The Taupo network system has two DRSs which supply gas to the Taupo MP4 pressure systems. As part of the reinforcement options, one of the DRSs will be set to provide an MP7 outlet for the proposed Taupo MP7 pressure system.

5.11.10.4 Pressure Systems

Taupo IP20

The Taupo IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 1,294scmh, resulting in a MinOP of 1,712kPa (90% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,997scmh, resulting in a MinOP of 1,712kPa (90% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Taupo MP4

The Taupo MP4 pressure system operates at a NOP of 400kPa. A section of MP7 PE pipeline has been constructed and is interlinked to this MP4 system. The maximum flow into the system in the base year was 1,294scmh, resulting in a MinOP of 272kPa (68% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,997scmh,

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[50] Taupo District Economic Trends Update Report, June 2010, http://www.taupodc.govt.nz/Global/Enterprise/Reports/Taupo%20District%20Economic%20Profile%20and%20Trends%20Report%20June%202010.pdf

[51] Ibid footnote 50.

[52] Taupo Urban Commercial and Industrial Structure Plan, adopted 25th January 2011, http://www.taupodc.govt.nz/Documents/Policy/Taupo%20Urban%20Commercial%20and%20Industrial%20Structure%20Plan/Taupo%20Urban%20Commercial%20and%20Industrial%20Structure%20Plan%20-%2025%20Jan%202011%20(Part%20B%20for%20web)%232.pdf

resulting in a MinOP of 194kPa (49% of the NOP). System pressure is forecast to marginally fall below the MinOP criteria during the planning period. To address this issue, the following system reinforcements are planned:

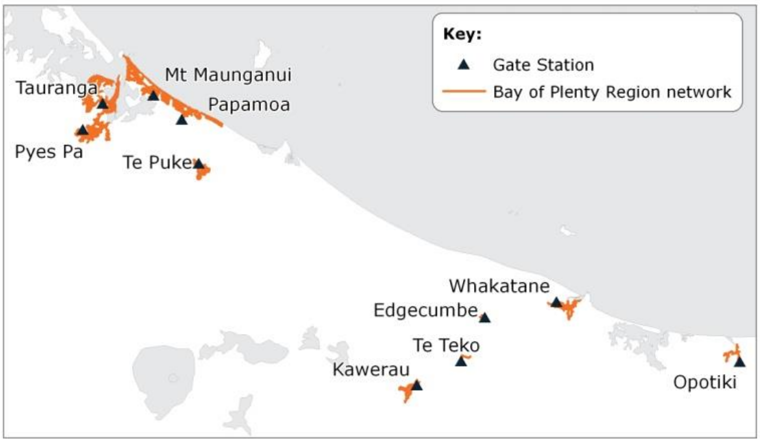
- Construct a 125mm diameter PE MP7 pipeline approximately 3,400 metres long from Centennial Drive along A C Baths Avenue, Taharepa Road, into Kiddle Drive junction of Birch Street; and
- Construct and install a new DRS (MP7/MP4) at Birth Street and Kiddle Drive.

Further reinforcement options will be developed once the planned projects are implemented.

5.11.10.5 Development Plans

As a result of the reinforcements listed above, a new MP7 pressure system will be created, which is anticipated to be commissioned over the next five years.

5.12 Network Development Programme – Bay of Plenty Region



The Bay of Plenty region stretches from the base of the Coromandel Peninsula in the west to Cape Runaway in the east. The region is bounded by the Kaimai and Mamaku Ranges in the west and extends inland to the sparsely populated forest lands around Rotorua, Kawerau and Murupara.

5.12.1 Load Forecasts

The load forecast for the Bay of Plenty region for the next ten years is shown in Figure 5-9.

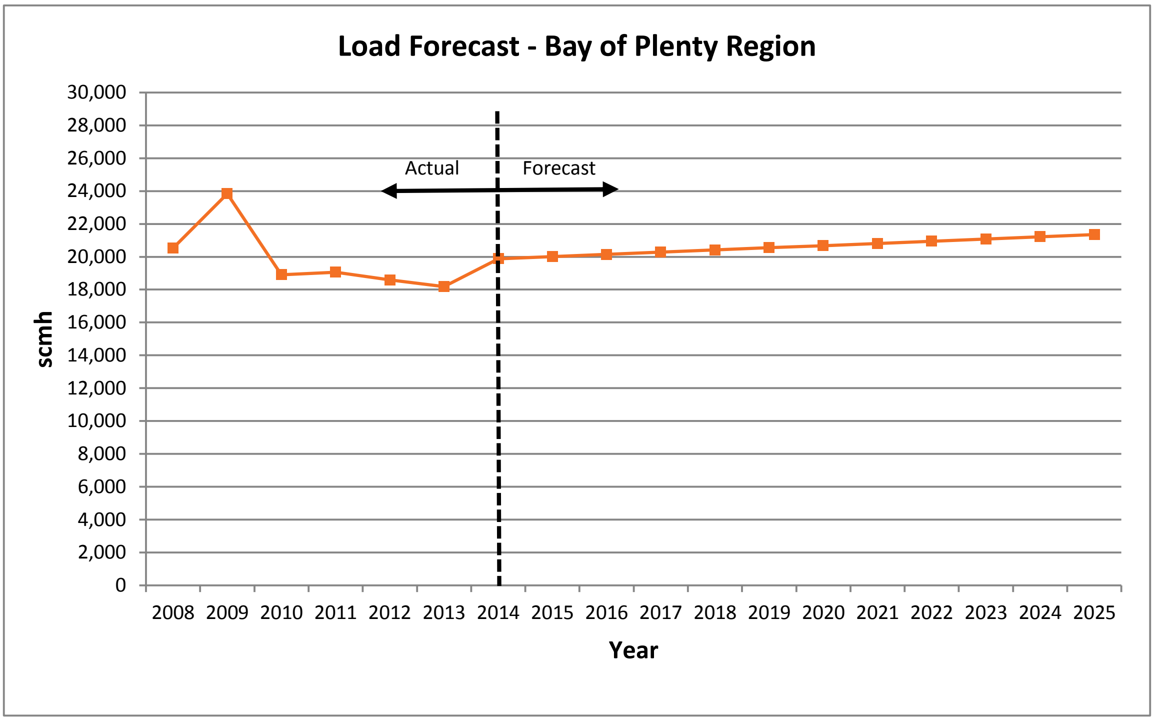


Figure 5-9 : Load forecast for Bay of Plenty region

5.12.2 Tauranga Network System

The Tauranga network system is supplied from the transmission system from two gate stations, located at Te Reti in the central Tauranga and Pyes Pa in the South West. The Tauranga network system consists of one IP20 pressure system, currently operating as an IP10 pressure system, one MP4 pressure system and five DRSs.

5.12.2.1 Consumer Growth and Demand Forecast

About 4,527 consumers are connected to the Tauranga network system. They are predominately residential consumers; only around 8% are commercial/industrial gas users.

The 2006 Census showed Tauranga's residential population was 103,635, which is projected to increase to 142,295 by the year 2021.

Tauranga is one of the fastest growth areas in the North Island and has experienced particularly strong growth in the last few years. At present, the Grasshopper development (Tauriko Business Estate) is the largest project in the region, with Pyes Pa area also planned to be developed continuously over the next few years. The distribution network is maturing and network capacity will have to be reviewed on a regular basis in the coming years.

The highest load growth is expected to occur around the Grasshopper, Pyes Pa and Bethlehem areas. There is also an expectation of some new major industrial and commercial loads requiring connections in the next ten years.

5.12.2.2 Gate Stations

The Tauranga network system has two gate stations (Tauranga and Pyes Pa). Vector gas distribution takes an IP10 supply from Tauranga gate station at a NOP of 1,000kPa and an MP4 supply from Pyes Pa gate station at a NOP of 400kPa. The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.2.3 District Regulating Stations

The Tauranga network system consists of five DRSs which supply gas to one MP4 pressure system.

5.12.2.4 Pressure Systems

Tauranga IP10

The Tauranga IP10 pressure system was upgraded to an IP20 pressure system in FY2012 and is currently operating at a NOP of 1,000kPa. The maximum flow into the system in the base year was 2,260scmh, resulting in a MinOP of 911kPa (91% of the NOP). Total forecast planning demand during the planning period is estimated to be 3,224scmh, resulting in a MinOP of 742kPa (74% of the NOP).

The pressure up-rating of the Tauranga IP10 pressure system from 1,000kPa to 1,700kPa resulted in a 100% increase in capacity. With this reinforcement now in place, no further constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Tauranga MP4

The Tauranga MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 2,087scmh, resulting in a MinOP of 281kPa (70% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,980scmh, resulting in a MinOP of 215kPa (54% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

The following planned PE MP4 links will provide further network security and enhance supply capacity to meet new industrial and commercial load requirements over the planning period:

- Construct approximately 360 metres of 100mm PE pipeline and 400 metres of 50 PE pipeline in Condor Drive to link Oropi to Pyes Pa;

- Construct approximately 700 metres of 100mm PE pipeline between Oropi Road and Windermere Drive, and overlay approximately 1,000 metres of 50mm PE pipeline to replace several sections of 10mm PE pipeline in Windermere Drive / College Place in order to reinforce the network in Ohauiti area; and
- Construct approximately 1,500 metres of 80mm PE pipeline between Bellevue and Bethlehem.

5.12.3 Mt Maunganui Network System

The Mt Maunganui network system is supplied from the transmission system from two gate stations, Mt Maunganui gate station and Papamoa gate station. The Maunganui network system consists of two IP20 pressure system, two MP4 pressure systems and seven DRSs.

5.12.3.1 Consumer Growth and Demand Forecast

About 4,313 consumers are connected to the Mt Maunganui network system. They are predominately residential consumers; only around 5% are commercial/industrial gas users.

Major industrial and commercial activities are expected in the northern part of Mt Maunganui. Growth and change in gas demand will be very much dependent on the business development in this area.

The Papamoa East area provides an important opportunity for Tauranga City Council to provide green field urban development. The estimated population for Papamoa East is around 25,000 should the development potential be fully realised. Urban development would occur over a period of 20-30 years, with the first part catering for a population of around 9,200. An urban design structure plan is presented for Wairakei (Part 1), setting out how low and medium density residential land, business land and open space land will be laid out. Services structure planning provides the main roading network for the Wairakei area and locations of necessary bulk infrastructure. The timing and way development occurs will depend on landowner responses, influencing the ultimate resident population.

5.12.3.2 Gate Stations

The Mt Maunganui network system has two gate stations (Mt Maunganui and Papamoa). Vector takes an IP20 supply from both stations at a NOP of 1,900kPa. The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.3.3 District Regulating Stations

The Mt Maunganui network system consists of seven DRSs which supply gas to two MP4 pressure systems.

The following DRSs are planned to be upgraded during the planning period:

- DR-80020-MM in FY2016 (refer section 6).

Mt Maunganui IP20

The Mt Maunganui IP20 pressure system operates at a NOP of 1900kPa. The maximum flow into the system in the base year was 2,960scmh, resulting in a MinOP of 1,486kPa (78% of the NOP).

Total forecast planning demand during the planning period is estimated to be 4,266scmh, resulting in a MinOP of 866kPa (46% of the NOP), therefore falling below the minimum system pressure criteria.

The following long-term reinforcement options are planned:

- Up-rate the IP20 pipeline from Mt Maunganui gate station to Hewletts Road. This option also requires the upgrade of Mt Maunganui gate station and installation of a new DRS near Hewletts Road; and
- Reduce the maximum allowable operating pressure of the Mt Maunganui 806 gas tranmission pipeline[53] from 8,600kPa to 1,960kpa and transfer the ownership from gas transmission to gas distribution. This initiative is subject to regulatory approval and is anticipated to be completed in 2016.
- Create IP20 pipeline loops. Possible solution would be to construct approximately 2,400 metres of 80mm IP20 steel pipeline along Newton Street, Hull Road into Totara Road Mt Maunganui.

Papamoa IP20

The Papamoa IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 497scmh, resulting in a MinOP of 1,613kPa (85% of the NOP). Total forecast planning demand during the planning period is estimated to be 685scmh, resulting in a MinOP of 1,606kPa (85% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

To support the growth opportunities in the Papamoa East areas, the following network development projects have been identified during the planning period:

- Construct approximately 800 metres of 225mm MP7 PE pipeline in Domain Road;
- Construct approximately 1,000 metres of 180mm MP7 PE pipeline in Parton Road;
- Construct approximately 1,700 metres of 225mm MP7 PE pipeline in Tara Road;
- Install a DRS (MP7/MP4) at the junction of Parton Road and Papamoa Beach Road; and
- Install a DRS (IP20/MP7) inside Papamoa gate station.

Mt Maunganui MP4

The Mt Maunganui MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 2,781scmh, resulting in a MinOP of 325kPa (81% of the NOP). Total forecast planning demand during the planning period is estimated to be 3,567scmh, resulting in a MinOP of 300kPa (75% of the NOP).

However, recent analysis has confirmed that the system pressure dropped below the MinOP criteria due to unexpected demand on the Mt Maunganui MP4 pressure system. In order to maintain supply pressure quality, the following system reinforcement is planned:

- Extend approximately 500 metres of 50mm PE MP4 pipeline in Maru/Te Maire Street.

Tip Lane MP4

The Tip Lane MP4 pressure system operates at a NOP of 400kPa and is supplied by DR-80227-MM. The maximum flow into the system in the base year was 67scmh, resulting in a MinOP of 314kPa (76% of the NOP). Total forecast planning demand during the planning period is estimated to be 86scmh, resulting in a MinOP of 299kPa (75% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

[53] The Mt Maunganui 806 transmission pipeline is a coated steel pipeline with a diameter of 80mm and is 3.6km long.

5.12.4 Te Puke Network System

The Te Puke network system is supplied from the transmission system from one gate station located in Washer Road. This network system consists of one IP10 pressure system, two MP4 pressure systems and three DRSs.

5.12.4.1 Consumer Growth and Demand Forecast

About 617 consumers are connected to the Te Puke network system. They are predominately residential consumers; only around 9% are commercial/industrial gas users.

Te Puke's population in 2006 was 521 and is projected to increase by 34% to 700 in 2021 and by 60% by 2051. Residential development in Te Puke continues to grow but is limited to protect versatile and productive horticultural land[54]. Industrial land is progressively being developed which will provide up to 50 hectares of usable land by 2021. An example of this is the major industrial subdivision in the Te Puke West Industrial area. It is expected that future gas demand will be driven by the potential commercial and industrial activities, while new residential demand will be minimal.

5.12.4.2 Gate Stations

The Te Puke network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.4.3 District Regulating Stations

The Te Puke network system has three DRSs which supply gas to the Te Puke MP4 pressure system and the Washer Road MP4 pressure system.

5.12.4.4 Pressure Systems

Te Puke IP10

The Te Puke IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 466scmh, resulting in a MinOP of 965kPa (97% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 965kPa (97% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Te Puke MP4

The Te Puke MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 403scmh, resulting in a MinOP of 325kPa (81% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 325kPa (81% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Washer Road MP4

The Washer Road MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 63scmh, resulting in a MinOP of 350kPa (88% of the NOP). Total forecast planning demand during the planning period is not anticipated to

[54] Smart Growth Strategy 2051 (Revised May 2007), West Bay of Plenty, http://www.smartgrowthbop.org.nz/SmartGrowth-Western-Bay-of Plenty/Strategy_IDL=2_IDT=1052_ID=4797_.html

change, resulting in the same MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.12.5 Kawerau Network System

The Kawerau network system is supplied from the transmission system from one gate station located in East Bank Road. This network system consists of one IP10 pressure system, two MP4 pressure systems and three DRSs.

5.12.5.1 Consumer Growth and Demand Forecast

About 257 consumers are connected to the Kawerau network system. They are predominately residential consumers; only around 8% are commercial/industrial gas users.

5.12.5.2 Gate Stations

The Kawerau network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.5.3 District Regulating Stations

The Kawerau network system has three DRSs which supply gas to the Paora St MP4 pressure system and the Kawerau MP4 pressure system.

5.12.5.4 Pressure Systems

Kawerau IP10

The Kawerau IP10 pressure system operates at a NOP of 1,000kPa and is fed from the Kawerau gate station which comprises three steel pipeline laterals. One lateral distributes gas to the Paora St MP4 and Kawerau MP4, while the other two supply gas to two large industrial consumers.

The maximum flow of the section of IP10 pipeline feeding into the Paora Street MP4 and Kawerau MP4 systems in the base year was 162scmh, resulting in a MinOP of 622kPa (62% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 622kPa (62% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

The maximum flow of the section of IP10 pipeline feeding into the Kawerau (ex-Caxton) in the base year was 3834scmh, resulting in a MinOP of 622kPa (62% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 622kPa (62% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

The maximum flow of the section of IP10 pipeline feeding into the Kawerau (ex-Tasman) in the base year was 3044scmh, resulting in a MinOP of 635kPa (64% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 635kPa (64% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Paora St MP4

The Paora MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 6scmh, resulting in a MinOP of 350kPa (88% of the NOP).

Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Kawerau MP4

The Kawerau MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 154scmh, resulting in a MinOP of 346kPa (87% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 346kPa (87% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.12.6 Te Teko Network System

The Te Teko network system is supplied from the transmission system from one gate station located in Tahuna Road. This network system consists of one IP10 pressure system, one MP4 pressure system and one DRS.

5.12.6.1 Consumer Growth and Demand Forecast

The Te Teko network system supplies 3 residential consumers and 4 commercial gas users. Total demand forecast is not anticipated to change during the planning period.

5.12.6.2 Gate Stations

The Te Teko network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.6.3 District Regulating Stations

The Te Teko network system has one DRS which supplies gas to the Te Teko MP4 pressure system.

5.12.6.4 Pressure Systems

Te Teko IP10

The Te Teko IP10 pressure system operates at a NOP of 1,000kPa. The maximum flow into the system in the base year was 33scmh, resulting in a MinOP of 720kPa (72% of the NOP). Total forecast planning demand during the planning period is estimated to be 68scmh, resulting in a MinOP of 719kPa (72% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Te Teko MP4

The Te Teko MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 23scmh, resulting in a MinOP of 400kPa (100% of the NOP). Total forecast planning demand during the planning period is estimated to be 48scmh, resulting in a MinOP of 350kPa (88% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.12.7 Edgecumbe Network System

The Edgecumbe network system is supplied from the transmission system from one gate station located in Awakeri Road. This network system consists of one IP20 pressure system and one MP4 pressure system. The Edgecumbe IP20 and the Edgecumbe MP4 pressure systems are metered separately inside the gate station.

5.12.7.1 Consumer Growth and Demand Forecast

The Edgecumbe network system supplies 5 residential consumers and 5 commercial/industrial gas users. Demand growth is anticipated to be flat over the planning period.

5.12.7.2 Gate Stations

The Edgecumbe network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.7.3 District Regulating Stations

No DRS is installed in the Edgecumbe network system.

5.12.7.4 Pressure Systems

Edgecumbe IP20

The Edgecumbe IP20 pressure system operates at a NOP of 1,900kPa and connects to two large consumers. The maximum flow into the system in the base year was 6,022scmh, resulting in a MinOP of 1,921kPa (99% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Edgecumbe MP4

The Edgecumbe MP4 pressure system operates at a NOP of 400kPa (currently operating at a lower pressure of 360kPa). The maximum flow into the system in the base year was 10scmh resulting in a MinOP of 360kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.12.8 Whakatane Network System

The Whakatane network system is supplied from the transmission system from one gate station located in Mill Road. This network system consists of one IP20 pressure system, two MP4 pressure systems and three DRSs.

There is an industrial consumer directly located adjacent to the Whakatane gate station from which gas is directly fed to this factory. The peak flow of 3,241scmh was recorded at 5:00pm on 24th February 2012.

For the Whakatane IP20 pressure system, the peak flow of 540scmh at 9:00am on 20th July 2012 was calculated based on the available hourly flow data of the industrial gas user.

5.12.8.1 Consumer Growth and Demand Forecast

About 453 consumers are connected to the Whakatane network system. They are predominately residential consumers; only around 20% are commercial/industrial gas users.

Demand growth was flat over the last few years. However, the Whakatane hospital (an existing 20TJ gas user) has increased its demand (as a result of redevelopment in 2013/2014 to about 660scmh).

5.12.8.2 Gate Stations

The Whakatane network system is fed from one gate station. As noted above, there is an industrial consumer supplied directly from the Whakatane gate station whose supply does not enter the IP20 network. Thus its load is subtracted from the gate station meter from a modelling perspective.

The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.8.3 District Regulating Stations

The Whakatane network system has three DRSs which supply gas to the Whakatane MP4 pressure system and Mill Road MP4 pressure system.

5.12.8.4 Pressure Systems

Whakatane IP20

The Whakatane IP10 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 4,133scmh, resulting in a MinOP of 1,508kPa (79% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 1,508kPa (79% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Whakatane MP4

The Whakatane MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 1,272scmh resulting in a MinOP of 221kPa (55% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 221kPa (55% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Mill Road MP4

The Mill Road MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 510scmh, resulting in a MinOP of 295kPa (74% of the NOP). Total forecast planning demand during the planning period is not anticipated to change, resulting in the same MinOP of 295kPa (74% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.12.9 Opotiki Network System

The Opotiki network system is supplied from the transmission system from one gate station located in Factory Road. This network system consists of one IP10 pressure system, two MP4 pressure systems and two DRSs.

5.12.9.1 Consumer Growth and Demand Forecast

About 112 consumers are connected to the Opotiki network system. They are predominately residential consumers; only around 27% are commercial/industrial gas users. Opotiki's population has 9,000 people. Approximately half of the resident population lives in the Opotiki township with the other half living in smaller outlying communities. The resident population of the Opotiki District is expected to increase by around 10% (1% per annum) to reach 10,040 by 2016. Over the past three years there has been a steady increase in both the number of consents issued by the Opotiki Council and the value of the building consents[55].

The economy is driven primarily by agriculture, with 410 farms accounting for a total land area of 75,660ha, 38% of which is allocated for beef and dairy farming, 29% for planted forests, and 1% for horticulture units. The majority of horticultural land is planted in kiwifruit and there are plans for further developments in this industry[56].

It is expected that future gas demand will be driven by the population growth and potential industrial activities in Opotiki. The total demand forecast is anticipated to be relatively flat during the planning period.

5.12.9.2 Gate Stations

The Opotiki network system is fed from one gate station. There is an industrial consumer supplied directly from the Opotiki gate station, i.e. not connected to the IP20 network. For modelling accuracy, the load from the industrial consumer is deducted from the total gate station flow when modelling the Opotiki network system. The gate station winter peak demand statistics are summarised in Table 5-2.

5.12.9.3 District Regulating Stations

The Opotiki network system has two DRSs which supply gas to the Opotiki MP4 pressure system and the Hospital Hill MP4 pressure system.

5.12.9.4 Pressure Systems

Opotiki IP20

The Opotiki IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 223scmh, resulting in a MinOP of 1,491kPa (78% of the NOP). Total forecast planning demand during the planning period is estimated to be 377scmh, resulting in a MinOP of 1,466kPa (77% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Opotiki MP4

No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

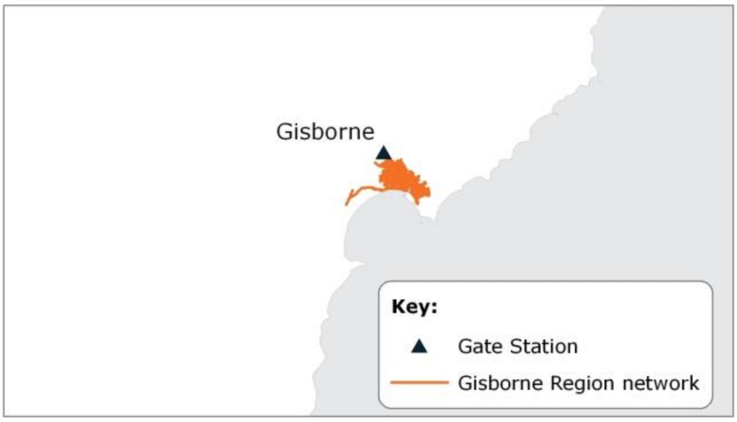
Hospital Hill MP4

No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

[55] See Opotiki District Council website, http://www.odc.govt.nz/AboutOpotiki/Pages/AboutOpotiki.aspx

[56] Ibid.

5.13 Network Development Programme – Gisborne Region



The region is located in the north-eastern corner of the North Island and is also referred to as the East Cape or East Coast or Eastland region. It is a sparsely inhabited and isolated region, with small settlements mainly clinging to small bays along the eastern shore such as Tokomaru Bay and Tolaga Bay.

5.13.1 Load Forecasts

The load forecast for the Gisborne region for the next ten years is shown in Figure 5-10.

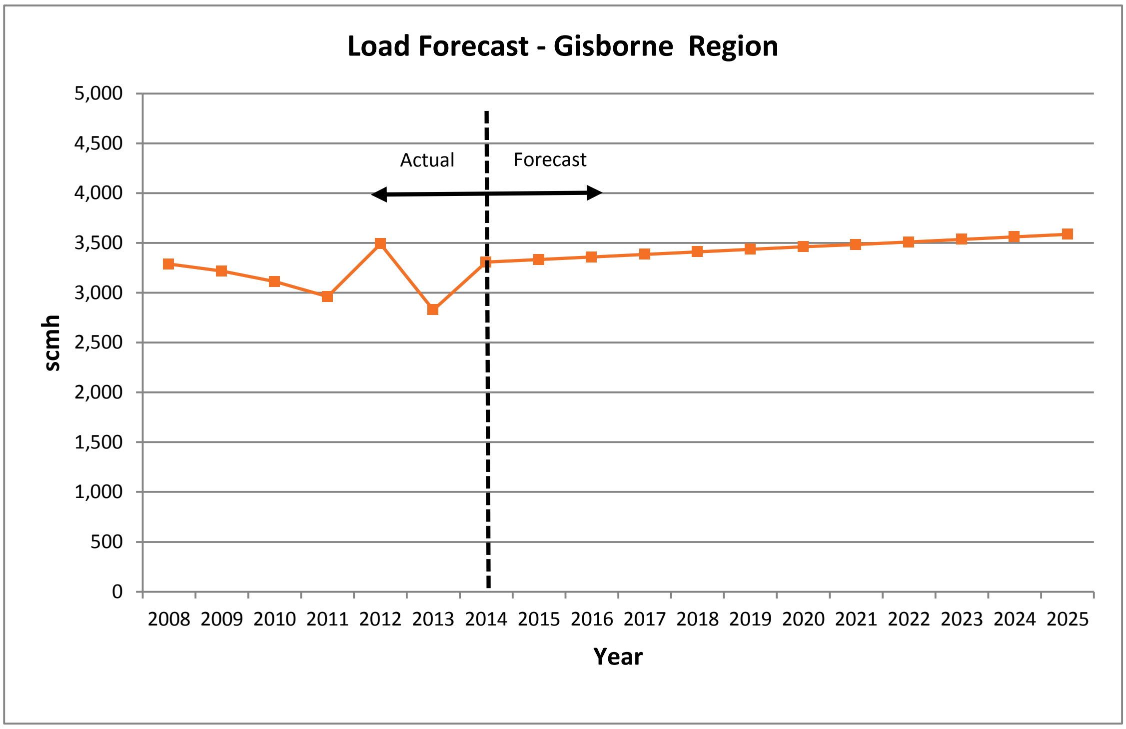


Figure 5-10 : Load forecast for Gisborne region

5.13.2 Gisborne Network System

The Gisborne network is supplied from the transmission system from one gate station and consists of one IP20 network and one MP4 network.

5.13.2.1 Consumer Growth and Demand Forecast

About 3,364 consumers are connected to the Gisborne network system. They are predominately residential; only around 9% are commercial/industrial gas users.

The 2006 Census data states that the population of Gisborne region is about 44,500, with about 42,000 of the population living in Gisborne City[57].

According to the Gisborne Urban Development Strategy[58], large population increases are unlikely. Development is focused within the existing urban area to capitalise on possible benefits of future population growth and to insulate the community against the impact of any population decline. 50% of dwellings built over the last 7 years were within existing residential areas, 14% in rural lifestyle areas and 36% in green field locations.

Urban development is expected to be limited to the existing urban areas and the fringe areas of Taruheru, Kaiti, Sponge Bay and Wainui. Ample land is available within these areas for infill housing and new development. More housing will be required within the existing urban area to accommodate the expected increase in numbers of households regardless of any total population growth[59].

The Gisborne District Council also recognises that a compact city helps to future proof the Gisborne urban area. Varied and intensive housing styles will be facilitated. Redevelopment will be encouraged in and around the suburban commercial hubs[60].

Gas demand is expected to be driven by infill housing, medium density and commercial developments over the next ten years.

Vector has recently committed to supply gas to two commercial and industrial consumers with a combined load of 750scmh. These proposed services will likely connect to the Gisborne MP4 in FY14. It is anticipated that the system peak of the Gisborne network system will grow significantly over the next few years.

5.13.2.2 Gate Stations

The Gisborne network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.13.2.3 District Regulating Stations

The Gisborne network system has seven DRSs which supply the Gisborne MP4 pressure system.

5.13.2.4 Pressure Systems

Gisborne IP20

The Gisborne IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 3,218scmh, resulting in a MinOP of 1,201kPa (63% of the NOP). Total forecast planning demand during the planning period is estimated to be 4,148scmh, resulting in a MinOP of 759kPa (40% of the NOP). System pressure is forecast to fall below the MinOP criteria during the planning period. The following reinforcements are planned:

- Upgrade the metering and regulator equipment at the Gisborne gate station to allow an increase in the outlet pressure from 1,700kPa to 1,840kPa; and
- Construct approximately 1,400 metres of 100mm IP20 steel pipeline in Lytton Road between Aberdeen Road and Manuka Street, Te Hapara.

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[57] See Gisborne District Council web site, http://www.gdc.govt.nz/our-district/

[58] Gisborne Urban Development Strategy adopted in May 2009, http://www.gdc.govt.nz/assets/Strategies/Urban-Development-Strategy/Urban%20Development%20Strategy%20Adopted%20May%202009.pdf

[59] Ibid.

[60] Ibid.

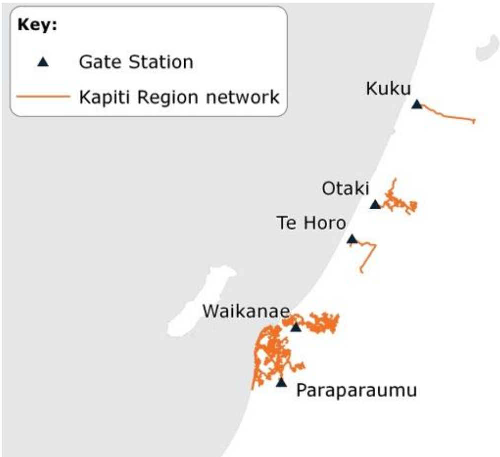
Gisborne MP4

The Gisborne MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 860scmh, resulting in a MinOP of 300kPa (75% of the NOP). Total forecast planning demand during the planning period is estimated to be 1,238scmh, resulting in a MinOP of 269kPa (67% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Attlee Pl LP

The Attlee Pl LP pressure system was decommissioned and removed in 2014.

5.14 Network Development Programme – Kapiti Region



Along the Kapiti Coast, numerous small towns are located adjacent to each other, many of them occupying spaces close to popular beaches. From the north, these include Otaki, Waikanae, Paraparaumu, the twin settlements of Raumati Beach and Raumati South, Paekakariki and Pukerua Bay, the last of which is a northern suburb of Porirua. Each of these settlements has a population of between 2,000 and 10,000, making this a moderately heavily populated coastline.

5.14.1 Load Forecasts

The load forecast for the Kapiti region for the next ten years is shown in Figure 5-11.

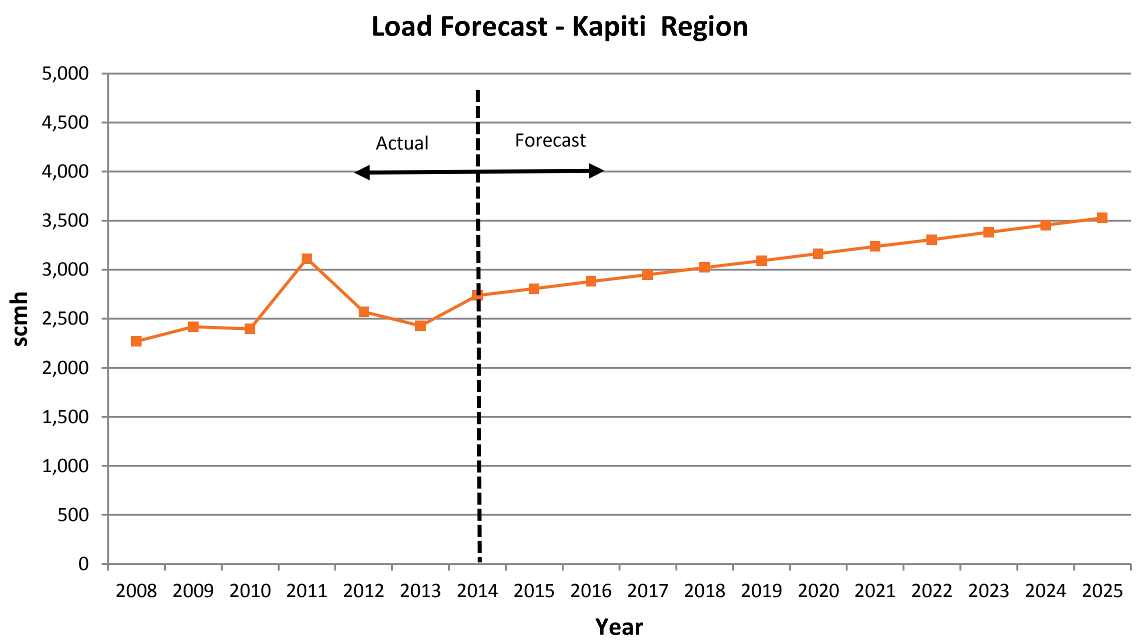


Figure 5-11 : Load forecast for Kapiti region

5.14.2 Kuku Network System

The Kuku network system is supplied from the transmission system from one gate station located in Kuku Beach Road. This network system consists of one MP2 pressure system.

5.14.2.1 Consumer Growth and Demand Forecast

A total of 31 consumers are connected to the Kuku network system comprising 28 residential consumers and 3 commercial gas users. Gas demand is not anticipated to change within the planning period.

5.14.2.2 Gate Stations

Flow data for the Kuku gate station is not available and collecting this information is not intended at this point in time.

5.14.2.3 District Regulating Stations

No DRS is installed in the Kuku network system.

5.14.2.4 Pressure Systems

Kuku MP4

The Kuku MP4 pressure system is currently operating at 250kpa. The Kuku pressure system used to operate at MP4 pressure but now operates at MP2. The maximum flow into the system in the base year was 6scmh, resulting in a MinOP of 250kPa (100% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.14.3 Otaki Network System

The Otaki network system is supplied from the transmission system from one gate station located in the southwest of Otaki. This network system consists of one MP4 pressure system.

5.14.3.1 Consumer Growth and Demand Forecast

About 402 consumers are connected to the Otaki network system. They are predominately residential consumers; only around 11% are commercial gas users. It is expected that future gas demand will be driven by the population growth and potential commercial activities in Otaki.

5.14.3.2 Gate Stations

The Otaki network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.14.3.3 District Regulating Stations

No DRS is installed in the Otaki network system.

5.14.3.4 Pressure Systems

Otaki MP4

The Otaki MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 247scmh resulting in a MinOP of 321kPa (80% of the NOP). Total forecast planning demand during the planning period is estimated to be 336scmh, resulting in a MinOP of 304kPa (76% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.14.4 Te Horo Network System

The Te Horo network system is supplied from the transmission system from one gate station located in Te Horo beach Road near Pukenamu Road. This network system consists of one MP4 pressure system.

5.14.4.1 Consumer Growth and Demand Forecast

The Te Horo network system supplies 13 residential consumers and 2 commercial gas users. Gas demand is not anticipated to change within the planning period.

5.14.4.2 Gate Stations

Flow data for the Te Horo gate station is not available and due to no foreseeable constraints in the network, collecting this information is not intended at this point in time.

5.14.4.3 District Regulating Stations

No DRS is installed in the Te Horo network system.

5.14.4.4 Pressure Systems

Te Horo MP4

The Te Horo MP4 pressure system operates at a NOP of 400kPa[61]. The maximum flow into the system in the base year was 7scmh, resulting in a MinOP of 290kPa (72% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

5.14.5 Waikanae Network System

The Waikanae network system is supplied from the transmission system from one gate station located in the west of Waikanae. This network system consists of one MP4 pressure system.

5.14.5.1 Consumer Growth and Demand Forecast

About 1,491 consumers are connected to the Waikanae network system. They are predominately residential consumers; only around 3% are commercial gas users. It is expected that future gas demand will be driven by the population growth and potential commercial activities in Waikanae.

5.14.5.2 Gate Stations

The Waikanae network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.14.5.3 District Regulating Stations

No DRS is installed in the Waikanae network system.

5.14.5.4 Pressure Systems

Waikanae MP4

The Waikanae MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 651scmh, resulting in a MinOP of 260kPa (65% of the NOP). Total forecast planning demand during the planning period is estimated to be 940scmh, resulting in a MinOP of 214kPa (54% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

In addition, the following projects will be investigated during the planning period:

[61] The current supply pressure available from the Te Horo gate station is 290kPa.

- Construct approximately 2,800 metres of 90mm MP7 PE pipeline from Waikanae gate station along Kauri Road, Puriri Road, Greenaway Road, and Park Avenue to Ngarara Road junction of Belvedere Avenue. Upgrade Waikanae gate station with MP7 outlet;
- Install a new DRS (MP7/MP4) in Ngarara Road junction of Belvedere Avenue; and
- Construct approximately 600 metres of 50mm PE MP4 pipeline from Bevedere Avenue to David Street.

5.14.6 Paraparaumu Network System

The Paraparaumu network system is supplied from the transmission system from Paraparaumu gate station located in Valley Road. The Paraparaumu network system consists of one IP20 pressure system, two MP4 pressure system and three DRSs.

5.14.6.1 Consumer Growth and Demand Forecast

About 3,363 consumers are connected to the Paraparaumu network system. They are predominately residential consumers; only around 5% are commercial/industrial gas users.

5.14.6.2 Gate Stations

The Paraparaumu network system is fed from one gate station. The gate station winter peak demand statistics are summarised in Table 5-2.

5.14.6.3 District Regulating Stations

The Paraparaumu network system has three DRSs which supplies gas to two MP4 pressure systems.

The following DRSs are planned to be upgraded during the planning period:

- DR-80052-PR in FY2016 (as part of Paraparaumu IP20 uprating reinforcement listed below);
- DR-80081-PR in FY2016 (as part of Paraparaumu IP20 uprating reinforcement listed below).

5.14.6.4 Pressure Systems

Paraparaumu IP20

The Paraparaumu IP20 pressure system operates at a NOP of 1,900kPa. The maximum flow into the system in the base year was 1,766scmh, resulting in a MinOP of 674kPa (35% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,354scmh, resulting in the MinOP falling below the minimum pressure criteria during the planning period.

The following reinforcements have are planned:

- Up-rate the Paraparaumu IP20 pressure system from the current operating pressure of 1,350kPa to 1,800kPa (including the upgrade of the Paraparaumu gate station and DRS upgrades); and
- Construct approximately 2,800 metres of 125mm MP7 PE pipeline (including a bridge crossing) from Waikanae gate station (including station upgrade) and install a MP7/MP DRS (in Mazengarb Rd and Ratanui Rd) and connect into the Paraparaumu MP4 pressure system.

  Note: The Waikanae gate station is currently being relocated in order to facilitate the construction of the NZTA M2PP expressway project.

Nikau Valley MP4

The Nikau Valley MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 345scmh, resulting in a MinOP of 333kPa (86% of the NOP). No constraints have been identified and the system pressure is not forecast to fall below the MinOP criteria during the planning period.

Paraparaumu MP4

The Paraparaumu MP4 pressure system operates at a NOP of 400kPa. The maximum flow into the system in the base year was 1,437scmh, resulting in a MinOP of 265kPa (66% of the NOP). Total forecast planning demand during the planning period is estimated to be 2,284scmh, resulting in the MinOP falling below the minimum pressure criteria during the planning period. The following reinforcements are planned:

- Construct approximately 1,900 metres of 100mm MP4 PE pipeline from the proposed MP7/MP4 DRS (in Mazengarb Rd and Ratanui Rd) along Ratanui Road to Mazengarb Road;
- Construct approximately 530 metres of 100mm MP4 PE pipeline in Raumati Road in conjunction with the NZTA M2PP project; and
- Install a 200mm PVC duct (future proof) in conjunction with NZTA M2PP expressway project.
- Construct approximately 580 metres of 100mm MP4 PE pipeline from DR-80081-PR in SH1 to Tutanekai Street.

5.14.6.5 Development Plans

Subject to the above reinforcements proceeding, a new Waikanae gate station will provide a second supply source to the Paraparaumu MP4 pressure system.

5.15 Project Programme Update

Table 5-3 summarises the key projects and programmes for development of the gas distribution network. It shows the current target completion dates for these projects, compared with that in the previous plan. If there is a difference the reasons for the change are described (advanced or delayed) in the following tables. Newly identified and completed projects are also highlighted.

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
Auckland	50nb PE road crossing at Albert Road / Vauxhall road, Devonport, North Shore	$5	FY20	FY20	No change
Auckland	50nb PE road crossing at Albert Road / Victoria Road, Devonport	$9	FY20	FY20	No change
Auckland	76 Hillsborough Road to 10 Herd Road (approx. 240m of 50nb PE to integrate into future Central Auckland MP4)	$65	FY19	FY19	No change
Auckland	Auckland Airport Reinforcement - 180m of 100nb PE MP4 in Puhinui Road	$74	FY22	FY22	No change
Auckland	Auckland Airport Reinforcement - 300m of 100nb PE MP4 in Ray Emery Drive	$62	FY18	FY18	No change
Auckland	DRS upgrade project to address capacity issue	$1,750	FY15 to FY24	FY19 to FY25	Ongoing programme
Auckland	From Appleby Road along Albany Highway to house number 286, North Harbour - 225m of 50nb PE MP4	$27	FY15	FY18	Deferred
Auckland	From East Coast Road along Blenvar Road to Long bay development (approx. 2500m of 100nb PE MP4)	$266	FY19	FY16	Rolled forward
Auckland	From East Coast Road along Okura River Road and Vaughans Road to Long Bay development, Long Bay - 3.8km of 100nb PE MP4	$478	FY21	FY17	Rolled forward
Auckland	From Mckenzie Road along Ascot Road, Kirkbride Road and Massey Road (approx. 3900m of 100nb PE MP4 link: to reinforce Auckland Airport and Mangere areas)	$537	FY19	FY16	Rolled forward
Auckland	From Northcroft Street along Lake Road to Cameron Street, Takapuna (approx. 750m of 100nb PE MP4 to reinforce Devonport area)	$213	FY20	FY20	No change
Auckland	From Westney Road along George Bolt Memorial Drive to Tom Pearce Drive - 1.9km of 100nb PE MP4	$342	FY17	FY17	No change
Auckland	Harris Rd from Cryers Rd to Ti Rakau Dr, Pakuranga (approx. 400m of 100nb PE MP4 Link)	$220	FY16	FY16	No change
Auckland	IP Reinforcements: 875kPa line in Glendowie (Possible solutions: Option (1) approx. 3.1 km of 180mm 10 Bar PE link (NOP 875kPa) from Sylvia	$5,499	FY20 to FY22	FY20 to FY22	No Change

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
	Park Rd along Mt Wellington Highway, Ellerslie-Panmure Hghway to DR0085 + DR0095 upgrade. Option (2) approx. 3.1 km of 150nb steel IP20 link from Sylvia Park Rd along Mt Wellington Highway, Ellerslie-Panmure Highway to DR0085 + Upgrade DR0085)				
Auckland	IP Reinforcements: IP20 lateral to 875kPa line (Possible solutions: 200nb IP20 steel main (1) approx. 1 km along Gilbert Rd and Alexander Crescent to DR0116 or (2) approx. 1 km along Gilbert Rd, Franich St, Clyde Rd and to DR0116)	$1,320	FY18 to FY19	FY24 to FY25	Deferred
Auckland	IP Reinforcements: Unknown	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	IP20/MP7 DRS to replace Tuakau gate station #1	-	FY15	Completed	
Auckland	Kohimarama Rd between Kepa Road and Whytehead Cr (approx. 1000m of 100nb PE MP4 Link)	$202	FY21	FY21	No change
Auckland	Motions Road, Pt Chevalier (approx. 730m of 50nb PE MP4 gas main)	$133	FY19	FY19	No change
Auckland	MP Reinforcements: Unknown	$900	FY15 to FY24	Removed	
Auckland	MP Reinforcements: Unknown	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	New (IP20/MP4) DRS J/O East Coast Road and Glenvar Road, Glenvar, North Shore	$220	FY22	FY20	Rolled forward
Auckland	New DRS in CBD - DR0049 in full capacity (Option (1) upgrade existing DR0049. Option (2) New DRS site.)	$300	FY17	FY17	No change
Auckland	NorSGA Development, Hobsonville - Northside Drive Bridge (future proof ducts 200mm PVC x 2)	$100	FY16	FY15	Rolled forward
Auckland	Pakuranga Road to the intersection of Bucklands Beach Road, Highland Park (approx. 190m of 100nb PE MP4 link)	$45	FY22	FY22	No change
Auckland	Provisional budget for commercial requests that support new customer growth initiatives.	$900	FY15 to FY24	Removed	Included in Customer Connection
Auckland	Ruskin Street between houses nos. 9 and 14, Parnell (approx. 30m of 32nb PE MP4 gas main)	$22	FY20	FY20	No change
Auckland	SH16 - Royal Road (200mm PVC duct for future proof)	$43	FY19	FY19	No change

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
Auckland	SH17 - 100nb PE and Bridge Crossing to The Avenue, North Shore (to integrate into North Harbour MP4)	$104	FY15	FY18	Deferred
Auckland	SH20A Upgrade - George Road Drive / Kirkbride Road Intersection	$17	FY18	FY17	Rolled forward
Auckland	Smales Road between houses nos. 18 and 40, East Tamaki (approx. 330m of 100nb PE MP4 link)	$50	FY22	FY22	No change
Auckland	Upgrade DR0117 EastTamaki MP	-	FY14	Completed	
Auckland	Upgrade DR0163 Kerwyn Ave MP	$250	FY16	FY18	Deferred
Auckland	Upgrade DR0179 Wiri MP4	$250	FY17	FY17	No change
Auckland	Upgrade DR183 Coronation Road	$250	FY18	FY16	Rolled forward
Auckland	Upgrade of 25nb PE MP4 service to 50nb PE, CRS Monier, New Lynn	$12	FY16	Cancelled	
Auckland	Drury NC reinforcement - From Drury gate station along Waihoehoe Road, Flanagan Road and Great South Road to the junction of Firth Street - 1.7km of 160mm PE MP4	$370	FY16	FY16	No change
North Island	Cambridge - (i) 3.4km of 80mm IP from GS + 1DRS or (ii) 5.5km of 110mm MP7 from GS + 2 new DRS)	$3,753	FY19 to FY21	FY16 to FY18	Rolled forward
North Island	DRS upgrade project to address capacity issue	$1,500	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Gisborne IP Reinforcement - Lytton Road between Aberdeen Road and Manuka Street, Te Hapara - 1.4km of 100mm IP20	$1,680	FY20	FY20	No change
North Island	Gisborne IP Reinforcement - Upgrade metering and regulators equipment of Gisborne gate station to allow an increase in the outlet pressure from 1,700kPa to 1,850kPa	$240	FY19	FY19	No change
North Island	Hamilton IP reinforcement - From DRS139 inTe Rapa to DRS100 in Hamilton East - 7 km of 225mm PE IP10	$2,352	FY18 to FY20	FY20 to FY22	Deferred
North Island	Hamilton IP reinforcement - Te Kowhai gate station upgrade + IP uprating to 17 bar + DRS upgrade + New IP20/IP10 DRS	$1,797	FY15 to FY17	FY16 to FY18	Deferred
North Island	Hamilton MP4 - 400m of 100nb PE in Cambridge Rd from DR-80101-HM to Hillcrest Road, Hamilton	$72	FY16	FY16	No change

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
North Island	Hamilton MP4 - Boundary Road and Heaphy Terrace - 50m of 50nb PE MP4	$6	FY17	FY17	No change
North Island	Hamilton MP4 - Gordonton Road between Wairere Drive and Thomas Road - 2.1km of 80nb PE MP4	$310	FY23	FY21	Rolled forward
North Island	Hamilton Pukete MP4 Reinforcement - Te Papa Road from Bryant Road to #558 Te Rapa Road - 180m of 50nb PE MP4	$22	FY19	FY19	No change
North Island	Hamilton Pukete MP4 Reinforcement - Te Rapa Road from DR-80139-HM to Mahana Road - 650m of 80nb PE MP4	$94	FY19	FY19	No change
North Island	Hamilton West MP4 Reinforcement - Install new DRS in Te Kowhai Road	$240	FY19	FY19	No change
North Island	Hamilton West MP4 Reinforcement - Roy Street to Livingstone Avenue - 100m of 50nb PE MP4	$12	FY20	FY20	No change
North Island	Hamiton West MP4 Reinforcement - Avalon Drive to Livingstone Avenue - 150m of 50nb PE MP4	$18	FY20	FY20	No change
North Island	Horotiu Development Plan - along Horotiu Bridge Road between Washer Road and SH1 - 560m of 100nb PE MP4	$101	FY23	FY23	No change
North Island	Horotiu Development Plan - From the new DRS to the junction of Horotiu Bridge Road and SH1 - 350m of 100nb PE MP4	$63	FY22	FY22	No change
North Island	Horotiu Development Plan - Install IP10/MP4 DRS opposite to #5 Washer Road at SH1	$240	FY21	FY21	No change
North Island	Horotiu Development Plan - Up-rate the operating presure of Horotiu IP20 pressure system	$114	FY20	FY20	No change
North Island	IP Reinforcement - Unknown	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	MP Reinforcement - Unknown	$900	FY15 to FY24	FY17 to FY25	Ongoing programme
North Island	Mt Maunganui (Bakels) - 500 metres of 50 NB MP4 at the very end of the network supplying Bakels	$90	FY16	New Project	
North Island	Mt Maunganui (Papamoa East) - 1700m of 225mm 7 bar PE (subject to growth) Tara Road	$514	FY19	FY19	No change
North Island	Mt Maunganui (Papamoa) - 1000m of 180mm 7 bar PE in Parton Road	$310	FY19	FY19	No change

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
North Island	Mt Maunganui (Papamoa) - 800m of 225mm 7 bar PE in Domain Road	$272	FY18	FY18	No change
North Island	Mt Maunganui (Papamoa) - IP20 / MP7 DRS inside Papamoa Gate Station	$245	FY20	FY20	No change
North Island	Mt Maunganui (Papamoa) - MP7 / MP4 DRS at J/O Parton Rd and Papamoa Beach Rd	$252	FY21	FY21	No change
North Island	Mt Maunganui IP Reinforcement (Possible solutions: Option (2) Create IP20 loop - 2400m in Newton St and Hull Rd.	$2,476	FY20 to FY21	FY20 to FY21	No change
North Island	Paraparaumu IP reinforcement - Uprate current operating pressure from 1350kPa to 1800kPa (including gate station upgrade) and DRS upgrade	$522	FY15	FY16	Deferred
North Island	Paraparaumu reinforcement - 1900m of 100 PE MP4 from the proposed MP7/MP4 DRS along Ratanui Road to Mazengarb Road	$300	FY19 to FY20	FY19 to FY20	No change
North Island	Paraparaumu reinforcement feed from Waikanae GS - 125mm 7 bar PE bridge crossing	$53	FY17	FY17	No change
North Island	Paraparaumu reinforcement feed from Waikanae GS - 2800m of 125mm 7 bar PE	$710	FY17	FY17	No change
North Island	Paraparaumu reinforcement feed from Waikanae GS - bridge crossing (provision of ducts for future proof)	-	FY15	In progress	
North Island	Paraparaumu reinforcement feed from Waikanae GS - Gate station upgrade with 7 bar outlet	$376	FY18	FY18	No change
North Island	Paraparaumu reinforcements - 580m of 100mm MP4 PE main from DRS081 in SH1 to Tutanekai St	-	FY15	Completed	
North Island	Provisional budget for commercial requests that support new customer growth initiatives.	$900	FY15 to FY24	Removed	Included in Customer Connection
North Island	Reinforcement in Ohauiti area Tauranga. Solution will be various links. 700 mtrs of 100mm PE and 1,000 mtrs of 50mm PE links.	$266	FY16	FY20	Deferred
North Island	Taupo MP4 reinforcements - 3400m of 125mm 7 bar PE	$892	FY21 to FY22	FY21 to FY22	No change
North Island	Taupo MP4 reinforcements - MP7/MP4 DRS in Kiddle Drive J/O Birch Street	$258	FY23	FY23	No change

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
North Island	Tauranga - Bellevue to Bethlehem 1500m of 80 PE in Carmichael Rd and Millers Rd (subject IP upgrade i.e. needed if IP system cannot be uprated without decommissioning). Needed if IP not upgraded.	$134	FY22	FY18	Rolled forward
North Island	Tauranga - Oropi Rd to Pyes Pa Rd link - 360m of 100 mm PE and 400m of 50mm PE in Condor Drive	-	FY14	Completed	
North Island	Tauranga IP upgrade (Gate station upgrade + IP uprating to 17 bar + DRS upgrade)	-	FY14	In progress	
North Island	Waitoa MP4 reinforcement (MP7/MP4 DRS at Ngarua)	$150	FY17	FY18	Deferred
North Island	Waitoa MP4 reinforcement (MP7/MP4 DRS at Ngarua) - Relocation south	$170	FY22	FY22	No change
North Island	Waitoa MP4 reinforcements (Incremental extension of 160mm MP7 PE if required - 5000m initial extension)	$610	FY15 to FY16	FY16 to FY17	Deferred
North Island	Waitoa MP4 reinforcements (Incremental extension of 160mm MP7 PE if required - 5200m futher extension)	$1,264	FY21 to FY22	FY16	No change
North Island	Whangarei IP reinforcement - Gate Station upgrade + IP uprating to 17 bar + DRS upgrade	$2,734	FY22 to FY23	FY22 to FY23	No change
North Island	Whangarei MP4 Link - Central Avenue from First Street to Maunu Road / Water Street - 140m of 50nb PE MP4	-	FY15	Cancelled	Alternative solution completed

* *Figures are in 2016 dollars ($'000);*

Table 5-3 : Network development programme update

5.16 Asset Relocation

Vector's gas distribution network assets are required to be relocated from time to time to make way for work carried out by other infrastructure service providers or landowners (Requiring Authorities). Infrastructure projects could be initiated by other utilities (such as Transpower and Kiwi Rail) or roading authorities such as New Zealand Transport Authority (NZTA) and local councils. Vector is obliged by law to relocate its assets when requested by these bodies. The process and funding of such relocation work is governed by the Gas Act 1992 and the Government Roading Powers Act 1989.

The timing of these projects is driven by the authority concerned and generally without the level of advance notice or detailed scope normally associated with growth projects. Information about projects more than one year in advance is generally not available for all but the large multi-year projects. In this respect relocation forecasts are based on continuation of the current level of relocation activity.

* Figures are in 2016 real New Zealand dollars ($'000);

Table 5-4 and * Figures are in 2016 real New Zealand dollars ($'000);

Table 5-5 provide Vector's asset relocation capex budget forecasts for the Auckland and North Island regions respectively for the next 10 years.

5.17 Long-term Development Plans

Traditionally, the method used for developing the network has been a bottom up approach. This has enabled the planner to plan the network in phases from the existing configuration based on projected demand (and other relevant information). The risk of this incremental approach is that the development will be significantly influenced by localised information available for the short term (three to five years) to medium term (five to ten years). This could result in short-term financially attractive solutions being adopted where better economic long-term solutions may be available.

Network modelling and long-term demand forecast information has been used to establish a very long-term vision for Vector's regional intermediate pressure network systems. The vision is presented in the form of a "target" network configuration in year 2050 that reflects the potential security and capacity needs of Vector's customers. This offers guidance to the planner for the ongoing development of the network and enables the planner to take a holistic long-term view to ensure that the network is not developed in a piecemeal fashion. Any duplication and redundancy can be minimised.

The plan takes into account the current and future land use where additional transmission facilities, such as additional gate stations, may be required to reinforce the gas distribution networks.

5.17.1 Concept Network Architecture

A high level concept network architecture has been developed to help guide network planners in the development of the gas distribution networks. The concept network architecture, shown in Figure 5-12, proposes that all IP pipelines have a NOP of 1,900kPa or 1,000kPa, and provide supply into the MP pipelines at a nominal operating pressure of 400kPa. These network systems provide supply to consumer's Gas Measurement Systems (GMS).

In the long term, improvements in plastic pipe materials may allow plastic pipe systems to operate at 1,000kPa.

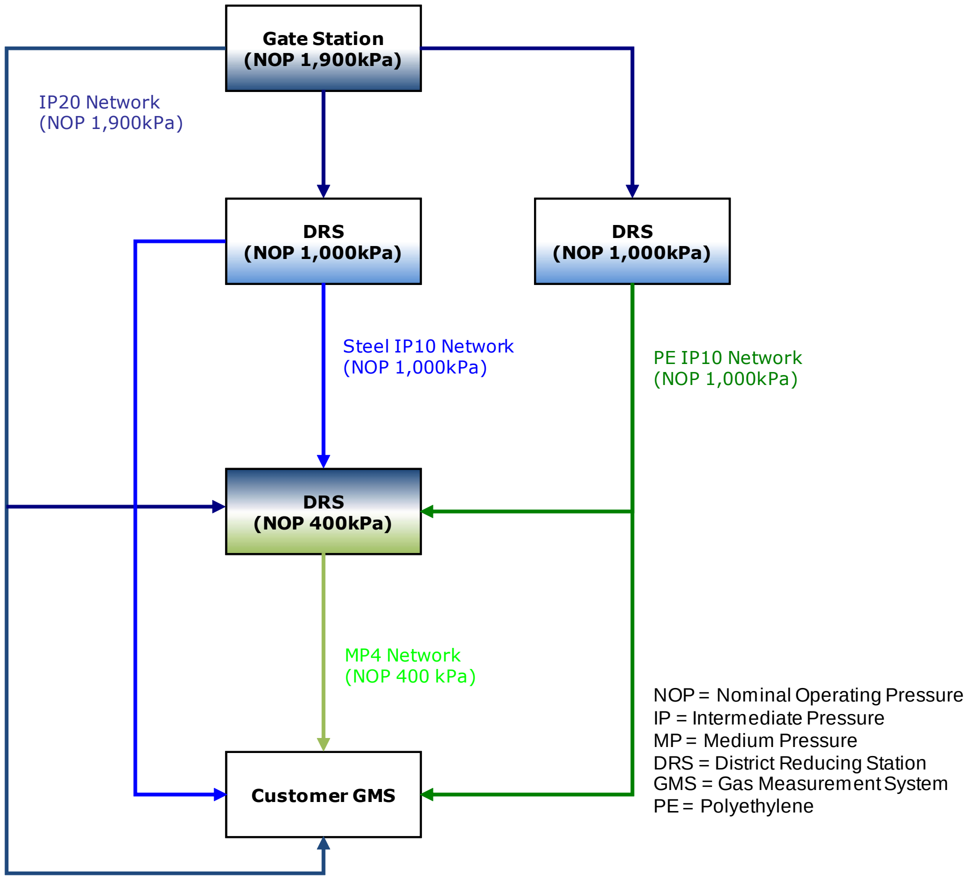


Figure 5-12 : Long-term network architecture (high level concept)

The following sections provide a summary of the envisaged long-term network architecture for the IP networks located in Auckland, Hamilton, Tauranga and Mt Maunganui. Other regions will be added as network development models (including load forecast information) become available.

5.17.2 Auckland Central Network System

The long-term load distribution at Auckland shows the potential demand growth can be accommodated by:

- Increasing the capacity of the section of IP20 pipeline between DR-00116-AK and DR-00136-AK or construct a new 200mm IP20 pipeline from the existing Flat Bush gate station (or construct a new gate station) to DR-00117-AK (year 2030);
- Increasing the NOP of the East Auckland IP10 pressure system from 875kPa to 1,900kPa from DR-00136-AK to DR-00160-AK (year 2030);
- Increasing the NOP of the East Auckland IP10 pressure system from 875kPa to 1,000kPa from DR-00244-AK to DR-00160-AK and DR-00164-AK (year 2030);
- Increasing the NOP of the Favona MP7 network from 700kPa to 1,000kPa (year 2030);
- Increasing the NOP of the Central Auckland MP7 network from 700kPa to 1,000kPa (year 2030);

- Increasing the NOP of the high pressure transmission pipeline located in North Harbour from 1,850kPa to 3,000kPa and installing two new DRS's in North Harbour (year 2030);
- Installing an IP20 pipeline between DR-800238 in Silverdale and Glenvar, Torbay (2030);
- Installing a section of IP20 pipeline from the Waikumete gate station to DR-00169-AK (year 2040), and
- Further consideration of increasing the NOP of the entire East Auckland IP10 pipeline is required (year 2040).

Figure 5-13 below shows the proposed long-term plan for the IP networks in the Auckland Central network system.

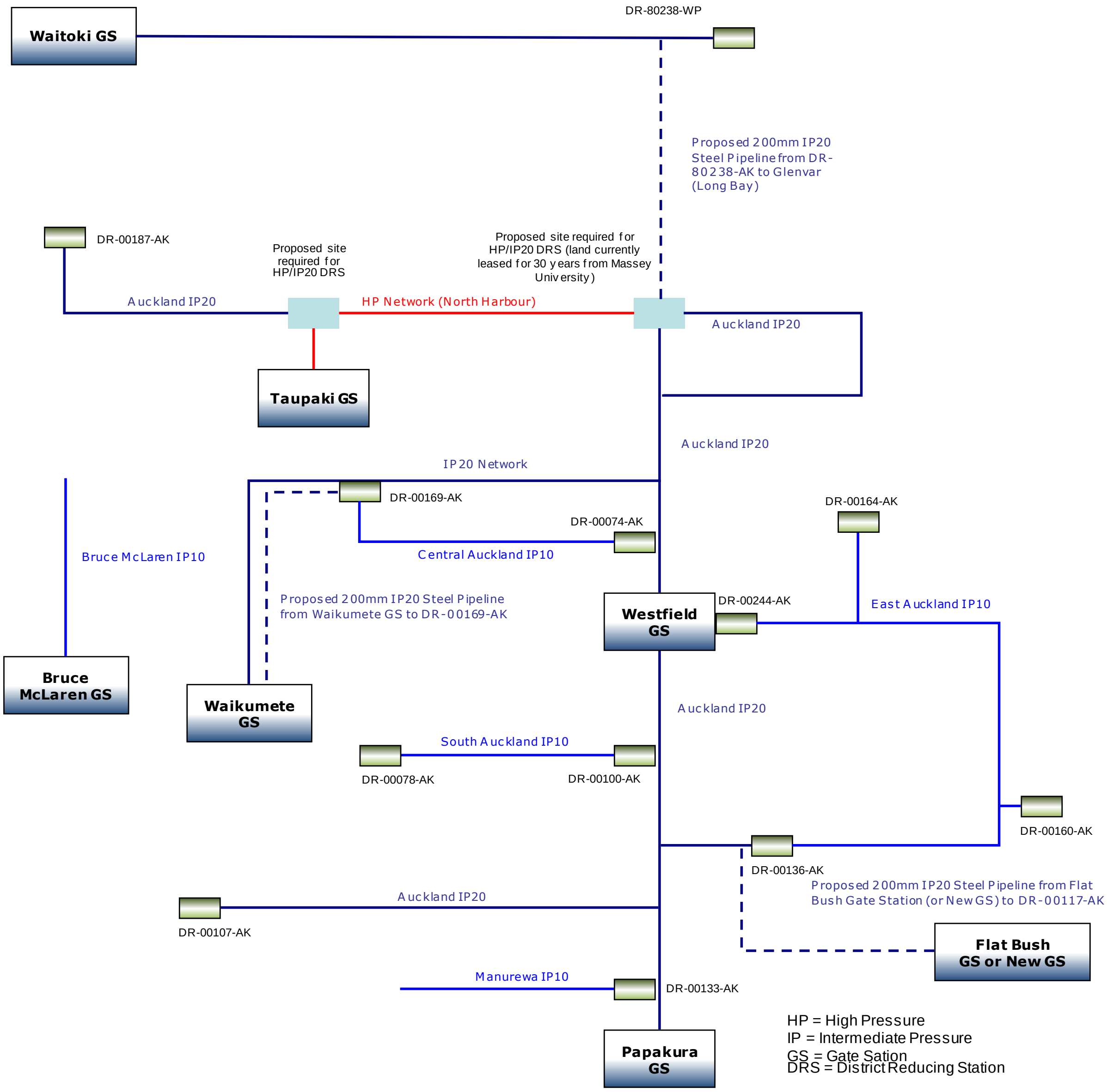


Figure 5-13 : Long-term network architecture: Auckland Central network system

5.17.3 Hamilton

The long-term load distribution in Hamilton shows that the potential demand growth can be accommodated by:

- Construct a new IP20 steel pipeline from the existing Horotiu gate station to DR-80129-HM (year 2030, subject to the pressure uprating of the IP10 pipeline from Te Kowhai gate station not proceeding);
- Constructing a new 180mm MP7 PE pipeline from Collins Road (near DR-80175-HM) to Peacocke (year 2030);
- Constructing a new 180mm IP10 PE pipeline from Matangi gate station to DR-80139-HM (year 2040); and
- Increasing the available capacity of the Matangi gate station[62] (year 2040).

Figure 5-14 below shows the proposed long-term plan for the IP networks in the Hamilton network system.

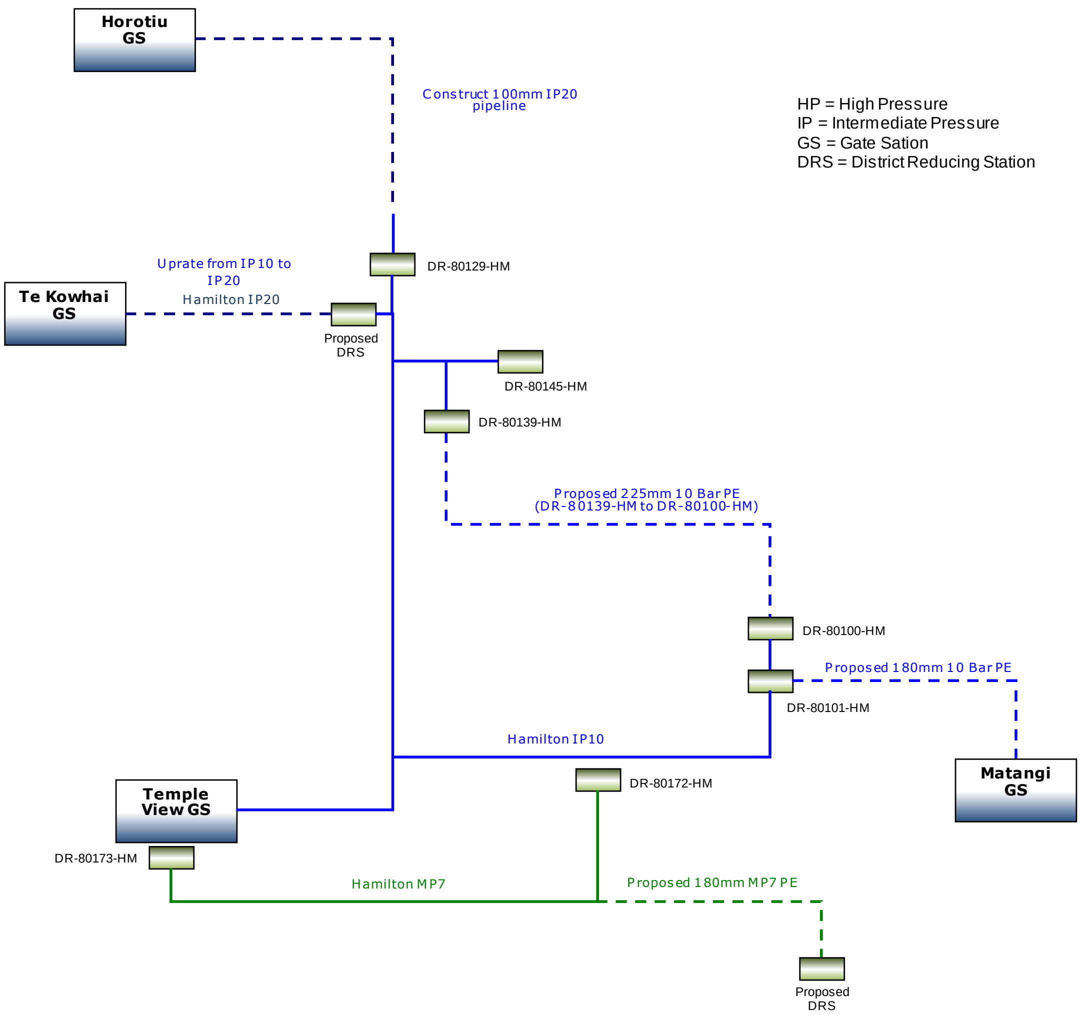


Figure 5-14 : Long-term network architecture: Hamilton network system

[62] Subject to transmission system capacity being available.

5.17.4 Tauranga

The long-term load distribution in Tauranga shows the potential demand growth can be accommodated by:

- Constructing a new IP10 125mm PE pipeline (approximately 3,200 metres) from near DR-80229-TR from Waihi Road, along Bellevue Road into Windsor Road and Charles Street, ending at 422 Ngatai Road. In addition, construct IP20/IP10 and IP10/IP4 DRS's near DR-80229-TR and 422 Ngatai Road respectively (year 2030);
- Constructing a new IP20 80mm steel pipeline loop (approximately 1,000 metres) along Waihi Road between Birch Avenue and a proposed IP20/IP10 DRS near DR-80229-TR. This is intended to improve system pressure; and
- Constructing a new IP10 160mm PE pipeline (approximately 8,000 metres) along Cambridge Road from Pyes Pa gate station to the proposed IP10 125mm PE pipeline (described above) to improve security of supply. Note that additional MP4 DRS reinforcement could be provided at various locations along this pipeline. An alternative option is to relocate the proposed IP20/IP10 DRS to Birch Avenue/Waihi Road and extend the IP10 pipeline. This option replaces the need to construct the IP20 80mm steel pipeline described above and replace it with a more cost effective IP10 PE pipeline (year 2040).

Figure 5-15 below shows the proposed long-term plan for the IP and MP networks in the Tauranga network system.

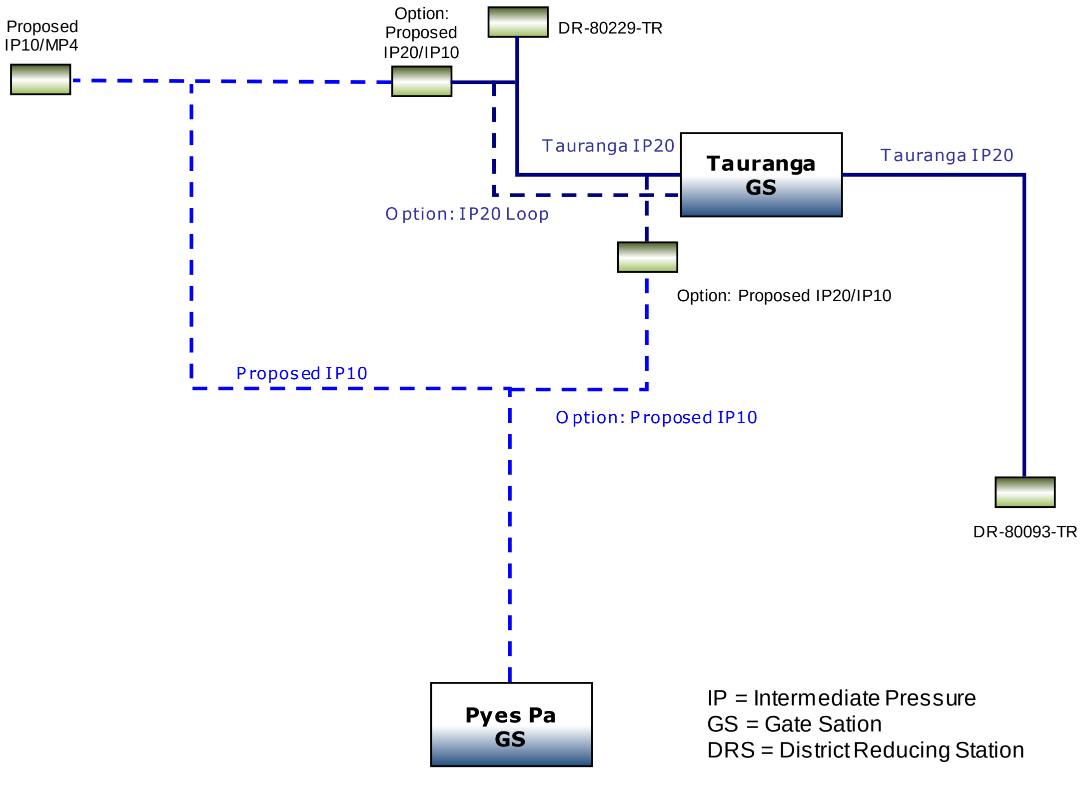


Figure 5-15 : Long-term network architecture: Tauranga network system

5.17.5 Mt Maunganui

The long-term load distribution in Mt Maunganui shows the potential demand growth can be accommodated by:

- Constructing a new 180mm IP10 (or MP7) PE pipeline from stage 1 to stage 2 of the Papamoa East developments (year 2040).

Figure 5-16 below shows the proposed long-term plan for the IP and MP networks in the Mt Maunganui network system.

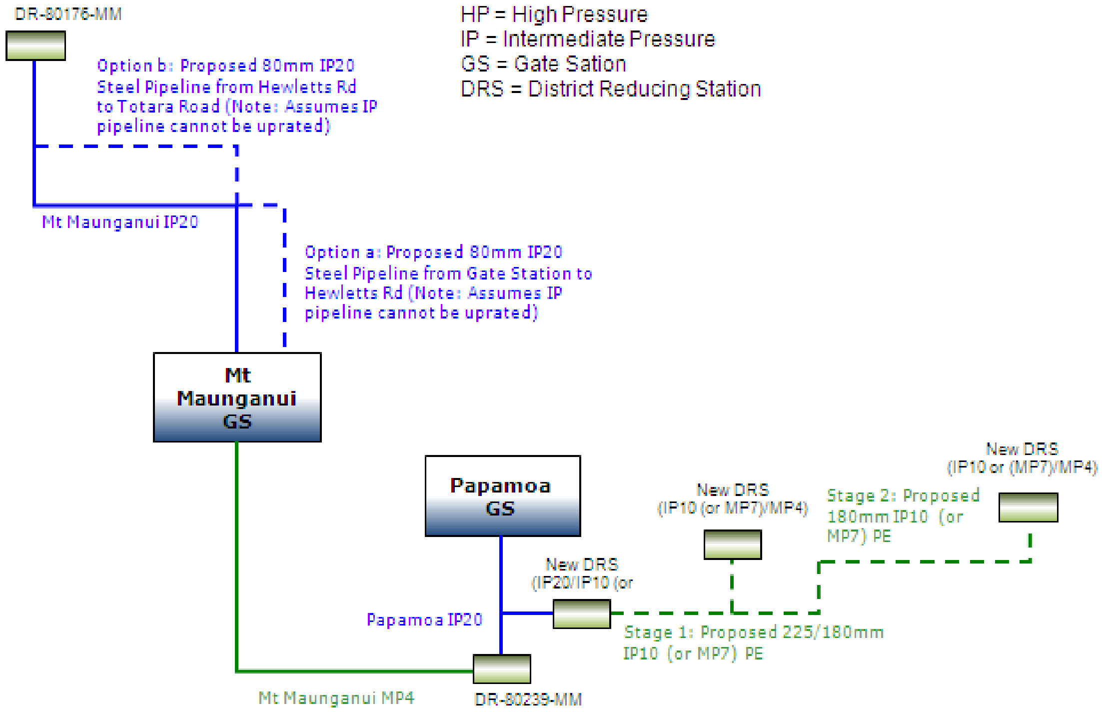


Figure 5-16 : Long-term network architecture: Mt Maunganui network system

5.18 Network Development Forecast Capex Expenditure

* Figures are in 2016 real New Zealand dollars ($'000);

Table 5-4 and * Figures are in 2016 real New Zealand dollars ($'000);

Table 5-5 provide Vector's network development capex budget forecasts for the Auckland and North Island regions respectively for the next 10 years.

Expenditure Description	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Mains Extensions/Subdivsions	$5,141	$5,151	$4,516	$4,573	$4,630	$4,530	$4,574	$4,674	$4,719	$4,719
Service Connections - Residential	$6,350	$7,028	$7,533	$6,306	$6,417	$6,529	$6,337	$6,425	$6,619	$6,708
Service Connections - Commercial	$1,202	$1,197	$1,193	$1,188	$1,184	$1,179	$1,175	$1,170	$1,166	$1,161
Customer Easements	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30
Reinforcement - MP	$1,223	$937	$293	$341	$349	$302	$269	$100	$100	$100
Reinforcement - IP	$720	$650	$350	$350	$2,570	$2,350	$1,849	$350	$1,010	$1,010
Relocations	$2,646	$2,613	$2,632	$2,692	$2,591	$2,613	$2,613	$2,695	$2,695	$2,695
Total Expenditure	**$17,313**	**$17,606**	**$16,548**	**$15,480**	**$17,770**	**$17,532**	**$16,847**	**$15,444**	**$16,339**	**$16,424**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 5-4 : Network development expenditure forecast for Vector's Auckland regions

Expenditure Description	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Mains Extensions/Subdivsions	$2,017	$1,911	$1,869	$1,951	$2,029	$2,115	$2,207	$2,305	$2,329	$2,329
Service Connections - Residential	$1,738	$1,688	$1,636	$1,582	$1,686	$1,786	$1,895	$2,013	$2,138	$2,170
Service Connections - Commercial	$206	$206	$208	$208	$210	$210	$212	$212	$212	$212
Customer Easements	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30
Reinforcement - MP	$162	$1,479	$914	$930	$806	$1,108	$779	$459	$100	$100
Reinforcement - IP	$4,156	$1,847	$1,708	$730	$3,873	$2,074	$3,409	$1,738	$250	$250
Relocations	$1,328	$1,716	$1,538	$1,527	$1,590	$1,430	$1,430	$1,430	$1,430	$1,430
Total Expenditure	**$9,637**	**$8,878**	**$7,903**	**$6,958**	**$10,223**	**$8,753**	**$9,961**	**$8,186**	**$6,489**	**$6,521**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 5-5 : Network development expenditure forecast for Vector's North Island regions

5.19 Opportunities for Improvement

During the course of preparing this AMP the following more significant improvements are intended:

5.19.1 Load and Energy Forecasts

Vector is improving its gas demand and energy consumption forecasting model. This is intended to be completed in 2016.

5.19.2 Transmission/Distribution Data Exchange

Gas transmission and distribution interface at gas gate stations. Constraints at gate station can impact on distribution investment decisions. Improved knowledge of the gate station capacities and constraints will lead to improved decision making by offering a wider range of solutions from which to choose the least cost option.

Gas Distribution
Asset Management Plan
2015 – 2025

Asset Maintenance and Renewal Planning – Section 6

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6 Asset Maintenance and Renewal Planning

6.1 Overview

This section covers Vector's life cycle asset maintenance and renewal plans, and the policies, criteria, assumptions, data and processes used to prepare these.

Vector's gas distribution network is designed and built to deliver gas safely to the service level standards set out in the connection agreements with its customers. In order to achieve this safety and level of service at optimum cost, the fixed assets have to be kept in good operating condition. This is achieved by way of renewing (replacing), and maintaining assets (regular maintenance).

Safety is the key consideration in the design, construction and maintenance of Vector's gas networks and accordingly Vector manages its gas distribution networks in accordance with relevant acts, regulations and industry standards. In particular the Gas Act, Gas (Safety and Measurement) Regulations, NZS 5263 Gas Detection and Odorisation, NZS 5258 Gas Distribution Networks, and AS/NZS 4645 Gas Distribution Networks require Vector to maintain and operate a safe and reliable network.

Although Vector strives to maintain the integrity of its gas networks at levels in line with good industry practice, some leakage and escapes occur on all utility networks (e.g. gas, water and wastewater services etc), including on Vector's gas networks from time to time. Vector's networks are subject to ongoing monitoring as part of preventive maintenance programmes that are carried out in accordance with industry code requirements. To provide assurance to government regulators and the general public, Vector is required to monitor and disclose reliability and quality performance measures including public reported escapes (PRE's) and system interruptions. Additionally Vector is subject to periodic audits by the Energy Safety division of WorkSafe New Zealand.

Vector's long-term asset maintenance strategy is to achieve the optimal trade-off between capital expenditure (capex) and operational expenditure (opex), while maintaining a safe, efficient and reliable network. Achieving this requires a balance between effective maintenance and judicious asset renewal.

6.1.1 Legislative requirements

Vector's gas distribution assets have been designed and constructed and are operated in accordance with the following principal Acts, Regulations and industry codes:

- Gas Act 1992 and Gas Amendment Act;
- Health and Safety in Employment Act ;
- Gas (Safety and Measurement) Regulations;
- Civil Defence and Emergency Management Act;
- Hazardous Substances and New Organisms Act;
- NZS 5258 Gas Distribution Networks;
- NZS 7901 Electricity and Gas Industries – Safety Management Systems for Public Safety;
- AS/NZS 4645.1 Gas Network Management;
- AS/NZS 2885 Pipelines – Gas and liquid petroleum; and
- NZS 5263 Gas detection and odorisation.

These Acts, Regulations and industry codes include both prescriptive and performance based requirements which have been embedded into Vector's suite of design, construction, maintenance and material specification technical standards. The purpose of the Vector technical standards is to provide a comprehensive reference source for use by Vector personnel and others involved in the design, construction and maintenance of natural gas networks. Vector has outsourced the construction and maintenance of its gas distribution network to Field Service Providers (FSPs), and Vector's technical standards form part of the contract with the FSPs.

6.1.2 Safety in Design

Vector takes health and safety very seriously and is committed to ensuring that its operations do not put our employees, contractors or the public at risk. This extends to safety being a key focus of the design phase of the work we do - it is at the design stage of creating assets that the greatest opportunity exists to build in safe operability for the whole life cycle of the asset.

Safety in design is about eliminating or controlling risks to health and safety as early as possible in the planning and design stage, so that whatever is designed will be safe to construct, operate, repair and maintain and ultimately, safe to decommission and dispose of at the end of its life cycle. This concept is implicit in our work practice.

Although we have implicitly always incorporated safety features into our asset designs (though for example adopting reputable international engineering standards and practices), until recently safety in design has not been considered a specific, measurable part of the design process. Vector have now developed a clear policy on safety in design, which is embedded in our Health Safety and Environmental management system. Our policy is to ensure, as far as is reasonably practicable, that all measures are taken during engineering design to avoid injury and ill health to those who construct, operate, maintain, decommission or demolish a Vector asset.

For Vector's gas distribution network, the safety in design process for all major steel pipeline installation projects and for projects where the risk level (e.g. due to the complexity or the size of the project) is sufficiently high to warrant it, will be based on the safety management study framework stipulated in AS 2885. The process for all other development and replacement projects will be based on a project-specific hazard identification (HAZID) and include an assessment of whether the standard designs, controls and threat-assessments are adequate.

6.1.3 Vector's Maintenance and Refurbishment Approach

Vector is required by the Gas Act to design, construct, maintain and operate its gas distribution networks in accordance with the Gas (Safety and Measurement) Regulations 2010. This regulation cites both NZS 5258 and AS/NZS 4645 as a means of compliance. Vector has up until now adopted NZS 5258 as its means of compliance, however this standard has not been updated since 2003 and no further updates of this standard are planned. For this reason there is a move within the wider NZ gas industry toward adopting AS/NZS 4645.

In 2013 Vector initiated a review of its suite of technical standards to align them with AS/NZS 4645. The review has seen a progressive adoption of specific requirements of AS/NZS 4645. This will continue until the review is competed in FY 2014/15, at which time the migration from NZS5258 to AS/NZS 4645 will be complete.

Vector has developed a comprehensive suite of asset maintenance standards that describe its approach to maintaining and refurbishing various asset categories. There are clearly significant differences required in the approach to different asset types, but as a broad rule the maintenance standards provide the following:

- The required asset inspection frequency;
- The routine and special maintenance activities required to be carried out during these inspections; and

- Condition testing that needs to be carried out and the required response to the test results.

In general, Vector's philosophy is to keep its assets in use for as long as they can be operated safely, technically and economically. The maintenance and renewal policies support this goal by intervening to ensure optimal asset performance.

In a small number of cases (such as meters used for network monitoring), assets that have low impact on the gas distribution network's integrity and performance are allowed to exceed their design life.

6.1.4 Vector's Asset Renewal Approach

Assets are only renewed when:

- Assets are irreparably damaged;
- There is an imminent risk of asset-failure;
- The operational and/or maintenance costs over the remaining life of the asset are disproportionate to that of replacement; and/or
- Assets become obsolete and hence impossible or inefficient to operate and maintain.

Asset renewal decisions are therefore in general condition-based rather than age-based.

Optimisation of capital investment and maintenance costs is an important part of Vector's capital investment efficiency drive. This requires comprehensive evaluation of the condition, performance and risk associated with the assets, to provide a clear indication of the optimal time for assets' renewal. Often it may be more efficient to extend the life of asset to beyond normal predicted asset life, by servicing or refurbishing the assets.

Asset condition evaluation is based on Vector's field service provider's (FSP's) surveys, observations, test and defect work schedules. The asset performance evaluation is based on asset fault records and reactive maintenance records.

Once an asset is identified for replacement, Vector's prioritisation methodology is applied to determine the ranking of replacement projects. This methodology is based on assessing the criteria giving rise to the need for replacement, the importance of the asset in question, the impact should the asset fail and the likelihood of such failure. Other important factors considered are the health and safety risk, risk to assets, risk to Vector's reputation, potential financial impacts and potential effects on the environment. The final project prioritisation list (that incorporates scoring based on conditions and performance as well as risk assessment), along with budgetary estimates forms the basis of the annual renewal budgets for each fiscal year.

It is essential to gain and maintain relevant information on the performance of assets in the field in order to undertake accurate assessments. The field data is currently collected and held by our FSPs. Vector uses a Systems Applications and Processes (SAP) based plant maintenance system. This system enables preventative and corrective maintenance data to be directly fed into Vector's databases, based on the activities of our FSPs.

The investigation data, field data and fault records collected and maintained in Vector's databases are increasingly being used to conduct asset condition/performance and risk assessments, informing our renewal programmes.

Asset renewal expenditure forecasts for each expenditure category are based on actual historical costs for similar renewal project types. The majority of asset renewal work is carried out by Vector's contracted FSP's (refer Section 2), and all major projects are managed through a competitive bid process to ensure that competitive pricing is achieved.

6.2 Maintenance Planning Processes, Policies and Criteria

This section presents the planning processes, policies and criteria for managing Vector's network assets. Vector's strategic focus drives the asset integrity strategies:

Operational excellence:

- Ensure the network operation is safe and reliable;
- Ensure network investments and operating activities are efficient;
- Maintain the existing assets in good and safe working order until new assets are built or until they are no longer required; and
- Strive for continual innovation and efficiency improvements in how assets are maintained and operated.

Customer service:

- Ensure the safety of the public, our staff and our FSPs;
- Ensure assets are designed**,** operated and maintained to the required level of standard to provide the targeted level of service; and
- Ensure an appropriate level of response to customer concerns, requests and enquiries.

Cost efficiency:

- Strive to achieve the optimal balance between capital and operational costs;
- Coordinate asset replacement and new asset creation programmes; and
- Apply innovative approaches to solutions, development and project execution.

6.2.1 Asset Maintenance Standards and Schedules

Vector's asset maintenance standards are prepared by the Asset Resilience (AR). Asset inspections and maintenance work is carried out by FSPs, under the direction of Vector's Service Delivery (SD) group.

Vector has developed maintenance standards for each major class of assets. The standards form a key part of Vector's schedule for planned maintenance. The purpose of these standards, in conjunction with the schedules of maintenance work, is to ensure assets operate safely and deliver their designed outcomes with regard to life and performance.

As part of the asset maintenance standards, the frequency of inspection and reporting per asset category has also been defined. This forms the basis of Vector's asset maintenance schedule.

Vector's maintenance standards are kept on Vector's secure websites and are available to personnel engaged in maintenance activities, as well as for our FSPs. The FSPs must comply with the standards and inspection schedules for each class of assets.

The standards are updated in accordance with an established review cycle and any new findings or updates are incorporated in Vector's standards as soon as they are reviewed by the asset management team, and signed off by all interested parties. Vector's FSPs contribute to and form an integral part of this continual improvement process.

Progress against the maintenance schedules and the associated maintenance costs are monitored on a monthly basis. Any concerns identified during asset inspections are recorded in a database. FSPs recommend the priorities for the remedial works for defects, which are then reviewed by Vector prior to issuing orders for the work. Maintenance priorities are based on costs, risks and safety criteria.

In making decisions on repairing or replacing the assets Vector will consider recommendations submitted by the FSPs, as well as the factors discussed above. The long-term plans supported by trend analysis for an asset will also be taken into account when assessing whether it should be maintained or replaced.

Root cause analysis is normally undertaken as a result of faulty equipment. If this identifies systemic faults or performance issues with a particular type of asset, and if the risk exposure warrants it, a project will be initiated to carry out the appropriate remedial actions on a class of assets. The assets and maintenance standards are also amended to reflect the learning from such root cause analysis.

6.2.2 Maintenance Categories

Maintenance works at Vector are categorised in three main categories:

- Preventive maintenance is defined by Vector's standards and is work intended to identify issues before they occur. The frequency of performing the preventive maintenance work (per asset group) is defined in the maintenance standards, flowing through into the contractors' schedule;
- Corrective maintenance work is the work that flows from the preventive activities, site inspections, testing and observations by Vector's contractors or any party that reports on potential issues relating to our network's conditions or performance; and
- Reactive maintenance work is undertaken following customers' complaints, accidents or any other work that is to rectify damage to the assets caused by unforeseen circumstances.

In addition, Vector also has categories for third party services maintenance and for maintenance management services.

The maintenance categories are further explained below.

6.2.2.1 Reactive Maintenance

Reactive maintenance is considered to encapsulate all maintenance activities that relate to the repair and restoration of supply, and the safeguarding of life and property (targets and measures for Vector's responses to Emergencies are detailed in Section 4). It primarily involves:

- Safety response and repair or replacement of any part of the network components damaged due to environmental factors or third parties interference; and
- Remediation or isolation of unsafe network situations.

6.2.2.2 Preventive Maintenance

Preventive maintenance covers activities defined through the maintenance standards, and relates to the following:

- Provision of network patrols, inspection and condition detection tasks, sampling and maintenance service work; and
- The coordination of shutdowns and decommissioning, and re-commissioning and restoration, along with the capture and management of all defined data.

Table 6-1 below provides a summary of preventive maintenance activities by asset class, together with appropriate standards and document references.

Asset Class / Category	Activity Standard	Preventive Maintenance Description
Leakage survey	GNS-0019	3 monthly – Hamilton LP and MP1 steel systems[1]
Leakage survey	GNS-0019	Annual - distribution systems adjacent to public buildings, hospitals, schools and business districts; Identified higher risk areas (Auckland International Airport, Auckland Harbour Bridge), steel pipelines without operating cathodic protection systems
Leakage survey	GNS-0019	2 yearly – service pipes located inside or under buildings; Distribution mains systems comprised predominantly of pre-1985 PE
Leakage survey	GNS-0019	4 yearly - all other pipes located under hard-paved surfaces in close proximity to buildings; Shallow IP mains
Leakage survey	GNS-0019	5 yearly - balance of distribution system, including service connections
Above ground steel pipework	GNS-0014	Annual – above ground corrosion inspection
Cathodic protection	GNS-0015	2 monthly – inspection of impressed current transformer/rectifier sites
Cathodic protection	GNS-0015	2 monthly - inspection of drainage bonds
Cathodic protection	GNS-0015	3 monthly, 6 monthly and annual - inspect & test on and instant-off pipe/soil potential in major urban, urban and rural areas
Cathodic protection	GNS-0015	3 monthly and 6 monthly – inspect & test "On" pipe/soil potential in rural and urban areas
Cathodic protection	GNS-0015	3 monthly, 6 monthly and annual - electrical test of galvanic anodes in major urban, urban and rural areas
Cathodic protection	GNS-0015	3 monthly, 6 monthly and annual - test electrical isolation at casing test points in major urban, urban and rural areas
Gate Station and DRS	GNS-0012	3 monthly - below ground DRS operational check
Gate Station and DRS	GNS-0012	6 monthly - above ground operational check
Gate Station and DRS	GNS-0012	3 yearly – all DRS; full inspection and confirmation of settings and function
Odorant checks	GNS-0020	Monthly - gate station odorant and odorant concentration tests
Odorant checks	GNS-0020	3 monthly – extremity point ICP and designated DRS odorant and odorant concentration tests
Valves	GNS-0013	Annual - full service of emergency and designated valves, and partial service of other designated plug valves

[1] Vector is implementing a replacement programme to complete the replacement of all remaining Hamilton LP and MP1 steel pipelines by 2014/15 FY.

Asset Class / Category	Activity Standard	Preventive Maintenance Description
Valves	GNS-0013	2 yearly – full service of other designated ball valves, and partial service of other plug valves; Audit of a sample of service riser valves
Telenet	GNS-0016	Annual – inspections of master station, field sites and repeater station
Telenet	GNS-0016	4 yearly - intrinsic safety inspections of field sites
Patrols	GNS-0021	3 monthly – visual inspection of above ground pipework, vent pipes and ducted crossings
Patrols	GNS-0021	Annual – visual inspection of service pipes inside/under buildings
Service regulators	GNS-0073	Annual – visual inspection of below ground installations
Service regulators	GNS-0073	2 yearly – visual inspection of above ground installations
Critical spares and equipment	GNS-0078	Monthly – visual inspection
Critical spares and equipment	GNS-0078	Annual – condition assessment of all critical spares and equipment; Review of inventory lists to determine level of inventory held is appropriate
Critical spares and equipment	GNS-0078	5 to 10 yearly - manufacture's check/refurbishment of all major items of equipment
Ground temperature	-	Monthly - monitoring of ground temperature at key reference sites (Rotorua and Taupo)

Table 6-1 : Preventive maintenance schedules and standards

6.2.2.3 Corrective Maintenance

Corrective maintenance catches the follow-up maintenance repair and component replacement requirements resulting from:

- Assets identified from planned inspections or service work to be in poor condition, requiring repair;
- Poor condition or unserviceable assets identified via one-off coordinated network inspections or identified through proximity capital works;
- Removal of graffiti, painting and repair of buildings and asset enclosures, removal of decommissioned assets, one-off type inspection and condition detection tasks outside of planned maintenance standards; and
- Coordination of shutdowns and associated restoration, along with the capture and management of all defined data.

Corrective maintenance activities are managed using SAP Plant Maintenance defect notifications. Defect notifications are assigned a priority ranking (based on risk and asset criticality) which defines the timeframe within which the repair should be completed.

6.2.2.4 Third Party Services

Third party services maintenance activities describe third party directed requests such as the following:

- Issuing maps and site plans to indicate the location of network assets via the beforeudig service;
- Asset location services, including the marking out of assets, safe work practice site briefings, worksite observer, urgent safety checks, safety disconnections;
- Issuing close approach consents; and
- Disconnection and reconnection associated with customers' property movements and any concerns relating to non-compliance with gas regulations.

6.2.3 Asset Maintenance and Field Services Provider Management Process

Vector has, through a competitive process, engaged a contractor to maintain its gas distribution networks. Electrix Ltd is Vector's maintenance contractor for the gas distribution networks. The maintenance contract drives the preventive, corrective and reactive maintenance works programmes, based on the requirements set by Vector's maintenance standards.

The relationship with Electrix Ltd is managed by Vector's Service Delivery (SD) group. The maintenance contract defines the responsibilities, obligations and key performance indicators (KPIs) to complete scheduled works. Vector's AR group works closely with the SD group to keep abreast of any issues with regards to the contractors' obligations and performance. The maintenance standards form part of the maintenance contract and contractors must comply with them when performing their duties.

Vector has a comprehensive preventive maintenance approach across its network asset base. The delivery of all of these maintenance activities in accordance with prescribed maintenance standards (see Table 6-1), is closely monitored and adjusted by SD on a monthly basis, to ensure the agreed annual target volumes are complied with. Extensive monthly feedback is obtained on actual versus planned progress, KPI performance, causality and issues impacting progress or performance, new risks, action plans and focal points for the coming months.

The overall effectiveness of the programme is evaluated by contract KPI performance and the roll up to Vector's corporate performance metrics, of which safety, environmental compliance, public, employee and contractor safety are the core measures.

Figure 6-1 below describes the flow of work and responsibilities in maintaining Vector's assets.

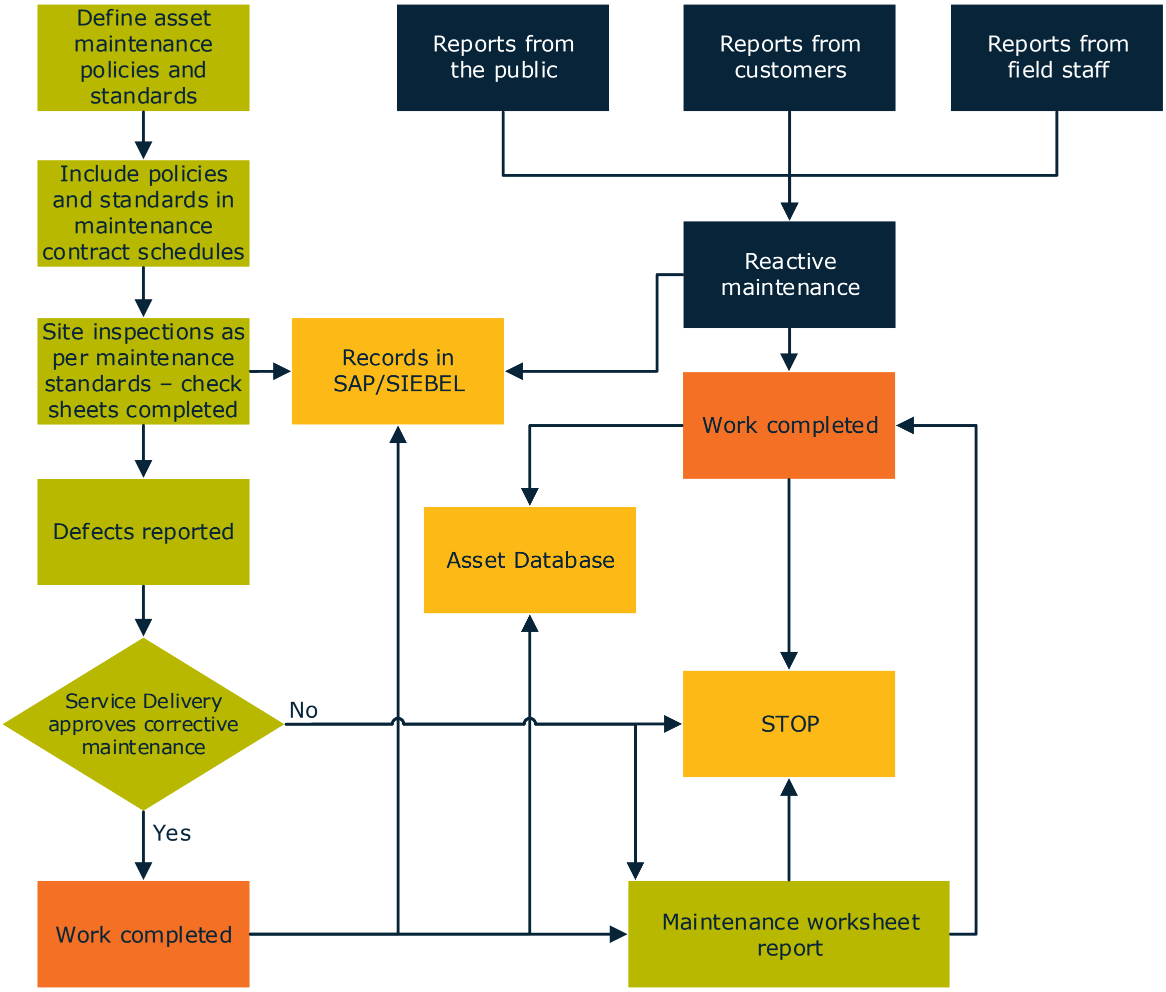

Figure 6-1 : Asset maintenance processes

6.2.4 Forecast Maintenance Budgets

Vector's maintenance expenditure forecast for the financial years ending 30 June each year from 2016 to 2025 for Vector's Auckland and North Island regions is set out in *
Figures are in 2016 real New Zealand dollars ($'000);

Table 6-2 to * Figures are in 2016 real New Zealand dollars ($'000);

Table 6-3.

Expenditure description	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Pipelines	$3,005	$3,006	$3,008	$3,010	$3,011	$3,013	$3,015	$3,016	$3,018	$3,020
District regulator and metering stations	$253	$253	$253	$253	$253	$253	$253	$253	$253	$253
Valves	$684	$684	$684	$684	$684	$684	$684	$684	$684	$684
Special crossings	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24
Monitoring and control systems	$168	$168	$168	$168	$168	$168	$168	$168	$168	$168
CP systems	$259	$259	$259	$259	$259	$259	$259	$259	$259	$259
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Network Operational Expenditure	**$4,393**	**$4,395**	**$4,397**	**$4,398**	**$4,400**	**$4,401**	**$4,403**	**$4,405**	**$4,406**	**$4,408**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 6-2 : Asset integrity opex expenditure forecast for Vector's Auckland region by asset category

Expenditure description	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Pipelines	$3,338	$3,339	$3,339	$3,340	$3,341	$3,342	$3,342	$3,343	$3,344	$3,345
District regulator and metering stations	$208	$208	$208	$208	$208	$208	$208	$208	$208	$208
Valves	$285	$285	$285	$285	$285	$285	$285	$285	$285	$285
Special crossings	$49	$49	$49	$49	$49	$49	$49	$49	$49	$49
Monitoring and control systems	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45
CP systems	$187	$187	$187	$187	$187	$187	$187	$187	$187	$187
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Network Operational Expenditure	**$4,112**	**$4,113**	**$4,114**	**$4,114**	**$4,115**	**$4,116**	**$4,116**	**$4,117**	**$4,118**	**$4,119**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 6-3 : Asset integrity opex expenditure forecast for Vector's North Island region by asset category

6.3 Asset Integrity Activities

6.3.1 Mains and Service Pipelines

6.3.1.1 Functional Description

Vector's gas distribution network mains pipes are used to transport natural gas from gate station delivery points to the individual service pipes that supply the customer's gas measurement system (GMS).

Vector's distribution network is comprised of 157 discrete pressures systems which operate at pressures ranging from LP (0-7 kPa) to IP (>700-2000 kPa) within the following nominal operating pressure bands:

- LP Up to or equal to 7 kPa
- MP1 Greater than 7 kPa but less than or equal to 110 kPa
- MP2 Greater than 110 kPa but less than or equal to 210 kPa
- MP4 Greater than 210 kPa but less than or equal to 420 kPa
- MP7 Greater than 420 kPa but less than or equal to 700 kPa
- IP10 Greater than 700 kPa but less than or equal to 1000 kPa
- IP20 Greater than 1000 kPa but less than or equal to 2000 kPa

The majority of Vector's "bulk" gas distribution assets are operated in the IP20 range of 1,000 kPa to 2,000 kPa. The selection of these pressures has, in the majority of cases, been made in historical times and has been justified on an economic basis (consideration of gas volumes, transmission distances, delivery pressures etc.).

In all but the larger supply areas, the regional IP systems are used to transport large volumes of gas from gate stations to the areas where it is to be used. The IP system generally forms the principal "backbone" of the distribution networks with laterals radiating from them to supply adjacent areas.

The distribution assets which are used to directly supply the majority of gas consumers operate in the MP4 range of 210 kPa to 420 kPa. LP systems typically operate between 3 kPa and 5 kPa and comprise the older parts of the distribution system supplying residential and small commercial loads.

Separate Use of Networks Agreements (UNAs) are in place between Vector and the various gas retailers for Vector's Auckland and North Island networks. The UNA for the Auckland network stipulates maximum and minimum delivery pressures as measured at the inlet valve on the consumer gas measurement system (GMS), whereas the UNA for the North Island network (which at the time included ownership of GMS's) stipulates delivery pressures as measured at the outlet of the customer GMS. The two UNAs are currently under review with the intent of harmonising the terms of the two UNAs and replacing them with a single UNA.

6.3.1.2 Physical Description

Distribution systems are defined as those parts of the gas network that extend from the outlet valve of the gate station delivery point to the inlet valve on the customer GMS. For the purposes of this AMP distribution systems are further stratified into network systems which are defined as discrete systems of interconnected (via DRS installations) pressure systems which are supplied via one or more gate stations.

Vector's distribution system comprises 54 network systems located in the Northland, greater Auckland, Waikato, Bay of Plenty, Gisborne and Kapiti regions of the North Island. The network systems are supplied via 63 gate stations with the Auckland Central network being supplied via 5 gate stations, and the Hamilton, Te Awamutu, Tauranga and Mt Maunganui networks each being supplied via 2 gate stations.

Pipelines operating at nominal pressures of IP10 and above are constructed of welded steel.

Pipelines operating at a nominal pressure of MP7 are predominantly constructed of welded steel, with a small quantity being constructed from PE100 material.

Pipelines systems operating at nominal pressures in the range of MP1 to MP4 are predominantly constructed of PE80 with a small quantity being constructed from welded steel.

LP systems are predominantly constructed from steel[2] and PE80 material.

Welded steel pipelines are coated (e.g. extruded high density polyethylene) and typically utilise cathodic protection (CP) systems to provide additional corrosion protection.

The MAOP (maximum allowable operating pressure) of steel pipelines is dependent on pipe and fitting types, and is typically in the region of either 1160 kPa or 1900 kPa. The MAOP of PE pipelines is dependent on the PE type (e.g. PE80 or PE 100) and standard dimension ratio (SDR) rating. Typical MAOP for PE80 pipelines is 420 kPa, and 700 kPa for PE100 pipelines. In some cases the pipeline MAOP may exceed its current nominal operating pressure – e.g. the North Harbour Pipeline section of the Auckland IP20 system was constructed as a HP pipeline and has a MAOP of 4,600 kPa.

The North Harbour Pipeline is operated as part of the IP20 system within the Auckland network. The pipeline is managed and maintained as a HP pipeline under a separate pipeline management plan in accordance with the requirements of the Health and Safety in Employment Regulations (Pipelines) Regulations 1999 and is certified by Lloyds Register.

6.3.1.3 Summary Statistics

The Auckland network system includes approximately 3,770 km of mains pipeline comprised of the following material types:

- 89% PE80 pipe; and
- 11% steel pipe.

The North Island network includes approximately 3,410 km of mains pipeline comprised of the following material types:

- 2% PE100 pipe;
- 88% PE80 pipe; and
- 10% steel pipe.

Steel pipelines date from the 1930s with most of it having been installed from the 1970s onward.

PE80 pipelines date from the 1970s with the majority of it having been installed since the 1980s.

PE100 pipelines date from the late 1990s.

[2] Ibid footnote 1.

6.3.1.4 Age Profiles

The age profile of mains pipelines (Auckland and North Island networks combined) is given in Figure 6-2, and the age profile of service pipelines (Auckland and North Island networks combined) is given in Figure 6-3.

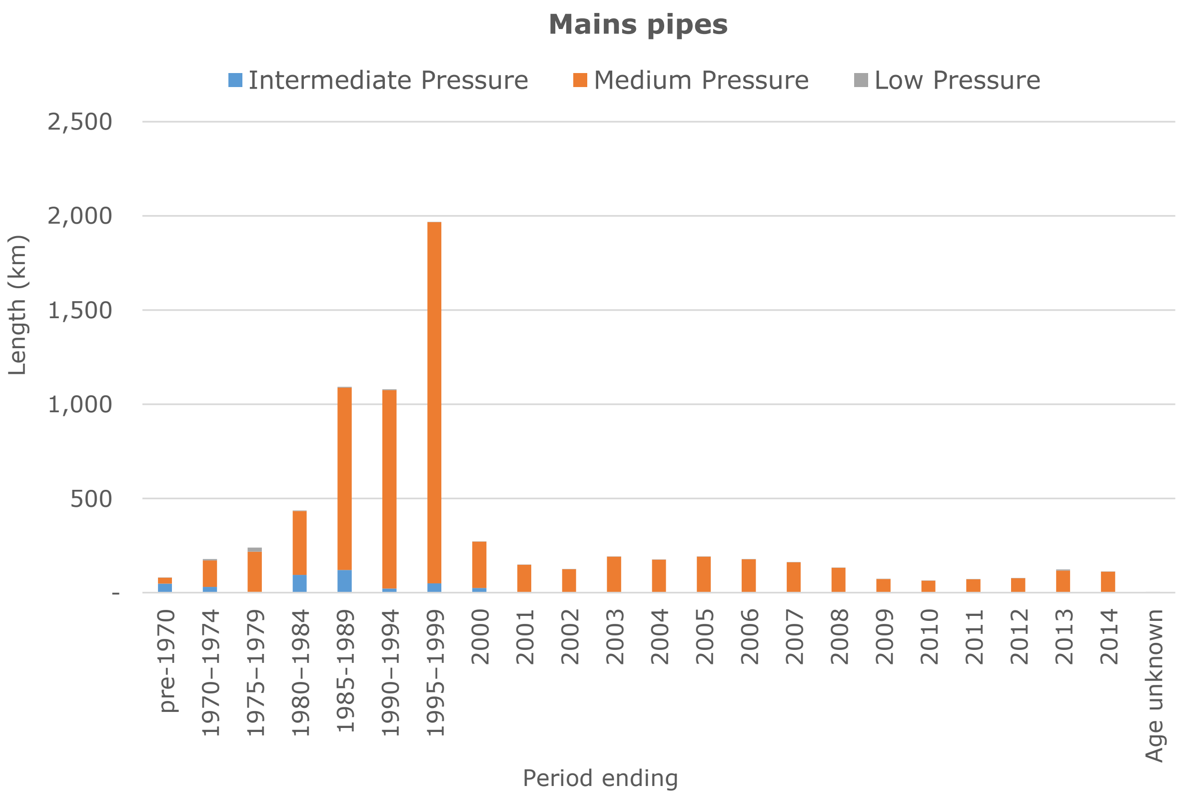

Figure 6-2 : Age profile of mains pipelines

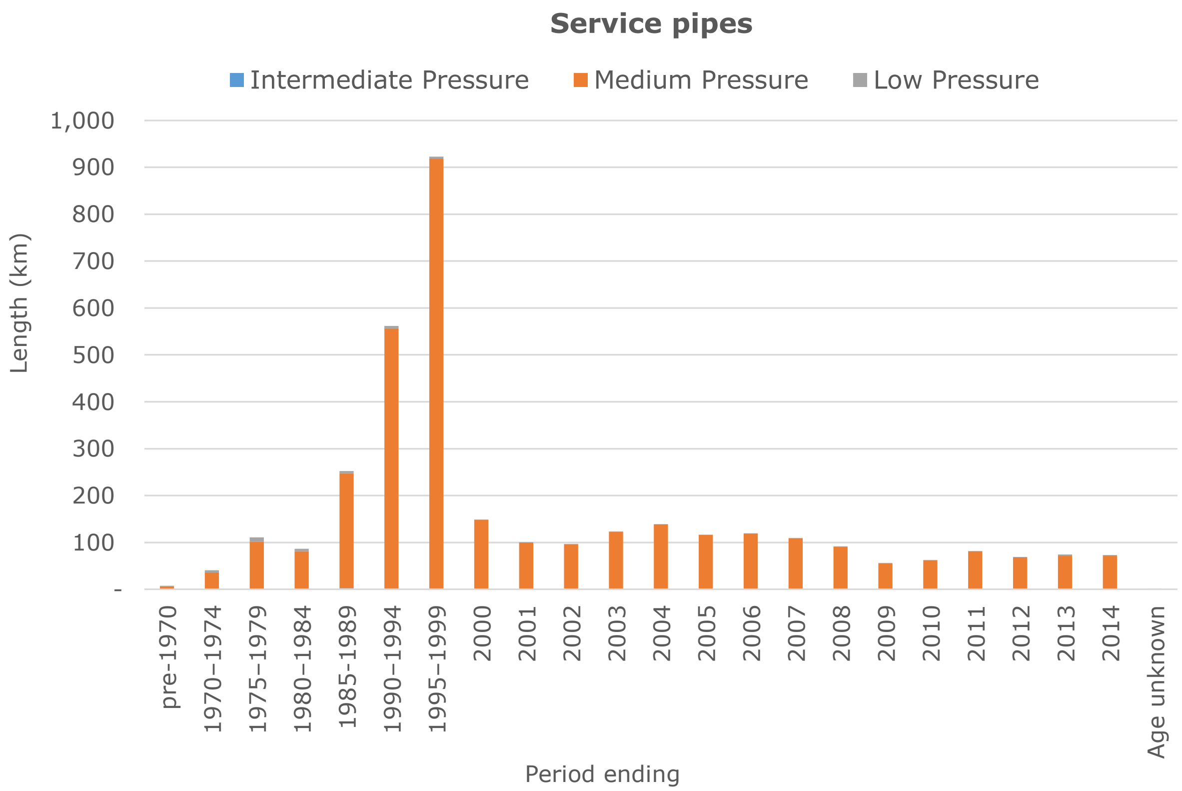

Figure 6-3 : Age profile of service pipelines

6.3.1.5 Condition, Performance and Risks - Steel Pipes

Condition of Assets

The majority of underground steel pipeline systems in use on both the Auckland and North Island networks are protected from corrosion by means of pipe coatings and the application of cathodic protection (CP) systems (refer below for non-protected steel pipelines). The average age of these pipelines is approximately 32 years. The standard life for steel pipelines (as used for ODV valuation purposes) is 60 years for MP pipelines and 70 years for IP pipelines. With the exception of the remaining MP4 steel pipelines without corrosion protection in Hamilton, the overall condition of the pipelines is good and no programmed replacement of these pipelines is envisaged within the standard life of the asset.

Performance of Assets

With the exception of the remaining MP4 steel pipelines without corrosion protection in Hamilton, the replacement of underground steel pipelines is expected to continue to be of a corrective nature, targeting specific locations and addressing localized issues rather than a large scale replacement programme.

Risks

North Harbour Pipeline Operated in Accordance with NZS 5223

The North Harbour Pipeline is managed and maintained as a HP pipeline in accordance with the requirements of the Health and Safety in Employment Regulations (Pipelines) Regulations 1999. These regulations require HP pipelines to be designed, constructed, operated and maintained in accordance with AS 2885, or NZS 5223 or ASME B31. When the pipeline was commissioned in the late 1990s NZS 5223 was adopted as the standard to which the pipeline would be certified, and the pipeline has been operated (and certified) in accordance with NZS 5223 ever since.

In the interim period AS 2885 has undergone major reviews and updates and is now considered by the wider gas industry to be best practice. By contrast NZS 5223 has had no changes made to it and there are no plans within the industry to review or update this standard in the future. Vector therefore initiated a review of the pipeline's design, construction and operation standards in the 2013/14 FY with a view to adopt AS 2885 as the standard to which this pipeline will be operated and certified to. It is anticipated that the adoption of AS 2885 will be completed prior to the expiry of the current certificate of fitness in 2018.

Pigging of North Harbour Pipeline

AS 2885 requires the pigging of pipelines to be considered along with other threat mitigation measures as part of its pipeline integrity management requirements. Pigs can be used to clean or dewater the pipeline, and inspection pigs can be used to provide information on the condition of the pipeline and the extent and location of any problem. As the North Harbour Pipeline has never been pigged since it was commissioned in the late 1990s, a risk assessment was carried out during the 2013/14 FY to determine if a pigging programme should be implemented. The review determined that the pipeline was not piggable due to risks associated with non-barred tees (e.g. the Helensville offtake) and changes to the pipe wall thickness due to a heavier grade pipe being used at waterway crossings and at pipe bends.

Steel Systems without Cathodic Protection

NZS 5258 and AS/NZS 4645 stipulate that steel pipelines shall be provided with CP and pipeline coatings. Whilst the majority of the steel pipelines have adequate CP, there are some sections of pipeline within the North Island network which need upgrading and this is underway:

- The Hamilton MP4 gas distribution system includes approximately 10 km of unprotected mains steel pipeline located within various small standalone steel systems.

  The majority of the Hamilton MP4 steel system was laid in the 1970s. Historical records indicate that this system originally had working CP systems, however regular CP monitoring ceased in the late 1980s. To assess the viability of restoring working CP on the MP4 steel system, a pilot project was initiated for the Melville area of the Hamilton MP4 pressure system. The project commenced in August 2010 and was completed in May 2012 at which time CP protection had been restored to the system. Based on the success of the Melville project, a 4 year programme (2011/12 FY to 2014/15 FY periods) to complete the upgrade of the remaining Hamilton MP4 steel CP system is being implemented; The restoration of CP to the various small standalone steel systems is the final project in the mains upgrade programme and is scheduled for completion during the 2014/15 FY.

- Following the completion of the initial stages of the Hamilton MP4 CP system upgrade programme, a problem with the electrical continuity of some steel service connections within the upgraded areas was identified. Subsequent investigations have confirmed that not all MP4 steel service lines within the upgraded areas are electrically connected to the steel mains that they are supplied from and therefore have limited or no CP. The investigations also confirmed that the cause of the electrical discontinuity is the presence of mechanical connections (e.g. gibault joints etc.) on the pipelines. The use of this type of joint (i.e. instead of welded connections) was prevalent on the Hamilton network in the 1970s when the majority of these pipelines were installed, but the practice has long since been discontinued.

A project to restore CP to steel services connected to the Melville MP4 steel network was issued for completion during the 2013/14 FY. As this project progressed it became apparent that in most instances the replacement of the entire service (i.e. in PE) was the only practical option to eliminate the CP issues on a particular steel service; This was primarily due to the difficulty in pinpointing the exact location/s of the cause of the electrical discontinuity on the steel service. Based on this experience, it is anticipated that a relatively high proportion of the services identified as having limited or no CP will require complete replacement. A 3 year programme (2014/15 FY to 2016/17 FY periods) to restore CP to the remainder of the Hamilton MP4 steel service pipes has been initiated.

- The remaining sections of the Hamilton LP gas distribution system include approximately 6 km of unprotected mains steel pipeline. These pipelines were installed (as part of a larger MP1 and LP steel pipeline system) in the late 1960s through to the late 1970s, and have never had CP systems installed on them. The commissioning of these pipelines without CP is attributable to the fact that the installation of CP systems was not mandatory under the industry codes (e.g. B31.8-1968) that were in place at that time.

  Previous analysis of Hamilton PRE data indicates that the PREs associated with the LP and MP1 steel mains was predominantly due to pipe corrosion or repair clamps or gibault fittings that were installed as part of previous repairs. (Note that the legacy practice of using repair clamps or gibault fittings for permanent repairs has now been curtailed. Modern techniques such as electrofusion jointing have been adopted). Because of these pipeline integrity issues, the retrofitting of a working CP system was not considered to be a cost effective or practical option.

  In 2011 Vector carried out a review of a range of options to identify any alternative strategies which may be applicable to addressing risks associated with the steel LP and MP1 networks. The review concluded a pipeline replacement option provided the best outcomes, and a 3-year pipeline replacement programme (2011/12 FY to 2014/15 FY) was subsequently approved. The programme is in the final stages of being completed. Table 6-4 below shows the individual LP and MP1 steel pipeline replacement projects that make up the complete 3 year programme.

Steel Replacement Project	FY Period
Hamilton West LP	Completed
Hamilton East LP	Completed
Frankton LP	Completed
Hamilton MP1 South	Completed
Fairfield LP South	Completed
Hamilton MP1 North	Completed
Hamilton MP1 Central	Completed
Fairfield LP North	Completed

Table 6-4 : Hamilton LP and MP1 steel pipeline replacement programme

In order to mitigate the risks associated with unprotected steel pipelines, Vector's leakage survey standard GNS-0019 requires all remaining sections of the Hamilton LP steel pipeline system to be surveyed on a 3 monthly cycle, and any other section of unprotected steel pipeline to be surveyed on an annual cycle. Any escapes of gas detected by the survey are repaired on an as required basis.

Mechanical coupling joints on Hamilton MP4 steel network

As the Hamilton MP4 steel main CP upgrade programme has progressed, mechanical coupler joints (e.g. gibault joints) have been encountered on a regular basis on some parts of the network. It appears that when the steel network was originally constructed in the 1970s, mechanical coupler joints were sometimes used (in conjunction with conventional welded joints) to facilitate the fabrication and handling of the sections of pipe being installed.

Where couplers have been identified by the CP upgrade programme, electrical continuity bonds have been installed to ensure that the coupler does not limit the level of CP protection available to the sections of pipeline either side of the coupler. However continuity bonds were typically not used at the time the pipeline was originally constructed, and as a result a coupler joint may have inhibited the level of CP protection available to adjacent sections of pipeline (i.e. through poor electrical continuity) over the period since it was originally installed, and the condition of the pipeline could have deteriorated significantly.

Historical fault records and construction records are being researched to identify sections of steel pipeline that have a higher concentration of mechanical coupling joints. The replacement of these sections of pipeline will be prioritised based on PRE levels and the known condition of the pipeline. The replacement of a section of pipeline in Hamilton East has been programmed for the 2014/15 FY and other priority pipeline sections will be targeted over the 2015/16 FY and 2016/17 FY periods.

Small Diameter Steel Pipes

The Hamilton MP4 distribution system includes approximately 11 km of steel mains pipe with a nominal diameter of 25mm or less.

As conventional stoppling equipment is not available (either locally or internationally) for 25mm diameter pipe or less, the isolation of sections of small-diameter steel pipe can only be achieved via the use of isolation valves already installed on these pipelines, or by the operation of isolation valves (and/or the installation of stopples) on the larger diameter upstream pipelines.

The small-diameter steel mains pipeline in Hamilton is comprised of pipeline sections that range in length from a few metres, supplying a handful of customers, to several hundred metres in length, supplying 20 to 30 customers. As many of the small-diameter mains sections do not have isolation valves fitted, in the event that a section needed to be isolated it is likely the isolation could only be achieved by operating isolation valves on the larger diameter upstream system and/or carrying out a stopple operation on the upstream system.

This situation inevitably increases the risk of delays in isolating the supply in emergency situations, and could significantly increase the number of service connections affected by an outage. In order to mitigate the risk, a long-term pipeline replacement programme to replace all Hamilton MP4 small diameter steel mains with PE will be initiated in the 2015/16 FY.

Electrical hazards on metallic pipelines

The close proximity of high voltage power networks and buried pipelines can result in hazardous voltages on the pipeline. The primary mechanisms involved in the transfer of electrical energy to a buried pipeline include earth potential rise (EPR) and low frequency induction (LFI). AS/NZS 4853 (Electrical hazards on metallic pipelines) requires pipeline owners/operators to reduce the risk to personnel and equipment from identified electrical hazards (including lightning) to an acceptable or tolerable level. AS/NZS 4853 also requires the electrical hazards and their controls be documented in an electrical hazard management plan (EHMP).

AS/NZS 4853 requires the assessment of electrical hazards and associated risks to be carried out over two levels - i.e. Level 1 is a conservative assessment and determines if an electrical hazard exists and, if so, whether the risk level is negligible; Level 2/3 is a detailed risk assessment of locations that are not accepted as low risk by the Level 1 assessment. Because of the nature of the analysis required, it is typically carried out by external consultants who are specialists in this field.

Vector is currently in the process of developing an EHMP for its gas distribution network. It is expected that an interim EHMP (including prioritisation and detailed electrical hazard studies on at-risk sections, and standard mitigation designs) will be ready by the end of the 2014/15 FY period, and the final EHMP implemented by the end of the 2016/17 FY period.

6.3.1.6 Condition, Performance and Risks - PE pipes

Condition of Assets

The average age of PE mains pipelines on the Auckland network is approximately 16 years, and for the North Island network the average age is approximately 21 years. The standard life (as used for ODV valuation purposes) for pre-1985 PE is 40 years and the standard life for modern PE is 60 years.

Although issues have been identified with pre-1985 PE systems (refer below), the majority of the total PE mains systems are comprised of modern PE (i.e. 98% of the Auckland network PE, and 86% of North Island network PE). The overall condition of the modern-PE pipelines is good and no programmed replacement of these pipelines is envisaged within the standard life of the assets.

Performance of Assets

PE pipelines have been in use on both the Auckland and North Island networks since the 1970s. Early PE systems (i.e. pre-1985) exhibited premature brittle-like issues (refer below for issues relating to pre-1985 PE), but modern PE has been found to be very durable. Isolated problems have been found with PE butt joints (refer below) used on earlier PE systems and some larger diameter modern PE systems.

Risks

Pre-1985 PE

The Auckland network includes approximately 81 km of pre-1985 PE mains of which 37 km (46%) operates at MP4, 29 km (35%) at MP2 and the balance at MP1 and LP. The North Island network includes approximately 420 km of pre-1985 PE mains of which 374 km (89%) operates at MP4 and the balance at LP and MP1.

PE pipe manufactured up to the mid-1980s is known to be susceptible to premature brittle-like issues due to the resin type that was in use at the time of manufacture. The issues occur as a result of stress intensification brought on by the PE pipe being exposed to excessive shear and/or bending forces while in service.

Vector's risk mitigation controls include a targeted leakage survey strategy, the monitoring and regular analysis of faults related to pre-1985 PE pipelines, and targeted pipeline replacement based on the results of the analysis.

This strategy is in line with the recommendations of a report published by the US National Transportation Safety Board in 1998 titled 'Brittle-like cracking in plastic pipe for gas service[3]. The report is recognised internationally and concluded that much of the plastic pipe manufactured and used for gas service from the 1960s through to the early 1980s

[3] http://www3.ntsb.gov/publictn/1998/SIR9801.pdf

may have been susceptible to premature brittle-like incidents when subjected to stress intensification. One of the key recommendations made in the report was for gas operators to closely monitor the performance of older plastic piping and to identify and replace in a timely manner any of the piping that indicates poor performance. In the USA the risks associated with pre-85 PE failure have been covered off by a 2009 amendment to the US Federal Pipeline Safety Regulations which requires all US gas distribution pipeline operators to develop and implement integrity management programmes.

The most recent analysis of faults relating to pre-1985 PE pipelines was completed in early 2014 and covered the July 2011 to June 2013 period. It identified a marked increase in the rate of squeeze-off failures (i.e. fractures at the point of previous squeeze-off locations) when compared to the results of a previous review covering the September 2009 to June 2011 period. These results indicate that a more proactive strategy is now appropriate. Whilst the review has confirmed that there has been a marked increase in the level of pre-1985 PE failure, it does not suggest that a full-scale replacement programme for all pre-1985 PE pipelines is required at this time. An ongoing programme to target the replacement of higher risk (i.e. based on operating pressure, failure consequence etc.) sections of the pre-1985 PE system was initiated in the 2014/15 FY.

Another avenue being explored to reduce the risks associated with pre-1985 PE pipeline is to identify any section of pre-1985 pipeline that has been duplicated with a more recent type of pipe. As these sections are identified, the viability of decommissioning the pre-1985 PE pipeline and transferring any service connections to the adjacent pipeline will be assessed. This strategy will also be augmented by the adoption of other risk mitigating measures - e.g. the avoidance of applying squeeze-offs on pre-1985 PE pipes where possible, and the use of pipe reinforcement fittings at pre-1985 PE squeeze-off locations. The performance of these pipelines will continue to be closely monitored.

Butt Fusion Joints

Butt fusion jointing of PE pipes was the standard method of jointing PE pipe when PE pipe was first introduced on the Auckland and North Island networks in the early 1970s. This jointing technique continued until the introduction of electrofusion (EF) jointing in the mid to late 1980s - although butt fusion jointing is still considered viable (using electronic controlled processes) for larger diameter pipes, due to the cost benefits it can provide.

Poor quality control and jointing techniques used in the early 1970s and 1980s has resulted in some butt fusion joint issues. This legacy issue has resulted in a higher risk for PE butt joints.

It is estimated that the Auckland distribution network includes approximately 37 km of MP4, 29 km of MP2 and 15 km of LP/MP1 older PE mains that utilise butt joints, and that the North Island network includes approximately 374 km of MP4 and 47 km of LP/MP1 older PE mains that utilise butt joints.

Vector’s risk mitigation controls include scheduled leakage survey. PE butt joints are currently replaced on an as required basis and no proactive replacement programme is anticipated unless there is a marked change in butt joint incidents.

6.3.1.7 Condition, Performance and Risks - Cast Iron Pipes

Condition

In 2010 a 4-year LP pipeline replacement programme to replace all remaining sections of the Auckland network LP pipelines was awarded to Electrix Ltd. This programme was successfully completed in the 2013/14 FY and with the exception of a small quantity of service pipes supplied from Vector’s street regulators, all Auckland network LP mains systems have now been upgraded to MP4 PE systems.

A small section (approximately 1.2 km) of MP1 cast iron remains in service within Vector's Auckland network. A pipeline replacement project to replace this section of cast iron is programmed for the 2015/16 FY.

There is no record of any cast iron mains in use on Vector's North Island network.

Performance

The remaining sections of cast iron pipeline form parts of two separate small MP1 systems within the Auckland network. Results of PRE analysis indicate that the PRE rate for these sections of cast iron pipeline is higher than the average rate of PRE for the entire Auckland network.

Risks

Cast iron pipelines are typically constructed from 3 metre sections of bell and spigot pipe joined via a caulked hemp and lead joint or other mechanical type joints. Although cast iron pipe possesses good resistance to corrosion, joints may fault over time as a result of the different physical characteristics of natural gas (i.e. drier) compared to the original coal gas that was in use when the pipes were first installed. Ground movement (due to subsidence, road works, effects of increased traffic volumes etc.) can also damage the joints and cause fractures in the pipe. The incidents can result in gas escapes, water ingress and poor pressure problems.

The condition of the remaining sections of Auckland network MP1 cast iron pipeline will continue to be monitored via periodic leakage survey and PRE analysis. The replacement of these pipelines will be programmed in accordance with the results of ongoing risk assessments.

6.3.1.8 Condition, Performance and Risks - Non-Standard Pipe Material

Condition of Assets

All network extensions or alterations are now constructed from approved steel or PE materials. However in the past (particularly before the introduction of natural gas) a range of other materials was used e.g. galvanised steel, asbestos, spiral welded steel etc. Although the presence of these (or similar) materials on the older parts of the Auckland and North Island networks have not been encountered, there remains a small chance some small quantities remain in operation. Vector will continue to record and improve its asset data information for non-standard pipe materials at the time when new connections or on-site inspections are undertaken.

Performance of Assets

Non-standard material types are not compatible with modern materials, and this has construction implications for pipeline alterations or repair. They also present possible H&S risks due to the integrity of the material.

Risks

Nylon

In the early 1980's nylon pipes were installed in several parts of the Auckland distribution network. These systems quickly became obsolete due to the introduction of polyethylene pipe in the mid 1980's. Fittings compatible with the nylon systems can no longer be purchased thereby necessitating the use of water fittings to affect repairs. In most cases these fittings are modified to accommodate the existing nylon and PE pipes. In addition, nylon pipes are brittle and cannot be squeezed off in case of an emergency.

GIS records indicate that the Auckland network now includes only a small remaining quantity (140m) of nylon mains pipe, which operates at MP4 (there is no nylon pipe in the North Island network). GIS records also indicate that there is approximately 3 km of nylon service pipe currently in use for approximately 200 service connections. The nylon service pipes operate at MP4 and are located throughout the suburbs of Ponsonby, St Marys Bay and Parnell and adjacent suburbs, with some located on the North Shore and Epsom and surrounding suburbs.

Vector monitors the performance of nylon pipe through regular analysis of fault data. At-risk sections are prioritised for replacement based on an assessment of the risks associated with the pipeline section.

The level of risk presented by the remaining nylon pipe is considered low. Analysis of fault data has not identified a higher incidence of faults for nylon pipes when compared to PE systems.

Currently no systematic pipeline replacement projects are planned for nylon pipes, and replacement will be carried out on an as required basis.

Stainless Steel

During a period of high growth in late 1995 through to early 1997 almost 15,000 new service connections were installed on the Auckland distribution network. This high volume of work, coupled with limited available resources, resulted in an increase in the number of non-compliant service installations.

A subsequent audit of the services installed during this period identified several problems, and in particular the use of stainless steel pipe in non-compliant situations. As a result of the audit, all identified non-compliant installations were either replaced or made compliant, and the Auckland leakage survey programme was modified to require all stainless steel service pipes to be surveyed annually.

In the intervening period regular reviews of PRE data have been carried out and have confirmed that there is no significant difference in the PRE rates of the remaining stainless steel service pipes and the PRE rates of other service types. The leakage survey frequency for stainless steel service pipes was therefore extended to align it with the standard survey frequency - i.e. 5 yearly.

The use of stainless steel service pipes is typically confined to commercial and high-rise building installations, where the use of underground service pipes is not practicable. Currently there are approximately 230 stainless steel service connections in use on the Auckland distribution system, and less than 30 in use on the North Island network.

PRE rates for stainless steel service pipes will continue to be monitored on a regular basis to assess whether additional measures are required to mitigate the risks associated with these types of service pipe.

Third Party Strikes

Third party incidents account for a substantial proportion of the total number of reported gas escapes that occur on Vector's Auckland and North Island networks – in the 2013/14 FY period, third party incidents accounted for approximately 43% of total recorded gas escapes.

Vector has ongoing public safety awareness communications programmes on gas, which are designed to increase public and contractor awareness and reduce the number of third party incidents. These include:

- Promoting safe work practices to external contractors whose work brings them in close proximity to Vector's networks i.e. council and water service contractors; and
- Vector is a founding member of the beforeudig service (www.beforeudig.co.nz) which allows contactors to obtain plans from Vector and a number of other asset owners simply by making a single enquiry.

These programmes are further complemented by programmes operated by Vector’s service provider (Electrix) which include:

- A close approach consent system to authorise and control all proposed excavation works within a restriction zone adjacent to pipelines operating at pressures of 700 kPa or greater and all strategic MP and LP pipelines;
- Provision of advice on good work practices and an outline of the hazards to be aware of at the time of issuing a consent;
- Standover works in the vicinity of North Harbour Pipeline assets; and
- Carrying out targeted company visits to take employees through a gas safety presentation.

In order to mitigate the risk of third party damage to critical pipeline assets, pipelines have been classified as “strategic” where the consequence of a third party strike event is considered to be serious or the likelihood of such an event is considered to be high. This classification allows Vector’s service provider to review beforeudig service plan-requests that effect strategic pipelines and determine if a close approach permit or on-site supervision will be required.

An analysis of third party incidents over the 2012/13 FY to 2013/14 FY period indicates that there has been a material increase in the number of third party strikes over the period. However the analysis also indicates that there has been a significant increase in the number of b4udig requests over the same period, and when the count of third party incidents is normalised against the number of b4udig requests the data shows a slight decline in the normalised number of third party incidents.

For the 2012/13 FY to 2013/14 FY period approximately 70% of third party incidents were related to service pipes. This coincides with the type of works being undertaken around the regions, in particular water and ultra-fast broadband (UFB) upgrades.

Various network-protection improvement initiatives to reduce the number of third party damage incidents are being considered. Key potential initiatives include:

- Reviewing the use of signage and markers - e.g. increased use of kerb markers to identify road crossings, tee junctions etc.; increased use of buried electronic marker systems - e.g. ball markers and rope markers etc.; and adoption of copper-coated steel tracer wire (less prone to failure than standard copper tracer wire).
- Expanding network patrolling to target strategic and higher risk networks.
- Modifying Vector's construction standards to require all new 10mm PE service pipes to be installed within a 25mm PE sleeve; the heavier wall thickness of the 25mm PE sleeve is more resistant to damage from hand excavation activities.
- Increased interaction between Vector and other utility operators and their contractors to discuss hazards and work methodologies; and a review of the information currently made available for education and compliance purposes.

Further details of Vector’s health and safety practices, as they relate to Vector’s asset base and asset management, can be found in Section 8 of the AMP.

Shallow pipes

A project to restore the required depth of cover to a 1.2 km section of shallow IP10 pipeline in Tuhikaramea Road in Hamilton was successfully completed during the 2013/14 FY.

Currently there are no known issues relating to shallow pipe, however where shallow pipes are identified Vector evaluates and applies one or more of the following risk mitigation options:

- Increasing the depth of cover by placing additional soil etc. over the pipe;
- Installing additional signage along the pipeline routes;

- Periodic notifications to affected landowners;
- Installation of protective barriers/slabbing;
- Lowering of the pipe along its existing alignment; and
- Relaying the pipe in a new alignment.

Vector will continue to record and improve its asset data information for potential legacy shallow pipelines at the time when new connections or on-site inspections are undertaken.

Pipes Under Buildings

Vector's pipeline design standards prohibit the installation or operation of mains or IP service pipes under buildings. Where the installation of LP or MP service pipe under a building cannot be avoided, special measures (e.g. gas tight conduits) must be employed to mitigate the risk.

Periodically, mains or service pipes located under building are identified. These situations typically result from the property owner not being aware of the existence of the pipeline, or its actual location when undertaking building work.

When these situations are identified, negotiations with the property owner are undertaken to relocate the pipeline. Vector will continue to record and improve its asset data information for potential pipes under buildings at the time when on-site inspections are undertaken.

Mains on Private Land

Gas mains located within private properties are exposed to a higher than normal risk of damage as well as a higher risk of being built over. Pipelines located on private property are typically protected by an easement, or if installed prior to 1992, by the pre-existing rights provisions of the Gas Act 1992.

Incidents of buildings being erected over gas mains (which require the relocation of the main) do occur occasionally, and although incidents of damage to gas mains on private property are rare, there have been some near misses. These risks are typically brought about by the property owner or occupier not being aware of the existence of the gas main, its actual location or their obligations under the provisions of the property easement or the Gas Act 1992.

Vector’s risk mitigations include the development of an easement strategy for mains located in private land, and the development of a property occupier notification scheme. The easement strategy and property occupier notification scheme is expected to be finalised and implemented during the 2014/15 FY.

Inactive Service Pipes

Vector has recently reviewed and amended its standard for decommissioning of facilities (GNS-0022) to require all service pipes that have been inactive for a period of 5 years to be physically disconnected where the cost to maintain the service pipe is disproportionate to the cost of disconnecting it or where a risk assessment indicates that the service should be disconnected.

Vector is also reviewing and amending its patrolling standard (GNS-0021) to include a periodic inspection to assess the condition of inactive service pipes and/or risers and assess the risk of damage from property owners or third parties. Where pipeline damage or the risk of damage is identified appropriate corrective action would be initiated as required. The periodic inspection strategy is expected to be finalised and implemented by the end of the 2014/15.

These measures are being implemented to meet the formal safety assessment requirements of AS/NZS4645 which requires risk assessment of threats to be undertaken and where necessary controls established to reduce risks to an acceptable level.

There are approximately 2000 ICP connections on the Auckland network that have been inactive for at least 5 years. The total number of inactive ICP connections (that have been inactive for at least 5 years) on the North Island network is currently unknown due to difficulties accessing historical billing data, however it is expected to be a similar quantity.

GIS Pipeline Data

Following the completion of a project to align the SAP PM models for the Auckland and North Island networks, asset data for both networks is now held jointly within the GIS and SAP PM systems. Historically GIS has been the repository of asset information as well as spatial information, however SAP PM is now being developed as the master technical asset register and GIS will hold a minimum set of attribute data only. A review of the data being held between the GIS and SAP PM systems has been carried out to identify addition asset information that should be held within SAP PM; It is expected that a data capture programme for the capture of additional SAP PM classification and characteristic data will commence during the 2014/15 FY.

Tsunami risk

Various regional councils (e.g. Auckland Council, Northland Regional Council, Bay of Plenty Regional Council) have contracted the National Institute of Water and Atmospheric Research (NIWA) to undertake studies on the risk of tsunami-inundation that face their respective communities. Vector has access to the results of these studies through its participation in the Engineering Lifelines Groups that operate in those areas.

The tsunami studies look at tsunami threats from remote sources (e.g. South American origin) and local/regional sources (i.e. Tonga-Kermadec and Southern New Hebrides tectonic faults). The studies show that tsunami threats from remote sources have a return period of 50-100 years and represent the most probable tsunami risk, while tsunami threats from local/regional sources have a return period 500-2000 years but represent the most devastating tsunami hazard for New Zealand. The studies also show that the tsunami hazard is considerably higher for the east coast of New Zealand than that posed to the west coast.

The largest impact on the Auckland region’s east coast is on Great Barrier Island. Omaha, Orewa and surrounding areas also have a high risk of inundation over significant areas. Further into the Hauraki Gulf, this risk lessens as the areas are sheltered by outlying islands. In most other areas, the inundation is confined to narrow coastal strips. There are relatively few gas distribution assets located within the inundation areas, and there are no critical above-ground assets at risk.

The largest impact on the Northland region occurs predominantly on the east coast with particularly significant impacts at Bland Bay, Helena Bay, Tauranga Bay, Taupo Bay, Te Ngaire and Hihi. Gas distribution assets located within the inundation areas are confined to the Whangarei and Marsden Point areas. The effected distribution assets comprise distribution pipelines and three DRS sites. Although gas distribution pipelines are buried, their condition could be compromised due to the removal of surface cover and undermining etc. Some of the effected distribution pipelines are attached to bridge-crossings and the condition of these pipelines could be compromised due to damage to the bridge structure. Further analysis to determine appropriate mitigation measures has still to be completed.

The largest impact on the Bay of Plenty region occurs on the open coast areas from Waihi Beach in the west to Opotiki in the east. These areas have a high risk of inundation. Vector has gas distribution assets located within these inundation areas (particularly in the Mt Maunganui and Papamoa areas and the Whakatane and Opotiki areas) and will undertake further analysis to identify the specific assets at risk and determine appropriate risk mitigation measures.

A tsunami risk also exists for Vector’s Gisborne network, and analysis will be undertaken to assess the level of risk and determine appropriate mitigation measures.

Volcanic risk

Any volcanic activity would likely have a devastating effect on the gas distribution network. Evidence from overseas volcanic activity provides clear examples of the magnitude and impact of such activity. Further studies are planned to assess this risk and determine any mitigation measures to protect against such events.

6.3.1.9 Maintenance Programme

Preventive maintenance cycles for mains and service pipelines have been determined based on regulatory and industry code requirements, risk management principles and good industry practice. Preventive maintenance of mains and service pipelines is carried out in accordance with the periodic cycles stipulated in the technical standards listed in Table 6-5.

Technical Standard	Periodic Maintenance Activities
GNS-0014 Maintenance of above ground corrosion protection systems	• Annual inspections of all above ground steel pipework
GNS-0015 Maintenance of below ground corrosion protection systems	• 2 Monthly inspection of impressed current transformer-rectifier installations to record output current and voltage • 2 monthly inspection of drainage bonds to check their satisfactory operation • 3 monthly, 6 monthly and annual inspections of CP test points to measure on and instant-off pipe to soil potentials in major urban, urban and rural areas respectively • 3 monthly and 6 monthly inspections of CP test points to measure "On" pipe to soil potentials in rural and urban areas respectively • 3 monthly, 6 monthly and annual inspections of galvanic anodes to check their satisfactory operation in major urban, urban and rural areas respectively • 3 monthly, 6 monthly and annual inspections of isolation between buried or submerged pipelines and other underground metallic structure (including associated protective casings) in major urban, urban and rural areas respectively
GNS-0019 Leakage survey	• 3 monthly leakage survey of Hamilton LP steel systems[4] • Annual leakage survey of distribution systems adjacent to public buildings, hospitals and schools; All distribution systems in designated central business districts; Identified higher risk areas (e.g. Auckland International Airport, Auckland Harbour Bridge); All steel pipelines without operating cathodic protection systems • 2 yearly leakage survey of all service pipes located inside or under buildings; Distribution mains systems comprised predominantly of pre-1985 PE • 4 yearly leakage survey of all other pipes located under hard-paved surfaces in close proximity to buildings; Shallow IP mains • 5 yearly leakage survey of all remaining portions of the distribution system, including services

[4] Ibid footnote 1.

Technical Standard	Periodic Maintenance Activities
GNS-0020 Odourisation system maintenance	• Monthly odorant checks at all gate stations • 3 Monthly odorant checks at ICP risers at key system extremity points and designated DRS
GNS-0021 Patrolling	• 3 monthly inspection of all above ground pipework, vent pipes and ducted crossings • Annual inspection of service pipes located inside or under buildings
Ground Temperature Checks (Rotorua and Taupo)	• Monthly monitoring of ground temperature at key reference sites

Table 6-5 : Maintenance standards for mains and service pipes

Preventive maintenance activities on mains and service pipelines may identify the need for corrective maintenance work including the repair of pipeline mounts, brackets, corrosion, pipeline coating repairs, and civil works (excavation and backfilling) associated with undertaking this work.

6.3.1.10 Replacement Programme

The sections below provide a description of the projects or expenditure planned for the relevant budget nodes for the forecast period.

ARP4 – MP1 Cast Iron Replacement (Auckland)

See discussion in Section 6.3.1.7. The Auckland MP1 network includes approximately 1.2 km of mains cast iron pipeline. The PRE rate for these sections of pipeline is higher than the average rate of PRE for the entire Auckland network; A pipeline replacement project to replace the cast iron sections of the Auckland MP1 cast iron network is programmed for the 2015/16 FY.

ARP4 – Pre-1985 PE Replacement (Auckland and North Island)

See discussion in Section 6.3.1.6. The Auckland network includes approximately 81 km of pre-1985 PE mains pipeline, and the North Island network includes approximately 420 km of pre-1985 PE mains pipeline. Vector is implementing an ongoing programme to target the replacement of higher risk (i.e. based on operating pressure, failure consequence etc.) sections of the pre-1985 PE system.

ARP4 – LP Unprotected Steel Replacement (Hamilton)

See discussion in Section 6.3.1.5. The remaining Hamilton LP gas distribution systems each include approximately 6 km of unprotected mains steel pipeline. Vector has completed a three year pipeline replacement programme (2012/13 FY to 2014/15 FY) to replace all LP unprotected steel pipelines in Hamilton.

ARP4 – MP4 Steel Replacement Due to Mechanical Coupling Joints (Hamilton)

See discussion in Section 6.3.1.5. Legacy mechanical coupling joints on the Hamilton MP4 networks may have inhibited the level of CP protection available to adjacent sections of pipeline and the condition of the pipeline could have deteriorated significantly. The replacement of a section of pipeline in Hamilton East has been programmed for the 2014/15 FY and other priority pipeline sections will be targeted over the 2015/16 FY and 2016/17 FY periods.

ARP4 – Replacement of Small Diameter Steel Mains (Hamilton)

The Hamilton distribution system includes approximately 11 km of MP4, MP1 and LP steel mains pipe with a nominal diameter of 25 mm or less which is difficult to sectionalise in the event of an emergency where supply needs to be isolated. Vector is implementing a long-term pipeline replacement programme to replace all Hamilton MP4 small diameter steel mains with PE.

ASC1 – Unspecified

Periodically sections of mains and service pipeline will be identified that need to be replaced (on an as required basis) due to safety or compliance issues. Examples include pipes located under buildings, or pipes of non-compliant material specification. The expenditure forecast for this item is based on historical expenditure.

6.3.2 Special Crossings

6.3.2.1 Functional Description

Special crossings are locations where a section of pipeline is installed aboveground in order to cross over a roadway, river or railway etc. The aboveground crossing enables the gas distribution pipeline route to negotiate obstacles in the form of a roadway, river or railway etc where a belowground crossing is not practical.

6.3.2.2 Physical Description

There are a total of approximately 160 special crossings located on the Auckland and North Island networks.

Special crossings are typically attached to road or rail bridge structures, although in a few cases special crossings are attached to dedicated pipe bridge structures. Special crossings are typically comprised of either PE or steel carrier pipe. Where the carrier pipe is PE it is encased in a steel or PVC duct in order to provide physical and ultraviolet protection to the carrier pipe. The duct is typically attached to the bridge structure by means of galvanised steel fittings. Where the carrier pipe is steel it is typically either painted or wrapped (to provide corrosion protection) and attached directly to the bridge structure by means of galvanised steel fittings and rollers.

6.3.2.3 Age Profiles

The age profile of special crossings (Auckland and North Island networks combined) is given in Figure 6-4.

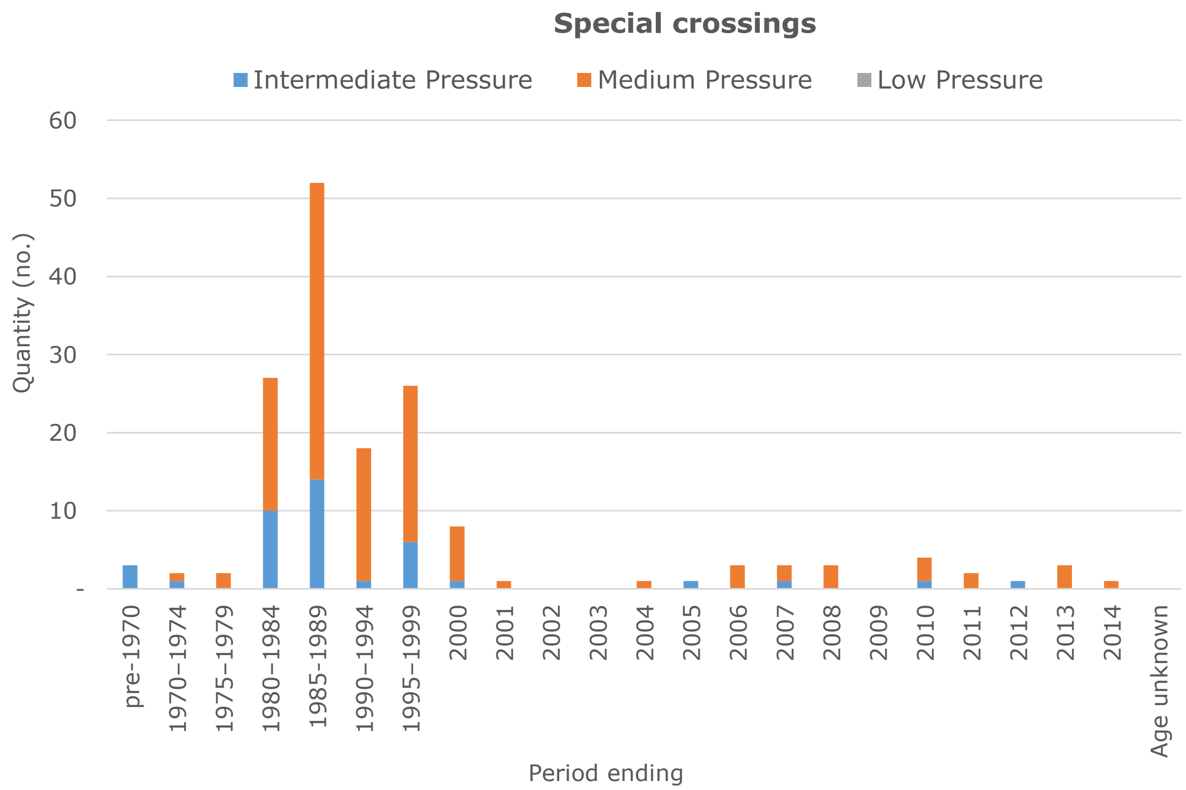

Figure 6-4 : Age profile of special crossings

6.3.2.4 Condition of Assets

Detailed condition assessments have been completed for the majority of the special crossings on the North Island network and indicate that approximately 60% of special crossings on the North Island network are in good or reasonable condition. The remainder of the North Island special crossing sites require various levels of upgrade work including corrective maintenance work to repair pipeline coatings and the ground to air interfaces etc; and replacement work to address corroded and/or poorly designed pipeline support brackets and damaged and/or loose bracket fixings etc.

Detailed condition assessments have been completed for all steel special-crossings on the Auckland network. These comprise approximately 60% of the total Auckland special crossings. The results of the assessments indicate that the majority of these crossings are in good or reasonable condition with a small number of sites requiring various levels of upgrade work to address corroded and/or poorly designed pipeline support brackets and damaged and/or loose bracket fixings etc. Detailed assessments of the balance of the special crossings (i.e. non-steel crossings) will be completed during the 2014/15 FY.

Ensuring adequate access to the special crossing to carry out maintenance inspections is an ongoing challenge at some special crossing sites. This can be due to the physical design of the bridge structure (e.g. the carrier pipe is encased within the structure), or the need to obtain approval (i.e. from the structure owner or operator) to gain access to the bridge structure.

6.3.2.5 Performance of Assets

Detailed condition assessments of special crossings on the North Island and Auckland network have identified the need for an increased level of upgrade work over the coming FY periods. Additional budget allowances have therefore been included in the capital and operating expenditure forecasts to cover a range of upgrade work including the replacement of damaged or loose bracket fixings and damaged or poorly designed pipeline support brackets, and corrective maintenance work to repair pipeline coating damage and ground to air interfaces etc.

6.3.2.6 Risks

Special crossings installed over waterways (particularly estuaries) and high-volume roads (e.g. motorways) are exposed to a harsh physical environment which can compromise the integrity of pipeline coatings and support brackets. Where above ground crossings are attached to bridges, additional risks are present due to the potential impact on the general public in the event of a pipeline incident or due to corrective maintenance activities. Targeted maintenance inspections are carried out to mitigate the risks associated with these crossings.

In 2012, Vector engaged a seismic specialist to undertake a review of critical gas distribution infrastructure to assess the selected assets for compliance with the seismic provisions of NZS1170. The review included four bridge crossings - two located in Auckland and one each in Hamilton and Whakatane. The subsequent report indicated that further engineering analysis of the two Auckland bridge crossings was required to determine the adequacy of the existing seismic design. It included recommendations to improve the seismic resilience of the two bridge crossings located in Hamilton and Whakatane.

A subsequent review of the seismic design of one of the Auckland bridge crossings found that the design was adequate and no further action was required; The engineering analysis recommended for the second Auckland bridge crossing will be completed during FY2015/16. Detailed designs to improve seismic resilience of the bridge crossings located in Hamilton and Whakatane have been completed. Upgrade work to improve seismic resilience of the Hamilton and Whakatane bridge crossings is expected to be completed during FY2015/16.

6.3.2.7 Maintenance Programme

Preventive maintenance cycles for special crossings have been determined based on industry code requirements, risk management principles and good industry practice. Depending on whether or not a special crossing includes a steel carrier pipe, preventive maintenance is carried out in accordance with the technical standards listed in Table 6-6 below:

Technical Standard	Periodic Maintenance Activities
GNS-0014 Maintenance of above ground corrosion protection systems	• Annual inspections of above ground steel pipework to check for pipeline coating deterioration or disbondment.
GNS-0021 Patrolling	• Three monthly inspections of special crossings to check the condition of pipework and equipment supports.

Table 6-6 : Maintenance Programme for Special Crossings

Preventive maintenance activities on special crossings may identify the need for corrective maintenance work including the repair of pipeline mounts, brackets, corrosion, pipeline coating repairs, and civil works (excavation and backfilling) associated with undertaking this work.

6.3.2.8 Replacement Programme

The following special-crossing projects are planned for the forecast period:

- Upgrade work is planned for FY2015/16 to address the recommendations made in the 2012 seismic review of critical gas distribution infrastructure (refer section 6.3.2.6 above).
- Upgrade work is planned for FY2015/16 to 2020/21 to address specific asset condition issues identified by the recent detailed condition assessments and includes the replacement of damaged or loose bracket fixings and damaged or poorly designed pipeline support brackets.
- Additional corrective maintenance work is planned for FY2015/16 to 2017/18 period to address specific asset condition issues identified by the recent detailed condition assessments and includes the repair of pipeline coating damage and ground to air interfaces etc.
- A small annual expenditure provision has been made to allow for the replacement of pipe brackets and supports as required due to integrity issues.

6.3.3 Telemetry

6.3.3.1 Functional Description

The telemetry systems used by Vector to monitor its gas distribution networks comprise the Telenet supervisory control and data acquisition (SCADA) system, and the Cello system. The Telenet SCADA system is currently deployed predominantly on the Auckland network, with four sites installed on the North Island network. The Cello system is deployed at permanent monitoring sites on both the Auckland and North Island networks.

Access to telemetry data (i.e. Telenet and Cello data) is provided via the PI archiving system.

The telemetry systems provide remote monitoring of critical inlet/outlet pressures, temperatures and flow rates, and corrected and uncorrected metering data. The telemetry monitors data at gate stations, DRSs, major gas customer sites, system extremity locations and provides remote control facilities for the operation of IP20 valves located at either end of the Auckland harbour bridge.

The following guidelines are used to determine what type of telemetry monitoring should be considered for DRS and system extremity point monitoring:

- Real time telemetry monitoring will be considered for all DRS that meet the following criteria:
  - The DRS is supplied from an MP7, IP10 or IP20 pressure system; and
  - The position of the DRS relative to the overall configuration of the pressure system provides a key pressure-monitoring location for that pressure system; and/or
  - The DRS has a peak throughput in excess of 500 scmh and/or it supplies 1000 ICPs or more;
- Real time telemetry will be considered for system extremity monitoring points where the ability to monitor real-time system pressure data during a contingency event is considered to be critical; and
- The use of the Cello monitoring will be considered for DRS sites and system extremity monitoring points where the availability of real time load flow and/or system pressure data is not considered to be critical, but where the availability of flow and/or pressure data is considered vital for planning purposes.

Both the Telenet and the Cello systems have the capability to provide additional functionality over what is currently available. Areas of expanded functionality will be investigated where a cost benefit analysis indicates that there are net benefits to be gained. Examples of areas where this functionality could be expanded include:

- Monitoring of a DRS slam-shut sensor (this is being evaluated at one site currently);
- Monitoring of unauthorized entry to DRS station;
- Detection of gas escapes at DRS stations; and
- Remote monitoring of CP sites.

A PI-based gas distribution monitoring system (GDMS) was implemented during the 2013/14 FY. The GDMS utilises PI telemetry data and allows alarm thresholds to be set for various conditions (e.g. high/low pressures) for each telemetry site. It provides a graphical interface to display data anomaly and alarm threshold breach alerts and allows real-time and/or historical data trends to be viewed. The GDMS also provides anomaly alert functions (i.e. via SMS text or email) for data anomalies (e.g. data gaps) and alarm threshold breaches (e.g. high/low pressures).

6.3.3.2 Physical Description

Telenet System

There are currently 68 Telenet field sites in operation on the Auckland network and 4 sites on the North Island network (two in Hamilton and one each in Tauranga and Mt Maunganui). The Telenet system was originally commissioned in the late 1990s. The original sites employed a Kingfisher configuration (see below) of which approximately 40 sites are still in use; The balance of the sites employ a GPRS configuration. Telenet installations provide pressure and flow monitoring at DRS and other locations on IP20, IP10, MP7, MP4 and MP2 pressure systems throughout the greater Auckland area, and on IP20, IP10 and MP4 pressure systems in Hamilton, Tauranga and Mt Maunganui.

The Telenet system incorporates two different telemetry configurations which utilise either Kingfisher or GPRS equipment.

Kingfisher System

This configuration utilises Kingfisher RTUs which are polled half-hourly by the Kingfisher master RTU (located at Vector's offices in Newmarket) using radio (via radio repeater stations) and dial-up communications. Data retrieved from the field RTUs is immediately passed from the master RTU to the Foxboro SCADA system and to the PI archiving system.

The system utilises three radio repeaters. Co-site agreements are in place for each of the sites which are located at:

- Sky Tower, Hobson St, Auckland;
- Titirangi Tennis & Squash Rackets Club, Titirangi; and
- Pukekohe Hill, Pukekohe Scenic reserve, Pukekohe.

GPRS Modem Configuration

This configuration utilises an electronic gas volume corrector/GPRS router configuration. The router is fitted with dual SIM cards enabling it to choose between the Vodafone and Spark GPRS mobile data network communication services depending on the level of service available at that site. Data is returned from the field sites every 5 minutes and is temporarily held in an I/O server (located at Vector's offices in Newmarket) from which it is immediately transferred to the PI archiving system.

Cello System

Permanent Cello installations currently provide pressure monitoring at approximately 60 DRS and other locations (e.g. system extremity locations) in the following geographic regions within the Auckland and North Island networks:

- Auckland

- Bay of Plenty
- Central Plateau
- Gisborne
- Kapiti
- Northland
- Waikato

The Cello system is comprised of GSM remote data loggers that use SMS messages for communication, and a receiving PC which has proprietary PMAC software and a GSM modem installed. The receiving PC is currently located at Vector's New Plymouth Bell Block office. The logger data from permanent Cello sites is uploaded from the PMAC database to the PI archiving system whenever a refresh of the PMAC data is detected.

The Cello is a self-contained (i.e. GSM modem and battery pack) and intrinsically safe unit that can monitor flow and pressure and initiate alarms and is used extensively in the UK. The units log data at a rate set by the operator (typically 15 minutes) and transmit the data at intervals also specified by the operator (typically daily). The rate of data transmission has an impact on battery life, and as a general rule a single pressure Cello unit logging data at a 15 minute interval and sending data on a daily basis (i.e. one SMS message) will yield a battery life of approximately 5 years.

In addition to the Cello units installed at permanent monitoring sites, an approximately further 50 units are used as portable data loggers for winter gauging or performance analysis purposes. The data from these units is accessed from the PMAC database - i.e. the data is not archived to the PI archiving system.

6.3.3.3 Age Profiles

The age profile of Telenet field-assets (Auckland and North Island networks combined) is given in Figure 6-5.

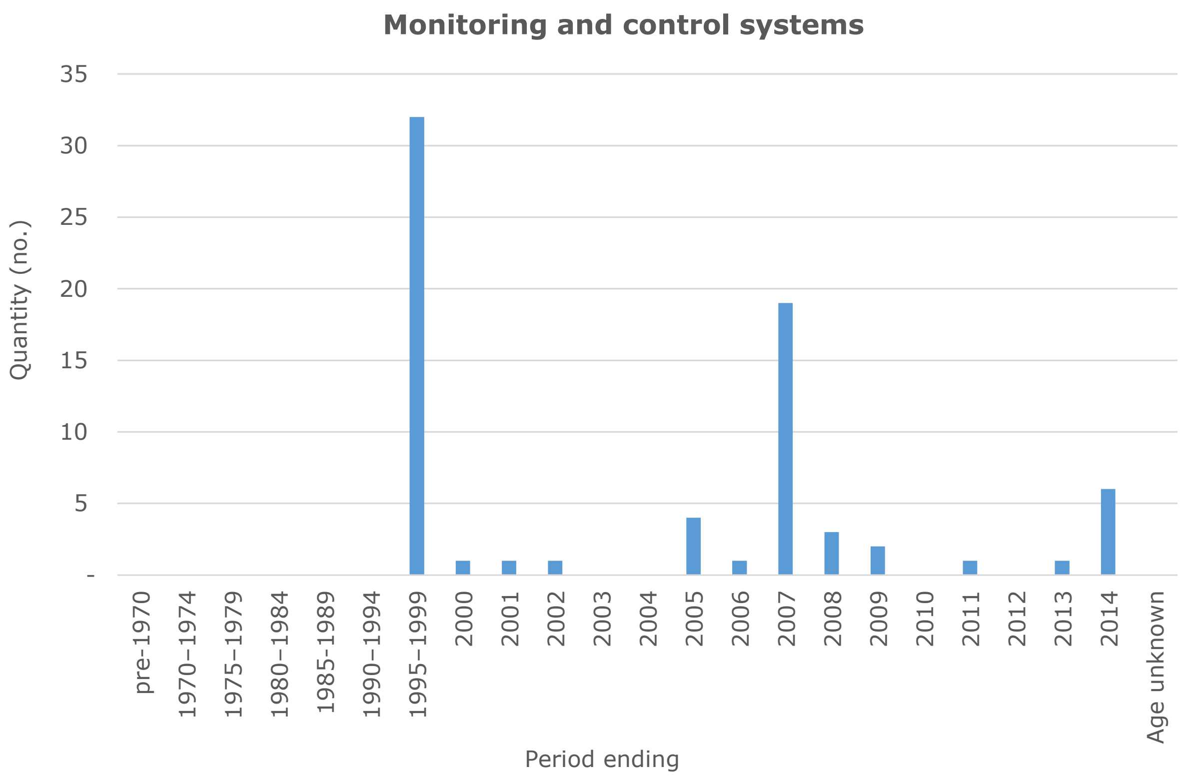

Figure 6-5 : Age profile of Telenet assets

6.3.3.4 Condition, Performance and Risks - Cello System

Condition of Assets

The average age of Cello units installed at permanent monitoring locations is approximately 2 years. The equipment is in good working order.

For ODV purposes, the standard life for telemetry equipment is 7 years.

Performance of Assets

The Cello system performs reliably and adequately.

Risks

A previous issue relating to restricted access to archived Cello data has now been resolved through the implementation of the GDMS. Currently there are no other significant risks associated with the Cello telemetry system.

6.3.3.5 Condition, Performance and Risks – Telenet System

Condition of Assets

Most of the telemetry equipment installed at Telenet Kingfisher sites was originally purchased and installed in the late 1990s. The average age of the field equipment is approximately 16 years and it is therefore at or near the end of its expected service life. Similarly the original powder coated RTU field cabinets are nearing the end of their service life.

The average age of the GPRS configuration telemetry field equipment is approximately 6 years and it is in good working order. Problems with corrosion of Mercury Mini-AT corrector casing have been encountered and these have been addressed through the corrector supplier.

Performance of Assets

The Kingfisher system performs well and reliably. It utilises thirty minute polling (compared to five minute polling for the GPRS configuration), which is at the upper end of the desired polling rate, however this is a limitation of the radio configuration.

The GPRS telemetry configuration provides five minute polling which has proved valuable in fault finding and contingency situations. Performance issues have developed with the I/O server that processes telemetry field data which has resulted in intermittent corruption of the telemetry field data (refer Risk section below).

Risks

RTU Cabinets

The original Telenet Kingfisher RTU cabinets are of a powder-coated-steel type and they are now starting to corrode due to their age and the physical environment in which they are located. Corroded cabinets are replaced (with stainless steel cabinets) as asset replacement projects, and the quantity replaced annually is expected to increase over time.

Aging Telemetry Equipment

The majority of the telemetry equipment (e.g. RTU and radio transceiver equipment etc) installed at the Telenet Kingfisher sites was originally purchased and installed in the late 1990s and is therefore at or near the end of its expected service life. Telemetry equipment is replaced as part of corrective maintenance, and the frequency of equipment faults is expected to increase over time.

Redundant Equipment at Customer Monitoring Sites

The original Telenet project initiated in 1998 included the installation of telemetry equipment at approximately 100 customer sites throughout the wider Auckland area in order to provide a time-of-use metering service to gas retailers. However, the service was never embraced by the retailers, and most of the sites became disconnected from the telemetry system over a period of time. A programme was initiated to decommission all remaining customer sites and remove any installed telemetry equipment in order to eliminate any associated health and safety risks (e.g. related to power supplies or antenna poles). All sites have now had all remaining telemetry equipment removed.

I/O Server Replacement

Performance issues have developed with the I/O server that processes telemetry field data (i.e. from GPRS-configuration Telenet sites). This has resulted in intermittent corruption of the telemetry field data. A project to replace the I/O server with two Foxboro SCD5200 RTUs is currently underway and is expected to be completed during the 2014/15 FY; The project will include the installation of a protocol converter device at each field site. The project is being carried out in conjunction with the field-testing of a new corrector (see below) to ensure that there are no issues with communications between the corrector and the Foxboro SCD5200 RTUs.

Electronic Volume Correctors

The type of corrector used at GPRS-configuration Telenet sites has recently been changed due to hazardous-area certification limitations of the previous corrector type. Although full bench-testing of the new corrector was successfully carried out prior to it being adopted for use on the gas network, full field-testing has not yet been completed due to the performance issues of the existing I/O server (see above). Full field-testing of the new corrector model is expected to be completed in conjunction with the I/O server replacement project during the 2014/15 FY.

Migration of Telenet Functions from Legacy Foxboro SCADA System

Vector's Auckland based Foxboro SCADA system is ready to be retired pending the migration of the Kingfisher Telenet functions to another platform. The Foxboro system was previously used to provide SCADA functions for Vector's Northern electricity network and the Auckland gas distribution network, however all electricity SCADA functions have now been migrated to another SCADA platform.

The Foxboro SCADA system currently forms part of the data-path between the Kingfisher Telenet system, and the PI archiving system - i.e. the Foxboro system retrieves telemetry field data from the Kingfisher Telenet system, and the PI archiving system then retrieves the telemetry field data from the Foxboro system. In addition the Foxboro SCADA system also provides remote control facilities for the operation of IP20 isolation valves located at either end of the Auckland Harbour Bridge.

The legacy Foxboro system is no longer supported, however before it can be retired all Kingfisher Telenet functions (i.e. data link between Kingfisher Telenet and PI archiving system; and Harbour Bridge valve control functions) need to be migrated to alternative platforms. This is expected to be completed by the end of FY2015/16.

6.3.3.6 Maintenance Programme

Cello units are maintained on an as required basis in accordance with the manufacturer's recommendation. Cello batteries have a nominal service life of approximately 5 years - the unit initiates a low battery alarm when the battery is reaching the end of its service life allowing a battery change to be scheduled. The Cello unit pressure transducers do not require periodic calibration as they do not drift.

Preventive maintenance cycles for Telenet have been determined based on industry code requirements, risk management principles and good industry practice. Preventive maintenance of the Telenet system is carried out in accordance with the periodic cycles stipulated in the following technical standard:

Technical Standard	Periodic Maintenance Activities
GNS-0016 Telenet maintenance	• Annual maintenance inspections of Telenet master station, field sites and repeater station installations • 4 yearly intrinsic safety inspections of Telenet equipment installed in hazardous zones

Table 6-7 : Maintenance Programme for Telenet field equipment

Preventive maintenance activities on Telenet field equipment may identify the need for corrective maintenance work, which could typically include the replacement of RTU cabinets (due to corrosion damage), or the replacement of faulty electronic correctors, modems etc.

6.3.3.7 Installation / Replacement Programme

There is no telemetry equipment replacement programme scheduled for the duration of the planning period. Individual equipment components will continue to be replaced on an as required basis as and when they fail.

The installation of new Telenet sites is typically carried out in conjunction with major DRS upgrade or installation projects. The deployment of two Telenet installations and 10 Cello installations (at DRS and/or system extremity sites) per year are planned for the duration of the planning period for each of the Auckland and North Island networks.

The ongoing replacement of corroded powder coated RTU cabinets with stainless steel cabinets will continue on an as required basis throughout the planning period.

The replacement of aging RTU and radio transceiver equipment will continue to be carried out on an as required basis.

6.3.4 Critical Spares and Equipment

6.3.4.1 Functional Description

A stock of critical spares and equipment is maintained so the repair of a network fault is not hindered by the lack of availability of required parts or equipment. Critical spares and equipment items for Vector's Auckland and North Island networks are owned by Vector and held on its behalf by its FSP; Electrix. Whenever new equipment is introduced to the network an evaluation is made of the necessary critical spares and equipment items required to be retained to support the repair of any equipment.

The majority of the critical spares and equipment items are held in Electrix's main depots in Albany and Hamilton, with small inventories also being held at Electrix's regional depots in Whangarei, Mt Maunganui, Rotorua, Taupo, Gisborne and Kapiti.

Separate lists of critical spares and equipment are maintained for each of the FSP's emergency depots. The lists have been developed over a period of time and are the result of collaboration between Vector's AR and SD staff and Vector's FSP. When new critical spares and equipment items are required they are typically sourced via Vector's FSP; Electrix. Where the scale of a proposed purchase warrants it (e.g. the purchase of a major equipment item), direct purchase by Vector would be carried out.

6.3.4.2 Physical Description

The critical spares and equipment lists include items that are low volume (turnover) or high cost, or have long lead times for purchase, or are no longer produced (obsolete) or where the level of risk associated with not holding a spare is considered high.

The list for the Auckland network is comprised predominantly of fittings and equipment related to steel pipelines (e.g. TDW drilling and stoppling equipment, repair clamps, spherical tees, valves etc), with some critical items for larger diameter PE systems (e.g. 280mm fittings) etc.

The list for the North Island network also includes DRS spares (e.g. Cocon cartridges, regulators) regulator overhaul kits, valves and PE fittings etc. The need for the wider range of items included in the North Island network list is due to the relatively longer lead times to obtain replacement parts from key suppliers and due to the geographic spread of the North Island network. A set of FRIATEC PE drilling and bagging equipment along with a storage trailer unit were added to the inventory of critical equipment during the 2013/14 FY.

6.3.4.3 Condition, Performance and Risks - Critical Spares and Equipment

Condition

The general condition of the critical spares and equipment is adequate. Some of the equipment (e.g. TD Williamson drilling equipment used for hot tap operations on live steel gas mains) is at least 25 years old and its current condition reflects the relatively high level of service. For ODV purposes the standard life for critical spares (i.e. excluding critical equipment) is 50 years.

Performance

A range of critical spares and equipment is held. The performance of the critical equipment items is adequate, although in some cases the type of equipment held currently limits the range of specialized fittings that can be used e.g. completion plugs. The compatibility of equipment with the range of specialized fittings currently available will be considered when planning the replacement of existing, or the acquisition of additional, items of critical equipment.

Risks

A replacement programme for critical spares and equipment has not been formalised. An audit of the condition of critical spares and equipment will be carried out in the 2015/16 FY to determine whether a replacement programme for key items is required.

The management of the critical spares and equipment inventory and associated preventive maintenance inspections is carried out within the Electrix data-warehouse system. Vector staff have access to the critical spares and equipment inventory data via a web-based Citrix report, however preventive maintenance inspection records are not currently included in the report. Options to provide Vector visibility to preventive maintenance records will be explored during the 2015/16 FY.

6.3.4.4 Maintenance Programme

Preventative maintenance inspection and periodic audit cycles have been determined based on risk management principles and good industry practice. Preventive maintenance of critical spares and equipment is carried out in accordance with the periodic cycles stipulated in the following technical standard:

Technical Standard	Periodic Maintenance Activities
GNS-0078 Maintenance of critical spares and equipment	• Monthly – visual inspection • Annual – condition assessment of all critical spares and equipment; Review of inventory lists to determine level of inventory held is appropriate • 5 to 10 yearly - manufacture's check/refurbishment of all major items of equipment

Table 6-8 : Maintenance Programme for critical spares and equipment

6.3.4.5 Replacement Programme

The development of a refurbishment/replacement programme for critical spares and equipment is expected to be completed in the 2015/16 FY. A nominal annual expenditure provision has been made for the replacement of unspecified critical spares and equipment on an as required basis.

The purchase of two sets of PE bagging-off equipment was completed during the 2013/14 FY. The equipment is held in the Auckland and Hamilton depots and is used for pipeline isolation operations on larger diameter PE mains pipes. The use of this equipment will mitigate the risks associated with squeeze-off damage on larger diameter mains and brittle-like cracking failures on pre-1985 PE pipe.

A SELMA BMP vehicle-mounted leak detection unit was purchased during FY2014/15 (the vehicle on which the equipment will be mounted is owned and operated by FSP Electrix). The unit is used for scheduled and ad-hoc leakage survey of mains and service pipes located in the road reserve - previously carried out by conventional walking surveys. The equipment is mounted on the bumper of the vehicle and employs laser technology to identify methane releases. The equipment detects leaks in front and to the side of the driving path, and its sensitivity allows detection at normal urban-driving speeds. The equipment automatically records the survey route and the location and details of any leaks detected.

6.3.5 Pressure Reducing Stations

6.3.5.1 Functional Description

Pressure reducing stations are those parts of a gas system that link two pressure levels in gas networks, through pressure regulators. They are the points of input to a pressure level and comprise the following three types:

- Gate stations;
- District regulator stations (DRS); and
- Service regulators.

Pressure stations linking the gas transmission system and a gas distribution network are known as gate stations. HP equipment (pressure regulating equipment, custody transfer metering, etc.) within the gate station is operated and maintained by Vector Gas Transmission, whereas distribution system equipment (i.e. check-metering where installed, and associated valves and pipework etc.) within the gate station is operated and maintained as part of Vector's distribution networks.

Where a pressure station links two gas distribution pressure networks, it is known as a district regulating station (DRS). These are operated and maintained as part of Vector's gas distribution networks.

A service regulator is used to regulate the pressure to individual or a small number of consumer premises, and is installed upstream and separate from the customer GMS. Service regulators are owned and maintained by Vector.

The purpose of DRS and gate stations is to automatically control the pressure in the downstream mains, and meet the following service and performance standards:

- Have the capacity to supply the forecast load based on minimum design inlet pressure and design outlet pressure and current load projections;
- Be twin stream with each stream meeting the forecast load capacity;
- Have adequate over-pressure protection – preferably two safety protection devices including an automatic shut off (ASO) device;
- Be accessible at all times and be able to be isolated external to the enclosure;
- Have a 35 year minimum life (same as standard life used for ODV purposes);
- Pilot loaded regulator DRSs should maintain delivery pressure at ±5% of set point;
- Spring loaded regulator DRSs should maintain delivery pressure at ±10% of set point;
- Normal operation shall maintain delivery pressure at or below MAOP at all times;
- Under fault conditions, delivery pressure should be maintained at or below 8 kPa for Hamilton LP systems, and at or below 110% MAOP for MP and IP systems;
- Each DRS is to have an inlet and outlet isolation valve located at least 5 metres away from the enclosure; and
- DRSs must comply with Vector standards and legislative requirements.

6.3.5.2 Physical Description

There are 63 gate stations feeding 54 distribution networks which in turn supply 233 DRS. The DRS installations comprise the following elements:

- Remote (fire stop) inlet and outlet isolation valves (in most sites);
- Inlet and outlet valves;
- Filters;
- Regulators;
- Over-protection control – monitor regulators and/or slam shut mechanism and/or relief valves;
- Metering (in some sites);
- Telemetry (in some sites); and
- Enclosure – varies from wire mesh to solid timber/concrete block building.

The average age of the DRS population is 23 years. For ODV purposes the standard life for DRS is 35 years.

DRSs are generally twin stream units. Due to legacy design practices, some second streams are not filtered and are a standby stream rather than a full capacity stream. DRSs are generally above ground, but a growing number of factory-built underground DRSs are being installed by Vector.

Approximately 205 service regulators remain in service on the Auckland network and two on the North Island network. The average age of the service regulators is 23 years, with the majority installed between the mid 1980s and the mid 1990s. For ODV purposes the standard life for service regulators is 35 years. Existing service regulators are mostly installed in small pits below ground, however all new service regulators are installed above ground. Service regulators are typically installed in situations where it is not possible (or considered impractical) to locate the GMS outside of the customer's premises. A service regulator is typically comprised of a small-capacity pressure regulator along with upstream and downstream isolation valves.

6.3.5.3 Age Profiles

The age profile of the combined DRS and service regulator population (Auckland and North Island networks) is given in Figure 6-6.

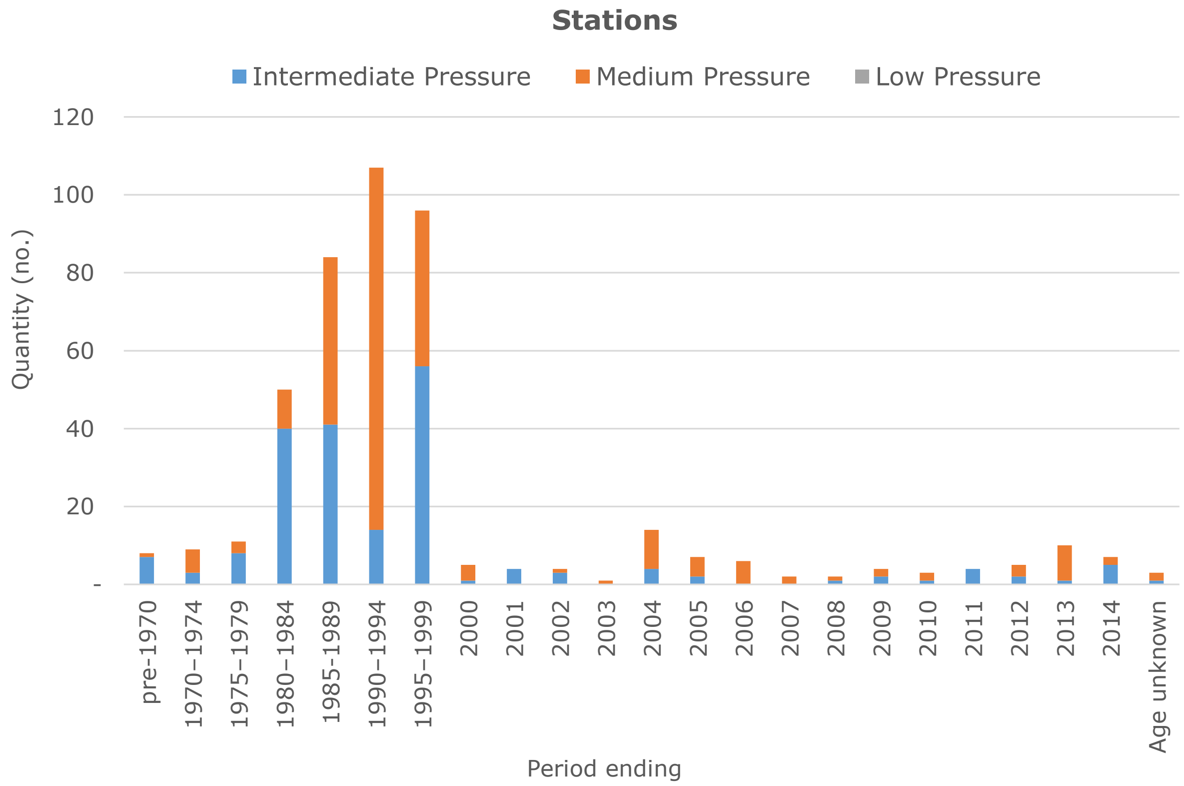

Figure 6-6 : Age profile of district regulator stations and service regulators

6.3.5.4 Condition, Performance and Risks - DRS

Condition of Assets

An initial field audit of all DRS was undertaken during the 2009/10 FY. The audit assessed the condition and status of each DRS and covered the following general areas:

- Enclosure dimensions, amount below ground, enclosure type and ventilation provided;
- Confirmation the reliefs valves vented to a safe location;
- Inlet and outlet fire valves present and accessible;
- The condition of the enclosure and ease of access/egress; and
- The condition of DRS equipment – i.e. regulators, pipework, filter, relief valve, meter and corrector.

A condition assessment rating was assigned for each of the DRS components based on the audit results. The assessment rating was based on a 7 point scale where 1 is very poor condition and 7 is good condition. The integrity register has been updated on an ongoing basis as DRS upgrades are completed. The graph below indicates that currently 1% of DRS have an average condition assessment rating of 4 (there are no DRS with a rating of less than 4). These DRS are considered to be high priority for replacement or refurbishment.

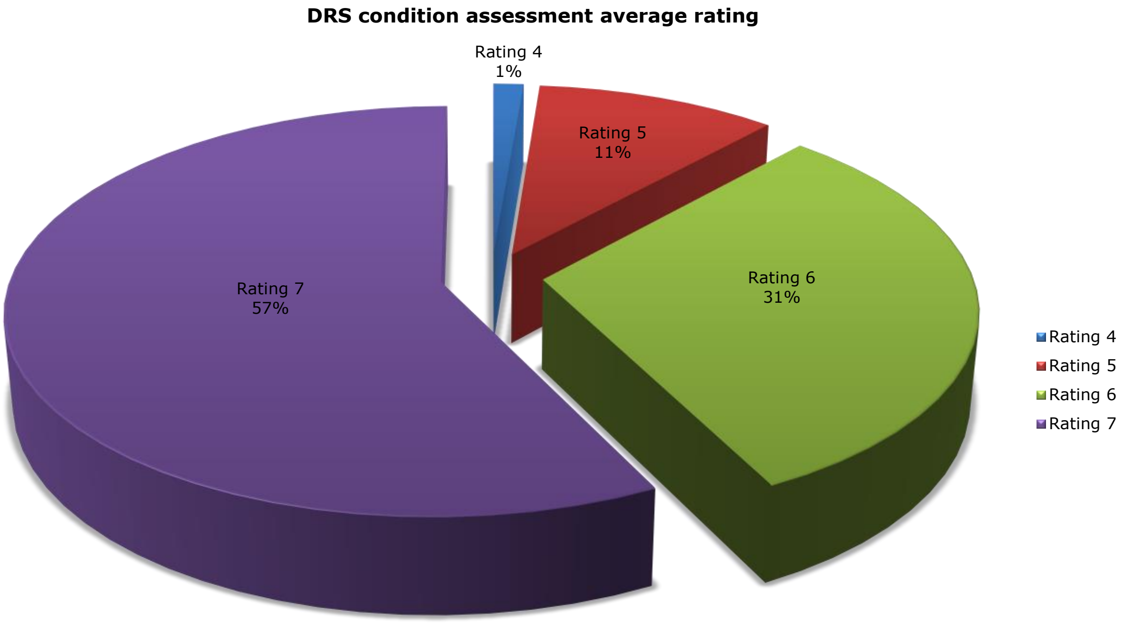

Figure 6-7 : DRS condition assessment

The relative priority of individual DRS for replacement or refurbishment has been further assessed by considering the relative number of low condition-assessment ratings (i.e. pipework rating, enclosure rating etc.) assigned to each DRS. DRS that have a relatively high number of compliance issues are considered to have the highest priority for replacement or refurbishment.

The ongoing condition assessments form the basis of Vector's DRS upgrade programme to address the integrity issues identified. The average integrity score for all stations has shown a steady improvement over the period, and the count of integrity ratings of less than 4 has shown a significant decrease (improvement) over the period.

Performance of Assets

Approximately 65 DRS sites have insufficient ventilation to meet Vector's design standards - i.e. there is insufficient ventilation and/or the ventilation openings are not adequately distributed on the walls of the DRS enclosure. These sites have been assessed and prioritised for upgrading. Ventilation upgrades at 14 sites have been completed in FY2014/15, and upgrades at the remainder of the sites will be completed over FY2015/16 to 2017/18.

Due to legacy practices, there are two sites where the relief valves are not piped or where the vent pipe ends within 1 metre of a building. One of these sites was upgraded during FY2014/15, and the other is scheduled for decommissioning pending the results of network modelling analysis.

A risk assessment has been carried out on those sites that do not have both an inlet and outlet fire valve. The high-risk sites will be programmed to have the valves installed. Replacement of the lower risk sites will be programmed with other site works.

There are number of sites where the DRS enclosure is located within 1 metre of another building. Some of these sites are scheduled to be rebuilt (and relocated) or decommissioned over FY2014/15 to 2016/17; the balance of the sites are being evaluated to determine if there are any openings into the building within 1 metre (or directly above) the enclosure, or to determine where the hazardous zones are. If there is a hazardous zone within 1 metre of an opening then options to alter or restrict the hazardous zone are to be considered and implemented.

In 2012, Vector engaged a seismic specialist to undertake a review of critical gas distribution infrastructure to assess the selected assets for compliance with the seismic provisions of NZS1170. The review included three gate stations (two located in Auckland and one in Hamilton), and five DRS sites (three in Auckland, and one each in Hamilton and Rotorua). The specialist's report recommended seismic reinforcement at one DRS site in Auckland - this work was completed in FY2013/14. The report also recommended further assessment of DRS kiosk reinforcing at two of the Auckland sites - this work is expected to be completed during FY2015/16.

Risks

Obsolete Regulators

There are 3 known DRSs (all in the North Island network) that have obsolete regulators. Spare parts for these regulators are no longer available and thus they cannot be easily maintained. The 3 sites are scheduled for decommissioning (pending the results of network modelling analysis) and so no upgrade of the sites is currently planned.

Inadequate Pressure Relief Capacity

Over-pressure protection in the North Island network (and to a much lesser extent in the Auckland network) is often provided by installing full capacity relief valves. With the increase in capacity caused by installing larger regulator orifices/ports, coupled with installing vent pipes on relief valves, some sites may no longer have full capacity relief. Currently there are approximately 20 DRS sites with inadequate relief capacity; 5 of these sites are candidates for decommissioning (pending the results of network modelling analysis) and the balance are scheduled for upgrade during FY2014/15 to 2017/18. The upgrades typically involve the installation of automatic shut off (ASO) devices.

Over-pressure Protection

Vector's standard DRS design for new DRS installations employs two over-pressure safety devices - e.g. a monitor regulator and a slam-shut ASO device. In certain circumstances Vector's DRS design standard allows a single over-pressure safety device to be used - i.e. where the inlet pressure is IP10 or lower, the outlet pressure is MP4 or lower, and the system demand is less than 500 scmh. This standard was adopted after reviewing the DRS over-pressure protection requirements of relevant industry codes, and exceeds the over-pressure protection requirements of AS/NZS 4645.

There are approximately 60 existing DRS sites that have a single over-pressure safety device only, and don't meet Vector's DRS design criteria. Although these sites are compliant with the over-pressure protection requirements of AS/NZS 4645 (i.e. with regard to the number of over-pressure safety devices), a risk assessment will be carried on these sites to determine if the current level of over-pressure protection is adequate. For those sites which are assessed as high risk, the installations will be bought up to Vector's current standard (for new installations).

Pressure Reducing Stations with Standby Streams

There are 18 known DRS sites that are twin stream but where the streams are not similar in terms of performance or quality of supply. Generally one stream has monitor/active pilot loaded 50 NB regulators while the second stream has a single spring loaded 25 NB regulator. The second stream is a standby stream and is meant to be valved off at all times except when maintaining the other stream. An audit and assessment of these type of sites has been carried out to determine if this action (i.e. valving off the second stream) compromises the ability to supply, and the relief capacity if the main stream malfunctions.

Currently 6 sites have the bypass valved off and a further 3 sites can have the bypass valved off; of the balance, 8 sites are to be upgraded or decommissioned during FY2014/15 to 2017/18.

Equipotential Bonding and Earthing

Vector is in the process of amending its DRS design standard to require the installation of equipotential bonding on all DRS pipework, the earthing of riser pipework and DRS kiosk (including concrete pad reinforcing and the enclosure structure where appropriate), and the installation of surge diverters (where required) for all new DRS. The amendments to the DRS design standard are being developed in conjunction with the development of an electrical hazard management plan (EHMP) as required by AS/NZS4853 - refer Section 6.3.1.5.

In order to mitigate electrical hazards that could be present at approximately 200 existing DRS installations, a 2-year programme to retrofit equipotential bonding, earthing and surge diverters (where required) to all existing DRS is planned for FY2015/16 to 2016/17.

6.3.5.5 Condition, Performance and Risks – Service Regulators

Condition of Assets

Service regulators are mostly sited underground in small pits close to the main in the street. These pits are vulnerable to filling with water, allowing water ingress into the regulator relief hole.

Since 2000 several service regulator audits and removal projects have been undertaken, and the population of service regulators has been reduced from in excess of 700 to approximately 205 currently. The condition of service regulators is monitored by means of annual (for belowground service regulators) and biennial (for aboveground service regulators) preventive maintenance inspections. Service regulator replacement candidates are identified through SAP PM inspection records, fault reports or an assessment of other risk factors – e.g. the service regulator location relative to buildings, roadways etc.

Performance of Assets

In some locations underground service regulators are affected by the ingress of water, silt or other debris that over time leads to corrosion and impaired regulator performance. This can result in gas escapes from corroded fittings and pipework, and can allow unacceptable over-pressure gas into downstream systems (and venting gas to atmosphere). This legacy issue only applies to the Auckland network.

Risks

Service regulator pits are vulnerable to water ingress which increases the risk of corrosion of the regulator fittings and the risk of water ingress into the regulator relief hole. This can potentially cause the loss of supply, resulting in a safety issue and a costly maintenance problem.

An ongoing removal programme targets higher risk belowground service regulator sites. Belowground service regulators are removed where possible or relocated aboveground. Replacement candidates are identified through SAP PM inspection records, fault reports or an assessment of other risk factors - e.g. the service regulator location relative to buildings, roadways etc.

6.3.5.6 Maintenance Programme

DRS and Gate Stations

DRS and gate station maintenance is carried out in accordance with Vector's technical standard GNS-0012 Maintenance of gate and district pressure reducing stations.

All underground sites are inspected quarterly, and all above ground sites are inspected six-monthly. The integrity of the site and enclosure is reviewed and all defects recorded. Operation of equipment is checked and variations outside normal conditions are remedied. Remedial actions are recorded.

In addition to the above, on an annual basis the set points of all equipment are checked and confirmed as within operating parameters. Any variations outside normal conditions are remedied. Remedial actions are recorded and all valves are actuated.

Maintenance records are reviewed on an annual basis. Trends are used to confirm the appropriateness of maintenance cycles and drive replacement programmes.

Service Regulators

All underground sites are inspected annually, and all above ground sites are inspected biennially in accordance with Vector's technical standard GNS-0073 Service regulator maintenance. The integrity of the site and enclosure is reviewed and all defects recorded. Operation of equipment is checked and any variations outside normal conditions are remedied. Remedial actions are recorded.

6.3.5.7 Replacement Programme

The replacement of gate station, DRS and service regulator assets is based on an assessment of the following criteria:

- Condition: Physical deterioration is excessive i.e. beyond economic maintenance. This includes the enclosure;
- Functional changes: Obsolete equipment – spare parts no longer available and equipment is not operating correctly; equipment malfunction leads to replacement; third party interference; inadequate/poor design;
- Site changes: Fire stop valves in carriageway; new/altered surrounding buildings compromising egress, ventilation and access to fire stop valves; vent pipes too close to new/altered buildings; risk consequence/frequency for DRS increased; flooding; and
- Code/standard changes: Legacy plant layout etc. does not meet current codes of practice/Vector standards.

A DRS replacement/refurbishment programme has been implemented based on the criteria described above and the results of ongoing condition assessments. The programme prioritises sites according to condition and risk. Specific replacement/refurbishment projects have been scheduled over FY2014/15 to 2017/18. The replacement programme targets the replacement or refurbishment of approximately 20 DRS of which the majority are on the North Island network. The programme includes those DRS that have been assigned an average condition assessment rating of 4 or less or which have a relatively high number of technical or regulatory compliance issues.

Where a DRS replacement or refurbishment candidate is scheduled for removal as part of a pipeline replacement programme or as a result of a system rationalisation study or is scheduled to be relocated as part of a relocation project, the replacement or refurbishment of that DRS is deferred.

The condition assessment rating was based on the following key assessments:

- Compliance assessment:
    - Fire valve rating
    - Relief valve rating
    - Relief venting rating
    - Ventilation rating
- Condition assessment:
    - Regulator obsolescence rating
    - Vector technical standards rating
    - Condition of fittings, equipment and enclosure

Priority is also given to those DRS where the design capacity will be exceeded and to those DRS which contain obsolete equipment. The scope of individual upgrades range from the complete rebuilding of a DRS to the replacement of individual DRS components as determined by the latest condition assessment.

The service regulator replacement programme is risk-based and ongoing. Service regulators identified for removal (or replacement above ground) are prioritised based an ALARP risk assessment. Service regulator replacement candidates are identified through SAP PM inspection records, fault reports and other sources. The service regulator replacement programme will target the replacement of 5 to 10 of the highest priority service regulators per annum.

6.3.6 Valves

6.3.6.1 Functional Description

Distribution system valves are comprised of inline mains and service valves (to control the flow of gas within the system) and blow down valves (to depressurise sections of the system in the event of an emergency).

Valve types currently in use include ball valves, plug valves and gate valves. Due to their design, ball valves are relatively maintenance free whereas the other types require some measure of periodic maintenance to prevent issues and to ensure they remain operable.

Specifically valves are expected to achieve the following level of service and performance standards:

- Mains are to have sufficient valves to isolate consumers in blocks of 500 to 1,000;
- Installation at every 2,000 metres in PE systems with MAOP greater than 420 kPa;
- All IP services are to be fitted with an isolation valve;
- All services that enter a building at other than the GMS location, or pass through a space where gas could accumulate and become a hazard, or cross private property to supply another property, or is one of several extending to different floors of a building, are to be fitted with isolation valves;
- Each service shall end with an isolation valve(s) and shall be upstream of the GMS;
- Valves are to be installed to isolate high risk areas, such as CBD areas, bridges and rail crossings (note that these valves may be automatic shutoff valves);
- Valves are easily accessible, operable and leak free; and
- Valves comply with Vector’s standards and legislative requirements.

6.3.6.2 Physical Description

There are 3,484 inline mains and service valves in the Auckland network, and 1,358 inline mains and service valves in the North Island network. A breakdown of quantities by operating pressure is shown in Table 6-9.

Pressure category	North Island	Auckland
LP 0-7 kPa	14	15
MP1 7-110 kPa	31	84
MP2 110-210 kPa	13	113
MP4 210-420 kPa	1,017	2,251
MP7 420-700 kPa	48	338
IP10 700-1000 kPa	114	313
IP20 1000-2000 kPa	121	370
Total	1,358	3,484

Table 6-9 : Operating pressure of valves used in the Vector networks

The average age of the valve population is 26 years. For ODV purposes the standard life for valves is 35 years.

Information on valve types (i.e. ball, plug etc.) installed on the Auckland and North Island networks is not currently available as it was not historically held in either the GIS or SAP-PM systems (refer Risk section below). Over 40% of mains valves installed on the Auckland network are thought to be plug valves, whereas the quantity of plug valves installed on the North Island network is unknown.

Mains and service valves are typically installed below ground. The majority are direct-buried and access to the valve is provided via a valve sleeve. In some cases (e.g. on larger diameter mains) valves are installed in pits or above ground. Below ground valves are generally operated by a purpose made valve key, whereas above ground valves are typically operated by a hand wheel and gearbox mechanism. Note that the reference to mains valves excludes valves that are installed above ground at gate station and DRS sites; these valves are operated and maintained as part of the station equipment.

6.3.6.3 Age Profiles

The age profile of the total population of mains and service valves (Auckland and North Island networks combined) is given in Figure 6-8.

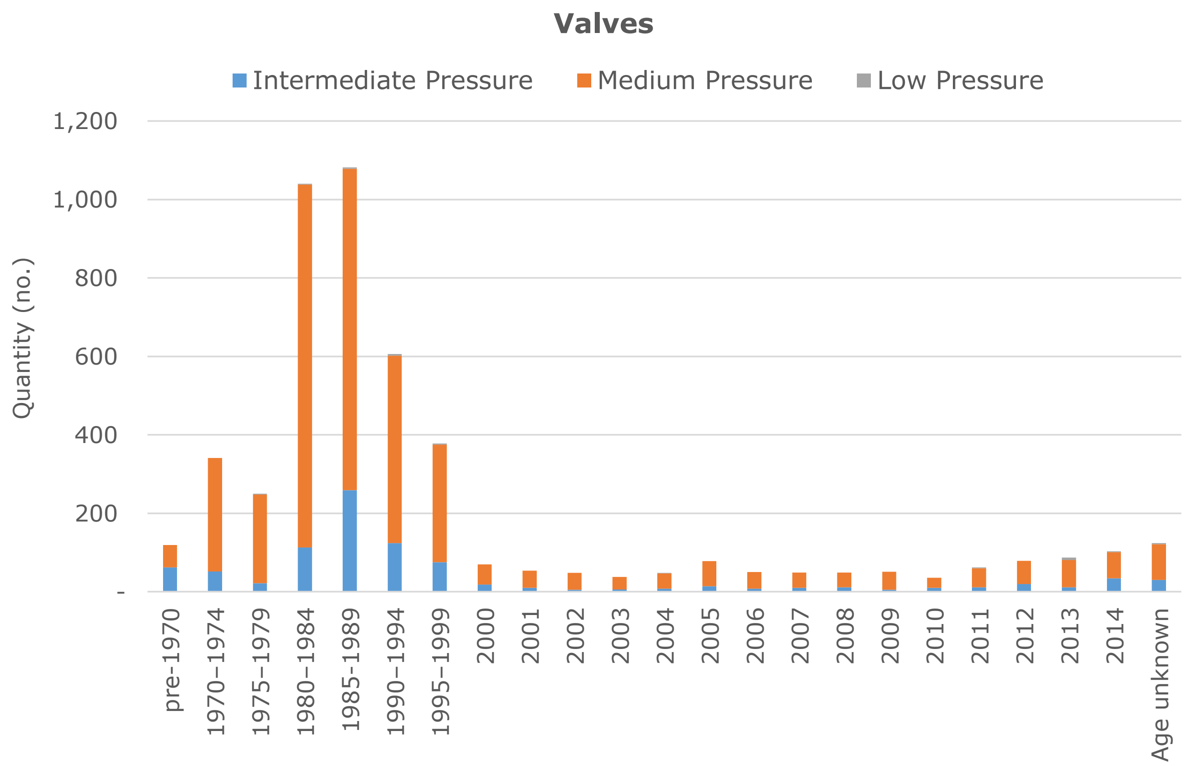

Figure 6-8 : Age profile for mains and service valves

6.3.6.4 Condition, Performance and Risks

Condition of Assets

Ball valves are typically in good condition and operate adequately.

Plug valves represent a significant operational and maintenance problem due to:

- The need for continual greasing to overcome seizing problems;
- The grease drying out; and
- Wads of grease contaminating downstream facilities.

Some valve sites are susceptible to the access sleeve filling up with debris. This has to be cleaned out before the valve can be maintained.

In some cases older valves are no longer able to be located. This is typically due to road alterations or re-sealing which result in obscured valve locations. This is an ongoing problem and in order to mitigate the risk, the deployment of electronic locator balls is being trialled.

Performance of Assets

Ball valves have been used since the mid-1980s and are considered to be reliable and relatively maintenance free.

The use of plug valves ceased around the mid-1980s. Plug valves require a higher level of maintenance, because of their design, which includes regular greasing to prevent the valve seizing and/or leaking.

Risks

Under Pressure Shut-off Valves

Occasionally a road controlling authority has insisted that an under-pressure shut-off (UPSO) valve be fitted on the upstream side of a pipeline attached to a bridge. Where UPSO valves have been fitted, in some cases they have been installed without an appropriate means of periodic testing/tripping of the valve. Vector has carried out an assessment of known UPSO valves to determine the risk of the valve malfunctioning and causing a gas outage. As a result of this assessment, two UPSO valves without testing/tripping facilities have been replaced (i.e. with ball valves).

Two remaining UPSO valves are known to be in service on the North Island network (there are none on the Auckland network). These valves have the required testing/tripping facilities to allow periodic maintenance to be carried out. The current maintenance standard GNS-0013 Valve maintenance is currently being amended to include provision for the testing of UPSO valves.

Valve Activation

The maintenance programme for ball valves requires valves to be partially operated to confirm that the valve is operable, whereas the maintenance programme for plug valves requires only valves that are "designated emergency valves" to be partially operated.

The reason for different maintenance practices for ball and plug valves is that plug valves can be prone to seizing and by limiting the partial movement operation to critical valves only, the risk of a plug valve seizing in a partially closed position is reduced. However this approach does increase the risk of a plug valve that is not subject to a periodic partial movement operation seizing during an emergency operation. International practice is being researched during the 2015/16 FY to determine an appropriate maintenance strategy for plug valves.

Blow Down Valves – North Island Network

It is an AS/NZS 4645 requirement that section blow down valves be installed on gas distribution networks where shown to be necessary by risk assessment. Due to legacy practices, blow down valves have never been considered for the North Island networks. Risk assessments will be carried out on a system by system basis as part of a long term network isolation study (refer below) to determine if additional blow down valves are necessary.

Riser Plug Valves

Prior to the introduction of ball valves in the early 1990s, a plug type riser valve was used for residential and small commercial connections. Because of its mechanical design, this type of valve is prone to seizing and gas escapes.

In order to mitigate the risks associated with riser plug valves, annual audits of approximately 1000 to 2000 riser valves are undertaken. The audits target areas known to have relatively high populations of plug type riser valves, and are carried out in accordance with Vector's technical standard GNS-0013 Valve maintenance.

Sectional Isolation Valves

It is an AS/NZS 4645 requirement that sectional isolation valves be installed to facilitate the safe operation of the gas distribution network.

A long-term network isolation study of high risk areas (such as CBD areas) is underway to determine if there are sufficient isolation valves to ensure the safe operation under normal or emergency conditions.

Unknown Valve Types

Information on valve types has historically not been captured in the GIS or SAP-PM systems. This impacts on preventive maintenance scheduling as different valve types (e.g.

ball or plug etc.) require different types of maintenance activity. Over 40% of mains valves on the Auckland network are thought to be plug valves, whereas the quantity of plug valves installed on the North Island network is unknown. A review of available valve data will be undertaken and uploaded into SAP-PM where possible. This will be carried out as part of a larger programme to upload asset data into SAP-PM and is expected to commence during the 2014/15 FY.

6.3.6.5 Maintenance Programme

Valve maintenance is carried out in accordance with Vector's technical standard GNS-0013 Valve maintenance. Mains, service and service riser valves are inspected as follows:

- 12 Monthly - all designated emergency valves; All other MP and IP mains plug valves; All mains and service valves located within business districts; and
- 24 Monthly - all other HP, MP and IP mains ball valves; All MP and IP service valves not located within business districts; Any LP mains and service valves designated to be included in the valve maintenance programme. A sample of approximately 1,000 service riser valves (in areas known to include higher concentrations of plug type riser valves) are to be inspected.

The integrity of the site and access to the valve is checked, as well as the presence of gas escapes. The operation of the valve (excluding plug valves that are not designated emergency valves) is also tested. All defects are recorded and prioritised for rectification.

6.3.6.6 Installation / Replacement Programme

In general valves are expected to last the lifetime of the network system to which they are connected. However, valves will be replaced on an as required basis where:

- The valve cannot be practically actuated;
- Excessive gas escapes are evident;
- In the case of plug valves, the amount of lubricant being installed is compromising the operation of the downstream network; or
- The cost of maintenance outweighs the cost of replacing/relocating the valve.

The ongoing network isolation study has identified the need for additional valves on key pipeline systems to ensure their safe operation under normal or emergency conditions. As a result of the study, additional isolation valves have been installed on the Auckland IP20 system and the Hamilton IP10 systems. The installation of additional isolation valves on the Auckland and North Island networks is planned for the 2014/15 FY and following periods.

6.3.7 Cathodic Protection

6.3.7.1 Functional Description

Underground steel plant is protected against corrosion by the provision of a protective coating (e.g. high density polythene) and the application of either an impressed current or sacrificial anode CP system. CP systems are intended to meet the following level of service and performance standards:

- Provide an instant off potential of more negative than 850 mV;
- Provide an instant off potential less negative than 1,200 mV when measured with a copper/copper sulphate reference electrode; and
- Comply with Vector standards and legislative requirements.

6.3.7.2 Physical Description

The CP systems on the Auckland and North Island networks comprise:

- 13 impressed current CP (IC) systems – i.e. 8 on the Auckland network and 5 on the North Island network;
- A further 2 IC systems that are operated and maintained by Vector Gas Transmission but which also provide CP protection to the North Island network;
- Approximately 35 sacrificial anode CP systems – predominantly on the North Island network with some on the Auckland network; and
- A number of other small sacrificial anode systems protecting pockets of steel pipe, bridge crossings etc. on the Auckland and North Island networks.

6.2.2.1 Age Profiles

The age profile of cathodic protection systems (Auckland and North Island networks combined) is given in Figure 6-9.

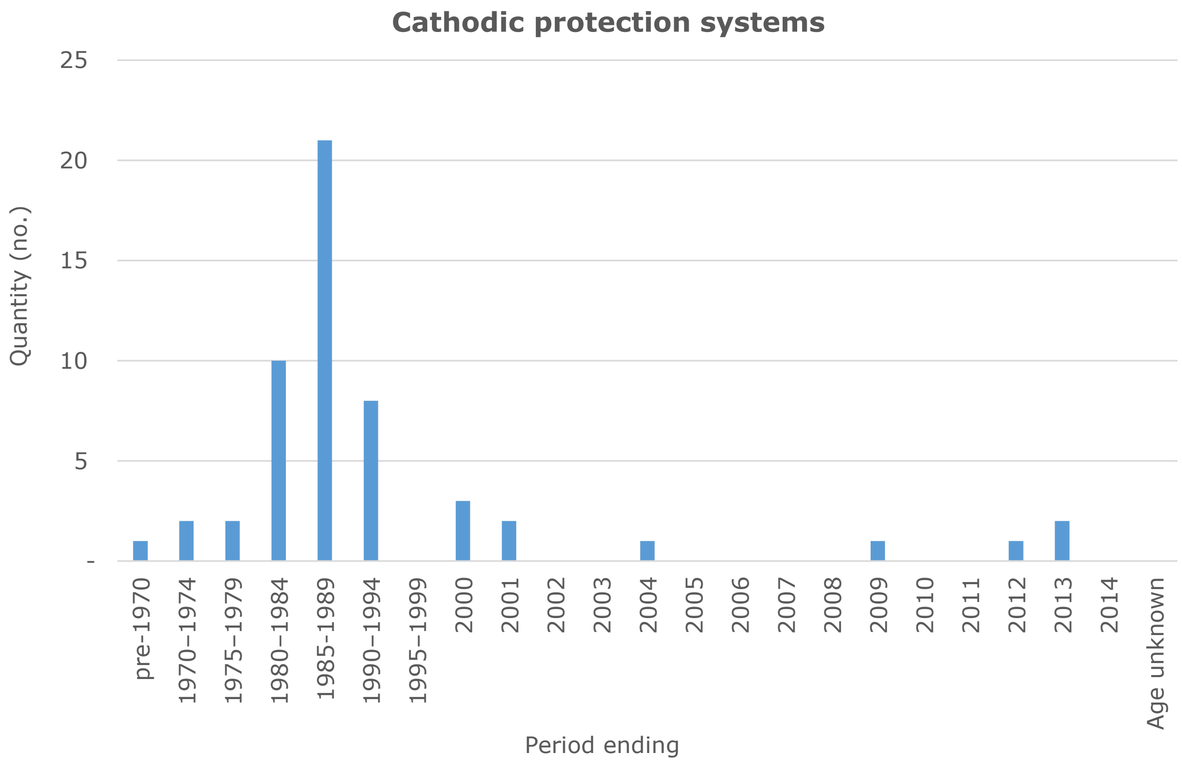

Figure 6-9 : Age profile of cathodic protection systems

6.2.2.2 Condition, Performance and Risks

Condition of Assets

Apart from the exceptions noted below, the condition of the overall CP system is considered adequate.

Approximately 60 km of MP4 steel pipelines in Hamilton still remain with inadequate or no CP. The original sacrificial-anode CP systems that were installed when the MP4 steel network was constructed in the 1960s and 1970s have largely expired and a 4-year programme to restore CP to this network was initiated during FY2011/12. Adequate levels of CP have been restored to more than 50% of the Hamilton MP4 mains system and significant work has been completed on restoring the necessary electrical-connectivity to the balance of the network. It is anticipated that the installation and commissioning of additional IC CP ground-bed and TR equipment will allow adequate levels of CP to be restored to most of the Hamilton MP4 steel mains system by the end of FY2015/16.

Following the completion of the initial stages of the Hamilton MP4 CP system upgrade programme, a problem with the electrical continuity of some steel service connections within the upgraded areas was identified. Subsequent investigations confirmed that not all MP4 steel service lines within the upgraded areas are electrically connected to the steel mains that they are supplied from and therefore have limited or no CP. A 3 year programme (FY2014/15 to 2016/17) to restore CP to the remainder of the Hamilton MP4 steel service pipes has been initiated - refer section 6.3.1.5.

Performance of Assets

Apart from the Hamilton MP4 systems, all steel pipelines on the Auckland and North Island networks now have working CP systems. A number of small pockets of steel system that had previously been identified as having poor or no CP protection have since been upgraded.

Similarly, with the exception of the Hamilton MP4 systems and some short pipeline sections in Auckland, instant-off testing can now be carried out on all steel pipelines on the Auckland and North Island networks. A number of locations that had previously been identified where instant-off testing could not be carried out on sacrificial-anode systems due to the inability to synchronously interrupt the CP system (typically because the location of the buried anodes is unknown, or because of the existing anode configuration) have since been upgraded. The upgrade involved the installation of CP coupons and this approach will also be used to enable instant-off testing to be carried out on the remaining short pipeline sections in Auckland.

Figure 6-10 shows (for each region and for the total network) the percentage of steel pipeline that currently has CP protection, and the percentage of pipeline that currently has on/instant-off CP testing. It shows that with the exception of the Waikato region, all regions have good levels of CP protection and good levels of instant-off CP testing.

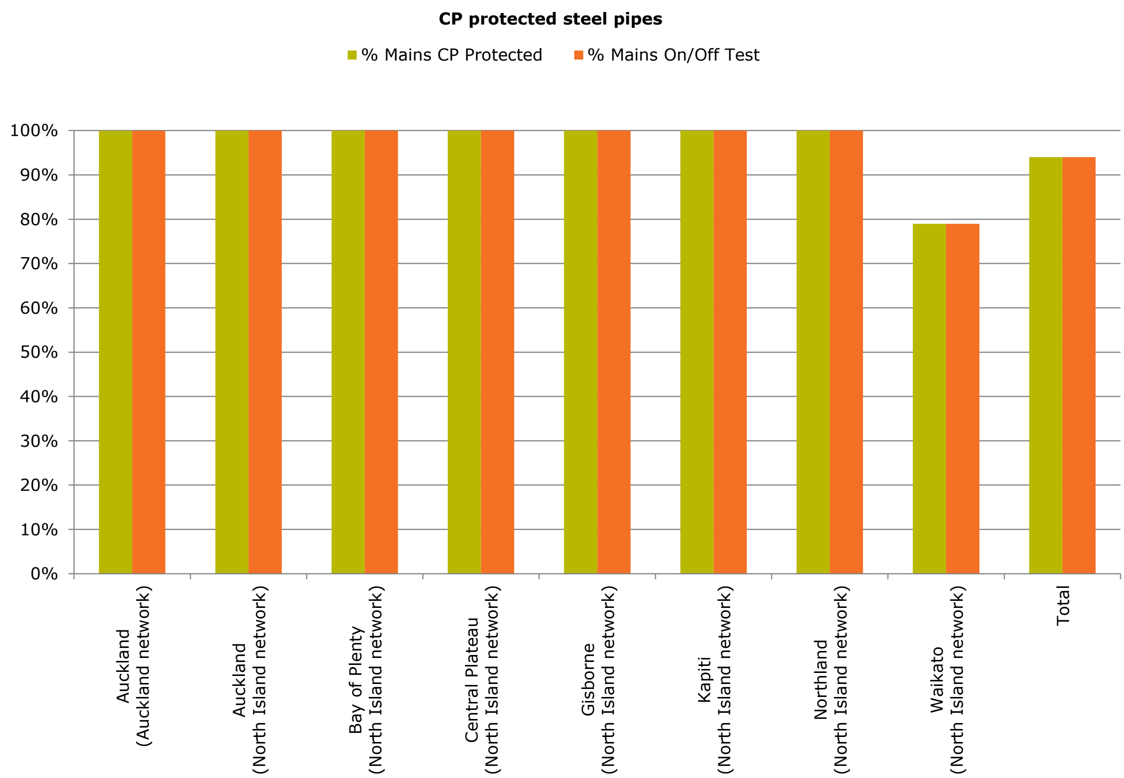

Figure 6-10 : Percentage of cathodically protected steel pipelines

The low percentage of CP protection in the Waikato region is due to the relatively low level of CP protection on the Hamilton MP4 steel systems – of approximately 127 km of MP4 steel mains pipeline, approximately 60 km currently does not have working CP. A 4-year CP upgrade programme to restore CP to the Hamilton MP4 steel mains pipelines was completed in FY2014/15. The programme included the installation of two additional IC systems and associated transformer rectifier and ground bed equipment.

Previously the Hamilton steel network also included approximately 30 km of LP and MP1 unprotected steel mains. A 3-year programme to replace these pipelines was completed in FY2014/15 - refer Section 6.3.1.5.

Risks

Interference / Stray Currents

Watercare is undertaking a significant upgrade of its trunk water main and associated CP systems in Auckland. Vector is liaising closely with Watercare to facilitate the installation of interference test points to allow joint monitoring of the Vector and Watercare pipelines at points where the pipelines cross or are in close proximity to one another.

Third Party Issues

Short circuits are an ongoing problem in a number of areas in Auckland and Hamilton, particularly the CBDs. They are generally due to faulty insulation joints or to the steel pipes touching other utility assets. Due to the nature of the problem and their location they can be difficult and time consuming to identify and expensive to remedy. These short-circuits can take months/years to locate and can cause excessive current drain, which may contribute to early failure of the CP systems.

When GMSs are replaced on steel services, the insulation joints are sometimes not properly reinstated. These can also cause excessive current drain and contribute to early failure of the CP systems. To address this risk a CP insulating joint tag has been developed. The tag is designed to be installed on GMS risers to warn anyone working on the GMS or the riser that an insulating joint is required on the outlet of the riser valve. The requirement to use the tag will be included in the next revision of Vector's technical standard GNS-0059 Construction of below ground corrosion protection systems.

Incomplete Inspection

The configuration of a small number of sacrificial anode CP systems has prevented instant-off measurements being taken due to the inability to synchronously interrupt the CP system. Although "on" readings are being taken and these give an indication of CP protection, they do not meet the requirements of AS/NZS 4645. The majority of these sacrificial anode systems have now been upgraded by means of installing CP coupons which allow instant-off testing to be carried out. There are some short pipeline sections remaining in Auckland, and these will be addressed in conjunction with the programme to improve test point spacing - refer below.

Test Point Spacing

Analysis of Vector's CP test point spacing has shown that on some sections of both the Auckland and North Island networks the test point spacing may not meet the requirements of AS2832.1 Cathodic protection of metals. A 5-year (FY2012/13 to 2016/17) programme to install additional CP test points on the Auckland and North Island networks to meet the requirements of AS2832.1 is underway.

Cased Crossings

There are a number of cased crossings of steel pipelines. Cased crossings are typically installed on steel pipelines which cross under railway lines or major roads etc., and consist of a larger diameter steel duct through which the steel carrier pipe has been installed. Rail and road operators sometimes insist on the installation of cased crossings on the basis that the casing will vent gas away from the rail or road crossing in the event of a fault on the steel carrier pipe.

Cased crossings are generally avoided because the casing can shield the pipeline from its CP. In the event that water, or another electrically conducting medium, enters the casing, the steel pipeline may be exposed to risk of corrosion. In some cases the actual casings do not have CP, thus over time they will corrode which may lead to problems with water etc entering the casing.

The current checks made to cased crossings are to confirm that the CP voltage readings are different from the pipeline readings, and that their readings do not alter while an instant on/off potential survey is carried out. This confirms that the casing and the steel pipeline are not touching. A review has confirmed that all known cased sites are being monitored, however further research is being carried out to identify any unrecorded cased sites.

6.3.7.3 Maintenance Programme

CP maintenance is carried out in accordance with Vector's technical standard GNS-0015 Maintenance of below ground corrosion protection systems:

- All impressed current installations are inspected every two months. The output current and voltage are to be recorded;
- All drainage bonds are inspected every two months. Electrical connections are inspected to ensure satisfactory operation;
- All galvanic installations are inspected three monthly, six monthly and annually in major urban, urban and rural areas respectively. Inspect to ensure satisfactory operation;
- All test points are tested three monthly, six monthly and annually in major urban, urban and rural areas respectively. The on and instant off pipe to soil potential measurements with respect to a copper/copper sulphate reference electrode is to be recorded;
- All test points are tested three monthly and six monthly in urban and rural areas respectively. The on pipe to soil potential measurements with respect to a copper/copper sulphate reference electrode is to be recorded;
- Electrical isolation points are tested three monthly, six monthly and annually in major urban, urban and rural areas respectively. Any electrical isolation between buried or submerged pipelines and other underground metallic structure are to be tested to ensure they are electrically isolated from each other; and
- Interference test points are tested every five years. The on and instant-off pipe to soil potential measurements with respect to a copper/copper sulphate reference electrode is to be recorded. The testing is to be carried out in conjunction with the foreign-structure owner with each system being interrupted in turn.

6.3.7.4 Replacement Programme

In general, impressed current systems are expected to last the lifetime of the network system to which they are attached. However, they will be replaced where the cost of maintenance outweighs the cost of replacing them.

Sacrificial anode systems will be replaced when the anodes have been consumed, or when the CP current requirement exceeds the capacity of the anode system. This may be due to coating deterioration (it is usually more cost effective to increase current to protect coating defects than repair coating defects) or an increase in network size which is beyond the capacity of a sacrificial anode system.

The replacement programmes for the Auckland and North Island networks include an annual provision for the replacement of CP assets as required e.g. installation of surge diverters, installation of new ground beds, upgrade of existing ground beds, replacement of expired sacrificial anodes, relocation of at-risk test points etc.

Work has been completed to upgrade a number of small sacrificial-anode CP systems on both the Auckland and North Island networks to enable instant-off testing to be carried out. Further work is planned (in conjunction with the programme to install additional CP test points - refer below) to upgrade some remaining short pipeline sections in Auckland to enable instant-off testing to be carried out.

A five year programme (FY2012/13 to 2016/17) is underway to install additional CP test points as required to meet the test point spacing requirements of AS2832.1 for "suburban and high-rise" areas.

A four year CP upgrade programme (FY2011/12 to 2014/15) to address the lack of CP on the Hamilton MP4 steel mains system has been completed. Table 6-10 below shows the individual MP4 CP upgrade projects that make up the complete four year programme.

Hamilton MP4 Mains CP Upgrade Project	FY Period
Melville	Completed
Hamilton CBD	Completed
Hamilton West	Completed
Hamilton South East	Completed
Hamilton North East	Completed
Hamilton Balance	Completed

Table 6-10 : Hamilton MP4 CP upgrade programme

Following the completion of the initial stages of the Hamilton MP4 CP system upgrade programme, a problem with the electrical continuity of some steel service connections within the upgraded areas was identified. Following investigations into the cause of the electrical continuity problems, a project to restore CP to steel services connected to the Melville MP4 steel network was issued for completion during the 2013/14 FY. Based on the results of the Melville project, a 3 year programme (FY2014/15 to 2016/17) to restore CP to the remainder of the Hamilton MP4 steel service pipes has been initiated - refer Section 6.3.1.5.

6.4 Project Programme Update

Table 6-11 summarises the key integrity projects and programmes for renewal and replacement of the gas distribution network. It shows the current target completion dates for these projects, compared with that in the previous plan. If there is a difference the reasons for the change are described (advanced or delayed) in the following tables. Newly identified and completed projects are also highlighted.

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
Auckland	8 year RTU replacement programme	$125	FY15 to FY24	Cancelled	
Auckland	DRS earthing and bonding	$482	New Project	FY16 to FY17	
Auckland	DRS surge diverters	$120	New Project	FY16 to FY17	
Auckland	DRS upgrade project to address compliance (e.g. appropriate over pressure protection) and integrity issues (specific sites identified in accordance with DRS register	$2,500	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	Installation of additional test points to meet class location requirements of AS2832.1	$150	FY16 to FY17	FY16 to FY17	No change
Auckland	Installation of isolation valves	$200	FY15 to FY16	FY15 to FY16	No change
Auckland	Installation of new Telenet (2) sites on existing DRS's.	$600	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	FY 13 Reactive Replacement Bucket	$900	FY15 to FY24	Removed	Included in Asset Safety and Compliance
Auckland	Moxa protocol translator (40 sites)	$60	New Project	FY16 to FY18	
Auckland	Purchase and /or installation of remote pressure monitoring facilities (e.g. Cello units) at nominated sites. FY16 to FY18 additional installs of existing temp winter gauging loggers that will be fixed.	$520	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	Replacement of bridge crossing brackets and supports	$575	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	Replacement of CP assets as required - e.g. installation of new ground beds, upgrade of existing ground beds, replacement of expired sacrificial anodes, CP interference-monitoring test points (in conjunction with Watercare, relocation of at-risk test points etc	$700	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	Replacement of MP1 cast iron pipeline in Mt Wellington	$175	New Project	FY16	
Auckland	Replacement of MP1 cast iron pipeline in Mt Wellington	$75	New Project	FY16	
Auckland	Installation of new CP interference-monitoring test points (in conjunction with Watercare 4 year starting FY11))	$180	FY15 to FY24		
Auckland	Riser valve replacements	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
Auckland	Strategic Spares (leakage survey and valves)	$200	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	IP Reinforcements: 875kPa line in Glendowie. Upgrade to A/M configuration	-	FY15	Completed	
Auckland	Street regulator removal	$500	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	Targeted replacement of high priority MP pre-1985 PE pipe	$8,000	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	Unknown asset safety and compliance issues	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme
Auckland	Seismic work required as a result of review	-	FY15	Completed	
North Island	5 year program (Start FY11) to restore the Hamilton MP CP system to a fully compliant condition	-	FY15	In progress	
North Island	Installation of additional impressed current CP anode beds for Hamilton MP4 system	-	FY15	In progress	
North Island	Lay new PE pipe to enable removal of MP4 steel pipe from culvert in Te Kuiti.	-	FY15	In progress	
North Island	DRS earthing and bonding	$622	New Project	FY16 to FY17	
North Island	DRS relocation/remove/upgrade/rebuild - (5 year program Start FY12 based on DRS register) plus ongoing bucket spend	$1,800	FY18 to FY24	FY18 to FY25	
North Island	Replace DRS122, Hamilton	-	FY15	Completed	
North Island	DRS surge diverters	$155	New Project	FY16 to FY17	
North Island	Install filters DRS232, Rotorua	$20	FY17	FY17	No change
North Island	Installation and purchase of remote pressure monitoring facilities (e.g. Cello units) at nominated sites	$400	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Installation of additional test points to meet class location requirements of AS2832.1	$130	FY16 to FY17	FY16 to FY17	No change
North Island	Installation of isolation valves	$150	FY15 to FY16	FY15 to FY16	No change
North Island	Replacement of LP mains in Hamilton (3 year)	-	FY15	Completed	

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
North Island	Replacement of LP services in Hamilton (3 year)	-	FY15	Completed	
North Island	Installation of new Telenet (2) sites on existing DRS's.	$600	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Mechanical coupling replacements in Hamilton	$300	New Project	FY16 to FY17	
North Island	Replace DRS100, Hamilton	$250	FY17	FY17	No change
North Island	Replace DRS101, Hamilton	$250	FY18	FY18	No change
North Island	Replace regulators in DRS139, Hamilton	$50	FY16	FY16	No change
North Island	Seismic work required as a result of review	-	FY15	Completed	
North Island	Replacement of bridge crossing brackets and supports	$850	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Replacement of CP assets as required - i.e. installation of new ground beds, upgrade of existing ground beds, replacement of expired sacrificial anodes, relocation of at-risk test points etc	$500	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Restore CP to Hamilton MP4 CS services	$650	FY15 to FY17	FY16 to FY17	No change
North Island	Riser valve replacements	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Small diameter pipe replacements	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Strategic Spares	$200	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Targeted replacement of high priority MP pre-1985 PE pipe	$8,000	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Unknown asset safety and compliance issues	$1,000	FY15 to FY24	FY16 to FY25	Ongoing programme
North Island	Upgrade DRS0003, Rotorua	$120	FY17	FY17	No change
North Island	Upgrade DRS020, Mount Maunganui	$120	FY16	FY16	No change
North Island	Upgrade DRS038, Opotiki	-	FY15	Completed	
North Island	Upgrade DRS060, Whangarei	-	FY15	Completed	
North Island	Upgrade DRS090, Whangarei	$120	FY16	FY16	No change
North Island	Upgrade DRS102, Hamilton	-	FY15	Completed	

Region	Project Description	Expenditure ($,000)	Previous AMP Date	Current AMP Date	Comments
North Island	Upgrade DRS103, Hamilton	$120	FY16	FY16	No change
North Island	Upgrade DRS129, Hamilton	$160	FY17	FY17	No change
North Island	Upgrade DRS203,Te Kuiti - Upgrade and link to DRS202	$170	FY16	FY16	No change
North Island	Upgrade DRS209, Kihikihi	-	FY15	Completed	
North Island	Upgrade DRS213, Morrinsville	$120	FY17	FY17	No change
North Island	Various Small Projects - Waikato Region	$900	FY15 to FY24	FY16 to FY25	Ongoing programme

* *Figures are in 2016 dollars ($'000);*

Table 6-11 : Project programme update for network integrity

6.5 Capital Expenditure Forecasts

Based on the renewal requirements described in Section 6.2 and after applying the prioritisation criteria (described in Section 9), the proposed network integrity (asset renewal or replacement) capex programme for the Auckland and North Island networks for the next ten years is outlined in * Figures are in 2016 real New Zealand dollars ($’000);

Table 6-12 and * Figures are in 2016 real New Zealand dollars ($’000);

Table 6-13, respectively.

Expenditure description	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cathodic Protection	$145	$145	$70	$70	$70	$70	$70	$70	$70	$70
DRS Replacement	$450	$250	$250	$250	$250	$250	$250	$250	$250	$250
Asset Replacement - Pipeline	$925	$700	$650	$650	$1,150	$1,150	$1,150	$1,150	$1,150	$1,150
Asset Performance	$200	$140	$140	$100	$100	$100	$100	$100	$100	$100
Safety, Compliance and Environment	$651	$451	$150	$150	$150	$150	$150	$150	$150	$150
Strategic Spares and Equipment	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Total Expenditure	**$2,391**	**$1,706**	**$1,280**	**$1,240**	**$1,740**	**$1,740**	**$1,740**	**$1,740**	**$1,740**	**$1,740**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 6-12 : Asset integrity capex expenditure forecast for Vector's Auckland region

Expenditure description	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cathodic Protection	$493	$415	$50	$50	$50	$50	$50	$50	$50	$50
DRS Replacement	$580	$670	$300	$250	$250	$250	$250	$250	$250	$250
Asset Replacement - Pipeline	$1,125	$1,080	$850	$725	$1,210	$1,260	$1,250	$1,250	$1,250	$1,250
Asset Performance	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
Safety, Compliance and Environment	$639	$489	$100	$100	$100	$100	$100	$100	$100	$100
Strategic Spares and Equipment	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Total Expenditure	**$2,956**	**$2,774**	**$1,420**	**$1,245**	**$1,730**	**$1,780**	**$1,770**	**$1,770**	**$1,770**	**$1,770**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 6-13 : Asset integrity capex expenditure forecast for Vector's North Island region

Gas Distribution Asset Management Plan 2015 – 2025

Systems and Processes – Section 7

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7 Introduction

This section of the AMP describes the information systems that Vector uses to manage its gas distribution business processes and data, and the strategy driving some of the proposed development decisions.

Vector’s day-to-day gas distribution operation involves specialists and teams within the organisation and its Field Service Providers (FSPs) undertaking a wide variety of business information gathering, analysis and reporting functions such as compliance reporting, financial forecasting, network planning, project management, asset valuation, maintenance management, asset inspection and condition monitoring.

These business functions and processes are supported by information systems and their associated data sets, allowing us to mine, manipulate and analyse the data in order to help us optimally operate our gas distribution network; troubleshoot problems; understand the history and significance of events and trends; and to target our spending, whether on new developments or asset improvement projects.

Vector’s Enterprise Resource Planning (ERP) strategy is designed to ensure that all ERP solutions are fit for purpose - that is as precisely as possible designed for the function they are delivering and cost effective to maintain. Fit for Purpose ERP Solutions allow Vector to leverage its asset information without the systems becoming overly complex or costly. It enables Vector to use its asset information to help achieve its customer & regulatory outcomes, increase its operational efficiency, lower costs, and identify opportunities for disciplined growth.

It should be noted that Vector uses a wide range of IT products from a wide range of vendors. In the following commentary we identify products by name that Vector currently uses. There is no implied endorsement of any particular product in such statements. In fact the performance and suitability of every product is under continual review in our drive to provide fit-for-purpose, sustainable information technology solutions.

7.1 Overview

Vector implements and manages all of its information management systems and associated infrastructure components in the context of an overall IT Technical Reference Architecture. This ensures that each information technology component has clear boundaries and is fit-for-purpose, neither too limiting nor unnecessarily complex. It also helps to ensure that Vector’s Information System environment maintains a “separation of concerns” between its information systems and infrastructure.

The components within the IT Technical Reference Architecture can be divided into three broad categories relating to the type of business capabilities that each supports;

- Primary Network-Related Systems: These are systems with information management capability relating directly to Vector’s network assets and their operation and management.
- Supporting Network-Related Systems: These are systems that process data derived from Primary Systems to inform network operation and management decisions.
- Supporting IT Infrastructure Systems: These are systems that support the integration and operation of both the Primary Network-Related Systems and Supporting Network-Related Systems.

The relationship between primary and supporting network-related systems and supporting IT infrastructure is shown in Figure 7-1.

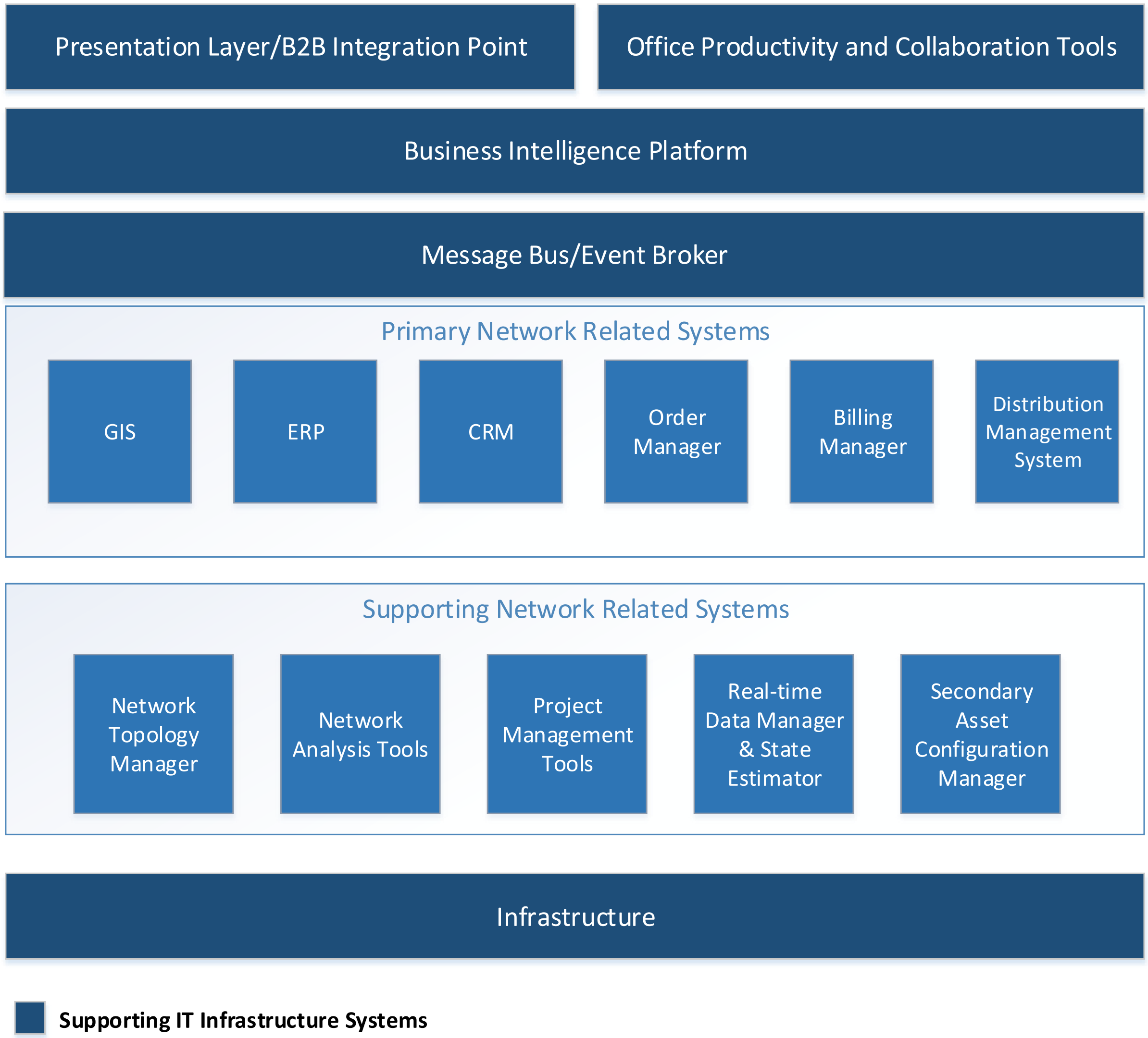

Figure 7-1 : Vector IT Technical Reference Architecture

7.2 How the IT architecture supports Vector's business capabilities

Figure 7-2 illustrates the relationship between Vector's primary network-related systems and its business functions and processes ('business capabilities').

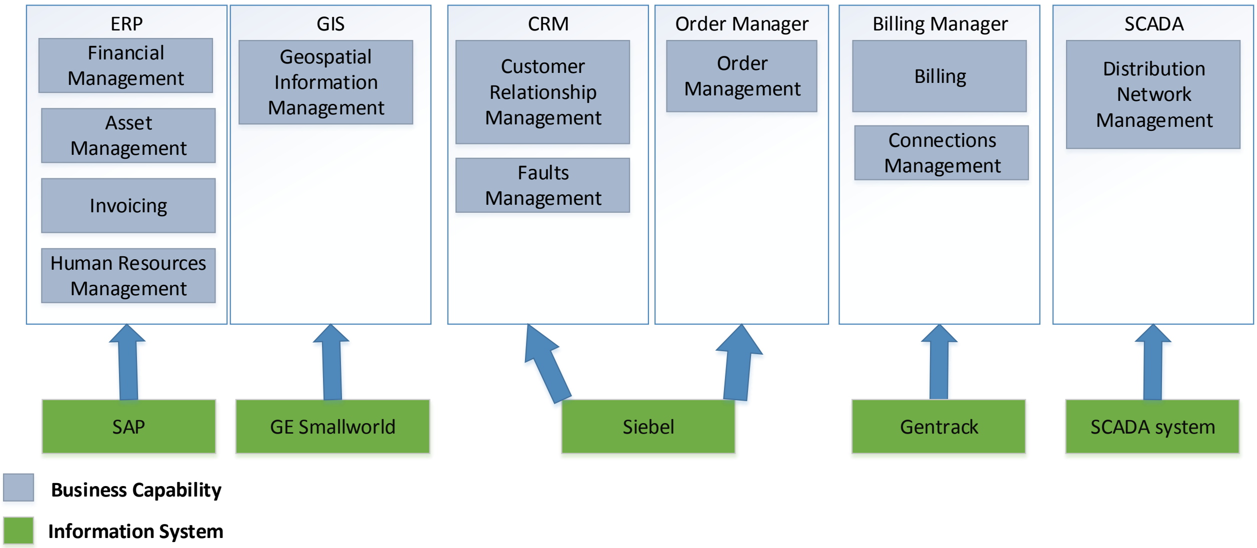

Figure 7-2 : Business Capabilities and Primary Network-Related Systems

Figure 7-3 illustrates the relationship between Vector's business capabilities and its supporting network-related systems.

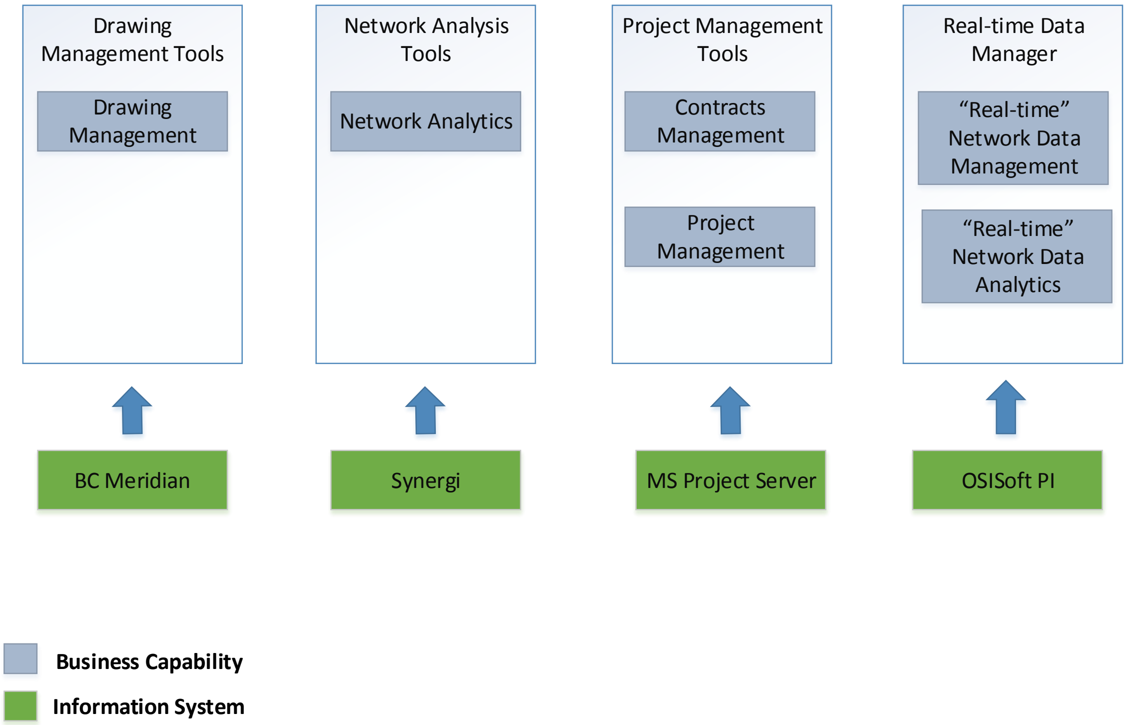

Figure 7-3 : Business Capabilities and Supporting Network-Related Information Systems

Vector also manages and maintains systems that support the integration and operation of the primary and supporting network-related systems. These systems are shown in Figure 7-4 along with the additional features they provide.

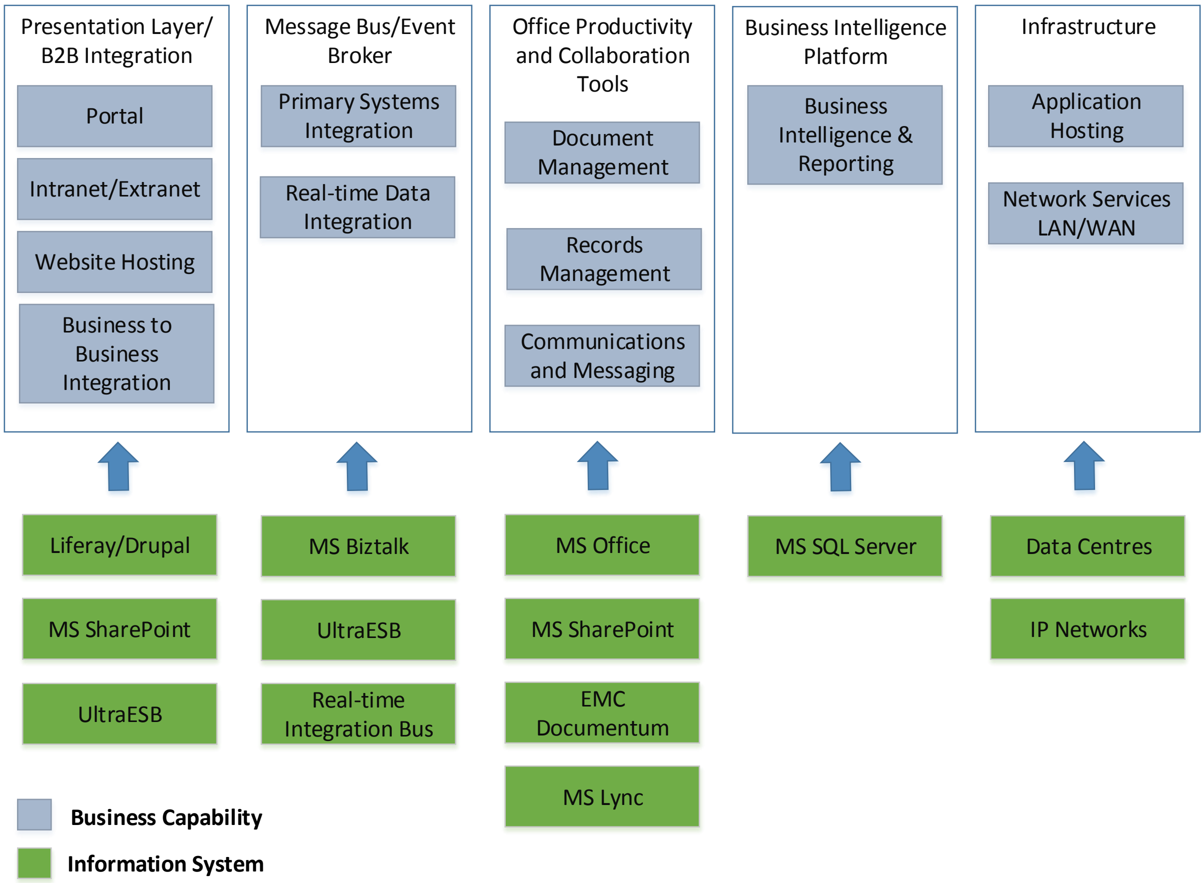

Figure 7-4 : Business Capabilities and Supporting IT Infrastructure Systems

7.3 Information management

Vector's primary and supporting network-related information systems are used to handle data and process it into useful information that is necessary for the effective day-to-day operation of its network assets and the ongoing planning activities relating to those assets.

The information can be divided into several categories;

- Asset
- Location
- Customer
- Order
- Financial
- Faults and Maintenance
- Real-time Data and Measurements

This is managed by Vector's information systems as shown in Figure 7-5.

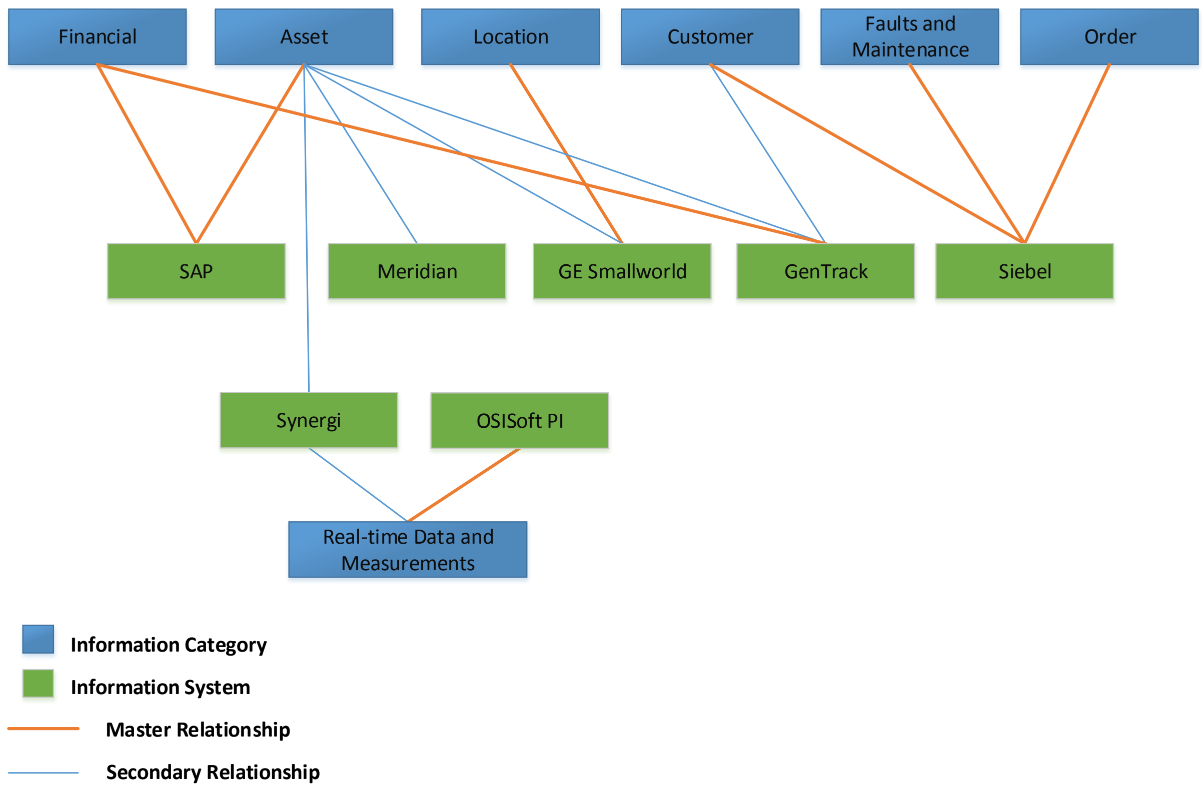

Figure 7-5 : Data and Systems Relationships

7.4 IT Technical Reference Architecture strategy

7.4.1 Overview

Each component within the Vector IT Technical Reference Architecture has a collection of supporting architecture documents (see Figure 7-6).

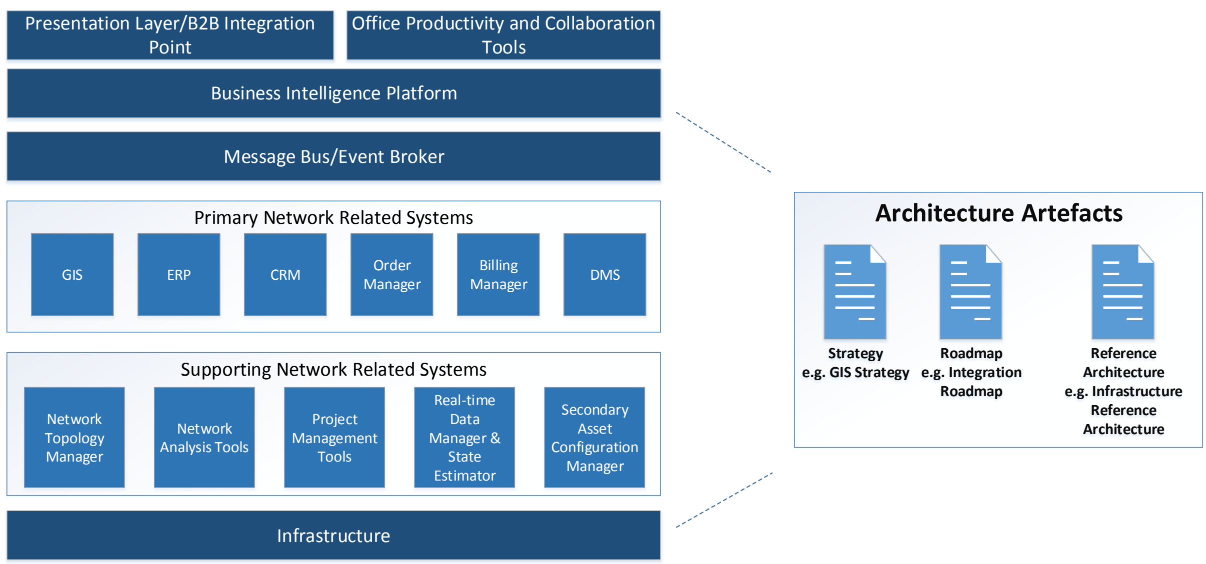

Figure 7-6 : Architecture Artefacts

These “Architecture Artefacts” are used to inform the investment planning for each information technology system and infrastructure component in conjunction with financial modelling, which takes into account aspects such as total cost of ownership and IT asset depreciation.

While Vector always looks for opportunities to improve the functionality of individual systems and the efficiency of the interdependencies, the following commentary describes some of the specific strategies to develop our systems.

7.4.2 Strategy for Primary Network-Related Systems

7.4.2.1 ERP

Vector's ERP system is SAP. The primary purpose of the ERP system for the gas distribution business is to provide the master for financial assets (SAP-FI) and technical assets (SAP-PM). SAP-PM is a complete inventory of all network physical assets and is the master record for all static information (attributes or characteristics) relating to the gas distribution network physical assets.

In line with the objective of optimising our lifecycle asset management capability, SAP-PM has been designed to hold the planned maintenance regime for each asset, according to the relevant engineering standard. The secondary purpose of SAP-PM is to capture, from Vector’s FSPs, the transactional history of each asset record, in terms of inspection and maintenance activities and defects. The system has been extended to capture measurement points from field inspections and maintenance activities. Data is provided continually from the FSPs’ Works Management Systems via a file upload facility.

The strategy for ERP for the gas distribution businesses is to maintain the current platform, SAP, invest in supporting integration components and common portals and continue development of the plant maintenance module for asset management.

7.4.2.2 Geographic Information System (GIS)

Vector’s GIS holds a geospatial model of Vector’s gas distribution networks between the gas transmission system off-take points and the customer isolation valves. The model is continually updated by Vector’s FSPs and is integrated with SAP. GIS acts as the master register for asset geospatial information and default network connectivity.

The strategy for GIS for the gas distribution business is to maintain the current platform, GE Smallworld, while investing in supporting technology components that will enable Vector to leverage its spatial information, for example by integrating with other information tools and enabling web viewing, and allowing for integration with mobile devices for asset location and data capture.

7.4.2.3 Customer Relationship Management (CRM)

Vector’s Customer Management System (CMS) is a core operational application in which a full record of gas distribution network faults and other customer information is captured by Vector’s FSPs. This includes certain asset-related technical information as well as the operational and customer information more conventionally associated with a CMS. In order to enable reporting and analysis of this information from an asset management perspective, whenever a specific asset is associated with a network fault event, the service request (SR) number from CMS is cross-referenced against the technical asset record in SAP-PM.

7.4.2.4 Billing and Order Managers

Vector’s billing system records all metered revenue data, and includes a database of all Installation Control Points (ICPs). The database is linked to the GIS and to the central gas registry.

7.4.2.5 SCADA

Vector's gas distribution network does not have a dedicated SCADA system. Real time data is retrieved from the network using the Foxboro SCADA system and PI.

The strategy for SCADA in the context of both gas distribution businesses is to review the usage of PI and Foxboro, identify opportunities to improve the way the systems are used, and upgrade or replace components and implement customisations as required.

7.4.3 Strategy for Supporting Network-Related Systems

7.4.3.1 Drawing Management Tools

Engineering drawings and related technical documents from network projects are and will continue to be maintained in the BC Meridian management system.

7.4.3.2 Network Analysis Tools

Vector's gas distribution network is modelled with Synergi Gas software. SynerGi is designed to model the gas network flow, pressure profile and capacity margins. This enables Vector to undertake a wide range of systems studies on the network in its present state and to model the potential impact of changes to the network configuration or to the network load.

7.4.3.3 Real-time Data Manager

A large archive database of historical time-series data is maintained in OSISoft PI, which captures data transmitted across the SCADA system from telemetry points located at DRSs and other key points around the gas network. A separate system is used to capture data from mobile data loggers. This information is used to provide asset utilisation information and support decision-making in network planning and operational control.

Both systems are still fit-for-purpose and will continue to be used for the indefinite future.

7.4.4 Strategy for Supporting IT Infrastructure Systems

7.4.4.1 Presentation Layer/B2B Integration

Vector's Presentation Layer/Business to Business (B2B) Integration Strategy is to implement a consistent, cost effective, and supportable Portal and B2B technology set that will allow Vector to expose the functionality of its systems to the appropriate stakeholders.

The strategy for Presentation Layer/B2B Integration in the context of the gas distribution businesses is to implement a Portal Platform based on Liferay and migrate all relevant Intranet and Extranet sites onto the new platform. Alongside this, Vector will introduce a B2B platform based on UltraESB and migrate its current B2B interfaces onto that new platform.

7.4.4.2 Message Bus/Event Broker

Vector's integration strategy is to ensure that all systems integration solutions are user requirements-led, cost effective, and maintainable.

The integration strategy for the gas distribution businesses is to select the technology for and then implement a Corporate Integration Environment. All current integration points between corporate systems will be migrated to this platform over time.

7.4.4.3 Office Productivity and Collaboration Tools

Vector's office productivity and collaboration tools strategy is to maintain the current fit for purpose toolset, that is, MS Office and MS SharePoint. Vector will review its records management functionality requirements and make an informed decision regarding the upgrade or replacement of EMC Documentum over the next two years.

7.4.4.4 Business Intelligence (BI)

Vector's BI strategy is to ensure that all solutions are business requirements-led, cost effective, and maintainable. Requirements-led BI solutions will allow Vector to report on its day to day operational performance and streamline the mechanisms that it uses to fulfil its compliance reporting obligations.

The strategy for BI for the gas distribution businesses is to maintain and extend the use of the MS SQL Server platform and toolset. Visualisation tools will also be introduced over time as the tools and platform become embedded in the way reporting is performed by the business.

7.4.4.5 Infrastructure

Vector's IT Infrastructure Strategy is to maintain the current fit for purpose IT infrastructure environment which includes servers, network hardware, security specific hardware/software, operating systems, and other supporting infrastructure tools. The infrastructure will be invested in to ensure that it is able to support the growth of Vector but not exceed the current infrastructure requirements. It is likely that Vector may need to assess its data centre investments at the 5 year point and decide whether or not investing in another data centre is necessary.

7.5 Information management strategy

Vector has also been revising its asset information strategy, aspects of which will address the learnings identified by a recent benchmarking audit against the international standard asset management standard, ISO55000. In particular, Vector is implementing a five-year improvement plan to address the findings from the audit report.

7.5.1 Legacy data improvement

Vector's gas distribution asset data has been inherited from previous organisations and in some cases is incomplete and inaccurate. To address this legacy issue, systematic efforts are being made to verify data accuracy and map existing systems to complete our data.

7.5.2 Better reporting tools

Vector's Asset Information team is routinely called upon to produce gas distribution asset performance reports. It is also called upon by various parts of the business to produce performance and fault trends for diagnostic and maintenance planning purposes. To this end the team has developed data warehousing facilities that allow one-touch mining of data using a SQL based reporting solution (SQL = Structured Query Language). The ultimate objective is to provide a comprehensive suite of tools to allow stakeholders in the organisation to manage their own reporting requirements.

7.5.3 Mobile data capture and audit

Vector is working with its field service providers to develop mobile data gathering and quality verification tools to allow easy capture of accurate asset characteristic and condition data, including three-dimensional GPS coordinates for buried assets such as gas pipes. Electrix has already made some progress in this area with its field data capture of reactive and project management activities.

7.5.4 System Integration

Vector operates a number of data management systems which were originally purchased to meet a specific need. Vector's objective is to integrate useful systems either by providing a common portal or synchronising databases, and retiring systems that have been superseded. System integration will allow us to develop a B2B (Business to Business) gateway approach for all interfaces with the service providers' own applications, which will provide considerably more flexibility and efficiency.

7.5.5 Condition Based Risk Management (CBRM)

Vector's initiative to develop a CBRM system for the gas distribution business will require adaptation of our existing systems to record and process asset condition measurements, and to convert them to useful information for the purposes of maintenance planning. Some progress has already been made with the collection of measurement point data points for crossing and District Regulator Stations.

7.6 Data Quality Management

7.6.1 Asset Standards

Vector's asset data is largely captured and maintained by FSPs through an as-building process. These activities are controlled by asset data standards, business rules, work instructions and the relevant provisions of the contractual agreement between Vector and the FSPs.

We have a current initiative ongoing to update our Asset Data Standards. The standards determine which assets are captured in our asset management systems, what attributes of those assets are recorded, and what transactions we want to recorded e.g. records of planned inspections, faults and defect data. The new standards will be rolled out to our Field Service Providers in 2015.

The FSPs gather and upload data in accordance with Vector standards, but are not responsible for processing the data or formulating maintenance plans or strategy on the basis of the data. That responsibility remains within Vector.

7.6.2 Assurance

The quality of data in Vector's primary network related systems, particularly SAP and GIS, is measured through monthly performance indicator management reporting. Vector standard GNS0081 defines the data content and quality requirements.

Vector undertakes comprehensive internal data quality reviews in preparation for regular audits undertaken by KPMG on Vector's information submissions to the Commerce Commission.

Refer also to Section 4.7.1.3, which describes the contracted Information Quality KPIs that FSPs are subject to.

7.7 Expenditure Forecast

* Figures are in 2016 real New Zealand dollars ($'000);

Table 7-1 summarises Vector's projected capital expenditure in the asset management IT component of Non-Network Assets (figures are June 2016 real values).

	Financial Year ($000)										
Expenditure description	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
Non Network Assets	$1,322	$1,646	$1,978	$1,563	$1,652	$1,970	$1,760	$1,749	$2,010	$1,891	$17,540
Total Capital Expenditure	**$1,322**	**$1,646**	**$1,978**	**$1,563**	**$1,652**	**$1,970**	**$1,760**	**$1,749**	**$2,010**	**$1,891**	**$17,540**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 7-1 : Forecast capital expenditure on asset information systems (non-network assets)

Gas Distribution
Asset Management Plan
2015 – 2025

Risk Management– Section 8

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8 Risk Management

8.1 Introduction

Risk management supports organisational performance by identifying, understanding, monitoring and proactively treating the uncertainty risk may present. The aim of risk management is not to eliminate risk, but to manage the risks involved in all activities to maximize opportunities and minimise adverse effects, thereby having an impact on Vector's ability to meet its objectives.

Risk management is integral to Vector's asset management process and core operational capabilities. Vector's risk management policy sets out the company's intentions and directions with respect to risk management, including its objectives and rationale around decision making.

Vector's goal is to maintain robust and innovative risk management practices, consistent with the ISO31000 standard and implement those practices in a manner appropriate for a leading New Zealand publicly-listed company that supplies critical infrastructure and manages potentially hazardous products.

Risk and assurance management also underpins Vector's ability to meet its compliance obligations. By the nature of the Vector's business there are many inherent risks and safety management is one of Vector's top priorities in the day to day operations of the network. Vector takes this responsibility seriously and has effective risk management processes in place covering hazard identification, risk assessment and the monitoring and review of hazards.

8.2 Enterprise Risk Management

Successful risk management is an ongoing, integrated and iterative process. Risk management capability is therefore dependent on a robust and effective risk management process.

Vector's Enterprise Risk Management (ERM) framework provides the method and processes to be applied Vector-wide to manage risk and assess opportunities against the company's objectives. The framework is based on AS/NZS ISO31000:2009 and is illustrated in Figure 8-1 below.

The framework requires risks to be identified and analysed, assessed and managed on an ongoing basis. This is a process that requires an understanding of both the nature of a risk and the level of the risk, thus it is important that each risk is considered within its own context.

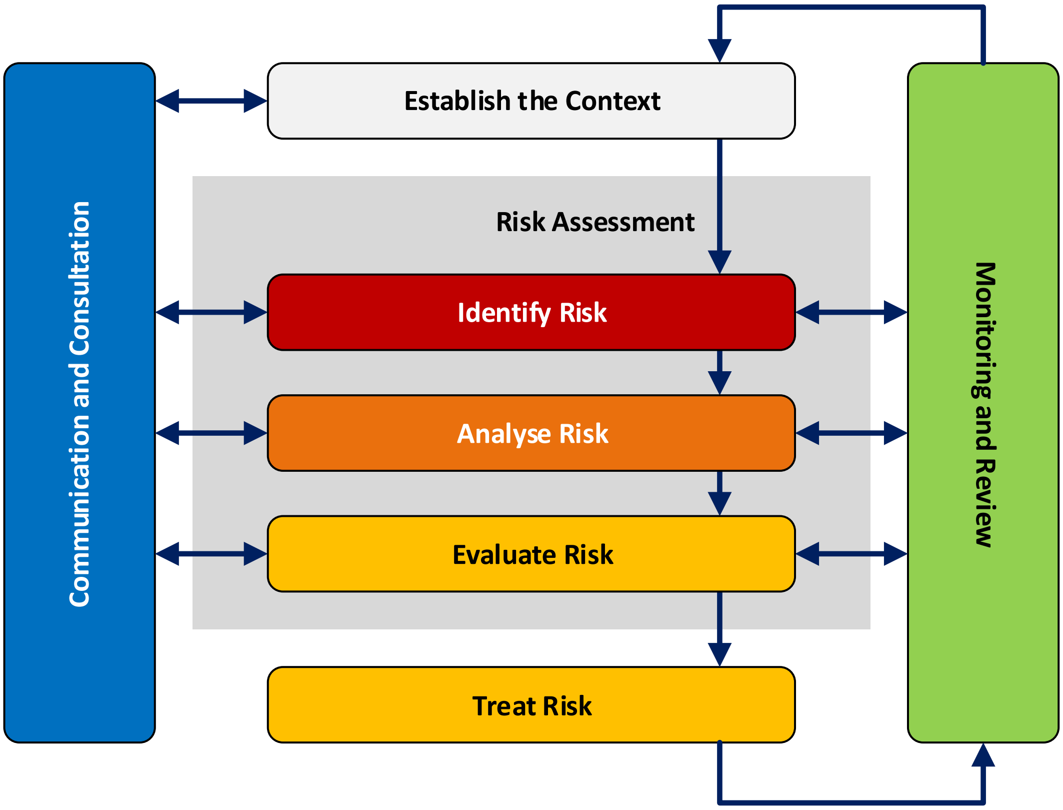

Figure 8-1 : Vector's risk management process (based on ISO31000: 2009)

The level of a risk is determined by considering the combination of the "likelihood" (i.e. rare, unlikely, likely or almost certain) and "consequences" (i.e. minor, moderate, major or catastrophic) of the risk occurring, given its existing controls, and applying the risk matrix assessment (a 4x4 heat map) in Figure 8-2, below.

	Minor	Moderate	Major	Catastrophic
Almost Certain	M	H	VH	VH
Likely	L	M	H	VH
Unlikely	L	M	H	VH
Rare	L	L	M	H

Very High	Risks significantly exceed Vector's risk appetite; immediate escalation for Board attention along with detailed treatment plans to reduce overall risk
High	Risks exceed Vector's risk appetite; escalation for Board attention along with detailed treatment plans to reduce overall risk
Medium	Risks within Vector's risk appetite; but active monitoring required by Management
Low	Risks that can be managed as part of business as usual

Figure 8-2 : Vector's risk assessment matrix

As part of Vector's periodic review and assessment of its ERM and risk appetite, Vector recently updated its risk assessment matrix from a 5x5 to a 4x4 matrix. The new matrix is the result of the Vector Group's review of the board's appetite for risks with impacts across a number of consequence categories. Changing the risk assessment matrix also forces risk assessors to make a choice between a risk being 'major' / 'moderate' or 'likely' / 'unlikely'.

Best practice with respect to setting risk appetite starts with a top-down view from the board (which has an enterprise-wide perspective) in order to set the cultural context for the organisation. As the board holds the ultimate accountability for risk governance and oversight, this approach enables the board to facilitate the alignment of risk management to group strategy.

In order to assess, manage and monitor risk on an on-going basis the business identifies and evaluates (irrespective of the level of board visibility): the cause and effect of a risk; the potential likelihood of a risk occurring; and the potential impact(s) of a risk. Once these elements are identified, assessed and understood, the desired risk exposure is agreed. Examples of risks which have "major" or "catastrophic" consequences include those which could lead to a fatality, or long term or permanent ecological damage.

A "desired level" of risk exposure is a determination of what is considered appropriate given the context within which the risk could manifest (e.g. an impact could have severe health and safety impacts but no financial consequences), and the likelihood and severity of any undesirable consequences. Thus to manage and achieve a desired level of risk, controls and treatments need to be identified – i.e. actions (developed and prioritised) that are put in place to modify a risk.

Vector has controls in place to manage key risks and has internal review processes associated with these controls. A key component of the assurance process is Vector's internal audit programme which provides assurance around significant controls in the business including organisation-wide 'risk management' – for example, business continuity management. The Internal Audit programme is overseen by the BRAC (Board Risk and Assurance Committee).

8.3 Risk Accountability and Management Structure

Figure 8-3 below shows Vector's risk management structure and reporting lines.

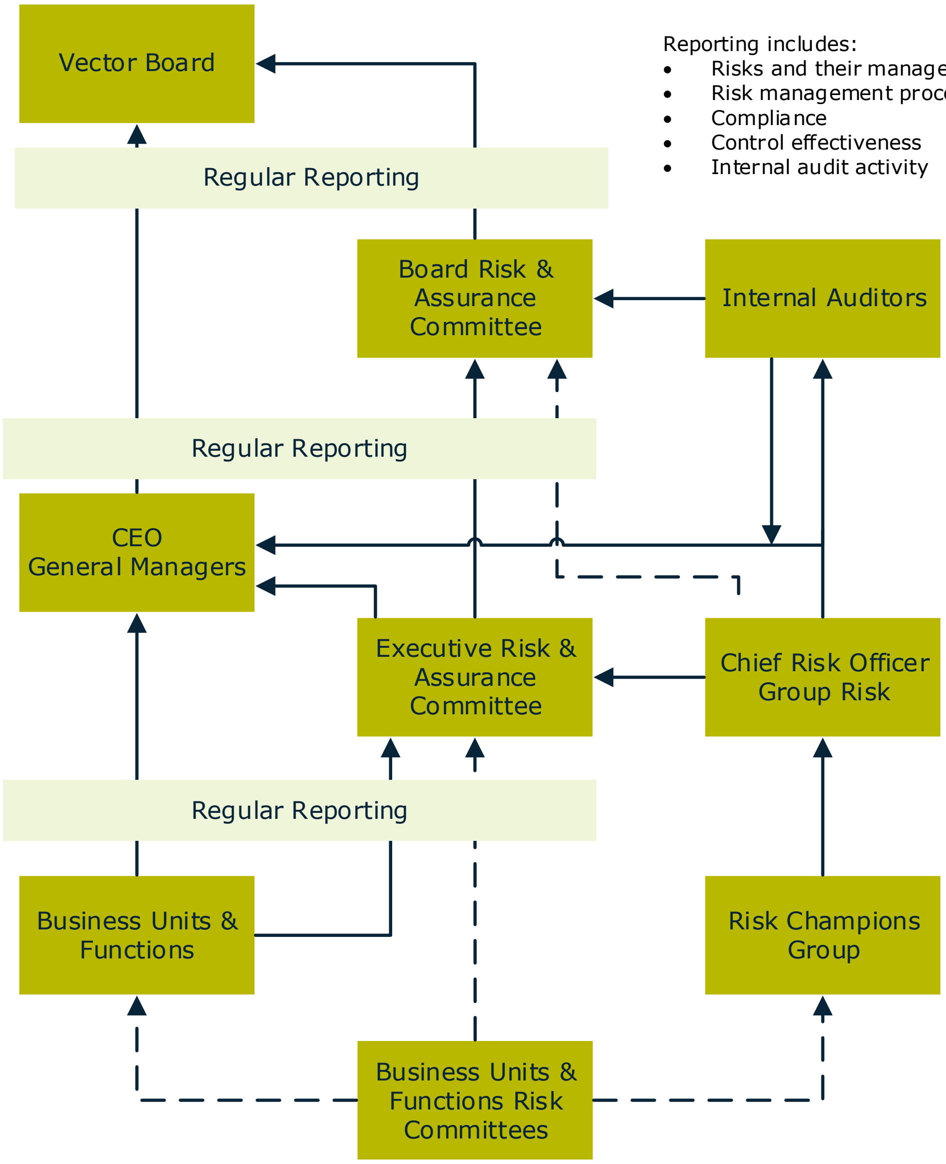

Figure 8-3 : Vector's risk management structure

The following paragraphs describe the accountabilities and authorities of the committees within the risk management structure.

8.3.1 Board Risk and Assurance Committee

Vector's board has overall accountability for risk management. This responsibility (excluding security of supply risks which remain a full board responsibility) has been delegated to the BRAC, which provides oversight of Vector's risk and assurance framework and performance.

The BRAC meets four times a year to review the group's risk context, key risks and key controls, which include the internal audit and insurance programmes.

8.3.2 Executive Risk and Assurance Committee

The Vector executive has established an Executive Risk and Assurance Committee (ERAC) to assist management execute its oversight responsibilities of risk management, internal control activities and business continuity management practices within Vector. The committee helps ensure risk management and assurance in Vector is appropriate in terms of scope and strategy, as well as implementation and delivery.

8.3.3 Management and Business Areas

The group general managers and their direct reports have responsibility for ensuring that sustainable risk management and assurance practices are developed and effectively implemented within each of Vector's business groups.

Asset related risks and their control and mitigation measures are largely the responsibility of the Asset Investment (AI) and Service Delivery (SD) groups. The AI group oversees network asset management strategy and performance and includes the development of standards for all gas and electricity networks and their component assets.

The SD group manages the operational delivery of the strategy. This includes delivery in the field of the requisite levels of maintenance and capital expenditure (capex) so the network meets the stated reliability, safety, environmental and performance standards. The SD group also manages the safe and reliable operation of the gas and electricity networks to predefined levels.

8.3.4 Chief Risk Officer

The Vector Chief Risk Officer is part of the Vector executive leadership and is responsible for the development of the Enterprise Risk Management (ERM) framework, including all supporting business systems, policies and processes. The risk management framework is approved by the BRAC.

The role also requires:

- Monitoring and reporting of risk maturity and assisting/facilitating in establishing and co-ordinating risk and control profiles;
- Developing Vector's risk appetite and facilitating the desired risk culture across the group;
- Delivering risk management and assurance, and communicating associated issues;
- Implementing and embedding risk management activities within the annual business and strategic planning and review cycle.

8.3.5 Risk Champions

Risk champions have the responsibility of facilitating risk management practices in their business groups by:

- Ensuring, in conjunction with the risk-owners, that their risk registers are accurate and up to date;
- Completing general risk management reporting requirements within their business groups;
- Ensuring effective risk management meetings are conducted in their areas (and cross-functionally as appropriate); and

- Ensuring appropriate risk communication is undertaken in their business groups.

8.3.6 Staff

Each staff member is responsible for ensuring they understand the risk management practice in Vector and how it applies to them. This includes being actively engaged in the identification of new risks and ensuring these are appropriately acknowledged.

Individual staff may have specific responsibilities for the ownership and management of a specific risk, control or treatment depending on their roles.

8.4 Business Continuity

8.4.1 Business continuity management

Business continuity management (BCM) is integral to Vector's risk management framework. BCM provides the support the organisation needs to respond to, and be prepared for, any disruptive or critical incidents that might otherwise prevent us from achieving our objectives.

To achieve this, Vector strives to ensure that its BCM aims to:

- Ensure the continuity of critical business functions;
- Establish controls, processes and procedures to improve BC and to deliver results;
- Monitor and review performance against the policy objectives so that any necessary remedial actions can take place;
- Provide testing and training on a cyclical basis to help keep staff, roles and responsibilities up to date and prepared;
- Integrate BCM within wider corporate risk management approaches, policies, and procedures; and
- Ensure that Vector's approach is consistent with the following:
    - Australian / New Zealand Standard AS/NZ 5050/2010 Business Continuity – Managing disruption-related risk;
    - ISO 22313:2012 Societal Security – Business continuity management systems – Guidance;
    - SAA/SNZ HB 221:2004 Business Continuity Management; and
    - AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines.

Figure 8-4 below illustrates Vector's BCM approach, which allows for a flexible and purpose-built approach and is aligned with external best practice.

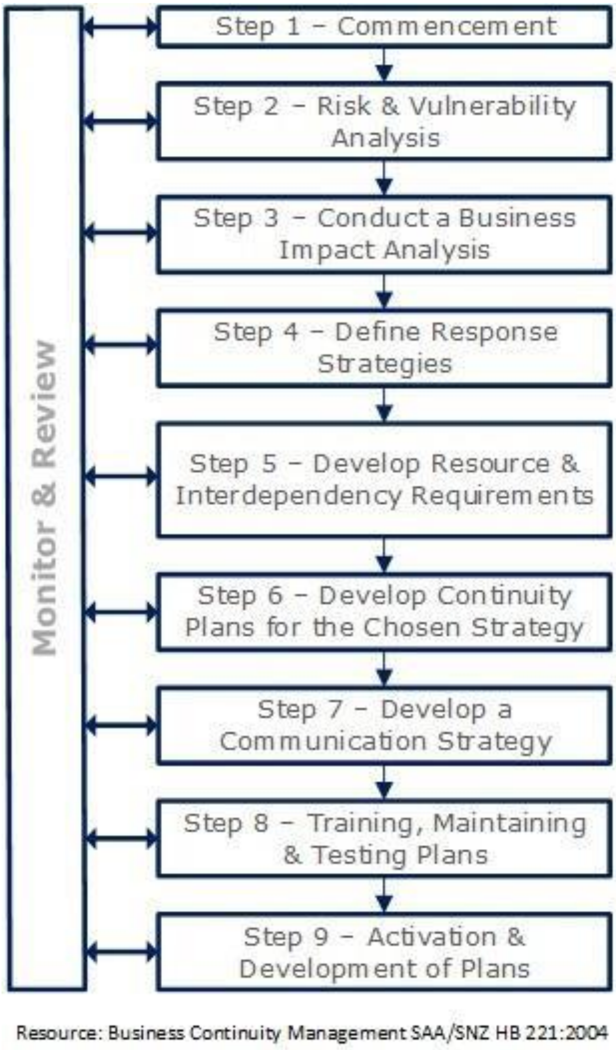

Figure 8-4 : Vector's BCM flow chart

The overall BCM framework and plan is developed and monitored by the Chief Risk Officer. Vector's overall BCM capability and programme activities are overseen by the ERAC.

The head of each business and functional unit is responsible for maintaining the appropriate BCM capability and compliance requirements for their areas. All employees are responsible for contributing to the maintenance of the BCM capability and to assist with the emergency/crisis response and recovery efforts in a real situation.

With respect to individual Business Continuity Plans (BCP) Vector's policies require appropriate governance aspects to be in place as well as each plan to have certain components.

With respect to governance, each BCP:

- Has an owner. The owner has responsibility for the plan and all aspects of the capability around this plan;
- Is developed by those who are associated with the activity and who are named in the Plan;
- Is fully reviewed annually and within a timeframe appropriate to the associated activity, or when required if significant external or internal changes occur;
- Has a programme for testing the combination of:
  - People;

- Plan;
- Infrastructure; and
- Has an appropriate associated training and communication plan;

With respect to the components of a BCP, each BCP:

- Identifies which individuals/groups are notified of an event, including naming appropriate alternates, and having an appropriate escalation process defined;
- Identifies third parties that are required to support a given activity and identifies planning around their disruption;
- Outlines key activities to be undertaken;
- Provides key information required to make the implementation of the Plan achievable; such as:
    - Contact lists (internal and external);
    - Maps/plans/drawings/instructions/flow charts;
    - Criticality information;
    - List of required associated equipment; and
    - Appropriate check lists.

8.4.2 Call Centre Business Continuity Plan

Vector's call centre provider is Telnet Services. Telnet's business relies heavily on various computer and telephony technologies that, by their very nature, have the potential to fail.

The purpose of the call centre BCP is to assess the potential risks and planned workarounds for those risks in order that Telnet's core business can continue in the event of any failure or disaster. In addition to the general BCP strategy employed at Telnet, there are a number of specific provisions as part of Telnet's relationship with Vector to provide additional services to ensure the continuity of service around handling of safety critical and emergency calls.

8.4.3 Crisis Management Plan

The crisis management plan (CMP) identifies procedures for a crisis affecting Vector, its customers and/or its employees, contractors and other stakeholders. The plan and procedures outlined in this document identify how Vector will manage the consequences of a crisis. It is designed to establish clear lines of communication and reporting, as well as action guidelines for the Vector Group.

The CMP is an "all hazards" plan as it encompasses the management of all possible crisis events. While the CMP procedures have been developed to cover a broad set of circumstances, Vector is mindful that every crisis has its own unique set of circumstances. Thus, each crisis relies on the good judgement of Vector employees to tailor the response and management to what is most appropriate given the circumstances at hand.

The CMP is not intended to cover operational emergency response requirements, as these are covered by the relevant emergency response plans – Vector has individual emergency response plans for major events. Together the CMP plan and emergency response plans better enable staff to fulfil their roles as efficiently and safely as possible, and to ensure the wider public implications of an emergency are identified and addressed.

8.4.4 Crisis Communication Plan

Vector's crisis communications plan aims to ensure that it is prepared to manage unforeseen events and gain, or retain, public confidence in its management of the situation and is part of the overarching CMP.

The Plan seeks to achieve this by ensuring that in any emergency, crisis or business continuity event affecting Vector, Vector's customers, the affected community and other stakeholders are kept well-informed and up-to-date of:

- The status of the crisis;
- Any actions they can or should take to mitigate the effect or consequences of the emergency / crisis;
- When the situation is expected to be (or is) resolved;
- Updates to the above to reflect any changes to the situation; and
- Post-crisis debriefs or ay follow up information.

The plan is designed as a template that can be tailored to the management response requirements determined by the particular nature of the emergency, crisis or business continuity event. It is designed to provide a consistent, robust and scalable approach to communications.

8.4.5 Civil Defence and Emergency Management

As a "lifeline utility" under the Civil Defence and Emergency Management Act 2002 (CDEM), Vector is required to be "able to function to the fullest possible extent, even if this may be at a reduced level, during and after an emergency". Vector also is required to have plans regarding how it will function during and after an emergency and to participate in the development of a CDEM strategy and BCPs.

As discussed above, Vector has a number of BCPs in place as well as an overall crisis plan. Vector participates in CDEM emergency exercises on a regular basis to ensure CDEM protocols are understood, as well as to test aspects of Vector emergency and BCP plans.

Vector is a member of the Auckland Lifelines Group (ALG), as well as a number of lifeline groups throughout New Zealand. Membership in the ALG helps ensure Vector keeps abreast of developments in the CDEM area and that it is fully prepared for emergencies arising from identified threats including volcanic eruption, tsunami, earthquake, tropical cyclones and storms, both in general and in particular as they relate to Auckland where it has network assets.

A key area of focus for the company is to better utilise information from the ALG and from other Lifelines groups around the country into its asset management process.

Vector is also a member of the National Engineering Lifelines Committee and keeps abreast of national issues and initiatives through this forum.

8.4.6 Insurance

The Treasury function manages the placement of insurance for Vector.

Vector's approach to its insurance programme has been to balance risk and cost and has involved regular review of the financial risk appetite of the group. This translates into a programme whereby Vector seeks cover for low probability major or catastrophic events, and carries as an operational expense the cost of other events which have a lesser financial impact. With respect to the latter category, risk mitigation activity is undertaken to reduce the likelihood of these events through proactive maintenance programmes and thorough management processes.

8.5 Health, Safety and the Environment Management

8.5.1 Health and Safety Policy

Vector's health and safety policy states the company's overarching commitments and requirements for health and safety. Vector conducts its business activities in such a way as to protect the health and safety of all employees and contractors of Vector Limited and its' Related Companies ("Vector People"), the public and visitors in its work environment.

The Vector framework for managing its health and safety performance is underpinned by three key corporate policies, Health and Safety, Environment and Rehabilitation. The Vector Health, Safety and Environment Management System (HSEMS) details the minimum HSE requirements for all Vector business units, subsidiaries, employees and contractors. Compliance to these standards is audited on an annual basis.

Vector is committed to continual and progressive improvement in its health and safety performance, and all Vector People are required to work in line with this policy. Vector is currently preparing for the proposed changes that the new health and safety legislation will bring under the Health and Safety Reform Bill.[1] This includes reviewing current documentation and current processes to ensure alignment with the proposed requirements.

Vector commits to:

- Providing a safe and healthy workplace for all Vector People, the public and visitors;
- Ensuring health and safety considerations are part of all business decisions;
- Monitoring and continuously improving our health and safety performance;
- Communicating with Vector People, customers, and stakeholders on health and safety matters;
- Operating in a manner that manages health and safety hazards;
- Fostering personal commitment to health, safety and wellbeing and encouraging safe and healthy lifestyles, both at work and at home; and
- Supporting the safe and early return to work of injured or ill Vector People.

To achieve this Vector will:

- As a minimum, meet all relevant legislation, standards and codes of practice for the management of health and safety;
- Identify, assess and control workplace hazards;
- Accurately report, record and learn from all incidents and near misses;
- Establish health and safety goals for the business, and regularly monitor and review the effectiveness of our HSEMS;
- Consult, support and encourage participation from Vector People on issues that have the potential to affect their health and safety and the health and safety of their co-workers;
- Promote Vector People's understanding of their health and safety responsibilities relevant to their roles;
- Provide Vector People with information and advice on the safe and responsible use of our products and services; and
- Suspend activities if safety would be compromised.

All Vector People are responsible for ensuring their own and other's safety by familiarising themselves with this policy and adhering to it and all Vector safe work practices, and

[1] The Bill is part of 'Working Safer: a blueprint for health and safety at work,' and reforms New Zealand's health and safety system following the recommendations of the Independent Taskforce on Workplace Health and Safety. Working Safer is aimed at reducing New Zealand's workplace injury and death toll by 25 per cent by 2020. Leadership and action from businesses, workers and Government will be needed to achieve this goal.

escalating any health and safety issues if they have the potential to put any Vector People (including themselves) at risk.

8.5.2 Health and Safety Practices

Vector's HSEMS defines the minimum standards necessary to maintain a safe, healthy and incident free environment. This is documented in a set of 12 Standards. Beneath these standards are more detailed "key requirement" documents that provide more specific detail on specialised activities such as confined space entry, working at heights etc.

These standards and key requirements allow each business unit to develop their own procedures and processes. Each business unit has annual HSE improvement plans which support the implementation of the HSEMS and the achievement of the corporate strategy. This approach allows each business unit the flexibility to develop processes and procedures that are relevant and specific to their health and safety risks and operational requirements.

Vector continually strives for excellence in safety performance and recognises the importance of a robust, well-structured health, safety and environmental management system framework to assist in delivering an incident and injury free workplace. A full programme review is conducted on an annual basis to ensure continual improvement opportunities are identified.

Vector's HSEMS is certified to NZS 7901:2008 – Electricity and Gas Industries – Safety Management Systems for Public Safety. Vector also holds Tertiary Level certification under the ACC Workplace Safety Management Programme.

Vector safety management systems are audited both internally and externally on an annual basis. The Vector Board receives monthly HSE performance reports detailing injury statistics, trending analysis, reporting of key incidents (safety and environmental), results of audits (internal and external), drug and alcohol testing and updates on key HSE matters such as legislative reform, training and the HSE impacts of any new business procedures or processes.

8.5.3 Incident Management and Reporting

A key component of Vector's health and safety management system is incident reporting and management, implemented through a centralised incident and risk management database. Accurate, effective and efficient reporting and management of incidents is an important input into risk analysis and management, providing the board and management with an appropriate level of visibility across all Vector-wide incidents.

Incident reporting is a significant source of information on the nature and level of risks and the effectiveness of controls, providing a key mechanism for gaining insight into the root causes of incidents. Staff are provided training on how to appropriate report incidents, and the HSE team promote awareness of, and engagement in incident reporting.

This level of visibility provides a valuable opportunity to trend, learn, improve, and avoid similar events in future. In managing incidents, Vector's priorities are to:

- Stabilise and manage the immediate situation. Depending on the event this includes ensuring the safety of its employees, contractors and members of the public; limiting damage to assets; limiting environmental harm, and preserving operations;
- Notify the appropriate internal staff and external authorities, agencies and organisations (where required) of the incident within the required timeframes;
- As appropriate, investigate the incident and prepare an incident report that considers all of the contributing factors, identifies the root cause(s) and recommends corrective actions as appropriate;
- Carry out any corrective actions; and

- Close out the incident.

Vector also provides a weekly report to the executive team and senior managers, showing all incidents rated with a potential severity of "serious or above". This report is reviewed as the first agenda item on the weekly executive meeting every Monday.

8.5.4 Safety Management System for Public Safety

The passing of the Electricity Amendment Act 2006 and Gas Amendment Act 2006 required companies in New Zealand engaged in the generation, transmission and distribution of electricity or gas to develop, implement and maintain a safety management system that will ensure their generation and distribution systems will not pose a significant risk of serious harm to members of the public or of significant damage to public property.

This amendment to the legislation was followed by the production of the New Zealand Standard (NZS7901) that sets out the detail. Vector has been audited to, and passed, the NZS7901 requirements in accordance with Section 51 of the Electricity (Safety) Regulations 2010, and has a current audit certificate certifying compliance with NZS7901.

As mentioned above, Vector is currently preparing for the changes that will be brought about under the Health and Safety Reform Bill.

8.5.5 Safety in Schools

Vector's safety in schools programme, Stay Safe around Electricity commenced in Auckland in 2005 and in 2011 was introduced to the Taranaki region. It has so far engaged more than 110,000 primary and intermediate school children about how to stay safe around electricity, both at home and in their neighbourhoods. Programmes are offered free and are supported by workbooks, teacher's guides and a dedicated website with additional information to help kids continue learning at school and at home.

Similarly in Taranaki, children learn about how to be safe around natural gas through the Discover Natural Gas programme, as well as how to Be Sustainable with Energy, which has so far engaged more than 3,000 school children in the region.

All three of Vector's programmes link directly into the New Zealand Curriculum through the topics of Science, Health and Physical Education.

The programmes have been very successful and have gained positive feedback from teachers and children alike. In 2014, Vector's school safety programme won the Public Safety award at the Electricity Engineers' Association awards.

8.5.6 Environmental Policy

Vector strives to be recognised as a leading environmentally responsible company, and conducts its operations in such a way as to respect and protect the natural environment, taking account of legislation and standards. Vector's environmental policy sets out the standards expected of all Vector People.

Vector is committed to being a trusted and valued member of the community. Accordingly, Vector is committed to continual and progressive improvement in its environmental performance and strives to provide sufficient, competent resources and effective systems at all levels of the organisation to fulfil this commitment.

Vector believes its commitment to managing operations in an environmentally responsible manner will maximise value for the company, Vector People, its customers and the community and as such, all Vector People are required to work in line with the policy.

Vector commits to:

- Ensuring environmental aspects are considered as part of all business decisions;
- Meeting and where possible exceeding the requirements of all relevant environmental legislation, regulations or codes;

- Participating and working with central and local government and other organisations to create pragmatic laws, regulations, standards and codes of practice to protect the environment while enabling Vector's business to operate;
- Monitoring and continuously improving our environmental performance in line with industry leading practice;
- Operating in a manner that minimises adverse environmental impacts and promotes beneficial environmental impacts wherever practicable; and
- Communicating with Vector People, customers and other relevant stakeholders on environmental aspects to ensure environmental impacts are appropriately managed.

To achieve this Vector will:

- Ensure that appropriate and proactive environmental planning is considered in all aspects of Vector's operations;
- Focus on responsible energy management and practice energy efficiency throughout all our premises, plant and equipment where it is practicable to do so;
- Establish environmental goals for the business, and regularly monitor and review the effectiveness of our Environmental Management Standard; and
- Educate Vector People ensuring the requirements for environmental responsibility are integrated into work practices.

The long term operational objectives of Vector are to:

- Utilise energy as efficiently as practicable;
- Plan for the future reduction of emissions and in particular the management of greenhouse gas emissions;
- Wherever practical, use ambient and renewable energy; and
- Influence and work with and within our supply chains to maximise energy efficiency.

Gas Distribution
Asset Management Plan
2015 – 2025

Summary of Expenditure Forecast – Section 9

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9 Expenditure Forecast and Reconciliation

This section summarises how the capital, operating and maintenance forecast expenditures are compiled, including prioritisation of expenditures.

As indicated in Section 2 of this AMP, while this AMP also satisfies regulatory requirements, its main purpose is as a working guideline for the management of Vector's gas distribution network assets. As Vector operates to a June financial year all its budgeting, financial and management reporting activities align with the June year. The forecasts contained in Sections 5, 6, 7 and 9 of this AMP are presented on a real 2016 New Zealand dollars basis, for Vector financial (July – June) years – which is the input required into Vector's budgeting and financial forecasting processes.

The Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) requires Vector to disclose the financial information in real 2015 dollars and in regulatory years (ending 30th June[1]). These figures are presented in the Report on Forecast Capital Expenditure (Information Disclosure Schedule 11a, Appendix 1 of this AMP) and the Report on Forecast Operational Expenditure (Information Disclosure Schedule 11b, Appendix 2 of this AMP). These two reports also contain the expenditure forecasts expressed in nominal dollars as required by the Information Disclosure Determination.

The price inflation factors used to convert the constant price forecasts to nominal forecasts are explained in Section 9.5. It should be noted that the capital expenditure forecasts given in the AMP are prepared in accordance with Generally Accepted Accounting Principles (GAAP) and are different from the forecasts given in Schedule 11a which are presented as expenditure on assets as required by the Commerce Commission ID Determination. Given the many variants in reporting financial information, the reader is cautioned when comparing the expenditure information in this AMP and the associated appendices.

While the expenditure forecasts in this AMP are the best estimates available at the time of preparing this plan[2] they will be subject to change in future as circumstances change and projects are reviewed.

The forecasts contained in this AMP would need to be reviewed if Vector applied to the Commerce Commission for a customised price-quality path (CPP). A CPP application requires certain information on capital and operational expenditures, and demand. Vector would need to ensure its capital and operational expenditure forecasts were aligned for the period of the CPP, and that they meet the requirements of the CPP Input Methodology.

9.1 Capital Expenditure

9.1.1 Capital Expenditure Categories

The expenditure categories contained in the forecasts are based on the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) as follows:

9.1.1.1 Customer Connection

Customer connection is the gross capital expenditure for the establishment of a new customer connection point or alterations to an existing customer connection point. This expenditure category includes gross capital expenditure relating to:

- Connection assets and/or parts of the network for which the expenditure is recoverable in total, or in part, by a contribution from the customer requesting the new or altered connection point; and

[1] The Vector financial year coincides with the regulatory disclosure year.
[2] This AMP is published on Vector's website on 30 June 2015.

- Gas injection and off-take points of connection.

Capital contributions for this type of work are accounted for separately. Expenditures under this category are discussed in more detail in Section 5 of this AMP.

9.1.1.2 System Growth

System growth is the gross capital expenditure to provide additional capacity on a part of the network to meet a change in demand, or additional investment to maintain current security and/or quality of supply standards due to the increased demand. This expenditure category includes gross capital expenditure associated with SCADA and telecommunications assets.

Expenditures under this category are discussed in more detail in Section 5 of this AMP.

9.1.1.3 Asset Replacement and Renewal

Asset replacement and renewal refers to the gross capital expenditure required to maintain network asset integrity so as to maintain the current security and/or quality of supply standards and includes expenditure as a result of:

- The progressive physical deterioration of the condition of network assets or their immediate surrounds;
- The obsolescence of network assets;
- Preventative replacement programmes, consistent with asset life-cycle management policies; or
- The need to ensure the ongoing physical security of the network assets.

Expenditures under this category are discussed in more detail in Section 6 of this AMP.

9.1.1.4 Asset Relocation

Asset relocation refers to the gross capital expenditure required to relocate assets due to third party requests, such as for the purpose of allowing road widening or similar needs. Capital contributions for this type of work are accounted for separately.

Expenditures under this category are discussed in more detail in Section 5 of this AMP.

9.1.1.5 Reliability, Safety and Environmental

Safety, reliability and the environmental impact of installations are key priorities in the design or maintenance of Vector' assets and, as such, form primary inputs into our asset management processes. However, in particular instances the need may arise in specific parts of the network to enhance safety or reliability, or to mitigate a (potential) negative environmental impact. Expenditure on such works is covered under the following sub-categories:

Quality of Supply

The primary purpose of this expenditure is to maintain the security and/or quality of supply performance of the network. This may include expenditure, in specific parts of the network where intervention is required, to reduce the:

- Interruption/fault rate;
- Average time that customers are affected by planned and/or unplanned interruptions; or
- Number of consumers affected by planned and/or unplanned interruptions.

Legislative and Regulatory

The primary purpose of this expenditure is to create or modify network assets as a result of a new regulatory or legal requirement.

Other Reliability, Safety and Environmental

The primary purpose of this expenditure is to improve network reliability or safety or to mitigate the environmental impacts of the network, but is not included in either of the quality of supply or legislative and regulatory categories.

Expenditures under this category are discussed in Sections 5 and 6 of the AMP.

9.1.1.6 Non-network capital expenditure

Non-network asset expenditure relates to the expenditure required to provide gas pipeline services but is not directly related to any gas network asset, and includes expenditure on or in relation to:

- Information and technology systems;
- Asset management systems;
- Office buildings, depots and workshops;
- Office furniture and equipment;
- Motor vehicles;
- Tools, plant and machinery; or
- Any other items treated as non-network assets under Generally Accepted Accounting Practice (GAAP).

For the purpose of this Asset Management Plan, only expenditures on asset management systems, information and technologies are included. These expenditures are discussed in more detail in Section 7 of this AMP. Other expenditures such as corporate IT, office furniture, etc are excluded from this AMP. It should be noted that the forecasts provided under Schedule 11a of the Information Disclosure (Appendix 1 of this AMP) include all non-network asset expenditures (on an allocation basis) and not just the asset management systems, information and technologies discussed in Section 7 of this AMP.

9.1.2 Capital Expenditure Forecast

Vector's gas distribution capital expenditure forecast for the next ten financial years (ending 30th June) is presented in * Figures are in 2016 real New Zealand dollars ($'000);

Table 9-1.[3] The figures are presented in 2016 prices to reflect the expenditure level of this works programme to be implemented during the planning period. For reference purposes we have also included the corresponding capital expenditure forecast disclosed in the 2014 AMP Update (* Figures are in 2016 real New Zealand dollars ($'000);

Table 9-2), escalated to 2016 prices. * Figures are in 2016 real New Zealand dollars ($'000);

[3] The totals in Table 9-1 below are slightly lower than the sum-totals for the individual projects described in sections 5 and 6 of this AMP. This reflects efficiencies arising from Vector's portfolio-management approach.

Table 9-3 below shows the difference between the 2014 AMP Update and 2015 AMP expenditure forecasts by expenditure categories. The 2014 forecast has been inflation adjusted (using a PPI of 3.3%[4]) to enable comparison with the 2015 figures.

[4] Refer to Table 9-8: Inflation factors

2015 AMP	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Consumer connection	$16,714	$17,242	$17,016	$15,869	$16,215	$16,408	$16,459	$16,858	$17,243	$17,359
System growth	$6,381	$5,033	$3,120	$2,338	$7,718	$5,954	$6,331	$2,767	$1,580	$1,580
Asset replacement and renewal	$4,008	$3,550	$2,460	$2,285	$3,270	$3,320	$3,310	$3,310	$3,310	$3,310
Asset relocations	$3,974	$4,329	$4,170	$4,219	$4,180	$4,043	$4,043	$4,125	$4,125	$4,125
Quality of supply	$530	$120	$385	$213	$80	$80	$175	$80	$80	$80
Legislative and regulatory	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other reliability, safety and environment	$690	$690	$0	$0	$0	$0	$0	$0	$0	$0
Capital Expenditure on network assets	**$32,296**	**$30,964**	**$27,151**	**$24,923**	**$31,463**	**$29,805**	**$30,318**	**$27,140**	**$26,338**	**$26,454**
Non Network Assets	$1,322	$1,646	$1,978	$1,563	$1,652	$1,970	$1,760	$1,749	$2,010	$1,891
Capital Expenditure on assets	**$33,619**	**$32,609**	**$29,129**	**$26,486**	**$33,115**	**$31,775**	**$32,078**	**$28,888**	**$28,348**	**$28,345**

* Figures are in 2016 real New Zealand dollars ($’000);

Table 9-1 : Capital expenditure forecast for Vector

2014 AMP Update	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Consumer connection	$14,808	$14,829	$15,435	$14,245	$14,461	$14,811	$14,916	$15,188	$15,511	
System growth	$3,481	$3,263	$3,667	$5,905	$8,911	$7,514	$6,814	$3,480	$1,260	
Asset replacement and renewal	$2,536	$3,062	$2,381	$3,413	$3,413	$3,388	$3,388	$3,388	$3,388	
Asset relocations	$4,974	$5,072	$5,127	$5,079	$4,649	$4,505	$4,505	$4,505	$4,505	
Quality of supply	$372	$131	$124	$261	$124	$83	$316	$83	$83	
Legislative and regulatory	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Other reliability, safety and environment	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Capital Expenditure on network assets	**$26,169**	**$26,358**	**$26,735**	**$28,904**	**$31,558**	**$30,301**	**$29,938**	**$26,643**	**$24,746**	
Non Network Assets	$2,116	$942	$998	$1,126	$1,565	$883	$915	$1,031	$974	
Capital Expenditure on assets	**$28,285**	**$27,300**	**$27,733**	**$30,030**	**$33,122**	**$31,184**	**$30,853**	**$27,674**	**$25,720**	

* Figures are in 2016 real New Zealand dollars ($’000);

Table 9-2: Capital expenditure forecast for Vector disclosed in the 2014 AMP Update

2014/2015 AMP Variances	Financial Year ($000)									
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**Total**
Consumer connection	$1,906	$2,413	$1,580	$1,623	$1,754	$1,597	$1,543	$1,670	$1,732	$15,818
System growth	$2,900	$1,771	-$547	-$3,567	-$1,193	-$1,560	-$483	-$713	$320	-$3,071
Asset replacement and renewal	$1,472	$488	$79	-$1,128	-$143	-$68	-$78	-$78	-$78	$467
Asset relocations	-$1,000	-$743	-$957	-$861	-$469	-$463	-$463	-$380	-$380	-$5,714
Quality of supply	$158	-$11	$261	-$48	-$44	-$3	-$141	-$3	-$3	$167
Legislative and regulatory	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other reliability, safety and environment	$690	$690	$0	$0	$0	$0	$0	$0	$0	$1,379
Capital Expenditure on network assets	**$6,126**	**$4,606**	**$417**	**-$3,981**	**-$95**	**-$495**	**$379**	**$497**	**$1,592**	**$9,046**
Non Network Assets	-$794	$704	$980	$437	$87	$1,087	$845	$718	$1,036	$5,100
Capital Expenditure on assets	**$5,332**	**$5,310**	**$1,397**	**-$3,544**	**-$8**	**$592**	**$1,224**	**$1,214**	**$2,628**	**$14,146**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 9-3: Variances between 2014 and 2015 capital expenditure forecast

9.1.3 Explanation of Major Variances in Capital Expenditure

This section highlights the significant changes to the 2015 disclosed capital expenditure forecasts[5]. The major changes in capital expenditure over the 9-year period for which the 2014 AMP Update and the 2015 AMP overlap, reflect:

- $16 million increase in consumer connection expenditure forecast due to the anticipated new requests for supply to large industrial and commercial connections;
- $6 million decrease in asset relocation expenditure reflecting the latest estimate of relocation activity;
- $5 million increase in non-network asset expenditure due to an increase in shared corporate costs; and
- $3 million decrease in system growth expenditure due to the deferment of a reinforcement project in East Auckland. This project is now anticipated to be completed in conjunction with the housing developments in the area, now anticipated to be completed outside of the planning period.

9.2 Operational Expenditure

Vector consistently looks for new opportunities and ways of improving our operating efficiency. Vector is still considering moving to a more clearly defined asset manager and service provider structure. The forecasts of operational expenditure in this section take account of the forecast costs associated with the new business arrangements.

Vector's gas distribution maintenance (direct operational) expenditure forecast for the disclosure years ending 30th June from 2016 to 2025 are set out in * Figures are in 2016 real New Zealand dollars ($'000);

Table 9-4. The expenditure forecasts are presented in June 2016 real New Zealand dollars and relate to the direct maintenance, inspection and field operation of assets to maintain network and asset integrity and their capability to deliver the level of service in accordance with Vector's asset management strategies. These expenditures do not include categories that are of an indirect/business support nature.

The expenditure forecasts presented in this table have been classified based on the expenditure categories defined in the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015). The forecast under the System Operations and Network Support category contains direct expenditure only (indirect components of this category are not included). The forecast for this category in the Information Disclosure Schedule 11b contains both direct and indirect expenditures and is therefore different from the figures in this section of the AMP.

9.2.1 Operating Expenditure Categories

Vector's direct operating expenditure is grouped under the following categories as defined in the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015).

9.2.1.1 Service Interruption and Emergency

This expenditure is provided for attending to any unplanned instantaneous event or incident that impairs the normal operation of network assets. This includes reactive work

[5] The figures are inflation adjusted.

(either temporary or permanent) undertaken in the immediate or short term in response to an unplanned event. This category also includes the direct cost of providing a service to respond to reported gas escapes, loss of supply and low pressure reports, make the network safe, repair leaks, rechecks, restore supply, provide for 24/7 response, non-productive time for response teams and back-up assistance required to restore supply. It also includes operational support used during the outage or emergency response and any necessary response to events arising upstream. It does not include expenditure on activities performed proactively to mitigate the impact such an event would have should it occur.

Planned follow-up activities resulting from an event which were unable to be permanently repaired in the short term are to be included under routine and corrective maintenance and inspection category.

9.2.1.2 Routine and Corrective Maintenance and Inspection

This category of expenditure is for activities specified in planned or programmed inspection, testing and maintenance work schedules including:

- Fault rectification work that is undertaken at a time or date subsequent to any initial fault response and restoration activities;
- Routine inspection;
- Functional and intrusive testing of assets, plant and equipment including critical spares and equipment;
- Helicopter, vehicle and foot patrols, including negotiation of landowner access;
- Asset surveys;
- Environmental response;
- Painting of network assets;
- Outdoor and indoor maintenance of stations, including weed and vegetation clearance, lawn mowing and fencing;
- Maintenance of access tracks, including associated security structures and weed and vegetation clearance;
- Customer-driven maintenance; and
- Notices issued.

9.2.1.3 Asset Replacement and Renewal

Asset replacement and renewal expenditure refers to the operational expenditure required to maintain network asset integrity so as to maintain the current security and/or quality of supply standards and includes expenditure as a result of:

- The progressive physical deterioration of the condition of network assets or their immediate surrounds;
- The obsolescence of network assets;
- Preventative replacement programmes, consistent with asset life-cycle management policies; or
- The need to ensure the ongoing physical security of the network assets.

Expenditures under the above three categories are discussed in more detail in Section 6 of this AMP.

9.2.2 Support Costs

In addition to the above three direct expenditure categories, the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) also defines two categories of operational expenditures that are related to the management of the gas distribution business but are not directly related to the maintenance and inspection of network assets. A description of these two expenditure categories is included in the following two sections. These two categories are a combination of internal / staff costs and external costs and are disclosed separately under Schedule 11b of the Information Disclosure regime, and do not form part of the AMP direct operational expenditure forecasts.

9.2.2.1 Business Support

Business support costs include operational expenditure associated with the following corporate activities:

- HR and training (other than operational training);
- Finance and regulation including compliance activities, valuations and auditing;
- CEO and director costs;
- Legal services;
- Consulting services (excluding engineering/technical consulting);
- Property management;
- Corporate communications;
- Corporate IT;
- Industry liaison and participation;
- Commercial activities including pricing, billing, revenue collection and marketing; and
- Liaison with the gas transmission business, customers and gas retailers.

9.2.2.2 System Operations and Network Support

System operations and network support costs include indirect operational expenditures for the management of the network and include expenditure relating to control centre and office-based system operations, including:

- Asset management planning including preparation of the AMP, load forecasting, network modeling;
- Network and engineering design (excluding capitalized design costs for capital projects);
- Network policy development (including the development of environmental, technical and engineering policies);
- Standards and manuals for network management;
- Network record keeping and asset management databases including GIS;
- Outage recording;
- Connection and customer records/customer management databases;
- Customer queries and call centre (not associated with direct billing);
- Operational training for network management and field staff;

- Operational vehicles and transport;
- IT & telecoms for network management (including IT support for asset management systems);
- Day to day customer management including responding to queries on new connections, disconnections and reconnections;
- Network planning and system studies;
- Logistics (procurement) and stores;
- Network asset site expenses and leases;
- Route/easement management (including locating pipelines for third parties, mark cuts, stand-overs, obstructions, plans and permits);
- Surveying of new sites to identify work requirements;
- Engineering/technical consulting services (excluding costs capitalised);
- Contractor/contracts management (excluding costs capitalised);
- Transmission operator liaison and management; and
- Network related research and development.

9.2.3 Operational Expenditure Forecast

Vector's gas distribution operational forecast for the next ten financial years (ending 30th June) is presented in * Figures are in 2016 real New Zealand dollars ($'000);

Table 9-4.6 The figures are presented in 2016 prices to reflect the expenditure level of this works programme to be implemented in 2016. For reference purposes we have also included the corresponding operational expenditure forecast disclosed in the 2014 AMP Update (* Figures are in 2016 real New Zealand dollars ($'000);

Table 9-5), escalated to 2016 prices. * Figures are in 2016 real New Zealand dollars ($'000);

Table 9-6 below shows the difference between the 2014 and 2015 expenditure forecasts by expenditure categories. The 2014 forecast has been inflation adjusted (using a PPI of 3.3%) to enable comparison with the 2015 figures.

[6] The totals in Table 9-1 below are slightly lower than the sum-totals for the individual projects described in sections 5 and 6 of this AMP. This reflects efficiencies arising from Vector's portfolio-management approach.

2015 AMP	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Service interruptions, incidents and emergencies	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040	$4,040
Routine and corrective maintenance and inspection	$4,464	$4,466	$4,468	$4,471	$4,473	$4,475	$4,478	$4,480	$4,483	$4,485
Asset replacement and renewal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System operations and network support	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309	$10,309
Business support	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575
Total Operational Expenditure	**$19,387**	**$19,389**	**$19,392**	**$19,394**	**$19,396**	**$19,399**	**$19,401**	**$19,403**	**$19,406**	**$19,408**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 9-4: Operational Expenditure Forecast for Vector

2014 AMP Update	Financial Year ($000)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Service interruptions incidents and emergencies	$4,037	$4,037	$4,037	$4,037	$4,037	$4,037	$4,037	$4,037	$4,037	
Routine and corrective maintenance and inspection	$4,698	$4,746	$4,797	$4,879	$4,882	$4,911	$4,940	$4,969	$4,998	
Asset replacement and renewal	$0	$0	$0	$0	$0	$0	$0	$0	$0	
System operations and network support	$4,181	$4,181	$4,181	$4,181	$4,181	$4,181	$4,181	$4,181	$4,181	
Business support	$8,548	$8,548	$8,548	$8,548	$8,548	$8,548	$8,548	$8,548	$8,548	
Total Operational Expenditure	**$21,465**	**$21,512**	**$21,564**	**$21,645**	**$21,649**	**$21,677**	**$21,706**	**$21,735**	**$21,764**	

* Figures are in 2016 real New Zealand dollars ($'000);

Table 9-5: Operational expenditure forecast for Vector disclosed in the 2014 AMP Update

2014/2015 AMP Variances	Financial Year ($000)									
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**Total**
Service interruptions incidents and emergencies	$3	$3	$3	$3	$3	$3	$3	$3	$3	$25
Routine and corrective maintenance and inspection	-$234	-$280	-$329	-$408	-$409	-$436	-$462	-$489	-$515	-$3,562
Asset replacement and renewal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System operations and network support	$6,128	$6,128	$6,128	$6,128	$6,128	$6,128	$6,128	$6,128	$6,128	$55,151
Business support	-$7,974	-$7,974	-$7,974	-$7,974	-$7,974	-$7,974	-$7,974	-$7,974	-$7,974	-$71,765
Total Operational Expenditure	**-$2,078**	**-$2,123**	**-$2,172**	**-$2,251**	**-$2,252**	**-$2,279**	**-$2,305**	**-$2,332**	**-$2,358**	**-$20,151**

* Figures are in 2016 real New Zealand dollars ($'000);

Table 9-6: Variances between 2014 and 2015 operational expenditure forecast

9.2.4 Explanation of Major Variances in Operational Expenditure

This section highlights the significant changes to the 2015 disclosed operational expenditure forecasts[7]. The major changes in operational expenditure over the 9-year period for which the 2014 AMP Update and the 2015 AMP overlap, reflect:

- $13 million reduction in network and business support costs which is driven by a lower allocation of corporate costs for the gas distribution business.
- $4 million reduction in routine corrective and maintenance costs following a review of some lower risk maintenance activities, and the reduction in our long-term asset cost escalators, and
- In addition, a reclassification of network and business support costs has resulted in a higher proportion of costs now being treated as network support rather than business support.

9.3 Assumptions for Preparing Expenditure Forecasts

While the 10 year expenditure forecasts have been prepared based on the best information at Vector's disposal. Factors that may materially influence investments levels going forward include:

- Economic cycles impact on business activities and hence gas demand. For the purposes of this AMP, Vector has assumed that economic growth will take place at relatively modest to low levels in the short to medium term;
- Part 4 regulation. This has an impact on both operational expenditure and capital expenditure. The requirement to meet the regulated service price-quality standards can impact on the required operational expenditure and capital expenditure levels. The Commerce Commission's operation of Part 4 can also impact on the ability and incentives to innovate and to invest, including in replacement, upgraded, and new assets; and to improve efficiency and provide services at a quality that reflects consumer demands;
- Whether the regulatory regime supports investment in capacity, security and quality improvements or energy efficiency and whether customers expect such investment activity. The quality requirements for gas distribution businesses focus only on the time to attend to emergencies rather than supply quality improvements under normal operation.

In addition to those discussed above, Vector has also observed other factors that have historically caused major variations between forecast and actual expenditure:

- Gas demand, which is a prime driver for network investment, is closely linked to customer behavior (which is sensitive to the weather), commercial and industrial customer consumption and new connection numbers which are related to economic conditions;
- The timing of large customer and relocation projects is very uncertain, and Vector often experiences significant discrepancies between previously requested timelines, which drives the AMP cost estimates, and actual construction periods; and
- Vector is continually improving the manner in which it collects, store and analyses asset information data. As better and more information become available, this sometimes identifies a need for accelerated (or decelerated) asset renewal.

[7] The figures are inflation adjusted.

9.4 Prioritisation of Expenditure

Section 2 of this AMP explains the relationship between Vector's goals and strategies, its asset management and investment strategies and policies and how these are used to guide the capital and maintenance works programme.

Section 5 of this AMP details the planning policies and standards, industry information, load growth assumptions, asset capacities, network operations information and network data required for the preparation of a ten year network development plan. A ten year expenditure projection on customer and growth works programme has been prepared, based on the network development plan. An asset relocation programme is also identified based on information available from roading and local authorities.

Section 6 of this AMP details the asset inspection, maintenance, replacement and refurbishment policies and standards. A replacement and refurbishment programme has been prepared for each asset category, based on these policies and standards and taking into account the information on asset age and condition and unit rates (material and labour). Following from this works programme, a ten year capital and operating expenditure projection on maintenance and replacement has been prepared.

An expenditure prioritisation process has been developed in line with Vector's strategies and goals to ensure those projects are of the highest importance and with the highest cost-benefit are implemented. A four band prioritisation matrix[8] has been developed to rank all projects identified in Section 5 and Section 6, as illustrated in Table 9-7 below. The four priority bands are:

1. Vital investments;
2. Critical investments;
3. Essential investments; and
4. Beneficial investments.

The prioritisation process involves assigning a priority band to each of the value drivers for each project based on an understanding of the purpose, value and risk of the project. The value drivers[9] as illustrated in Table 9-7 are:

- Health, safety and environmental;
- Security and capacity;
- Customer connections;
- Network reliability and asset performance;
- Brand and reputation;
- Legal compliance;
- Financial performance; and
- Operational performance improvement.

The highest priority band will be chosen as the score for the project. The projects are then ranked according to the scores, with a ranking of one being the highest priority. Projects and programmes with a ranking of 1 to 3 are selected as the main expenditure forecast (refer to Table 9-7).

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[8] This prioritisation matrix is used for Vector's Electricity Business and Gas Distribution Business.

[9] The value drivers are not listed in any order of priority.

Rank	Security & Capacity	Customer Connections	Network Reliability & Asset Performance	Brand & Reputation	Legal Compliance	Health, Safety & Environment	Financial Performance	Operational Performance Improvement
1. Vital investments	Mitigate capacity breach leading to asset damage Mitigate capacity breach to widespread or critical areas	Mitigate capacity breach to critical customer	Reactive replacement of critical assets	Avoid potentially serious reputation damage	Avoid serious breach of technical regulations Avoid serious breach of HSE or environmental legislation	Mitigate imminent serious HSE or environmental threats	Mitigate extreme and very high risks	Mitigate critical cyber security breach
2. Critical investments	Mitigate security breach to widespread or critical areas Mitigate capacity breach	Satisfy contractual obligations (critical customers) New connections and capacity increase (critical customers)	Replacement of severely deteriorated assets with high risk and high consequence of failure Reactive replacement of assets required for network operation	Avoid potential reputation damage	Regulatory compliance (including Industry Participation Code, environmental, HSE, etc) Asset relocation as required by statute	Mitigate anticipated serious environmental or HSE threats	Mitigate high impact direct risks	Mitigate serious cyber security breach
3. Essential investments		Customer capacity and security requests Customer funded projects	Replacement of rapidly deteriorating assets or assets at the end of technical life with increased risk of failure. High consequence of failure Medium term mitigation against natural disasters Reliability improvements (to widespread or critical areas)		Regulatory improvement Mitigate breach of technical regulations (pressure, etc) in localised areas	Medium term safety & environmental improvement	Assets costing more to maintain and operate than to replace	Technology trials. Enhance operational efficiency Asset relocation required by requiring authorities

Rank	Security & Capacity	Customer Connections	Network Reliability & Asset Performance	Brand & Reputation	Legal Compliance	Health, Safety & Environment	Financial Performance	Operational Performance Improvement
4. Beneficial investments			Asset condition deteriorating gradually with increased risk of failure Steady state asset replacement programmes. Reliability improvements.			Long term safety & environmental improvement	Safeguard future options Discretionary initiatives that are NPV>0.	Asset relocation requested by consumers and land owners Enhance supply quality. Improve asset management and operational practices.

Table 9-7: Asset investment Prioritisation matrix

9.5 Price Escalation Factors

Vector is required under Clause 2.6 of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) to disclose its Forecast Capital and Operational Expenditure as set out in Schedules 11a and 11b. Schedules 11a and 11b require the expenditure forecasts to be presented in both constant price and nominal terms.

Clause 3.9 of the Attachment A of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) requires the assumptions used in the price inflator to be recorded in the AMP. Table 9-8 below shows the price inflation factors used to convert constant price forecasts to nominal forecasts[10].

Financial Year	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY25
Inflation Factor	0.1%	3.3%	2.7%	2.7%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%

Table 9-8: Inflation factors

[10] Source: NZIER (New Zealand Institute of Economic Research) December 2014 PPI (Producer Price Index-inputs)

Gas Distribution Asset Management Plan 2015 – 2025

Appendices

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Appendix 1

Schedule 11a: Report on Forecast Capital Expenditure

Company Name	**Vector**
AMP Planning Period	**1 July 2015 – 30 June 2025**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

GDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

sch ref												
7		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8	for year ended	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**	**30 Jun 19**	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
9	**11a(i): Expenditure on Assets Forecast**	**$000 (nominal dollars)**										
10	Consumer connection	17,791	16,679	17,673	17,904	17,114	17,925	18,592	19,116	20,069	21,040	21,711
11	System growth	1,879	6,322	5,122	3,259	2,503	8,471	6,698	7,301	3,270	1,914	1,962
12	Asset replacement and renewal	5,911	3,993	3,633	2,585	2,461	3,609	3,756	3,839	3,934	4,033	4,134
13	Asset relocations	1,935	3,924	4,391	4,341	4,502	4,572	4,532	4,645	4,859	4,980	5,105
14	Reliability, safety and environment:											
15	Quality of supply	67	530	123	406	230	89	91	204	95	98	100
16	Legislative and regulatory	413	-	-	-	-	-	-	-	-	-	-
17	Other reliability, safety and environment	259	682	701	-	-	-	-	-	-	-	-
18	**Total reliability, safety and environment**	739	1,212	824	406	230	89	91	204	95	98	100
19	**Expenditure on network assets**	28,255	32,130	31,643	28,495	26,810	34,666	33,669	35,105	32,227	32,065	33,012
20	Expenditure on non-network assets	1,071	1,308	1,672	2,063	1,670	1,810	2,212	2,026	2,063	2,431	2,343
21	**Expenditure on assets**	29,326	33,438	33,315	30,558	28,480	36,476	35,881	37,131	34,290	34,496	35,355
22												
23	*plus* Cost of financing	119	181	181	156	145	209	198	205	173	168	171
24	*less* Value of capital contributions	5,004	6,701	7,308	7,322	7,337	7,551	7,642	7,848	8,220	8,509	8,747
25	*plus* Value of vested assets	-	-	-	-	-	-	-	-	-	-	-
26	**Capital expenditure forecast**	24,441	26,918	26,188	23,392	21,288	29,134	28,437	29,488	26,243	26,155	26,779
27												
28	Assets commissioned	28,374	29,650	26,188	23,407	21,072	25,385	23,862	38,349	26,243	25,348	27,606
29												
30		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
31	for year ended	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**	**30 Jun 19**	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
32		**$000 (in constant prices)**										
33	Consumer connection	17,791	16,150	16,658	16,440	15,332	15,667	15,854	15,903	16,288	16,660	16,772
34	System growth	1,879	6,121	4,827	2,992	2,242	7,404	5,712	6,073	2,654	1,516	1,516
35	Asset replacement and renewal	5,911	3,865	3,424	2,373	2,203	3,154	3,203	3,193	3,193	3,193	3,193
36	Asset relocations	1,935	3,799	4,139	3,987	4,033	3,996	3,865	3,865	3,943	3,943	3,943
37	Reliability, safety and environment:											
38	Quality of supply	67	513	116	373	206	77	77	169	77	77	77
39	Legislative and regulatory	413	-	-	-	-	-	-	-	-	-	-
40	Other reliability, safety and environment	259	661	661	-	-	-	-	-	-	-	-
41	**Total reliability, safety and environment**	739	1,174	777	373	206	77	77	169	77	77	77
42	**Expenditure on network assets**	28,255	31,109	29,825	26,165	24,016	30,298	28,711	29,203	26,155	25,389	25,501
43	Expenditure on non-network assets	1,071	1,266	1,576	1,894	1,496	1,582	1,887	1,685	1,674	1,925	1,810
44	**Expenditure on assets**	29,326	32,375	31,401	28,059	25,512	31,880	30,598	30,888	27,829	27,314	27,311
45	**Subcomponents of expenditure on assets (where known)**											
46	Research and development	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
	for year ended	30 Jun 15	30 Jun 16	30 Jun 17	30 Jun 18	30 Jun 19	30 Jun 20	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Difference between nominal and constant price forecasts		$000										
Consumer connection		-	529	1,015	1,464	1,782	2,258	2,738	3,213	3,781	4,380	4,939
System growth		-	201	295	267	261	1,067	986	1,228	616	398	446
Asset replacement and renewal		-	128	209	212	258	455	553	646	741	840	941
Asset relocations		-	125	252	354	469	576	667	780	916	1,037	1,162
Reliability, safety and environment:												
Quality of supply		-	17	7	33	24	12	14	35	18	21	23
Legislative and regulatory		-	-	-	-	-	-	-	-	-	-	-
Other reliability, safety and environment		-	21	40	-	-	-	-	-	-	-	-
Total reliability, safety and environment		-	38	47	33	24	12	14	35	18	21	23
Expenditure on network assets		-	1,021	1,818	2,330	2,794	4,368	4,958	5,902	6,072	6,676	7,511
Expenditure on non-network assets		-	42	96	169	174	228	325	341	389	506	533
Expenditure on assets		-	1,063	1,914	2,499	2,968	4,596	5,283	6,243	6,461	7,182	8,044

11a(ii): Consumer Connection

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	for year ended	30 Jun 15	30 Jun 16	30 Jun 17	30 Jun 18	30 Jun 19	30 Jun 20
*Consumer types defined by GDB**		$000 (in constant prices)					
Mains Extensions/Subdivsions		8,991	6,916	6,823	6,170	6,303	6,434
Service Connections - Residential		7,082	7,815	8,421	8,859	7,622	7,828
Service Connections - Commercial		1,687	1,361	1,356	1,353	1,349	1,347
Customer Easements		31	58	58	58	58	58
** include additional rows if needed*							
Consumer connection expenditure		17,791	16,150	16,658	16,440	15,332	15,667
less Capital contributions funding consumer connection		3,201	2,948	3,033	3,009	2,815	2,876
Consumer connection less capital contributions		14,590	13,202	13,625	13,431	12,517	12,791

11a(iii): System Growth

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
Intermediate pressure						
Main pipe	-	2,782	1,343	1,247	192	5,351
Service pipe	-	-	-	-	-	-
Stations	1,221	683	1,052	727	844	830
Line valve	22	-	-	-	-	-
Special crossings	-	-	-	-	-	-
Intermediate Pressure total	1,243	3,465	2,395	1,974	1,036	6,181
Medium pressure						
Main pipe	636	2,445	2,301	512	1,050	1,108
Service pipe	-	-	-	-	-	-
Stations	-	-	-	391	-	-
Line valve	-	-	-	-	-	-
Special crossings	-	96	16	-	41	-
Medium Pressure total	636	2,541	2,317	903	1,091	1,108

92	**Low Pressure**						
93	Main pipe	-	-	-	-	-	-
94	Service pipe	-	-	-	-	-	-
95	Line valve	-	-	-	-	-	-
96	Special crossings	-	-	-	-	-	-
97	**Low Pressure total**	-	-	-	-	-	-
98	**Other network assets**						
99	Monitoring and control systems	-	115	115	115	115	115
100	Cathodic protection systems	-	-	-	-	-	-
101	Other assets (other than above)	-	-	-	-	-	-
102	**Other network assets total**	-	115	115	115	115	115
103							
104	**System growth expenditure**	1,879	6,121	4,827	2,992	2,242	7,404
105	*less* Capital contributions funding system growth	-	-	-	-	-	-
106	**System growth less capital contributions**	1,879	6,121	4,827	2,992	2,242	7,404
107							
108							

109		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
	for year ended	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**	**30 Jun 19**	**30 Jun 20**
110	**11a(iv): Asset Replacement and Renewal**						
111	**Intermediate pressure**	**$000 (in constant prices)**					
112	Main pipe	-	19	19	19	19	19
113	Service pipe	-	-	-	-	-	-
114	Stations	1,305	994	888	531	482	482
115	Line valve	598	-	-	-	-	-
116	Special crossings	376	241	318	193	72	58
117	**Intermediate Pressure total**	2,279	1,254	1,225	743	573	559
118	**Medium pressure**						
119	Main pipe	1,278	1,664	1,399	1,254	1,254	2,219
120	Service pipe	47	72	-	-	-	-
121	Station	52	48	48	48	48	48
122	Line valve	-	-	-	-	-	-
123	Special crossings	-	-	-	-	-	-
124	**Medium Pressure total**	1,377	1,784	1,447	1,302	1,302	2,267
125	**Low Pressure**						
126	Main pipe	1,378	-	-	-	-	-
127	Service pipe	-	-	-	-	-	-
128	Line valve	-	-	-	-	-	-
129	Special crossings	-	-	-	-	-	-
130	**Low Pressure total**	1,378	-	-	-	-	-

Other network assets						
Monitoring and control systems	9	-	-	-	-	-
Cathodic protection systems	731	615	540	116	116	116
Other assets (other than above)	137	212	212	212	212	212
Other network assets total	877	827	752	328	328	328
Asset replacement and renewal expenditure	5,911	3,865	3,424	2,373	2,203	3,154
less Capital contributions funding asset replacement and renewal	-	-	-	-	-	-
Asset replacement and renewal less capital contributions	5,911	3,865	3,424	2,373	2,203	3,154

11a(v): Asset Relocations

*Project or programme**						
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
** include additional rows if needed*						
All other projects or programmes - asset relocations	1,935	3,799	4,139	3,987	4,033	3,996
Asset relocations expenditure	1,935	3,799	4,139	3,987	4,033	3,996
less Capital contributions funding asset relocations	1,803	3,656	3,983	3,837	3,881	3,846
Asset relocations less capital contributions	132	143	156	150	152	150

11a(vi): Quality of Supply

	Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
for year ended	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**	**30 Jun 19**	**30 Jun 20**
*Project or programme**	**$000 (in constant prices)**					
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
** include additional rows if needed*						
All other projects or programmes - quality of supply	67	513	116	373	206	77
Quality of supply expenditure	67	513	116	373	206	77
less Capital contributions funding quality of supply	-	-	-	-	-	-
Quality of supply less capital contributions	67	513	116	373	206	77

11a(vii): Legislative and Regulatory

Project or programme						
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-

** include additional rows if needed*

All other projects or programmes - legislative and regulatory	413	-	-	-	-	-
Legislative and regulatory expenditure	413	-	-	-	-	-
less Capital contributions funding legislative and regulatory	-	-	-	-	-	-
Legislative and regulatory less capital contributions	413	-	-	-	-	-

11a(viii): Other Reliability, Safety and Environment

Project or programme*						
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-

** include additional rows if needed*

All other projects or programmes - other reliability, safety and environment	259	661	661	-	-	-
Other reliability, safety and environment expenditure	259	661	661	-	-	-
less Capital contributions funding other reliability, safety and environment	-	-	-	-	-	-
Other Reliability, safety and environment less capital contributions	259	661	661	-	-	-

11a(ix): Non-Network Assets

Routine expenditure

Project or programme*						
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-

** include additional rows if needed*

All other projects or programmes - routine expenditure	527	557	678	802	647	680
Routine expenditure	527	557	678	802	647	680

Atypical expenditure

Project or programme*						
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-

** include additional rows if needed*

All other projects or programmes - atypical expenditure	544	709	898	1,092	849	902
Atypical expenditure	544	709	898	1,092	849	902
Expenditure on non-network assets	1,071	1,266	1,576	1,894	1,496	1,582

Schedule 11a Explanatory Notes

The box below provides commentary specific to the difference between nominal and constant price capital expenditure for the current disclosure year and the 10 year planning period. It is provided in the same format as required for Box 1, Schedule 14a of the Gas Distribution Information Disclosures, which will be fully disclosed within 6 months of the end of the disclosure year.

Commentary on difference between nominal and constant price capital expenditure forecasts
Vector has used the NZIER (New Zealand Institute of Economic Research) December 2014 PPI (Producer Price Index-inputs) forecast from 2015 to 2018. Thereafter we have assumed a long-term inflation rate of 2.5%. The constant price capital expenditure forecast is then inflated by the above mentioned PPI forecast to nominal price capital expenditure forecasts.

Gas Distribution Asset Management Plan 2015 – 2025

Appendix 2

Schedule 11b: Report on Forecast Operational Expenditure

Company Name	**Vector**
AMP Planning Period	**1 July 2015 – 30 June 2025**

SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.
GDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref												
7		*Current year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8	for year ended	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**	**30 Jun 19**	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions, incidents and emergencies	3,911	4,040	4,150	4,260	4,366	4,476	4,587	4,702	4,820	4,940	5,064
11	Routine and corrective maintenance and inspection	4,177	4,464	4,588	4,712	4,832	4,955	5,082	5,212	5,345	5,481	5,621
12	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
13	**Network opex**	8,088	8,504	8,738	8,972	9,198	9,431	9,669	9,914	10,165	10,421	10,685
14	System operations and network support	9,932	10,309	10,589	10,870	11,141	11,420	11,705	11,998	12,298	12,605	12,921
15	Business support	556	575	590	606	621	637	652	669	686	703	720
16	**Non-network opex**	10,488	10,884	11,179	11,476	11,762	12,057	12,357	12,667	12,984	13,308	13,641
17	**Operational expenditure**	18,576	19,388	19,917	20,448	20,960	21,488	22,026	22,581	23,149	23,729	24,326
18		*Current year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
19	for year ended	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**	**30 Jun 19**	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
20		**$000 (in constant prices)**										
21	Service interruptions, incidents and emergencies	3,911	3,912	3,912	3,912	3,912	3,912	3,912	3,912	3,912	3,912	3,912
22	Routine and corrective maintenance and inspection	4,177	4,322	4,324	4,326	4,329	4,331	4,333	4,336	4,338	4,340	4,343
23	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
24	**Network opex**	8,088	8,234	8,236	8,238	8,241	8,243	8,245	8,248	8,250	8,252	8,255
25	System operations and network support	9,932	9,981	9,981	9,981	9,981	9,981	9,981	9,981	9,981	9,981	9,981
26	Business support	556	556	556	556	556	556	556	556	556	556	556
27	**Non-network opex**	10,488	10,537	10,537	10,537	10,537	10,537	10,537	10,537	10,537	10,537	10,537
28	**Operational expenditure**	18,576	18,771	18,773	18,775	18,778	18,780	18,782	18,785	18,787	18,789	18,792
29	**Subcomponents of operational expenditure (where known)**											
30	Research and development	-	-	-	-	-	-	-	-	-	-	-
	Insurance	223	223	223	223	223	223	223	223	223	223	223
32												
33		*Current year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
34	for year ended	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**	**30 Jun 19**	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
35	**Difference between nominal and real forecasts**	**$000**										
36	Service interruptions, incidents and emergencies	-	128	238	348	454	564	675	790	908	1,028	1,152
37	Routine and corrective maintenance and inspection	-	142	264	386	503	624	749	876	1,007	1,141	1,278
38	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
39	**Network opex**	-	270	502	734	957	1,188	1,424	1,666	1,915	2,169	2,430
40	System operations and network support	-	328	608	889	1,160	1,439	1,724	2,017	2,317	2,624	2,940
41	Business support	-	19	34	50	65	81	96	113	130	147	164
42	**Non-network opex**	-	347	642	939	1,225	1,520	1,820	2,130	2,447	2,771	3,104
43	**Operational expenditure**	-	617	1,144	1,673	2,182	2,708	3,244	3,796	4,362	4,940	5,534

Schedule 11b Explanatory Notes

The box below provides commentary specific to the difference between nominal and constant price operational expenditure for the current disclosure year and the 10 year planning period. It is provided in the same format as required for Box 2, Schedule 14a of the Gas Distribution Information Disclosures, which will be fully disclosed within 6 months of the end of the disclosure year.

Commentary on difference between nominal and constant price operational expenditure forecasts
Vector has used the NZIER (New Zealand Institute of Economic Research) December 2014 PPI (Producer Price Index-inputs) forecast from 2015 to 2018. Thereafter we have assumed a long-term inflation rate of 2.5%. The constant price operational expenditure forecast is then inflated by the above mentioned PPI forecast to nominal price operational expenditure forecasts.

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Appendix 3

Schedule 12a: Report on Asset Condition

										Company Name	**Vector**
										AMP Planning Period	**1 July 2015 – 30 June 2025**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a.

sch ref											
7					**Asset condition at start of planning period (percentage of units by grade)**						
8	**Operating Pressure**	**Asset category**	**Asset class**	**Units**	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
9	Intermediate Pressure	Main pipe	IP PE main pipe	km	-	-	-	-	-	N/A	-
10	Intermediate Pressure	Main pipe	IP steel main pipe	km	-	-	-	100.00%	-	3	-
11	Intermediate Pressure	Main pipe	IP other main pipe	km	-	-	-	-	-	N/A	-
12	Intermediate Pressure	Service pipe	IP PE service pipe	km	-	-	-	-	-	N/A	-
13	Intermediate Pressure	Service pipe	IP steel service pipe	km	-	-	73.30%	26.70%	-	3	-
14	Intermediate Pressure	Service pipe	IP other service pipe	km	-	-	-	-	-	N/A	-
15	Intermediate Pressure	Stations	Intermediate pressure DRS	No.	-	4.86%	36.22%	58.92%	-	4	10.81
16	Intermediate Pressure	Line valve	IP line valves	No.	0.53%	6.18%	71.00%	2.35%	19.94%	3	0.53
17	Intermediate Pressure	Special crossings	IP crossings	No.	-	15.00%	82.50%	2.50%	-	3	1.35
18	Medium Pressure	Main pipe	MP PE main pipe	km	-	0.49%	-	99.51%	-	3	0.18
19	Medium Pressure	Main pipe	MP steel main pipe	km	-	-	-	100.00%	-	3	-
20	Medium Pressure	Main pipe	MP other main pipe	km	-	100.00%	-	-	-	3	100.00
21	Medium Pressure	Service pipe	MP PE service pipe	km	-	0.36%	99.64%	-	-	3	0.13
22	Medium Pressure	Service pipe	MP steel service pipe	km	-	-	100.00%	-	-	3	0.27
23	Medium Pressure	Service pipe	MP other service pipe	km	-	-	100.00%	-	-	3	-
24	Medium Pressure	Stations	Medium pressure DRS	No.	-	-	32.56%	67.44%	-	4	-
25	Medium Pressure	Line valve	MP line valves	No.	0.03%	2.74%	76.35%	1.31%	19.57%	3	0.03
26	Medium Pressure	Special crossings	MP special crossings	No.	-	4.07%	68.29%	26.02%	1.63%	3	4.17
27	Low Pressure	Main pipe	LP PE main pipe	km	-	-	-	100.00%	-	3	-
28	Low Pressure	Main pipe	LP steel main pipe	km	-	-	-	-	-	3	-
29	Low Pressure	Main pipe	LP other main pipe	km	-	-	-	-	-	3	-
30	Low Pressure	Service pipe	LP PE service pipe	km	-	-	-	100.00%	-	3	-
31	Low Pressure	Service pipe	LP steel service pipe	km	-	-	-	-	-	3	-
32	Low Pressure	Service pipe	LP other service pipe	km	-	-	-	-	-	3	-
33	Low Pressure	Line valve	LP line valves	No.	-	-	86.36%	-	13.64%	3	-
34	Low Pressure	Special crossings	LP special crossings	No.	-	-	-	-	-	N/A	-
35	All	Monitoring and control systems	Remote terminal units	No.	-	1.33%	24.00%	74.67%	-	3	-
36	All	Cathodic protection systems	Cathodic protection	No.	1.85%	11.11%	72.22%	14.81%	-	4	7.50

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Appendix 4

Schedule 12b: Report on Forecast Utilisation

Company Name	**Vector**
AMP Planning Period	**1 July 2015 – 30 June 2025**

SCHEDULE 12b: REPORT ON FORECAST UTILISATION

This Schedule requires a breakdown of current and forecast utilisation (for heavily utilised pipelines) consistent with the information provided in the AMP and the demand forecast in schedule S12c.

sch ref

7 **Forecast Utilisation of Heavily Utilised Pipelines**

8 **Utilisation**

sch ref	Region	Network	Pressure system	Nominal operating pressure (NOP) (kPa)	Minimum operating pressure (MinOP) (kPa)	Total capacity at MinOP (scmh)	Remaining capacity at MinOP (scmh)	Unit	*Current Year CY* y/e 30 Jun 15	*CY+1* y/e 30 Jun 16	*CY+2* y/e 30 Jun 17	*CY+3* y/e 30 Jun 18	*CY+4* y/e 30 Jun 19	*CY+5* y/e 30 Jun 20	Comment
11	Auckland	Auckland Central	AU Penrose MP2	200	100	1,210	47	scmh	1163	1173	1183	1192	1202	1212	Remaining capacity at MinOP is available in the Penrose East area. System reinforcement is planned in FY17.
12								kPa	103	101	127	126	124	123	
	Auckland	Auckland Central	AU North Shore MP4	400	200	13,902	22	scmh	13880	14059	14238	14417	14596	14775	Remaining capacity at MinOP is available in the Devenport area.
								kPa	240	235	230	224	219	214	
	Auckland	Auckland Central	AU Central Auckland MP4	400	200	42,248	31	scmh	42217	42572	42926	43281	43635	43990	Remaining capacity at MinOP is available in the South Titirangi area. Refer to Notes 5, 8 and 10 for other explanatory information.
								kPa	259	256	253	251	248	245	
	Auckland	Auckland Central	AU East Auckland MP4	400	200	19,282	99	scmh	19183	19375	19569	19764	19962	20161	Remaining capacity at MinOP is available in Mangere area. System reinforcement is planned to implement in 2014. Refer Notes 5, 9 and 10 for other explanatory information.
								kPa	262	259	256	252	249	246	
	Auckland	Auckland Central	AU Auckland Airport MP4	400	200	2,223	37	scmh	2186	2208	2230	2253	2275	2298	Remaining capacity at MinOP is available in the vicinity of the Domestic Terminal Building, and also in the business park adjacent George Bolt Memorial Drive.
								kPa	206	201	196	207	203	198	
	Auckland	Auckland Central	AU Wattle Downs MP4	400	200	862	58	scmh	804	811	817	824	830	837	Remaining capacity at MinOP is available in the Mahia Park area.
								kPa	353	352	351	351	350	349	
13	Auckland	Auckland Central	AU Manurewa North MP4	400	200	3,271	60	scmh	3211	3238	3265	3292	3319	3346	Remaining capacity at MinOP is available in The Gardens area.
14								kPa	231	228	224	221	217	214	
15	Auckland	Auckland Central	AU Manurewa South MP4	400	200	802	115	scmh	687	693	699	704	710	716	Remaining capacity at MinOP is available in the Redhill area.
16								kPa	390	390	390	389	389	389	
17	Waikato	Hamilton	HA Hamilton West MP4	400	200	3,195	26	scmh	3169	3229	3291	3353	3417	3482	Remaining capacity at MinOP is available in Nawton east area. Refer Note 6 for other explanatory information.
18								kPa	228	224	219	215	210	205	
19	Waikato	Hamilton	HA Pukete MP4	400	200	2,885	72	scmh	2813	2867	2921	2977	3033	3091	Remaining capacity at MinOP is available in Te Rapa East area. System reinforcement is planned in 2019. Refer Notes 6 and 10 for other explanatory information.
20								kPa	214	209	203	198	242	239	
21	Waikato	Waitoa	WT Waitoa MP4	400	200	1,746	-	scmh	1746	1792	1838	1886	1935	1985	Remaining capacity at MinOP is available nil. System reinforcement is planned in 2017. Refer Notes 7 and 10 for other explanatory information.
22								kPa	137	118	234	226	217	208	
23	Gisborne	Gisborne	GS Gisborne IP20	1,900	950	3,634	301	scmh	3333	3358	3384	3409	3435	3460	Remaining capacity at MinOP is available at Matawhero south area. Refer Note 4 for other explanatory information.
24								kPa	1161	1152	1142	1133	1124	1113	
25	Kapiti	Paraparaumu	PR Paraparaumu IP20	1,900	950	1,766	-	scmh	1766	1814	1862	1911	1960	2008	Remaining capacity at MinOP is nil. System reinforcement is planned in 2016. Refer Notes 4 and 10 for other explanatory information.
26								kPa	674	1336	1314	1291	1267	1243	

31 * *Current year utilisation figures may be estimates. Year 1–5 figures show the utilisation forecast to occur given the expected system configuration for each year, including the effect of any new investment in the pressure system.*

32

33 **Disclaimer for supply enquiries**

34 The information in this table contains modelled estimates of utilisation and capacity. Any interested party seeking to invest in supply from Vector's distribution networks should contact their retailer and confirm availability of capacity.

36 **Notes and assumptions**

37 1. A 'heavily utilised' pressure system is a pressure system where the modelled flow rate, at system peak during 2014, is greater than or equal to 500 scmh, and its utilisation (pressure drop) is greater than or equal to 40% from the nominal operating pressure (NOP). The utilisation of a pressure system is calculated using the formula: [1 – (system minimum pressure/nominal operating pressure)] *100%.

2. The remaining capacity of a 'heavily utilised' pressure system is obtained by examining the modelled flows at various extremity points in each pressure system, and the level at which the minimum operating pressure (MinOP) is reached. Vector's security standards set the MinOP at 50% of the rated pressure (which equates to approximately 82% of the pipeline capacity) for a pressure system (based on standard operating pressures). The minimum modelled flow rate, analysed at one extremity point, is used to calculate the remaining capacity of the entire pressure system being studied.

38 3. A forecast model of a pressure system is obtained by applying either its forecast flow rate or an annual growth rate, in each forecast year; and scaling its loads evenly to give the system total flow. The resulting minimum system pressure is simulated on this basis.

4. The forecast system flow is populated using the respective network system as tabulated in Table 5.1 of Section 5 - Network Development Planning of Gas Distribution Asset Management Plan 2015 - 2025.

5. The forecast system flow for the Central Auckland network system is based on an annual growth rate of 0.84%, as tabulated in Table 5.1 of Section 5 - Network Development Planning of Gas Distribution Asset Management Plan 2015 - 2025.

39 6. The forecast system flow for the Hamilton network system is based on an annual growth rate of 1.6%, as tabulated in Table 5.1 of Section 5 - Network Development Planning of Gas Distribution Asset Management Plan 2015 - 2025.

7. The forecast system flow for the Waitoa network system is based on an annual growth rate of 3.9%, as tabulated in Table 5.1 of Section 5 - Network Development Planning of Gas Distribution Asset Management Plan 2015 - 2025.

8. The AU Central Auckand MP4, AU Onehunga MP4, AU Main Highway MP4, AU Station Road MP4 and AU Station Road (19) MP4 pressure systems merged together following the completion of the Auckland LP pipeline replacement programme in FY2014.

9. The AU East Auckland MP4, Mangere MP4, AU Fairburn MP4 and AU Westfield MP4 pressure systems were merged together following completion of the Auckland LP pipeline replacement programme in FY2014. Further modelling will be undertaken in FY2016.

40 10. Details of performance, capacity and system reinforcement are described in Section 5 - Network Development Planning of Gas Distribution Asset Management Plan 2015 - 2025.

11. Schedule 12b provides a snapshot in time of the pressure system capacity, at the date of its preparation, and it should be noted that the figures will change over time. Schedule 12b is provided on the basis that it be used for consumer guidance only.

12. The capacity limits specified in Schedule 12b for each 'heavily utilised' pressure system, highlights only the most constrained part of the pressure system, at that specific location the MinOP is lowest, in reality more capacity may be available at other locations within the pressure or network system.

41 13. Consumers considering using gas or wanting more capacity should always contact Vector to confirm availability. In these cases, Vector will prepare a dedicated model that will provide an accurate assessment of available gas capacity at the specified location.

14. For the purposes of ascertaining the highest utilised pipelines, there has been no segregation or prioritisation between the Auckland and North Island networks. Both networks have been amalgamated for the purposes of this exercise.

15. Due to resource constraints, the network models used to compile Schedule 12b are updated on a 3 year rolling cycle, meaning that the model update, forecast and validation of some models may not have been updated since 2013.

42 16. It has been assumed that the load forecasting documented in the AMP is correct, and that all assumptions and risks associated with this forecasting have been reviewed and approved as part of a separate exercise associated with signing off the AMP.

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Appendix 5

Schedule 12c: Report on Forecast Demand

Company Name **Vector**

AMP Planning Period **1 July 2015 – 30 June 2025**

SCHEDULE 12c: REPORT ON FORECAST DEMAND

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

sch ref

7 **12c(i) Consumer Connections**

8 **Number of ICPs connected in year by consumer type**

sch ref	Consumer types defined by GDB	*Current year CY* 30 Jun 15	*CY+1* 30 Jun 16	*CY+2* 30 Jun 17	*CY+3* 30 Jun 18	*CY+4* 30 Jun 19	*CY+5* 30 Jun 20
11	Residential	3,798	4,183	4,458	4,653	4,050	4,176
12	Commercial	354	314	313	313	312	313
13							
14							
15							
16	**Total**	4,152	4,497	4,771	4,966	4,362	4,489

18 **12c(ii): Gas Delivered**

sch ref		*Current year CY* 30 Jun 15	*CY+1* 30 Jun 16	*CY+2* 30 Jun 17	*CY+3* 30 Jun 18	*CY+4* 30 Jun 19	*CY+5* 30 Jun 20
20	Number of ICPs at year end (at year end)	162,412	165,676	169,215	172,949	176,078	179,334
21	Maximum daily load (GJ per day)	88,407	88,902	89,399	89,899	90,402	90,908
22	Maximum monthly load (GJ per month)	2,331,764	2,333,365	2,334,967	2,336,570	2,338,175	2,339,780
23	Number of directly billed ICPs (at year end)	1	1	1	1	1	1
24	Total gas conveyed (GJ per annum)	22,504,945	23,250,900	23,664,115	24,069,838	24,468,616	24,852,973
25	Average daily delivery (GJ per day)	61,657	63,527	64,833	65,945	67,037	67,904
26							
27	Load factor	80.43%	83.04%	84.46%	85.84%	87.21%	88.52%

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Appendix 6

Schedule 13: Report on Asset Management Maturity

Company Name	**Vector**
AMP Planning Period	**1 July 2015 – 30 June 2025**
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the GDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	1			Widely used AM practice standards require an organisation to document, authorise and communicate its asset management policy (eg, as required in PAS 55 para 4.2 i). A key pre-requisite of any robust policy is that the organisation's top management must be seen to endorse and fully support it. Also vital to the effective implementation of the policy, is to tell the appropriate people of its content and their obligations under it. Where an organisation outsources some of its asset-related activities, then these people and their organisations must equally be made aware of the policy's content. Also, there may be other stakeholders, such as regulatory authorities and shareholders who should be made aware of it.	Top management. The management team that has overall responsibility for asset management.	The organisation's asset management policy, its organisational strategic plan, documents indicating how the asset management policy was based upon the needs of the organisation and evidence of communication.	The organisation has an asset management policy, but it has not been authorised by top management, or it is not influencing the management of the assets.
10	Asset management strategy	What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders?	2			In setting an organisation's asset management strategy, it is important that it is consistent with any other policies and strategies that the organisation has and has taken into account the requirements of relevant stakeholders. This question examines to what extent the asset management strategy is consistent with other organisational policies and strategies (eg, as required by PAS 55 para 4.3.1 b) and has taken account of stakeholder requirements as required by PAS 55 para 4.3.1 c). Generally, this will take into account the same polices, strategies and stakeholder requirements as covered in drafting the asset management policy but at a greater level of detail.	Top management. The organisation's strategic planning team. The management team that has overall responsibility for asset management.	The organisation's asset management strategy document and other related organisational policies and strategies. Other than the organisation's strategic plan, these could include those relating to health and safety, environmental, etc. Results of stakeholder consultation.	Some of the linkages between the long-term asset management strategy and other organisational policies, strategies and stakeholder requirements are defined but the work is fairly well advanced but still incomplete.
11	Asset management strategy	In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship?	3			Good asset stewardship is the hallmark of an organisation compliant with widely used AM standards. A key component of this is the need to take account of the lifecycle of the assets, asset types and asset systems. (For example, this requirement is recognised in 4.3.1 d) of PAS 55). This question explores what an organisation has done to take lifecycle into account in its asset management strategy.	Top management. People in the organisation with expert knowledge of the assets, asset types, asset systems and their associated life-cycles. The management team that has overall responsibility for asset management. Those responsible for developing and adopting methods and processes used in asset management	The organisation's documented asset management strategy and supporting working documents.	The asset management strategy takes account of the lifecycle of all of its assets, asset types and asset systems.
26	Asset management plan(s)	How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems?	2			The asset management strategy need to be translated into practical plan(s) so that all parties know how the objectives will be achieved. The development of plan(s) will need to identify the specific tasks and activities required to optimize costs, risks and performance of the assets and/or asset system(s), when they are to be carried out and the resources required.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers.	The organisation's asset management plan(s).	The organisation is in the process of putting in place comprehensive, documented asset management plan(s) that cover all life cycle activities, clearly aligned to asset management objectives and the asset management strategy.

Company Name **Vector**
AMP Planning Period **1 July 2015 – 30 June 2025**
Asset Management Standard Applied

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
27	Asset management plan(s)	How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery?	2			Plans will be ineffective unless they are communicated to all those, including contracted suppliers and those who undertake enabling function(s). The plan(s) need to be communicated in a way that is relevant to those who need to use them.	The management team with overall responsibility for the asset management system. Delivery functions and suppliers.	Distribution lists for plan(s). Documents derived from plan(s) which detail the receivers role in plan delivery. Evidence of communication.	The plan(s) are communicated to most of those responsible for delivery but there are weaknesses in identifying relevant parties resulting in incomplete or inappropriate communication. The organisation recognises improvement is needed as is working towards resolution.
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	3			The implementation of asset management plan(s) relies on (1) actions being clearly identified, (2) an owner allocated and (3) that owner having sufficient delegated responsibility and authority to carry out the work required. It also requires alignment of actions across the organisation. This question explores how well the plan(s) set out responsibility for delivery of asset plan actions.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team.	The organisation's asset management plan(s). Documentation defining roles and responsibilities of individuals and organisational departments.	Asset management plan(s) consistently document responsibilities for the delivery actions and there is adequate detail to enable delivery of actions. Designated responsibility and authority for achievement of asset plan actions is appropriate.
31	Asset management plan(s)	What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)? (Note this is about resources and enabling support)	3			It is essential that the plan(s) are realistic and can be implemented, which requires appropriate resources to be available and enabling mechanisms in place. This question explores how well this is achieved. The plan(s) not only need to consider the resources directly required and timescales, but also the enabling activities, including for example, training requirements, supply chain capability and procurement timescales.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team. If appropriate, the performance management team. Where appropriate the procurement team and service providers working on the organisation's asset-related activities.	The organisation's asset management plan(s). Documented processes and procedures for the delivery of the asset management plan.	The organisation's arrangements fully cover all the requirements for the efficient and cost effective implementation of asset management plan(s) and realistically address the resources and timescales required, and any changes needed to functional policies, standards, processes and the asset management information system.
33	Contingency planning	What plan(s) and procedure(s) does the organisation have for identifying and responding to incidents and emergency situations and ensuring continuity of critical asset management activities?	3			Widely used AM practice standards require that an organisation has plan(s) to identify and respond to emergency situations. Emergency plan(s) should outline the actions to be taken to respond to specified emergency situations and ensure continuity of critical asset management activities including the communication to, and involvement of, external agencies. This question assesses if, and how well, these plan(s) triggered, implemented and resolved in the event of an incident. The plan(s) should be appropriate to the level of risk as determined by the organisation's risk assessment methodology. It is also a requirement that relevant personnel are competent and trained.	The manager with responsibility for developing emergency plan(s). The organisation's risk assessment team. People with designated duties within the plan(s) and procedure(s) for dealing with incidents and emergency situations.	The organisation's plan(s) and procedure(s) for dealing with emergencies. The organisation's risk assessments and risk registers.	Appropriate emergency plan(s) and procedure(s) are in place to respond to credible incidents and manage continuity of critical asset management activities consistent with policies and asset management objectives. Training and external agency alignment is in place.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
37	Structure, authority and responsibilities	What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)?	3			In order to ensure that the organisation's assets and asset systems deliver the requirements of the asset management policy, strategy and objectives responsibilities need to be allocated to appropriate people who have the necessary authority to fulfil their responsibilities. (This question, relates to the organisation's assets eg, para b), s 4.4.1 of PAS 55, making it therefore distinct from the requirement contained in para a), s 4.4.1 of PAS 55).	Top management. People with management responsibility for the delivery of asset management policy, strategy, objectives and plan(s). People working on asset-related activities.	Evidence that managers with responsibility for the delivery of asset management policy, strategy, objectives and plan(s) have been appointed and have assumed their responsibilities. Evidence may include the organisation's documents relating to its asset management system, organisational charts, job descriptions of post-holders, annual targets/objectives and personal development plan(s) of post-holders as appropriate.	The appointed person or persons have full responsibility for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s). They have been given the necessary authority to achieve this.
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	3			Optimal asset management requires top management to ensure sufficient resources are available. In this context the term 'resources' includes manpower, materials, funding and service provider support.	Top management. The management team that has overall responsibility for asset management. Risk management team. The organisation's managers involved in day-to-day supervision of asset-related activities, such as frontline managers, engineers, foremen and chargehands as appropriate.	Evidence demonstrating that asset management plan(s) and/or the process(es) for asset management plan implementation consider the provision of adequate resources in both the short and long term. Resources include funding, materials, equipment, services provided by third parties and personnel (internal and service providers) with appropriate skills competencies and knowledge.	An effective process exists for determining the resources needed for asset management and sufficient resources are available. It can be demonstrated that resources are matched to asset management requirements.
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	3			Widely used AM practice standards require an organisation to communicate the importance of meeting its asset management requirements such that personnel fully understand, take ownership of, and are fully engaged in the delivery of the asset management requirements (eg, PAS 55 s 4.4.1 g).	Top management. The management team that has overall responsibility for asset management. People involved in the delivery of the asset management requirements.	Evidence of such activities as road shows, written bulletins, workshops, team talks and management walk-abouts would assist an organisation to demonstrate it is meeting this requirement of PAS 55.	Top management communicates the importance of meeting its asset management requirements to all relevant parts of the organisation.
45	Outsourcing of asset management activities	Where the organisation has outsourced some of its asset management activities, how has it ensured that appropriate controls are in place to ensure the compliant delivery of its organisational strategic plan, and its asset management policy and strategy?	3			Where an organisation chooses to outsource some of its asset management activities, the organisation must ensure that these outsourced process(es) are under appropriate control to ensure that all the requirements of widely used AM standards (eg, PAS 55) are in place, and the asset management policy, strategy objectives and plan(s) are delivered. This includes ensuring capabilities and resources across a time span aligned to life cycle management. The organisation must put arrangements in place to control the outsourced activities, whether it be to external providers or to other in-house departments. This question explores what the organisation does in this regard.	Top management. The management team that has overall responsibility for asset management. The manager(s) responsible for the monitoring and management of the outsourced activities. People involved with the procurement of outsourced activities. The people within the organisations that are performing the outsourced activities. The people impacted by the outsourced activity.	The organisation's arrangements that detail the compliance required of the outsourced activities. For example, this this could form part of a contract or service level agreement between the organisation and the suppliers of its outsourced activities. Evidence that the organisation has demonstrated to itself that it has assurance of compliance of outsourced activities.	Evidence exists to demonstrate that outsourced activities are appropriately controlled to provide for the compliant delivery of the organisational strategic plan, asset management policy and strategy, and that these controls are integrated into the asset management system

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
48	Training, awareness and competence	How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)?	2			There is a need for an organisation to demonstrate that it has considered what resources are required to develop and implement its asset management system. There is also a need for the organisation to demonstrate that it has assessed what development plan(s) are required to provide its human resources with the skills and competencies to develop and implement its asset management systems. The timescales over which the plan(s) are relevant should be commensurate with the planning horizons within the asset management strategy considers e.g. if the asset management strategy considers 5, 10 and 15 year time scales then the human resources development plan(s) should align with these. Resources include both 'in house' and external resources who undertake asset management activities.	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	Evidence of analysis of future work load plan(s) in terms of human resources. Document(s) containing analysis of the organisation's own direct resources and contractors resource capability over suitable timescales. Evidence, such as minutes of meetings, that suitable management forums are monitoring human resource development plan(s). Training plan(s), personal development plan(s), contract and service level agreements.	The organisation has developed a strategic approach to aligning competencies and human resources to the asset management system including the asset management plan but the work is incomplete or has not been consistently implemented.
49	Training, awareness and competence	How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies?	2			Widely used AM standards require that organisations to undertake a systematic identification of the asset management awareness and competencies required at each level and function within the organisation. Once identified the training required to provide the necessary competencies should be planned for delivery in a timely and systematic way. Any training provided must be recorded and maintained in a suitable format. Where an organisation has contracted service providers in place then it should have a means to demonstrate that this requirement is being met for their employees. (eg, PAS 55 refers to frameworks suitable for identifying competency requirements).	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	Evidence of an established and applied competency requirements assessment process and plan(s) in place to deliver the required training. Evidence that the training programme is part of a wider, co-ordinated asset management activities training and competency programme. Evidence that training activities are recorded and that records are readily available (for both direct and contracted service provider staff) e.g. via organisation wide information system or local records database.	The organisation is the process of identifying competency requirements aligned to the asset management plan(s) and then plan, provide and record appropriate training. It is incomplete or inconsistently applied.
50	Training, awareness and competence	How does the organization ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience?	3			A critical success factor for the effective development and implementation of an asset management system is the competence of persons undertaking these activities. organisations should have effective means in place for ensuring the competence of employees to carry out their designated asset management function(s). Where an organisation has contracted service providers undertaking elements of its asset management system then the organisation shall assure itself that the outsourced service provider also has suitable arrangements in place to manage the competencies of its employees. The organisation should ensure that the individual and corporate competencies it requires are in place and actively monitor, develop and maintain an appropriate balance of these competencies.	Managers, supervisors, persons responsible for developing training programmes. Staff responsible for procurement and service agreements. HR staff and those responsible for recruitment.	Evidence of a competency assessment framework that aligns with established frameworks such as the asset management Competencies Requirements Framework (Version 2.0); National Occupational Standards for Management and Leadership; UK Standard for Professional Engineering Competence, Engineering Council, 2005.	The organization is in the process of putting in place a means for assessing the competence of person(s) involved in asset management activities including contractors. There are gaps and inconsistencies.
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	3			Widely used AM practice standards require that pertinent asset management information is effectively communicated to and from employees and other stakeholders including contracted service providers. Pertinent information refers to information required in order to effectively and efficiently comply with and deliver asset management strategy, plan(s) and objectives. This will include for example the communication of the asset management policy, asset performance information, and planning information as appropriate to contractors.	Top management and senior management representative(s), employee's representative(s), employee's trade union representative(s); contracted service provider management and employee representative(s); representative(s) from the organisation's Health, Safety and Environmental team. Key stakeholder representative(s).	Asset management policy statement prominently displayed on notice boards, intranet and internet; use of organisation's website for displaying asset performance data; evidence of formal briefings to employees, stakeholders and contracted service providers; evidence of inclusion of asset management issues in team meetings and contracted service provider contract meetings; newsletters, etc.	The organisation has determined pertinent information and relevant parties. Some effective two way communication is in place but as yet not all relevant parties are clear on their roles and responsibilities with respect to asset management information.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
59	Asset Management System documentation	What documentation has the organisation established to describe the main elements of its asset management system and interactions between them?	3			Widely used AM practice standards require an organisation maintain up to date documentation that ensures that its asset management systems (ie, the systems the organisation has in place to meet the standards) can be understood, communicated and operated. (eg, s 4.5 of PAS 55 requires the maintenance of up to date documentation of the asset management system requirements specified throughout s 4 of PAS 55).	The management team that has overall responsibility for asset management. Managers engaged in asset management activities.	The documented information describing the main elements of the asset management system (process(es)) and their interaction.	The organisation has established documentation that comprehensively describes all the main elements of its asset management system and the interactions between them. The documentation is kept up to date.
62	Information management	What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system?	2			Effective asset management requires appropriate information to be available. Widely used AM standards therefore require the organisation to identify the asset management information it requires in order to support its asset management system. Some of the information required may be held by suppliers. The maintenance and development of asset management information systems is a poorly understood specialist activity that is akin to IT management but different from IT management. This group of questions provides some indications as to whether the capability is available and applied. Note: To be effective, an asset information management system requires the mobilisation of technology, people and process(es) that create, secure, make available and destroy the information required to support the asset management system.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Operations, maintenance and engineering managers	Details of the process the organisation has employed to determine what its asset information system should contain in order to support its asset management system. Evidence that this has been effectively implemented.	The organisation has developed a structured process to determine what its asset information system should contain in order to support its asset management system and has commenced implementation of the process.
63	Information management	How does the organisation maintain its asset management information system(s) and ensure that the data held within it (them) is of the requisite quality and accuracy and is consistent?	2			The response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale. This question explores how the organisation ensures that information management meets widely used AM practice requirements (eg, s 4.4.6 (a), (c) and (d) of PAS 55).	The management team that has overall responsibility for asset management. Users of the organisational information systems.	The asset management information system, together with the policies, procedure(s), improvement initiatives and audits regarding information controls.	The organisation has developed a controls that will ensure the data held is of the requisite quality and accuracy and is consistent and is in the process of implementing them.
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	3			Widely used AM standards need not be prescriptive about the form of the asset management information system, but simply require that the asset management information system is appropriate to the organisations needs, can be effectively used and can supply information which is consistent and of the requisite quality and accuracy.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Users of the organisational information systems.	The documented process the organisation employs to ensure its asset management information system aligns with its asset management requirements. Minutes of information systems review meetings involving users.	The organisation's asset management information system aligns with its asset management requirements. Users can confirm that it is relevant to their needs.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
69	Risk management process(es)	How has the organisation documented process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle?	3			Risk management is an important foundation for proactive asset management. Its overall purpose is to understand the cause, effect and likelihood of adverse events occurring, to optimally manage such risks to an acceptable level, and to provide an audit trail for the management of risks. Widely used standards require the organisation to have process(es) and/or procedure(s) in place that set out how the organisation identifies and assesses asset and asset management related risks. The risks have to be considered across the four phases of the asset lifecycle (eg, para 4.3.3 of PAS 55).	The top management team in conjunction with the organisation's senior risk management representatives. There may also be input from the organisation's Safety, Health and Environment team. Staff who carry out risk identification and assessment.	The organisation's risk management framework and/or evidence of specific process(es) and/ or procedure(s) that deal with risk control mechanisms. Evidence that the process(es) and/or procedure(s) are implemented across the business and maintained. Evidence of agendas and minutes from risk management meetings. Evidence of feedback in to process(es) and/or procedure(s) as a result of incident investigation(s). Risk registers and assessments.	Identification and assessment of asset related risk across the asset lifecycle is fully documented. The organisation can demonstrate that appropriate documented mechanisms are integrated across life cycle phases and are being consistently applied.
79	Use and maintenance of asset risk information	How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs?	3			Widely used AM standards require that the output from risk assessments are considered and that adequate resource (including staff) and training is identified to match the requirements. It is a further requirement that the effects of the control measures are considered, as there may be implications in resources and training required to achieve other objectives.	Staff responsible for risk assessment and those responsible for developing and approving resource and training plan(s). There may also be input from the organisation's Safety, Health and Environment team.	The organisations risk management framework. The organisation's resourcing plan(s) and training and competency plan(s). The organisation should be able to demonstrate appropriate linkages between the content of resource plan(s) and training and competency plan(s) to the risk assessments and risk control measures that have been developed.	Outputs from risk assessments are consistently and systematically used as inputs to develop resources, training and competency requirements. Examples and evidence is available.
82	Legal and other requirements	What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system?	3			In order for an organisation to comply with its legal, regulatory, statutory and other asset management requirements, the organisation first needs to ensure that it knows what they are (eg, PAS 55 specifies this in s 4.4.8). It is necessary to have systematic and auditable mechanisms in place to identify new and changing requirements. Widely used AM standards also require that requirements are incorporated into the asset management system (e.g. procedure(s) and process(es))	Top management. The organisations regulatory team. The organisation's legal team or advisors. The management team with overall responsibility for the asset management system. The organisation's health and safety team or advisors. The organisation's policy making team.	The organisational processes and procedures for ensuring information of this type is identified, made accessible to those requiring the information and is incorporated into asset management strategy and objectives	Evidence exists to demonstrate that the organisation's legal, regulatory, statutory and other asset management requirements are identified and kept up to date. Systematic mechanisms for identifying relevant legal and statutory requirements.
88	Life Cycle Activities	How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities?	3			Life cycle activities are about the implementation of asset management plan(s) i.e. they are the "doing" phase. They need to be done effectively and well in order for asset management to have any practical meaning. As a consequence, widely used standards (eg, PAS 55 s 4.5.1) require organisations to have in place appropriate process(es) and procedure(s) for the implementation of asset management plan(s) and control of lifecycle activities. This question explores those aspects relevant to asset creation.	Asset managers, design staff, construction staff and project managers from other impacted areas of the business, e.g. Procurement	Documented process(es) and procedure(s) which are relevant to demonstrating the effective management and control of life cycle activities during asset creation, acquisition, enhancement including design, modification, procurement, construction and commissioning.	Effective process(es) and procedure(s) are in place to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
91	Life Cycle Activities	How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance?	3			Having documented process(es) which ensure the asset management plan(s) are implemented in accordance with any specified conditions, in a manner consistent with the asset management policy, strategy and objectives and in such a way that cost, risk and asset system performance are appropriately controlled is critical. They are an essential part of turning intention into action (eg, as required by PAS 55 s 4.5.1).	Asset managers, operations managers, maintenance managers and project managers from other impacted areas of the business	Documented procedure for review. Documented procedure for audit of process delivery. Records of previous audits, improvement actions and documented confirmation that actions have been carried out.	The organisation has in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during this life cycle phase. They include a process, which is itself regularly reviewed to ensure it is effective, for confirming the process(es)/ procedure(s) are effective and if necessary carrying out modifications.
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	3			Widely used AM standards require that organisations establish implement and maintain procedure(s) to monitor and measure the performance and/or condition of assets and asset systems. They further set out requirements in some detail for reactive and proactive monitoring, and leading/lagging performance indicators together with the monitoring or results to provide input to corrective actions and continual improvement. There is an expectation that performance and condition monitoring will provide input to improving asset management strategy, objectives and plan(s).	A broad cross-section of the people involved in the organisation's asset-related activities from data input to decision-makers, i.e. an end-to end assessment. This should include contactors and other relevant third parties as appropriate.	Functional policy and/or strategy documents for performance or condition monitoring and measurement. The organisation's performance monitoring frameworks, balanced scorecards etc. Evidence of the reviews of any appropriate performance indicators and the action lists resulting from these reviews. Reports and trend analysis using performance and condition information. Evidence of the use of performance and condition information shaping improvements and supporting asset management strategy, objectives and plan(s).	Consistent asset performance monitoring linked to asset management objectives is in place and universally used including reactive and proactive measures. Data quality management and review process are appropriate. Evidence of leading indicators and analysis.
99	Investigation of asset-related failures, incidents and nonconformities	How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated?	3			Widely used AM standards require that the organisation establishes implements and maintains process(es) for the handling and investigation of failures incidents and non-conformities for assets and sets down a number of expectations. Specifically this question examines the requirement to define clearly responsibilities and authorities for these activities, and communicate these unambiguously to relevant people including external stakeholders if appropriate.	The organisation's safety and environment management team. The team with overall responsibility for the management of the assets. People who have appointed roles within the asset-related investigation procedure, from those who carry out the investigations to senior management who review the recommendations. Operational controllers responsible for managing the asset base under fault conditions and maintaining services to consumers. Contractors and other third parties as appropriate.	Process(es) and procedure(s) for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances. Documentation of assigned responsibilities and authority to employees. Job Descriptions, Audit reports. Common communication systems i.e. all Job Descriptions on Internet etc.	The organisation have defined the appropriate responsibilities and authorities and evidence is available to show that these are applied across the business and kept up to date.
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	2			This question seeks to explore what the organisation has done to comply with the standard practice AM audit requirements (eg, the associated requirements of PAS 55 s 4.6.4 and its linkages to s 4.7).	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit teams, together with key staff responsible for asset management. For example, Asset Management Director, Engineering Director. People with responsibility for carrying out risk assessments	The organisation's asset-related audit procedure(s). The organisation's methodology(s) by which it determined the scope and frequency of the audits and the criteria by which it identified the appropriate audit personnel. Audit schedules, reports etc. Evidence of the procedure(s) by which the audit results are presented, together with any subsequent communications. The risk assessment schedule or risk registers.	The organisation is establishing its audit procedure(s) but they do not yet cover all the appropriate asset-related activities.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information	Majurity Level Description
109	Corrective & Preventative action	How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance?	2			Having investigated asset related failures, incidents and non-conformances, and taken action to mitigate their consequences, an organisation is required to implement preventative and corrective actions to address root causes. Incident and failure investigations are only useful if appropriate actions are taken as a result to assess changes to a businesses risk profile and ensure that appropriate arrangements are in place should a recurrence of the incident happen. Widely used AM standards also require that necessary changes arising from preventive or corrective action are made to the asset management system.	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit and incident investigation teams. Staff responsible for planning and managing corrective and preventive actions.	Analysis records, meeting notes and minutes, modification records. Asset management plan(s), investigation reports, audit reports, improvement programmes and projects. Recorded changes to asset management procedure(s) and process(es). Condition and performance reviews. Maintenance reviews	The need is recognized for systematic instigation of preventive and corrective actions to address root causes of non compliance or incidents identified by investigations, compliance evaluation or audit. It is only partially or inconsistently in place.
113	Continual Improvement	How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle?	2			Widely used AM standards have requirements to establish, implement and maintain process(es)/procedure(s) for identifying, assessing, prioritising and implementing actions to achieve continual improvement. Specifically there is a requirement to demonstrate continual improvement in optimisation of cost risk and performance/condition of assets across the life cycle. This question explores an organisation's capabilities in this area—looking for systematic improvement mechanisms rather that reviews and audit (which are separately examined).	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. Managers responsible for policy development and implementation.	Records showing systematic exploration of improvement. Evidence of new techniques being explored and implemented. Changes in procedure(s) and process(es) reflecting improved use of optimisation tools/techniques and available information. Evidence of working parties and research.	Continuous improvement process(es) are set out and include consideration of cost risk, performance and condition for assets managed across the whole life cycle but it is not yet being systematically applied.
115	Continual Improvement	How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation?	3			One important aspect of continual improvement is where an organisation looks beyond its existing boundaries and knowledge base to look at what 'new things are on the market'. These new things can include equipment, process(es), tools, etc. An organisation which does this (eg, by the PAS 55 s 4.6 standards) will be able to demonstrate that it continually seeks to expand its knowledge of all things affecting its asset management approach and capabilities. The organisation will be able to demonstrate that it identifies any such opportunities to improve, evaluates them for suitability to its own organisation and implements them as appropriate. This question explores an organisation's approach to this activity.	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. People who monitor the various items that require monitoring for 'change'. People that implement changes to the organisation's policy, strategy, etc. People within an organisation with responsibility for investigating, evaluating, recommending and implementing new tools and techniques, etc.	Research and development projects and records, benchmarking and participation knowledge exchange professional forums. Evidence of correspondence relating to knowledge acquisition. Examples of change implementation and evaluation of new tools, and techniques linked to asset management strategy and objectives.	The organisation actively engages internally and externally with other asset management practitioners, professional bodies and relevant conferences. Actively investigates and evaluates new practices and evolves its asset management activities using appropriate developments.

Schedule 17: Certification for Year-beginning Disclosures

Clause 2.9.1

1 We, **Robert William Thomson** and **James Albert Carmichael**, being directors of Vector Limited certify that, having made all reasonable enquiry, to the best of our knowledge:

(a) The following attached information of Vector Limited prepared for the purposes of clauses 2.6.1, 2.6.3, 2.6.6 and 2.7.2 of the Gas Distribution Information Disclosure Determination 2012 (consolidated in 2015) in all material respects complies with that determination.

(b) The prospective financial or non-financial information included in the attached information has been measured on a basis consistent with regulatory requirements or recognised industry standards.

(c) The forecasts in Schedules 11a, 11b, 12a, 12b and 12c are based on objective and reasonable assumptions which both align with Vector Limited's corporate vision and strategy and are documented in retained records.

Director

JA Carmichael

Director

22nd June 2015

Date