Gas Transmission
Asset Management Plan
2013 – 2023

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Executive Summary

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1. Executive Summary

1.1 Introduction

Vector's vision is to be:

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




The Asset Management Plan (AMP) supports achieving the Vector vision.

The AMP describes Vector's gas transmission business (GTB) asset management practices and includes a ten year forecast of capital expenditure (capex) and operational expenditure (opex) for Vector's high pressure gas transmission assets. The purposes of the AMP are to:

- Inform stakeholders about how Vector intends to manage its gas transmission assets based on the information available.
- Demonstrate alignment between asset management and Vector's vision and goals.
- Provide visibility of effective asset management at Vector.
- Provide visibility of effective health, safety and environment management at Vector.
- Provide visibility of forecast asset investment programmes and construction activities to external readers of the AMP.
- Demonstrate innovation and efficiency improvements.
- Discuss the impact of regulatory settings on future asset investment decisions.
- Discuss expected technology and consumer developments and the asset investment strategies to deal with a changing environment.
- Meet Vector's regulatory obligations for information disclosure requirements.

From an asset management perspective the AMP:

- Supports continued efficient improvement in Vector's performance.
- Is essential to Vector's goal of being an effective asset manager.
- Helps to achieve the Vector vision.

Vector's Board approves the AMP and subsequent AMP updates. The preparation of the AMP and any subsequent AMP updates are timed to align with Vector's Board meetings as well as regulatory disclosure requirements.

Implementation of the AMP is regularly monitored. Progress against investment plans and asset performance are 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.
- Security of supply.

The AMP meets the requirements of Section 2.6 of Commerce Commission Decision No. NZCC 24 – Gas Transmission Information Disclosure Determination 2012 dated 01 October 2012. The AMP covers the ten disclosure years 2014 to 2023 i.e. from 1st July 2013 to 30th June 2023.

The AMP consists of 9 separate sections including this Executive Summary. Sections 2-9 are summarised in Sections 1.3 to 1.10 of this Executive Summary and are listed in Table 1-1 below.

AMP Section Number	AMP Section Title
2	Background and Objectives
3	Assets Covered
4	Service Levels
5	System Development Planning
6	Asset Integrity and Maintenance
7	Systems and Data
8	Risk Management
9	Summary of Expenditure Forecasts

Table 1-1 : AMP Sections

1.2 Business Operating Environment

1.2.1 Qualification

The AMP represents Vector's current view of the ongoing investment, maintenance and operational requirements of the Vector's gas transmission system in the current operating environment. However, as discussed below, the business faces significant ongoing uncertainty, especially in relation to the current investment landscape and the still-developing regulatory environment. This has a direct impact on Vector's ability to make investment decisions and attract investment capital.

Vector follows an annual budget process and the implementation of 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. All expenditure must be approved through normal internal governance procedures. Therefore the AMP does not irrevocably commit Vector to any of the individual projects or initiatives it refers to or the defined timelines relating to them.

It is also 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 transmission business is therefore different to that of the electricity distribution business.

1.2.2 Economic Factors

Economic cycles impact on business activities and hence gas demand. Gross Domestic Product (GDP) figures published by Statistics NZ[1] over the four years ending March 2012 show three recent years of very low growth (1.7%, 1.4% and 1.8% for the years ending March 2012, 2011 and 2010) following a year of negative growth (-3.5% for the year ending March 2009). Other economic indicators such as consumer and business confidence, unemployment rate and housing construction are also pointing towards a cautious recovery. During the same period, gas transported through Vector's gas transmission system recorded growth rates of 2.1%, 0.4% and 4.9% respectively. Overseas, various economies are facing uncertainties caused by mounting debt, the fading effect of economic stimulus packages and low consumer confidence leading to low rates of job creation and economic growth during the same period. The impact of this on New Zealand's export earnings and therefore the state of its economy is still uncertain.

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 and that new consumer connection growth patterns will continue at historical rates. The volume of gas transported through and delivered from the system directly drives asset investment decisions for system growth and forecasts for this are included in Section 5 of the AMP.

1.2.3 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 transmission 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[2]) Vector's maximum allowable revenue (before allowing for pass-through and recoverable costs) was set at $110m. (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.

This AMP reflects the capital and operating expenditure required to ensure that Vector's gas transmission system is operated in accordance with the principles and standards set out in the document. Vector notes that the revenue it is allowed under the DPP determination is based on levels of both capital and operating expenditure forecast by the Commission that are materially less than that reflected in this AMP. This is a result of the Commerce Commission's approach to determining the expenditure allowance which arbitrarily limited forecasts provided by the business although these were based on in depth engineering assessments. It also relied on excluding "lumpy" expenditure on the basis that Vector could apply for a CPP if this expenditure was required. Vector's position is that there are many elements of the CPP process that could result in undue delay to an

[1] Statistics New Zealand is a government department and New Zealand's national statistical office. It is New Zealand's major source of official statistics and leader of the Official Statistics System.

[2] The first assessment period is 15 months to allow the regulatory regime to transition to an October-September regulatory year.

investment and that, in our view, the DPP should be capable of dealing with expenditure which, while “lumpy”, is inherently part of the gas transmission business.

1.2.4 Technical Compliance

The assets are required to comply with the Health and Safety in Employment (Pipelines) Regulations 1999 (the Regulations). Compliance with the Regulations places a number of obligations on Vector including compliance with the AS 2885 series of standards for Pipelines - Gas and Liquid Petroleum (the Standards).

The Regulations require Vector to obtain and maintain a valid Certificate of Fitness (CoF) for the pipeline from an inspection body specified in the Regulations. Vector uses the services of Lloyds Register to conduct the required 5-yearly CoF inspections and annual surveys. The most recent 5-yearly CoF was issued in November 2011 and the last annual survey conducted in August 2012. Under the Regulations, Vector also has to provide certain particulars about its gas transmission system to the Secretary of Ministry of Business Innovation and Employment.

Technical compliance with AS2885.3:2012 Pipelines - Gas and Liquid Petroleum Part 3: Operation and Maintenance is described and demonstrated in Vector’s Pipeline Management System (PMS). The PMS is a dynamic, ‘living’ document, that is subject to change as regulations and business requirements change.

Effective asset management is implicit in being able to demonstrate compliance with the Regulations and the Standards.

Additionally, following the October 2011 failure of the Maui Development Limited owned Maui pipeline at Pukearuhe due to land movement, Vector has applied the associated learnings to its own assets which include increasing its understanding of the nature of land movement threats, taking additional advice from geotechnical specialists and, if appropriate, additional monitoring.

1.2.5 Health and Safety

At Vector, safety is a fundamental value, not merely a priority. Vector is committed to a goal of zero harm to people and property. Vector has a comprehensive Health, Safety and Environment Management System (HSEMS) which provides a Vector wide system for effectively and consistently managing health, safety and environmental expectations across all of Vector’s activities and operations to comply with the Health and Safety in Employment Act 1992.

In summary, Vector has developed policies to ensure safety and wellbeing of employees, contractors and the public at all Vector work sites and asset locations. This is achieved by the following:

- Compliance with all relevant health and safety legislation, standards and codes of practice.
- Taking all practicable steps to ensure employees and services providers adhere to health and safety policies and procedures.
- Established procedures to ensure health and safety policies are followed.
- Encouragement of employees and service providers to participate in activities that will improve their health, safety and wellbeing.

The health and safety requirements for the asset are documented in the PMS prepared in accordance with AS2885.3:2012 Pipelines - Gas and Liquid Petroleum Part 3: Operation and Maintenance. The key health and safety issues identified in the PMS are:

- Continual reviewing of hazards and risks assessments.
- Maintaining records of inspections and audits.

- Developing a trend analysis from the incident reporting system.
- Ensuring ongoing pipeline integrity.
- Complying with regulatory requirements.

1.2.6 Environmental

Vector's environmental policy is developed to monitor and improve environmental performance and to take preventive action to avoid adverse environmental effects from business activities. To achieve this Vector will:

- Comply with all relevant aspects of the Resource management Act 1991, the Hazardous Substances and New Organisms Act 1996 and all territorial authority consenting requirements.
- Plan to avoid, remedy or mitigate any adverse environment effects arising from its operations.
- Focus on responsible energy management and energy efficiency for all premises, plant and equipment where it is cost effective to do so.
- Have in place an environmental management plan (EMP) guided by the latest revisions of AS 2885 and the Australian Pipeline Industry Association's (APIA) Code of Environmental Practice for onshore pipelines (CoEP).
- Implement and maintain the EMP through the gas transmission environmental management system (EMS).
- Upgrade the EMS guided by the latest revisions of AS 2885 and the APIA CoEP.

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

- Utilise fuel as efficiently as practicable.
- Minimise emissions where economically feasible.
- Minimise waste and the environmental footprint from operations.

1.2.7 External Review of Asset Management Practices

Vector has, over an extended period, engaged external expert technical advisers to review its asset management practices. While these reviews have been very positive in their feedback and confirm that asset management at Vector conforms to good industry practice, note has been taken of the feedback and recommendations received, and where practical and beneficial, asset management practices have been amended.

A review was carried out by The Asset Partnership Pty Ltd (Australia) in 2011. The main recommendation of this review was for the improvement of maintenance practices. Vector has since conducted a review of its maintenance strategy, introduced improved condition monitoring practices, established improved maintenance KPIs and initiated a number of cross-functional working groups to consider maintenance improvements in targeted areas.

In September 2012 GL Industrial Services UK Ltd (United Kingdom) trading as GL Noble Denton completed a review of Vector's Gas Transmission Security Standard GTS-01. GL Noble Denton found that standard was appropriate and in-line with operating strategies applied by other gas transmission system operators internationally. They also confirmed that the standard represented a reasonable and prudent approach to operating a gas transmission system and that the manner in which Vector model the system and confirm that the translation of the physical parameters from the Vector network into the SynerGEE network model was performed in a reasonable manner.

In November 2012 Elenchus Research Associates Inc (Canada) reviewed Vector's proposed Capacity Determination and Capacity Allocation methodology and found that the methodology to determine the maximum physical capacity, operational capacity, normalised peak demand and uncommitted operational capacity available were reasonable and consistent with general industry practices. They also found that the methodology used to allocate uncommitted operational capacity on a pro-rata basis to all new requests for service to be fair and reasonable.

1.3 Section 2 - Background and Objectives

The asset owner is the highest level of management within Vector that owns the assets i.e. Vector's executive, with oversight from Vector's Board. The asset owner determines the operating context for the asset manager, focusing on corporate governance and goals, regulatory issues, stakeholder relationships and customer's requirements.

The main objectives of this AMP are to:

- Ensure reliability and safety through efficient operation and maintenance delivering services that satisfy customers and key stakeholders and achieve regulatory compliance.
- Demonstrate that Vector undertakes effective maintenance, replacement and reinforcement to avoid deterioration to, and potentially enhance, the overall asset condition.
- Set out the asset management programmes for maintaining and developing the assets in the owner's interests.
- Accurately represent Vector's asset management practices.
- Provide accurate forecasts of capital expenditure (capex) and operational expenditure (opex).
- Inform stakeholders about how Vector intends to manage the asset based on information available at preparation of the AMP.
- Demonstrate alignment between asset management and Vector's goals.
- Demonstrate innovation and efficiency improvements.
- Demonstrate how Vector manages assets to most effectively balance the range of incumbent obligations.

The AMP supports Vector's overall strategic vision and the Vector values of Operational Excellence, Cost Efficiency/Productivity, Customer and Regulatory Outcomes and Disciplined Growth. These Vector values in turn drive asset management practices and determine the fundamental assumptions and premises on which the AMP is based.

Asset management is supported by various internal stakeholder groups across the whole Vector business and these stakeholders have been engaged in developing the AMP.

The AMP has also been developed by taking into account the views and expectations of external stakeholders and addresses how conflicts with external stakeholders interests are managed.

Vector aims to achieve asset management objectives and to deliver GTB services in a robust and efficient manner. Vector is aligned and operates to a clear asset investment process which takes the following factors into account:

- Asset inventory
- Assessment of asset condition and performance
- Establishment of business requirements
- Evaluation and selection of solution options
- Prioritisation

- Implementation of investment programmes
- Operational handover
- Governance (approvals and reporting)
- Risk management.

Asset management, general business and information technology IT activities are supported by a comprehensive set of documented policies, processes and procedures.

Vector aims to continually improve asset management practices and regularly conducts internal and external reviews. Feedback and recommendations from reviews are, where practical and beneficial, reflected in asset management practices.

Section 2 of the AMP contains a cross reference table indicating the sections of the AMP which correspond with the requirements of Attachment A of the Commerce Commission Decision No. NZCC 24 – Gas Transmission Information Disclosure Determination 2012 dated 01 October 2012.

1.4 Section 3 - Assets Covered

Vector owns and operates a high pressure gas transmission system consisting of pipelines, stations and non-network assets that supplies natural gas to most cities and large towns in the North Island of New Zealand.

The nominal bore of the pipelines ranges from 50mm to 500mm diameter and are substantially installed below ground. In places sections of pipelines are installed above ground as special crossings of major natural features such as rivers or manmade features such as dams. Buried pipelines are both externally coated and protected by cathodic protection systems.

The majority of pipelines are installed in private land over which Vector has formal easement rights documented with landowners to ensure full and unimpeded access to the assets is maintained. Some pipelines are installed in council owned road without the need for an easement as Vector has statutory rights of access.

Stations include eight strategically located compressor stations where gas is compressed for onward transportation. An increase in gas pressure is required to maintain satisfactory terminal pressure at the extremities of the system.

Other stations include delivery points (DPs), main line valve (MLV) stations and pipeline inspection gauge (PIG) launcher and receiver stations (also known as scraper stations).

DPs are stations where gas pressure is reduced and delivered to downstream gas distribution networks and/or direct to commercial/industrial users.

The system is monitored and to an extent controlled by a supervisory control and data acquisition (SCADA) system. This system consists of a master station at the operations control centre at Bell Block near New Plymouth and remote terminal units (RTUs) installed at various stations to monitor the asset.

Presently, New Zealand's natural gas is sourced in the Taranaki region, from where it is transported by Vector through its high pressure gas transmission system throughout the North Island as illustrated in Figure 1-1.

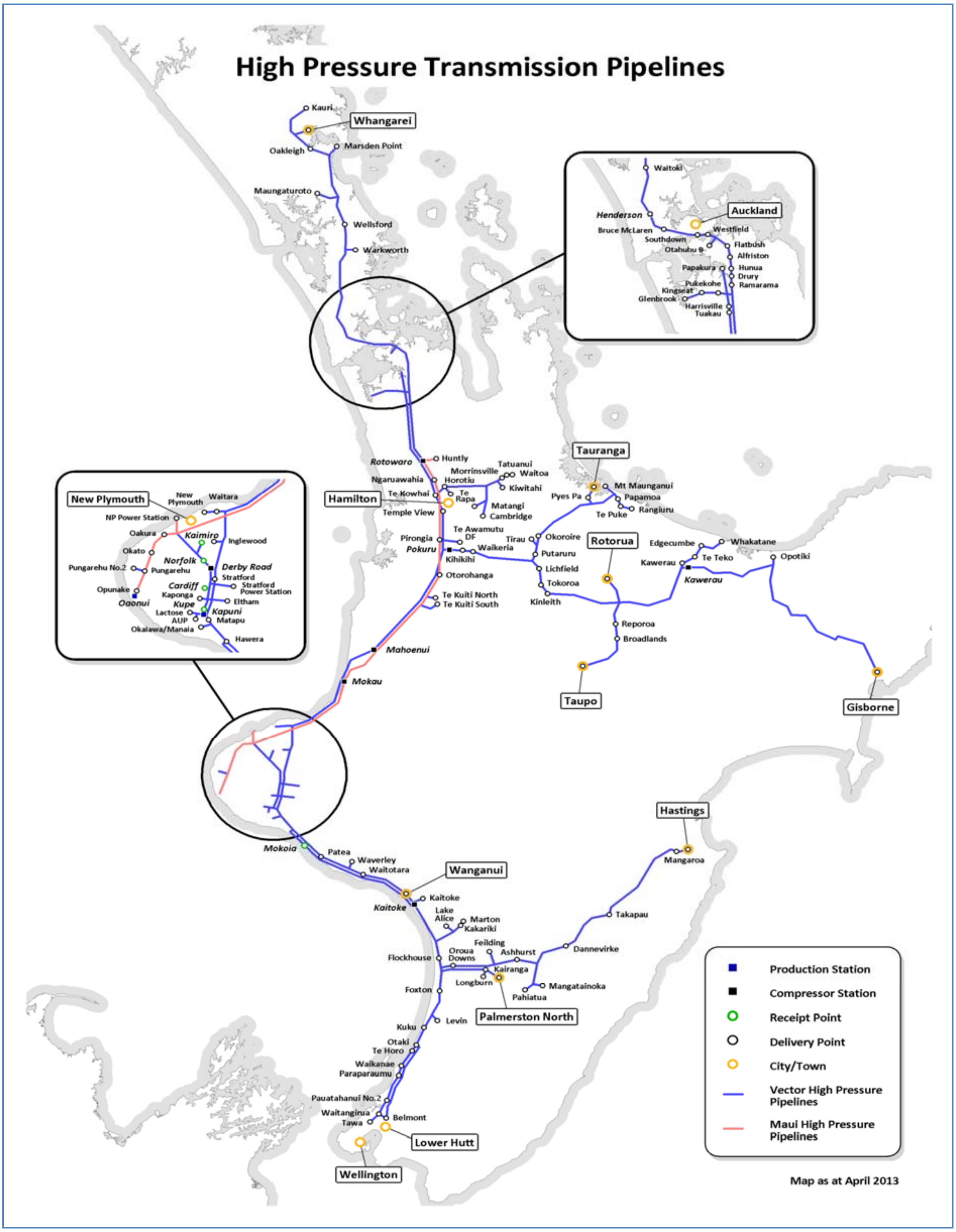

Figure 1-1: Vector's high pressure gas transmission system

1.5 Section 4 - Service Levels

Performance targets are set by Vector's asset management strategy and are also based on the requirements set out by the Commerce Commission. The performance targets are:

- Response time to emergencies (RTE) - target is to respond to all emergency events within 180 minutes.
- Health, safety and environment (HSE) - health and safety target is to achieve zero lost time injuries. Environmental target is full compliance with all requirements from local and regional councils and to have no prosecutions based on breaches, environmental regulations or requirements.
- Unplanned interruptions to supply – target is no more than one unplanned interruption per year.
- Service incidents and emergencies – targets are to have ratios of no more than 30:1 for Non-significant Events to Significant Events and no more than 220:1 Non-significant Events to Emergencies.
- Compressor availability – targets are to maintain compressor fleet availability at equal to or greater than 95% and compressor fleet reliability at equal to or greater than 97%.
- Public reported escapes (PREs) - target is no more than 13 confirmed PREs per 1000 km of pipeline per year.
- Unaccounted for gas (UFG) – target is to maintain UFG in each balancing and peaking pool (BPP) to a range of +/- 1%.

1.6 Section 5 - System Development Planning

Demand Forecasts

An accurate forecast of expected peak gas demand is essential for planning the future state of the system. Vector's GTB Security Standard defines the operational output measures to which the system should conform. Demand forecasting is an integral step in determining when these criteria are likely to be breached – a critical decision point for planning system augmentation.

The system is designed to cater for reasonably expected peak demand conditions, and capacity must be sufficient to ensure that the Security Standard is met under these conditions.

For the purposes of the AMP, it is assumed that increased demand will be contractually, commercially deliverable and that the solution cost is not disproportionate to the benefits obtained.

In order to identify the capacity required of the system two forecasts of peak demand are developed:

- System demand over a five day peak period.
- Delivery points peak hourly flow.

System Development

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

- Removing capacity constraints caused by system components to improve the overall capacity of a system (for example, upgrade a heating system, filter, metering system or pressure regulator to increase the overall capacity of a delivery point).
- Use of the risk assessment criteria to ascertain risk tolerability, and to test that the solution cost is not disproportionate to the benefits obtained.

- Deferring or avoiding asset expenditure where efficiency improvements or non-asset solutions would be more cost effective. Early investment is avoided unless there are good reasons to do otherwise (for example, to take advantage of the synergy of implementing in conjunction with other projects).
- Aligning the system development programme with other work programmes such as asset maintenance to achieve synergy benefits where possible and practical.
- Avoiding the loss of supply to large customers (or groups of customers) and consequential financial loss (while still allowing an acceptable risk profile).
- Ensuring recommended solutions are commercially sustainable.
- Being sufficiently flexible to allow for unexpected loads or growth opportunities not foreseen in planning.
- Achieving an appropriate return on investment under the regulatory regime.

Capex investment plans for consumer connections, system growth and asset relocations and their associated expenditure forecasts are described in Section 5 of the AMP.

1.7 Section 6 - Asset Maintenance Renewal and Replacement

Maintenance and Inspection Approach

Vector's asset maintenance and inspection strategy is based on four key factors:

- Ensuring the safety of consumers, the public, employees and contractors.
- Ensuring reliable and sustainable system 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. Where practicable, condition-based assessments have been adopted rather than age based replacement programmes.
- Asset replacement when consumables or replacement parts are no longer available.

The maintenance strategy details the required inspection, condition monitoring and maintenance tasks, and the frequency of such activities. The goal of the strategy is to ensure that assets can operate safely and efficiently to their rated capacity throughout their life. The data and information needs for maintenance purposes are also identified.

Vector's Transmission Services team develop an annual asset maintenance schedule based on the maintenance strategy. The asset maintenance schedule is agreed by the Asset Manager. Progress against the schedule is monitored monthly.

Defects identified during inspections are recorded and prioritised. Root cause analysis may be undertaken when significant, unexpected or unusual defects occur. This is supplemented by fault trend analysis. If performance issues with a particular type of asset are identified, and if the risk warrants it, a project will be developed to carry out the appropriate remedial actions. The maintenance strategy is reviewed periodically, informed by the findings from root cause analysis and fault trend analysis.

The different types of maintenance undertaken include:

Preventative Maintenance

- Asset inspections as per asset management standards.
- Condition testing as specified in asset management standards.
- Inspection and test intervals based on industry best practice and Vector experience.

Corrective Maintenance

- Correction of defects identified through preventative maintenance.

Reactive Maintenance

- Correction of asset defects caused by external influences, or asset failure.

Predictive Maintenance

- Technology-based methodology to determine an asset's condition without disturbing normal operation.

Proactive Maintenance

- Extends equipment life by applying advanced investigative and corrective technologies.

Value Added Maintenance

- Asset protection (e.g. asset location and marking, issuing permits).

Opex investment plans for maintenance and inspection programmes and their associated expenditure forecasts are described in Section 6 of the AMP.

Asset Renewal Approach

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 asset renewal. Often it may be more efficient to extend the asset life to beyond normal predicted asset life, by servicing or refurbishing the assets. Asset renewal is therefore in general condition-based rather than age-based.

Assets are only replaced when:

- They pose unacceptable health and safety risk.
- They are irreparably damaged.
- The operational and/or maintenance costs over the remaining life of the asset will exceed that of replacement.
- There is an imminent risk of asset failure.
- Assets become obsolete and hence impossible or inefficient to operate and maintain.
- Reliability and performance has become unacceptable.

Asset condition evaluation is based on:

- Results of field surveys, observations, tests and defect work schedules.
- Analysis of data associated with equipment condition e.g. ILI results, compressor oil analysis, vibration monitoring of rotating equipment and water bath heater water sampling.

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:

- Health and safety risks.
- The importance of the asset.
- The impact should the asset fail and the likelihood of such failure.
- Risk to other assets.
- Risk to the Vector's reputation.
- Potential financial impacts.

- 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.

Capex investment plans for renewal and replacement projects and programmes and their associated expenditure forecasts are described in Section 6 of the AMP.

1.8 Section 7 - Systems and Data

Vector uses a number of systems and processes to manage and record asset lifecycle data. Master registers are held for all asset static data (technical asset attributes including hierarchical, spatial and contextual data), cathodic protection and land management data.

The Intergraph geographical information system (GIS) is the primary asset register for the pipelines.

Vector's enterprise resource planning (ERP) system, Systems Applications and Processes (SAP), is used for all transactional data (inspection, maintenance and defects history) and the Plant Maintenance module, SAP-PM, is used as the master register for this data. SAP-PM is also used as the primary asset register for station equipment. The AM Meridian system supports SAP-PM with a full range of station drawings, data sheets, piping and instrumentation drawings (P and IDs) and photographs.

A separate master repository is maintained for historical time-series data derived from RTUs and other intelligent electronic devices (IEDs).

The recent implementation of the pipeline integrity management system (PIMS) has established enhanced data quality processes for data capture and management of intelligent pigging and cathodic protection data.

Vector employs a specialised computer modelling programme for system capacity management and forecasting.

Vector aims to continually improve asset information and data quality across the business to deliver the following benefits:

- Improved access to asset data.
- Supporting regulatory compliance.
- Improved audit compliance.
- Ability to reconcile technical and financial asset registers.
- Improved development, operational and maintenance planning efficiency and effectiveness.
- Improved investment decisions (optimised opex/capex).
- Accurate asset valuation.
- More efficient asset creation process and earlier settlement of work in progress (WIP).
- Ability to create technical asset records via the procurement process.
- Improved oversight of works management.

1.9 Section 8 - Risk Management

Assessing and managing risk is one of Vector's highest priorities. Risk management is practiced at all levels and parts of Vector and is overseen by the Board Risk and Assurance Committee (BRAC) and the Executive Risk and Assurance Committee (ERAC).

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 are assessed and managed using a combination of asset 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.
- Reducing the impact of failure through the application of appropriate asset security standards and information technology network architecture, selected use of automation, robust contingency planning and performance management of field responses.

Vector also recognises that IT systems are a very important part of its business and asset management framework. Vector operates advanced real-time asset control and protection systems, deeply integrated with the IT systems of the rest of the business. Potential compromise of the (cyber) security of Vector's IT systems, including real-time control systems, is recognised as a major (and increasing) business and asset risk. Over the past two years Vector has implemented several enhancements to its cyber-security systems to manage this risk and create a more robust operating environment. Further security enhancements will be implemented on an ongoing basis.

1.10 Section 9 - Expenditure Forecasts

A summary of the capex forecast included in the AMP is shown in Table 1-2 below.

Capital Expenditure	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Consumer connection	2,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
System growth	1,100	200	1,100	750	400	-	-	-	-	-
Asset replacement and renewal	8,735	8,270	10,515	10,620	6,915	10,570	9,070	7,440	7,740	6,800
Asset relocations	5,883	3,100	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Expenditure on network assets	**17,718**	**12,570**	**15,115**	**14,870**	**10,815**	**14,070**	**12,570**	**10,940**	**11,240**	**10,300**
Non network Assets	965	800	800	800	800	1130	1550	800	800	800
Expenditure on assets	**18,683**	**13,370**	**15,915**	**15,670**	**11,615**	**15,200**	**14,120**	**11,740**	**12,040**	**11,100**

- Figures are in 2014 real New Zealand dollars ($000)
- The year reference indicates the end of the Vector financial year
- The forecasts are inclusive of the cost of finance and in line with Vector's business practice

Table 1-2: Summary of capex forecast

A summary of the opex forecast included in the AMP is shown in Table 1-3 below.

Operational Expenditure	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**
Service interruptions, incidents and emergencies	904	921	875	875	875	967	1,013	967	875	898
Routine and corrective maintenance and inspection	8,574	8,732	8,297	8,297	8,297	9,166	9,600	9,166	8,297	8,514
Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-
Network Opex	**9,478**	**9,653**	**9,172**	**9,172**	**9,172**	**10,133**	**10,613**	**10,133**	**9,172**	**9,413**
System operations	666	679	645	645	645	712	746	712	645	662
Network support	1,812	1,881	1,852	1,852	1,852	1,911	1,940	1,911	1,852	1,867
Business support	155	158	150	150	150	166	173	166	150	154
Compressor fuel	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990
Land management and associated activity	685	697	663	663	663	732	767	732	663	680
Non network opex	**7,308**	**7,405**	**7,299**	**7,299**	**7,299**	**7,511**	**7,617**	**7,511**	**7,299**	**7,352**
Total	**16,786**	**17,058**	**16,472**	**16,472**	**16,472**	**17,644**	**18,230**	**17,644**	**16,472**	**16,765**

- Figures are in 2014 real New Zealand dollars ($000)
- The year reference indicates the end of the Vector financial year

Table 1-3: Summary of opex forecast

Gas Transmission Asset Management Plan 2013 – 2023

Background and Objectives
Section 2

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2. Background and Objectives

2.1 Context for Asset Management at Vector

Asset management is critical for ensuring Vector's gas transmission 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.

Vector also 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 currently being enhanced from the present well developed systems.

The Asset Management framework adopted for Vector's gas transmission 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.

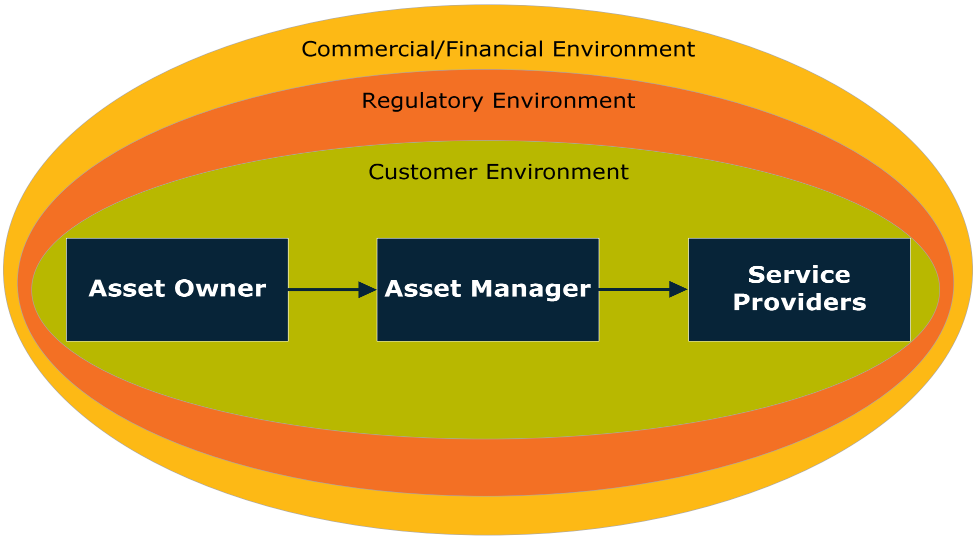


Figure 2-1 : Vector's Asset Management Framework

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 Asset Investment (AI) 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 (SD) group - capital programmes, network operations and service operations - and the external contractors and consultants supporting them (see Section 2.7 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, 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 Commercial and Regulatory Affairs group. Asset management involves close interaction with the Commercial and Regulatory Affairs group 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. The commercial return on investment is regulated. These regulations directly influence investment decisions. There are also a number of regulatory compliance rules that have an impact on network configuration and operations.

  Regulatory certainty is critical to the investment framework, given the long-term nature of the assets and the need for gas transmission 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.[1]

  Direct contact with the regulators is generally maintained through the Commercial and Regulatory Affairs 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 implements 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.

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

[1] In Vector's experience, the New Zealand regulatory regime is often cited by capital markets and rating agencies as being uncertain.

In the context described above, this Vector Asset Management Plan (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 transmission 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 transmission network is maintained and enhanced to support Vector's commercial investment approach and meet the needs of consumers, while ensuring safe and efficient gas transmission network operations. It also reflects feedback obtained from customers on their requirements for the quality and cost of their gas transmission services, and the manner in which they interact with Vector. The Plan sets out the forward path for Vector's gas transmission network capital investment and maintenance needs and how we intend to address these.

While this AMP's emphasis is on gas transmission 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 transmission 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 Vector.

This Plan 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 Transmission Information Disclosure Determination 2012.

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, meeting 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.

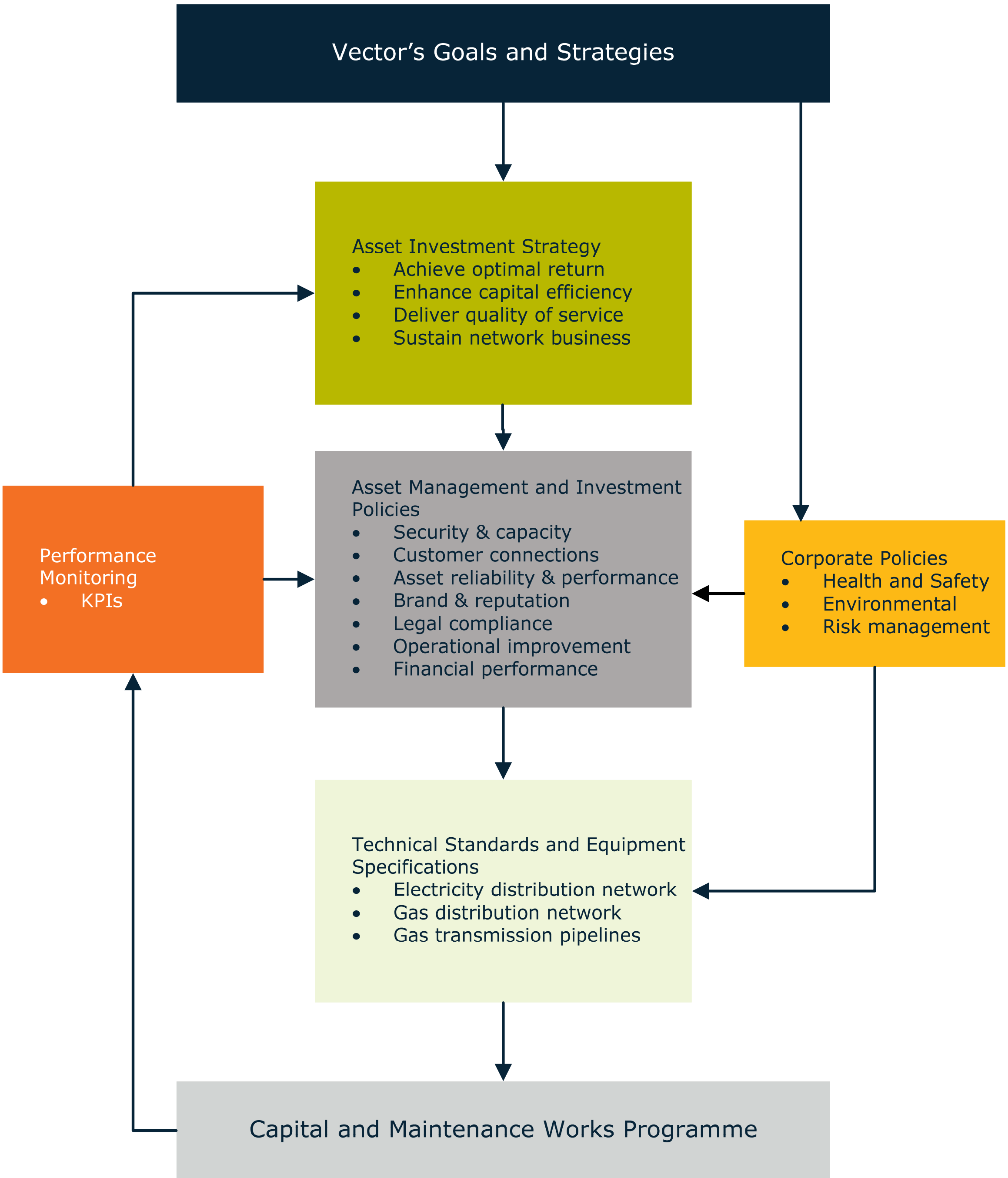


Figure 2-2 : How Vector's Asset Management strategies and policies relate to the strategic goals

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

2.2 Planning Period and Approval

This AMP covers a ten year planning period, from 01 July 2013 through to 30 June 2023 and was approved by the board of directors in September 2013.

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 important 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 Transmission Information Disclosure Determination 2012 and covers ten years starting on 01 July 2013. The purposes of this AMP are to:

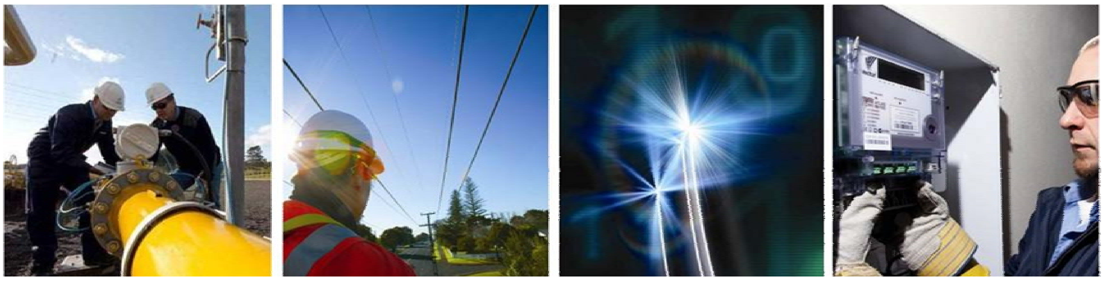
- Inform stakeholders how Vector intends to manage and expand its gas transmission network based on information available at preparation.
- Demonstrate the impact of regulatory settings on future investment decisions.
- Demonstrate alignment between gas transmission network asset management and Vector's 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.
- Meet Vector's regulatory obligation under the aforementioned Determination.
- Demonstrate that safe management processes are in place.

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 Zealanders' first choice for integrated infrastructure solutions that build a better, brighter future"



To support Vector in achieving this vision a number of Vector goals have been defined under the following headings:

- Public, employee and contractor safety
- Vector customer index
- Environmental compliance.
- Business line specific goals, including:
- Public Reported Escapes (PREs) for gas distribution business.
- Availability of core network for telecommunications.
- System Average Interruption Duration Index (SAIDI) for the electricity distribution business.
- Reliability of smart meters.
- Earnings Before Interest Tax Depreciation and Amortisation (EBITDA).

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

The Vector goals are supported by the strategies of the various Vector business units. Asset management, as captured in this AMP, is a key part of the wider AI business plan and consequently plays an important part in achieving the overall Vector vision.

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

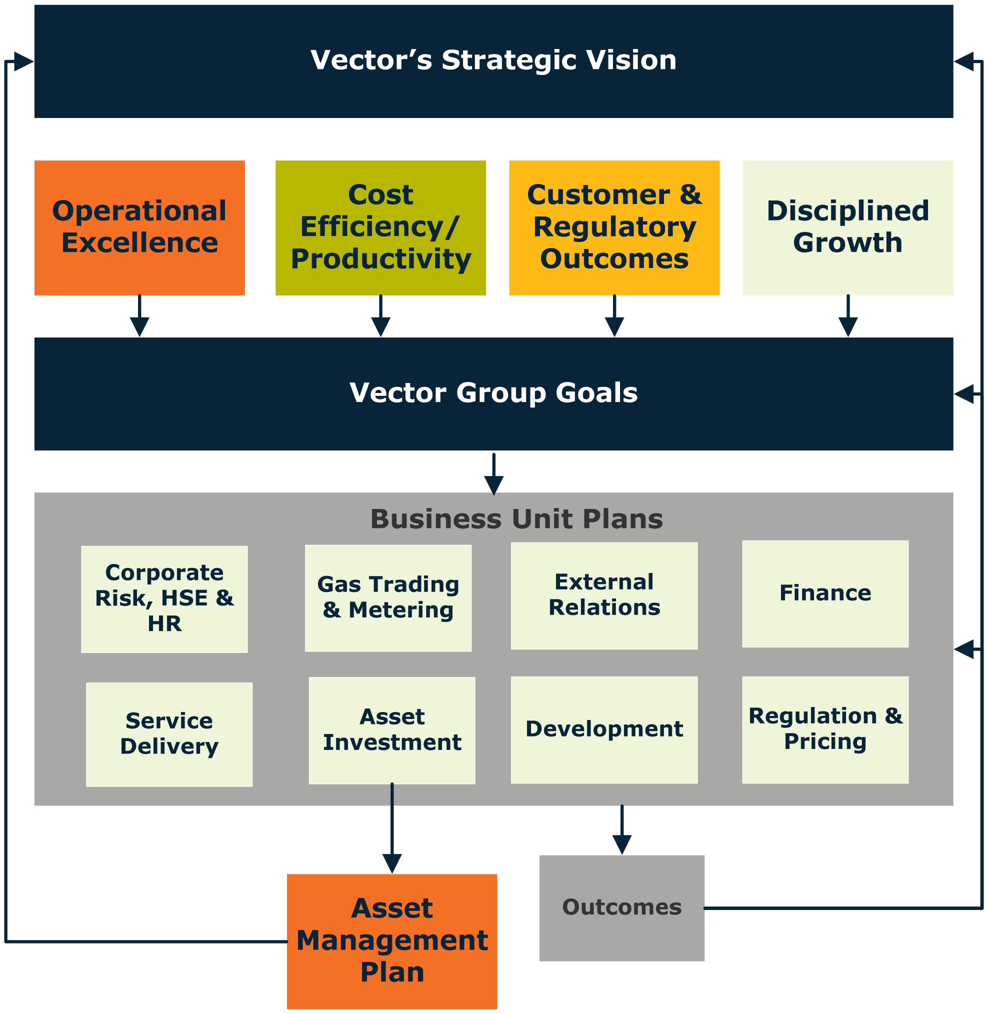


Figure 2-3 : The AMP in support of the overall Vector strategic vision

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

Vector Goal	← Asset Management in support of
Disciplined Growth	Investigate new technologies and associated opportunities
	Support commercially attractive investments
	Innovation and optimal investment efficiency Optimising economic returns of investment decisions Economies of scale from long term view
Customer and Regulatory Outcomes	Providing safe and reliable service Fit-for-purpose asset designs Understanding and reflecting customer needs in designs Meet customers' specific economic preferences where possible

[2] The Vector goals and initiatives are not in any priority order.

Vector Goal	Asset Management in support of
	Maintaining appropriate price/quality trade-off
	Reliable asset information source Detailed expenditure forecasts Strategic scenario planning
	High quality asset planning Good industry practice maintenance planning
Operational Excellence **Cost Efficiency / Productivity**	Safety is a fundamental value Full compliance with health, safety and environmental regulations
	Technical excellence Reliable asset information Investigate new technologies and opportunities offered
	Clear prioritisation standards Needs clearly defined Providing reliable service Understanding risks
	Fit-for-purpose asset designs High quality asset planning Effective maintenance planning Meet customer's specific economic preferences where possible Easy-to-maintain and operate asset
	Clear roles and responsibilities for asset management Strong, well-documented asset management processes
	Clear communication of asset standards and designs
	Setting KPIs for individual performance Leadership development Training and development Health and safety, environmental and risk management principles implemented at an asset investment level

Table 2-1 : How Asset Management supports Vector's Values

2.3.2 Vector's Vision Driving Asset Management

In the previous section it was indicated how asset management at Vector supports Vector's overall vision and strategic goals. Conversely, and very importantly for this AMP, the Vector vision, goals and values also set the framework and fundamental parameters for asset management and the AMP. This is illustrated in Table 2-2.

Vector goal driving	Asset Management
Disciplined Growth	Keep abreast of technology changes
	Seek optimal commercial outcomes in investment decisions
	Innovation and capital efficiency Optimised asset solutions and investment timing Asset development and investment where economically viable
Customer and Regulatory Outcomes	Just-in-time asset replacement Standardisation
	Understanding customer needs and reflecting this in decisions Good project communications Appropriate price/quality balance
	Soundly justified investment programme High quality asset data management Respond to regulatory incentives
	Fit-for-purpose solutions Meet customer's specific economic preferences where possible Respond to regulatory quality incentives
Operational Excellence **Cost Efficiency / Productivity**	Keep abreast of technology changes
	Consistent project prioritisation High-need projects only
	Appropriate to asset environment Maintain appropriate risk levels Easy-to-maintain and operate assets
	Asset decisions reflect safe assets as top priority Minimising asset environmental impact Effective consideration of health, safety and the environment in investment and maintenance decisions
	Clear roles and responsibilities Strong, well-documented asset management processes
	Clear forward view on upcoming work Consider partner capacity
	KPIs monitored for individual performance Established leadership development programmes Established training and development programmes

Table 2-2 : How Vector's values 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 premises on which the AMP is based. These assumptions reflect the manner in which AI understands and implements Vector's strategic direction and are shown in Table 2-3 below.

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.[3] • Vector fully complies with New Zealand safety codes, prescribed network operating practices and regulations.
The present industry structure remains	• The Vector gas transmission 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 transmission 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 transmission business operation model remains	• Field services will continue to be sourced from within Vector. (Alternative approaches for field services provision have been investigated and will be tested again in the future.)
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 small 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 will be met	• Regulatory requirements with regards to information disclosure or required operating standards will be met accurately and efficiently.
The asset will fully adhere to safety regulations and prescribed standards	• Vector complies fully with the Health and Safety in Employment (Pipelines) Regulations 1999 and the AS 2885 series of standards for Pipelines - Gas and Liquid Petroleum.
A sustainable, long term asset will be maintained	• Asset investment levels will be appropriate to support the effective, safe and reliable operation of the asset. • Expenditure will be incurred at the economically optimum investment stage without unduly compromising supply security, safety and reliability.

[3] This does not absolve Vector's service providers from meeting Vector's health and 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
	• New assets will be good quality and full life-cycle costing will be considered rather than short-term factors only. • Assets will be effectively maintained, adhering to good asset management principles. • Avoid over design or building excess assets. • Investments must provide an appropriate commercial return, reflecting their risks.
Existing efficiency, reliability and supply quality levels will generally be 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.
Asset security standards (for delivery) will be met	• In exceptional cases breaches may be accepted, as long as this is consciously accepted, explicitly acknowledged and communicated to affected parties. The security standards are based on Vector's best understanding of customer requirements and the price/quality trade-off.
Asset-related risks will be managed to appropriate levels	• Asset 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, excessive performance deterioration, age-profiles should be monitored and appropriate advance actions taken.
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 asset, the condition of the assets, the levels of risk accepted and the asset expenditure programmes.

2.3.4 Learning from Major Events

Another major approach to asset management is to learn from major events that happen in New Zealand and around the world with regard to any potential effects on the assets.

For example following the earthquakes experienced in Christchurch, the San Bruno, USA gas transmission asset failure and the Maui pipeline outage in October 2011, Vector has reviewed asset standards and maintenance practices accordingly.

2.4 Changing External Outlook

New Zealand has yet to experience a sustained economic recovery following the recession of 2008/09. Recent events around the world, and in particular in Europe where several countries face sovereign debt issues, could influence the economic recovery in New Zealand.

Additionally, there is currently excess electricity generation capacity in New Zealand. This is changing the nature of generation patterns, and in particular the manner in which thermal generation is used – with a direct impact on gas consumption.

Acceleration in the current slow growth trend for gas demand is therefore not anticipated in the foreseeable future.

2.5 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. As well as being a disclosure document, the AMP provides visibility of asset management activities to Vector, for incorporation into the broader business plans and strategies. In Figure 2-4 and Figure 2-5, this two-way support flow is illustrated.

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

2.5.1 Communication and Business Participation in Preparing the AMP

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

With respect to the preparation of the AMP, the action plan included in Table 2-4 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, asset 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): ➢ Definition of capex and opex categories ➢ Asset categories and asset classes ➢ 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 services 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 (Commercial, Service Delivery, Finance, Regulatory, IT) within Vector and field services providers (if applicable) 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 : Action Plan for development and implementation of AMP

2.6 Asset Management in the Wider Vector Context – External Stakeholders

As with any commercially focused business, Vector has a large number of internal and external stakeholders that have an active interest in how the assets of the Vector are managed. The essential service nature of the product Vector sells, and the importance to the nation's well-being, gives rise to stakeholders having a keen interest in how Vector conducts business.

In Figure 2-6, the important external stakeholders in Vector are highlighted. Understanding of how these stakeholders interact with Vector and the requirements or expectations they have has a major bearing on the manner in which Vector operates the asset.

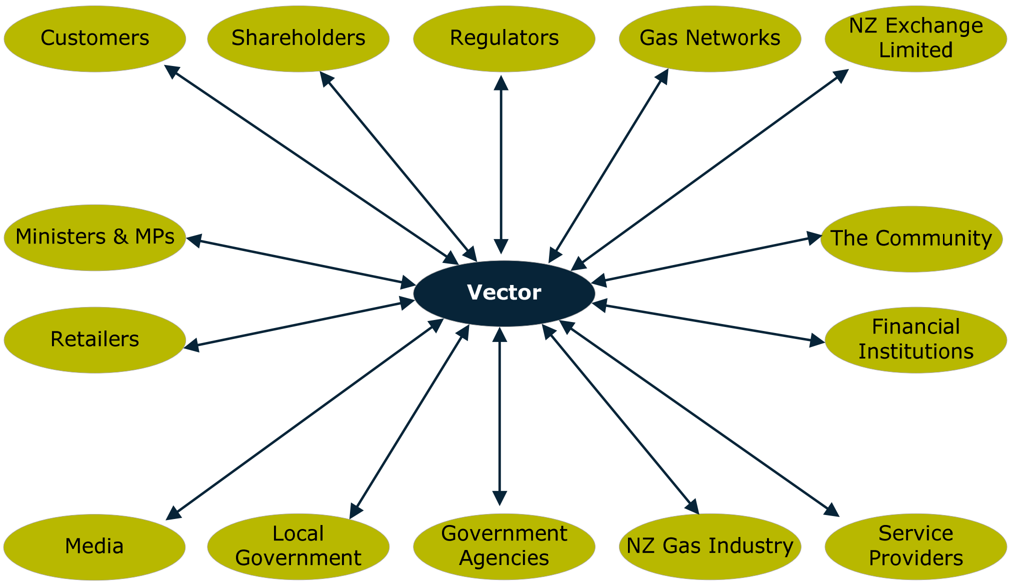


Figure 2-6 : Vector's key external stakeholders

2.6.1 Stakeholder Expectations

Vector ascertains its stakeholders' expectations in a number of ways including:

- Meetings and discussion forums
- Consumer engagement surveys
- Engagement with legislative consultation processes
- Annual planning sessions
- Direct liaison with customers
- Membership on industry working groups
- Feedback received via complaints and compliments
- Media enquiries and meetings with media representatives
- Monitoring publications and press releases.

Important stakeholder expectations ascertained are listed in Table 2-5 below.

Customers (End Use Consumers)	
Health and safety	Information in any outage situations
Reliable supply of gas	Consultation on planned outages
Quality of supply	Timely response to complaints/queries
Security of supply	Environment
Efficiency of operations	Fair price
Timely response to outages	
Shareholders	
Health and safety	Regulatory and legal compliance
Return on investment	Prudent risk management
Sustainable dividend growth	Good reputation
Reliability	Good governance
Confidence in board and management	Clear strategic direction
Accurate forecasts	
Regulators	
Health and safety	Inputs on specific regulatory issues
Statutory requirements	Fair behaviour
Accurate and timely information	Input into policy proposals and initiatives
New Zealand Exchange Limited	
Health and safety	Good governance
Compliance to market rules	Financial forecasts
Accurate performance information	
Financial Institutions	
Health and safety	Prudent risk management
Transparency of operations	Good governance
Accurate performance information	Accurate forecasts
Clear strategic direction	Confidence in board and management
Adhering to the listing rules of the NZSX and NZDX	
Service Providers	
Safety of the work place	Construction standards
Stable work volumes	Innovation
Quality work standards	Consistent contracts
Maintenance standards	Clearly defined processes
Clear forward view on workload	Good working relationships

Government Agencies	
Health and safety	Innovation
Accurate and timely provision of information	Infrastructure investment
Vector's views on specific policy issues	Reduction in emissions
Efficient and equitable markets	
Ministers and MPs	
Health and safety	Investment in infrastructure and technologies
Security and reliability of supply	Environment
Efficient and equitable markets	Good regulatory outcomes
	Energy and supply emergency management
Local Government	
Health and safety	Sustainable business
Compliance	Support for economic growth in the area
Environment	
Coordination between utilities	
Community	
Health and safety	Engagement on community-related issues
Public safety	Improvement in neighbourhood environment
Gas safety programme	Visual and environmental impact
Good corporate citizenship	
NZ Gas Industry	
Health and safety	Policy inputs
Participation in industry forums	Influencing regulators and government
Leadership	Sharing experience and learning
Innovation	
Retailers and Gas Distribution Network Companies	
Health and safety	Well maintained assets at the networks interface
Effective relationships	Coordinated approach to asset planning and operational interfaces
Ease of doing business	Sharing experience and learning
Secure source of supply	
Media	
Effective relationships	Information on Vector operations
Access to expertise	

Table 2-5 : Stakeholder expectations

Vector accommodates stakeholders' expectations in its asset management practices in a number of ways including:

- Due consideration of the health, safety and environmental impact of Vector's operations.
- Providing a safe and reliable asset.

- Quality of supply performance meeting consumers' needs and expectations.
- Optimisation of 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.
- Asset growth and development plans.
- Provision of accurate and timely information.
- Development of innovative solutions.
- Comprehensive asset replacement strategies.

2.6.2 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.
- Effective communication with affected stakeholders to assist them to understand Vector's position as well as that of other stakeholders that may have different requirements.
- Where Vector's fundamental values are compromised, seeking an acceptable compromise, or commercial solution.

Aspects considered when assessing the impact on stakeholder interests or resolving conflicts include:

- Health and safety
- Vector's reputation
- Cost/benefit analysis
- Long term planning strategy and framework
- Environmental impact
- Societal impact
- Sustainability of solutions (technically and economically)
- Works/projects prioritisation process
- Security and reliability standards
- Quality of supply
- Risks
- 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 assets.

2.7 Asset Management Structure and Responsibilities

Within Vector, the gas transmission assets are owned by Vector Gas Limited, a wholly owned subsidiary of Vector Limited. Vector Limited can be regarded as providing services associated with the assets that are owned by Vector Gas Limited. Advice from the Commerce Commission[4] indicates that Vector Gas Limited should be regarded as the regulated gas transmission business (GTB) while Vector Limited is appropriately regarded as a related party service provider to the GTB.

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

2.7.1 Vector Senior Level Structure

The Vector senior level structure is provided in Figure 2-7 below. Vector is split into several functional areas, each led by a Group General Manager (Group GM).

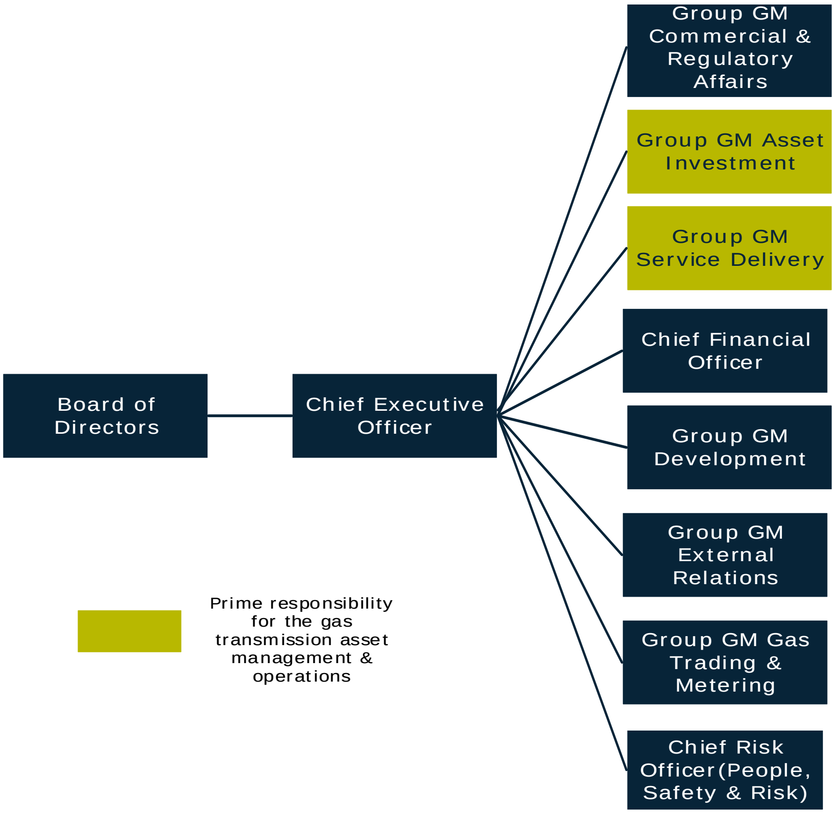


Figure 2-7 : The Vector senior management structure

The Group GM: Asset Investment has the primary responsibility for asset management. The Group General Manager: Service Delivery has the primary responsibility for the delivery of field services and maintenance as defined by the asset manager.

The responsibilities of the other groups are summarised below:

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[4] Letter from the Commerce Commission to Vector, *Vector business structures*, 10 September 2013.

- **Commercial and Regulatory Affairs**

  Responsible for interaction with the industry regulators, monitoring regulatory compliance, developing regulatory strategies, gas and electricity transmission, making regulatory submissions, setting gas pricing, developing pricing strategy and asset valuation, key customer relationships, mass market customer relationships, commercial strategies and energy consumption projections.

- **People, Safety and Risk**

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

- **Finance**

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

- **Development**

  Group legal services, company secretary, corporate initiatives, solar programme, business and data systems, IT support, computer hardware and software support and maintenance, cyber-security, economic analysis, communications strategies, Vector's Fibre and Communications business.

- **External Relations**

  Public affairs, government relations, marketing services and strategic relations.

- **Gas Trading and Metering**

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

2.7.2 Asset Investment Group

As the asset manager, the primary responsibility for the management of the asset and preparation of the AMP lies with the AI group. In broad terms, this group is responsible for:

- Setting asset security standards.
- Supporting Vector's development and implementation of a Pipeline Management System (PMS).
- Ensuring asset investment is efficient and provides an appropriate commercially sustainable return to the Vector's shareholders.
- Ensuring the configuration of the asset is technically and economically efficient, meets customer requirements, and is safe, reliable and practical to operate.
- Planning asset developments to cater for increasing demand and customer requirements.
- Ensuring the integrity of the existing asset base, through effective renewal, refurbishment and maintenance programmes including defining easement management activities.
- 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 asset planning.

- Maintaining current and accurate information about the extent and performance of the assets.
- Maintaining good strategic relationships with local government bodies and major infrastructure providers to support the long-term protection of Vector's assets by ensuring that obligations (from all perspectives) are well understood and met, works are co-ordinated and best mutual outcomes are sought.

In Figure 2-8 the structure of the AI group is expanded, emphasising the gas transmission asset management responsibilities.

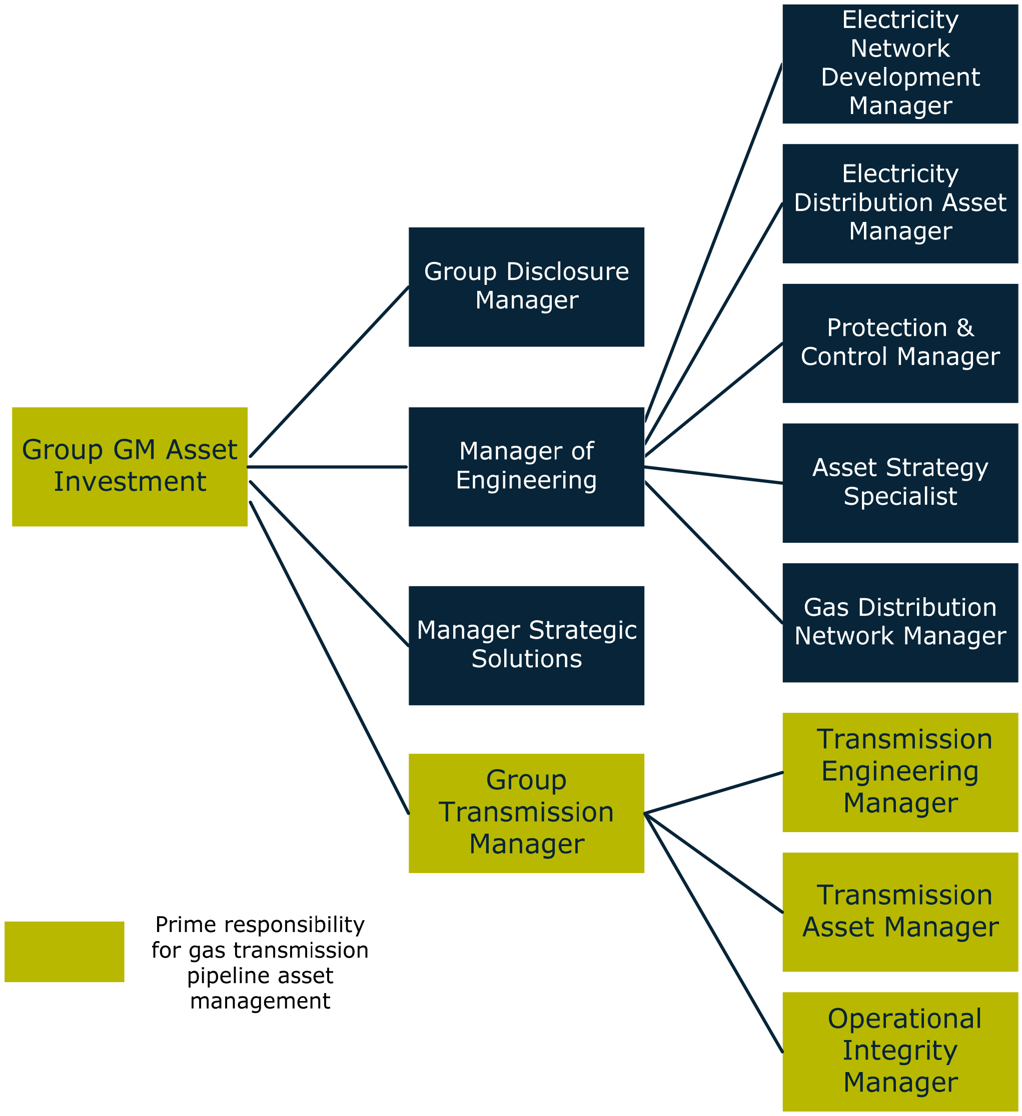

Figure 2-8 : The Asset Investment management structure supporting the AMP

Capital Programme

The Transmission Engineering section has the prime responsibility for delivery of the asset capital programme. This section provides programme and project management expertise to deliver the capex programme. It has the accountability to lead the development of the works programme, in addition to managing individual projects from kick-off to close-out. Vector does not have an in-house construction section and work is predominantly undertaken through external contractors and consultants with support from the Service Delivery Transmission Services team.

The Transmission Engineering team delivers the following:

- Input to the AMP in terms of resource capacity and outage requirements.
- Development of an annual works programme that balances asset, resources and outage requirements.
- Managing the end-to-end project delivery process.
- Engineering studies and design.
- Drawing office services.
- Work scopes and project briefs.
- Detailed project cost estimation.
- Reporting on project progress.
- Expenditure tracking and forecasting.
- Construction and commissioning standards.
- Project close-out and capturing learning.
- Capital budget management and approvals.

2.7.3 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 AI 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 are illustrated in Figure 2-9 and further expanded below.

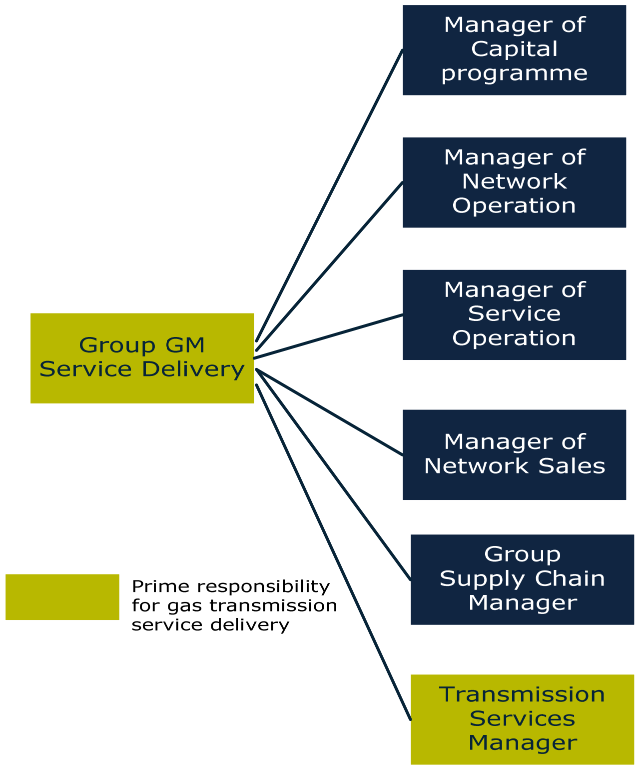

Figure 2-9 : Service Delivery as an Asset Management Service Provider

Transmission Services

The Transmission Services section is responsible for the delivery of field operations maintenance on the asset. This section employs a specialist in-house workforce that carries out work in the field with the support of contractors where appropriate.

The Transmission Services section interacts with the asset manager in various areas, including:

- Implementation of asset maintenance policies including easement management and surveillance.
- Providing asset information to AI for engineering analysis, condition and performance assessment.
- Feedback on asset performance and customer issues.
- Investigating asset failures.

Transmission Services is responsible for the day-to-day operational management of the asset. It includes the control room, from where the asset is monitored and operational instructions are issued. Other functions include managing, reporting and investigating outages and supporting emergency response.

As the prime "operator" of the asset, this team interacts closely with the asset manager, particularly on the following:

- Maintaining and controlling system operation within specified limits (short and long-term).
- Managing specified changes in asset configuration.
- Defining user requirements.
- Investigating outages and the root causes – especially if asset-related.
- Emergency and contingency management.

Supply Chain

The Supply Chain section manages procurement of major services and materials for Vector. Since the bulk of these services and materials are procured for capital programme projects this activity is closely linked to asset management, including:

- Preparation of asset (contract) specifications.
- Selection of equipment suppliers.
- Supply line negotiation.
- Tender awards.
- Equipment cost-estimation.

2.7.4 Asset Management Activities by Other Groups

While the bulk of asset management activities are performed by the AI group, supported by the SD group, other components of Vector also have inputs.

Commercial and Regulatory Affairs Group

- Liaising with new customers regarding connections to the asset and the revenues derived from any new assets installed.
- Setting and measuring the service experience that customers receive for connections and supply interruptions.
- Managing Vector's relationship with Gas Shippers.

- Providing a system operations group to manage system scheduling and balancing, and communications through the Open Access Transmission Information System (OATIS).

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.

Information Technology (part of Corporate Services)

- There is increasing overlap in the real-time operation of gas transmission 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.
- Procurement and implementation of Asset Management and IT support systems, and the core SCADA equipment, is managed by the Information Technology group.

2.8 AMP Approval Process

Approval of the disclosure AMP is sought at the September 2013 board meeting.

This AMP is subject to a rigorous internal review process, initially within the AI group (the developer of the Plan), and then by the Regulatory, External Relations, Financial and SD groups as well as external experts. Finally, the AMP is reviewed and certified by the board, in accordance with the Transmission Information Disclosure Determination 2012[5].

2.8.1 Alignment with the Vector Budgeting Process

Vector operates under a July to June financial year. The AMP processes and documents form a key input into the budgeting process. The AMP provides Vector's current view on future GTB requirements, including capital and maintenance expenditure requirements. As such, it forms the basis for inputs into the annual budgeting and 10-year expenditure forecast process.

The AMP contains a detailed, prioritised breakdown of GTB expenditure requirements for the next ten years, with justifications for the individual projects or programmes on which this is based. This is intended to assist the executive with the budget process, making it clear what the GTB priorities are, and how these compare with those of the rest of the business.

The forecast process for capital expenditure projects in the AMP is as follows:

- 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).
- A works programme is then drawn up and the corresponding budget to implement the works programme developed. This is an unconstrained budget.
- The prioritisation process described in Sections 5 and 6 is then applied to the projects and programme within the work category. This identifies projects that could be left

[5] Schedule 17 of the Gas Transmission Information Disclosure Determination 2012

out from the programme without undue negative consequences. Through this, it is possible to set an upper and lower boundary for the expenditure levels.

- An overall prioritisation process is then applied to the combined suite of asset projects, to develop the final AMP forecast for combined capital expenditure.

As noted before, the accuracy of forecasts further out in the planning period diminishes. The capex forecasts for year’s six to 10 are based on a combination of projects foreseen at this stage and trend analysis for other types of projects. A similar process is adopted for the opex forecasts.

2.8.2 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).
- 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. Through this, it is possible to set an upper and lower boundary for the expenditure levels.
- Discussions then take place with Service Delivery 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.
- 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 year six to year 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.

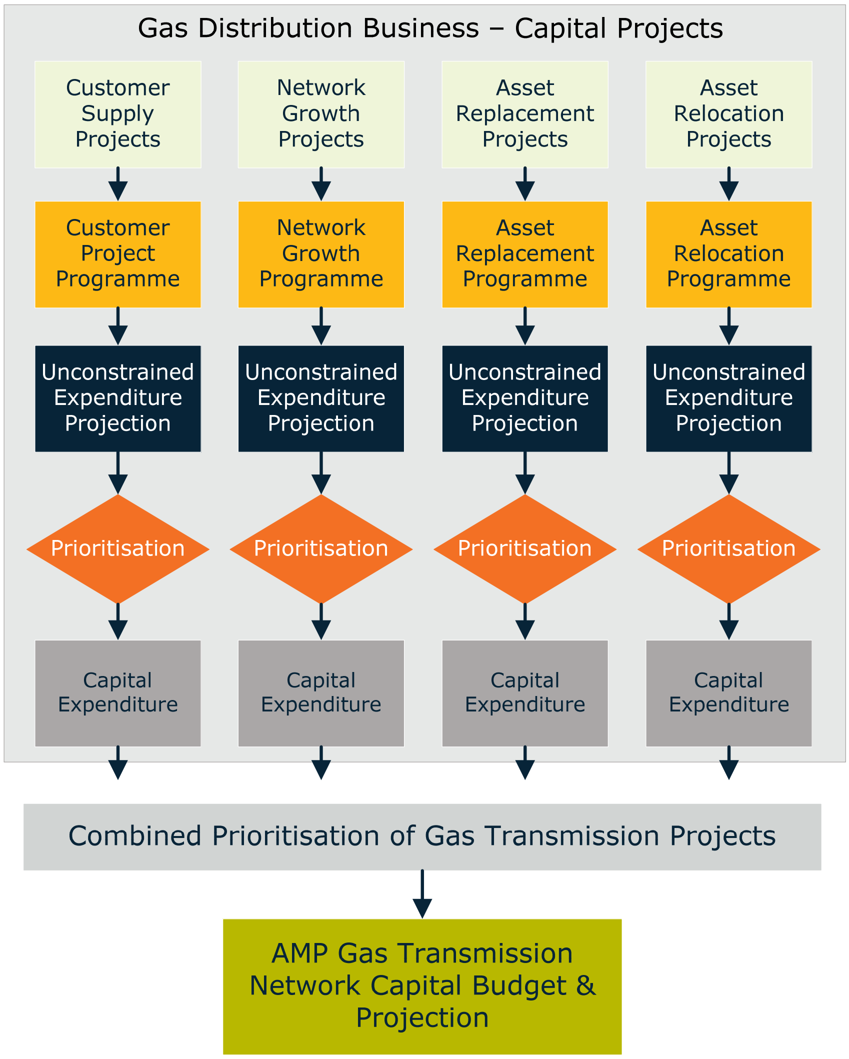

Figure 2-10 : Gas Transmission business - capital projects

2.9 Asset Management Decisions and Project Expenditure Approval

Implementation of the AMP requires decisions to be made by management and employees 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 roles of employees at 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 project budgets before any commitment can be made. Preliminary project approval is normally given through the annual (one-year) budgeting process. Project-specific capex approval has to be granted for all projects prior to committing expenditure. The detailed project approval process has been developed in accordance with the Vector DFA framework. 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.

Critical unbudgeted investments may 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 regulatory compliance issue.

2.10 Performance 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.
- Overall expenditure against budget.
- Progress of key capital projects against project programme and budget.
- Reliability performance (including compressor stations and pipelines).
- Performance and utilisation of key assets such as compressor stations and pipelines, etc.
- Progress status of risk registers actions (the board has a risk committee with a specific focus on risks to the business).

2.11 Asset Management Processes

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

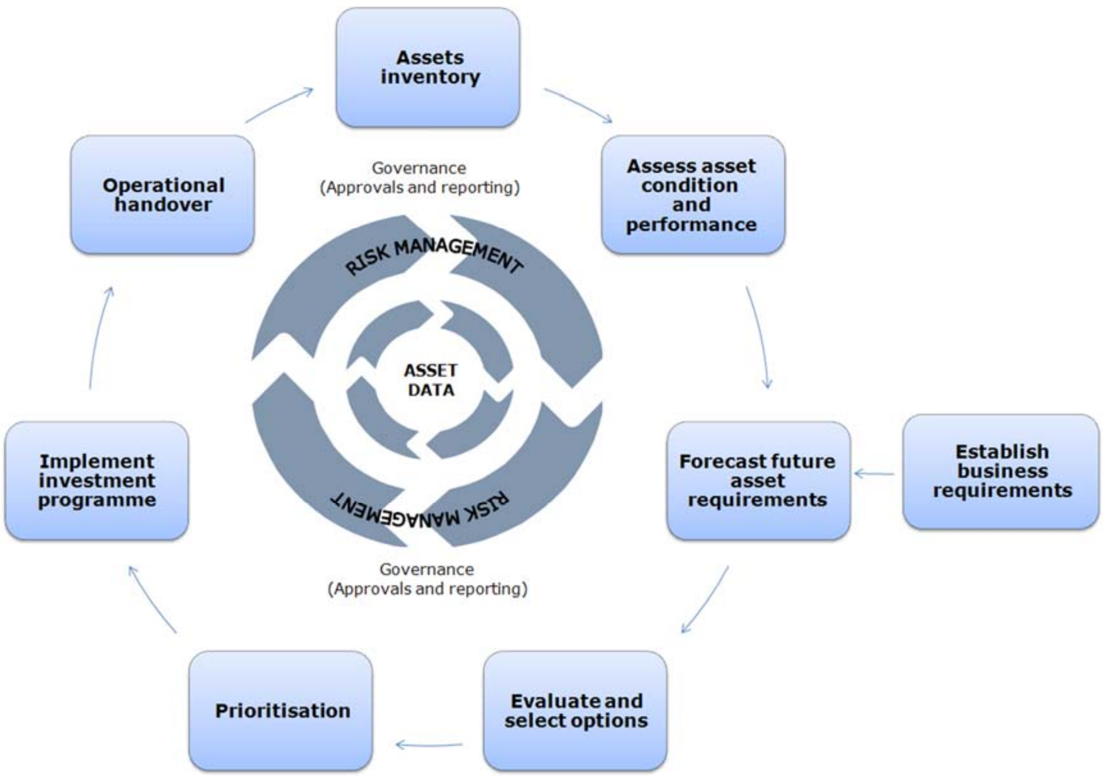

Figure 2-11 : High-level overview of the Vector asset investment process

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 asset configuration is set out in Sections 3 and 6.

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 Asset Condition and Performance

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

Establish Business Requirements

The levels of service required from the asset 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. Service levels are described in Section 4.

Forecast Future Asset Requirements

The combination of asset condition and performance drivers, load demand and the business requirement driver form the basis for assessing future asset needs and the resulting asset development plans. Sections 3, 5 and 6 discuss this information.

Vector operates the asset in a changing environment, and future requirements are likely to differ materially from the situation faced today. Such changes have to be anticipated in current development plans.

Evaluate and Select Options

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

At Vector asset investment planning is broadly categorised in two main streams:

- Asset development planning is undertaken to ensure service target levels are met in an environment of increasing 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 asset development planning is set out in Section 5.
- Maintenance planning is undertaken to ensure that assets remain fully functional for their reasonably expected lifespan when operating within expected 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 asset development and maintenance planning processes. This process ensures that only those projects that meet Vector's investment thresholds – which encompass commercial, safety 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 asset capital investment projects is discussed in Sections 5, 6 and 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 upgrade or replacement work on compressor stations, may straddle financial years. Budgetary provision is made in the year that the expenditure will be incurred.

The implementation of solutions identified as part of the System Development Planning (Section 5) and Asset Integrity and Maintenance (Section 6) are managed by the Transmission Development team. Approved consultants and contractors are contracted for the detailed design and execution of larger projects. The Vector Transmission Services team delivers smaller projects e.g. like-for-like replacement.

Operational Handover

Once construction and installation is completed, a formal handover process takes place. The process is designed to check that the quality of work and equipment meets Vector's standards and that the assets are fully operable and maintainable. Records of new or replaced assets are created or updated in SAP-PM for maintenance, data sheets for technical reference, Piping and Instrumentation Drawings (P and IDs) and the Graphical Information System (GIS).

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 which underpins all asset management business processes and forms an important part in defining project requirements is discussed in AMP Section 8.

2.12 Works Coordination

2.12.1 Internal Coordination

Over recent years, Vector has put extensive effort into continuously improving the coordination of 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. Improvement initiatives have included:

- Introduction of integrated works planning across the end-to-end capex process – this is to drive an efficient and deliverable works plan that coordinates work to optimise outage impacts and resource requirements.
- Introduction of early contractor involvement to drive:
  - Improved risk evaluation/mitigation/management/allocation.
  - Clear understanding and development of scope and delivery sequence.
  - Early constructability input and reviews.
  - Earlier operational acceptance, at product specification and design stage rather than at hand-over.
  - Improved innovation.
  - Better price definition for raising budgets – improved cost certainty and better executed project management with less variations.
- Significant refinement of the capex programme delivery process to better define accountabilities across all involved parties.
- Roll out of a standard Project Management Institute (PMI) process for all project managers.
- Refinement of the Project Server to improve project and programme planning and management.

2.12.2 External Coordination

As well as internal coordination, new processes have also been put in place to improve coordination between Vector and other utility organisations, roading authorities, local councils and their service providers. These works coordination processes are focused on maintaining effective communication channels 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, with Vector for example obtaining access to motorway corridors for laying cables.

2.13 Other Asset Management Documents and Policies

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

2.13.1 Other Asset Management Documents

The AMP is supported by a collection of detailed asset management documents and policies. These include (listed in no particular order):

- Asset management and investment policy
- Asset security standards and policies
- Detailed asset maintenance standards

- Asset design policies
- Risk management policies
- Contracts management policy
- Procurement policy
- Health and safety policy
- Environmental policy
- Asset settlement manual
- Asset contingency and emergency plans
- Asset projects quality assurance policy
- Drug and alcohol policy.

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

Vector's high pressure gas transmission assets are required to comply with the Health and Safety in Employment (Pipelines) Regulations 1999. Compliance with these regulations places a number of obligations on Vector including compliance with the AS 2885 series of standards for Pipelines - Gas and Liquid Petroleum. Vector has suite of internal management systems, plans and procedures to satisfy the requirements of the AS 2885 series. These documents can also be accessed on the Vector internal communications website.

Vector is a member of the high pressure gas pipeline industry committees that review and develop the AS 2885 series of standards and associated standards.

2.13.2 Other Vector Policies Affecting Asset Management

Vector has a number of business policies[6] 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:

- Code of conduct
- Legal compliance policy
- Protected disclosure policy
- Remuneration policy
- Customer credit policy
- Foreign exchange policy
- Expense management policy
- Asset WIP (work-in-progress) Management policy
- Asset Fixed Asset Creation and Disposal policy
- Capex policy.

[6] These policies are listed in no particular order.

Information Technology:

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

2.14 Review of Vector's Asset Management Practice

2.14.1 Asset Management Maturity Assessment (AMMAT)

In terms of the Gas Transmission Information Disclosure Determination 2012, the Commerce Commission now requires its Asset Management Maturity Tool (AMMAT) to be applied. 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.

Vector is not convinced that the AMMAT, or indeed PAS55, is necessarily an appropriate tool to measure asset management maturity for New Zealand GTBs. Over the years Vector has been striving to strike an appropriate balance between operating efficiency and the increased workload and bureaucracy associated with adopting formal asset management standards such as PAS55. As discussed in Section 2.14.2, asset management practices are independently reviewed by international experts on a regular basis repeatedly been found to be aligned with best industry practices.

Nonetheless, to comply with the Information Disclosure Determination (2012), Vector has applied the AMMAT. Vector's self-assessment was undertaken in a workshop setting by managers responsible for the various facets of asset management at Vector. The results were reviewed by senior executives responsible for the Asset Investment and Service Delivery groups. The assessment was undertaken in accordance with guidelines provided by the Commerce Commission.

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 organisation has not considered or does not have the elements of the function in place.

- **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. The full assessment criteria for the individual questions are included in Appendix 5.

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?	■	■	■		
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	■	■	■	■	

Question No.	Function	Question	Rating				
			0	1	2	3	4
		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	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 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?					

Question No.	Function	Question	Rating				
			0	1	2	3	4
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 and 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	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?	●	●	●	●	

Table 2-6 : Vector's maturity level self-assessment

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 or further improvement, but with some improvement initiatives required to enhance it. Two broad areas in particular have been identified where improvement in Vector's asset management could be achieved:

- **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.

- **Information Management**

  Vector owns a number of legacy information systems with data stretching back up to 40 years. Current improvement initiatives include 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.

2.14.2 External Asset Management Reviews

Vector has, over an extended period, engaged external expert technical advisers to review its asset management practices. While these reviews have been very positive in their feedback and confirm that asset management at Vector conforms to good industry practice, Vector has taken note of the feedback and recommendations received, and where practical and beneficial, reflected this in asset management practices.

2.15 Cross Reference to the Information Disclosure Requirements

As indicated in 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 Transmission Information Disclosure Determination 2012.

Table 2-7 provides a cross reference between the sub-sections in this AMP and the disclosure requirements referenced in Attachment A of Commerce Commission Decision No. NZCC 24 – Gas Transmission Information Disclosure Determination 2012 dated 01 October 2012.

Cross reference between AMP and Attachment A

ID Determination Attachment A Clause		Commerce Commission Disclosure Contents Requirements	AMP Section
Contents of the AMP			
3		The **AMP** must include the following:	
3.1		A summary that provides a brief overview of the contents and highlights information that the **GTB** considers significant.	Section 1 – Executive Summary
3.2		Details of the background and objectives of the **GTB**'s asset management and planning processes.	Section 2 – Background and Objectives
3.3		A purpose statement which:	
	3.3.1	Makes clear the purpose and status of the **AMP** in the **GTB**'s asset management practices. The purpose statement must also include a statement of the objectives of the asset management and planning processes	2.2, 2.3, 2.5 and 2.6
	3.3.2	States the corporate mission or vision as it relates to asset management.	2.1 and 2.3
	3.3.3	Identifies the documented plans produced as outputs of the annual business planning process adopted by the **GTB.**	2.3 and 2.13
	3.3.4	States how the different documented plans relate to one another, with particular reference to any plans specifically dealing with asset management.	2.3, 2.8 and 2.13
	3.3.5	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 **GTB**'s vision and mission statements and show a clear recognition of stakeholder interest.*	Section 2 - Background and Objectives
3.4		Details of the **AMP planning period**, which must cover at least a projected 10 year asset management planning period 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 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

ID Determination Attachment A Clause		Commerce Commission Disclosure Contents Requirements	AMP Section
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 the detail of:	
	3.6.1	How the **GTB**	
	3.6.2	Meets the requirements.	1.2, 6.1, 6.2, 6.3, 6.4 and 6.5
	3.6.3	The impact on asset management.	1.2, 6.1, 6.2, 6.3, 6.4 and 6.5
3.7		A description of stakeholder interests (owners, **consumers**, etc) which identifies important stakeholders and indicates:	
	3.7.1	How the interests of stakeholders are identified.	2.5 and 2.6
	3.7.2	What these interests are.	2.6
	3.7.3	How these interests are accommodated in asset management practices.	2.6
	3.7.4	How conflicting interests are managed.	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
	3.8.1	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, 2.8, 2.9 and 2.10
	3.8.2	Executive—an indication of how the in-house asset management and planning organisation is structured.	2.1 and 2.7
	3.8.3	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 and 2.12
3.9		All significant assumptions:	
	3.9.1	Quantified where possible.	2.3 and 9.3

ID Determination Attachment A Clause		Commerce Commission Disclosure Contents Requirements	AMP Section
	3.9.2	Clearly identified in a manner that makes their significance understandable to interested persons, and including:	2.3, 2.4 and 6.1
	3.9.3	A description of changes proposed where the information is not based on the **GTB**'s existing business.	n/a
	3.9.4	The sources of uncertainty and the potential effect of the uncertainty on the prospective information.	1.2, 2.4, 5.3, 5.4 and 9.3
	3.9.5	The price inflator assumptions used to prepare the financial information disclosed in **nominal New Zealand dollars** in the Report of Forecast Capital Expenditure set out in Schedule 11a and the Forecast on Forecast Operational Expenditure set out in Schedule 11b.	9.5
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.	1.2, 2.5, 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: 1. How the asset management strategy is consistent with the **GTB**'s other strategy and policies. 2. How the asset strategy takes into account the life cycle of the assets. 3. The link between the asset management strategy and the **AMP**. 4. Processes that ensure costs, risks and system performance will be effectively controlled when the **AMP** is implemented.	2.1, 2.3, 5.1, 6.1, 6.2, 6.3, 6.4, 6.5 and 8.4
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: 1. The processes used to identify asset management data requirements that cover the whole of life cycle of the assets. 2. 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. 3. The systems and controls to ensure the quality and accuracy of asset management information. 4. The extent to which these systems, processes and controls are integrated.	2.11, Section 7 – Systems and Data, 6.2, 6.3, 6.4, 6.5, 8.4

ID Determination Attachment A Clause		Commerce Commission Disclosure Contents Requirements	AMP Section
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.*	Section 7 – Systems and Data
3.14		A description of the processes used within the **GTB** for:	
	3.14.1	Managing routine asset inspections and **network** maintenance.	Section 6 – Asset Integrity and Maintenance
	3.14.2	Planning and implementing **network** development projects.	Section 5 – System Development Planning
	3.14.3	Measuring **network** performance.	Section 4 – Service Levels
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: 1. Identify the documentation that describes the key components of the asset management system and the links between the key components. 2. Describe the processes developed around documentation, control and review of key components of the asset management system. 3. Where the GTB outsources components of the asset management system, the processes and controls that the GTB uses to ensure efficient and cost effective delivery of its asset management strategy. 4. Where the GTB outsources components of the asset management system, the systems it uses to retain core asset knowledge in-house. 5. Audit or review procedures undertaken in respect of the asset management system.	Section 7 – Systems and Data, 6.2, 6.3, 6.4, 6.5, 8.4 [Note: items 3 and 4 n/a for Vector GTB]
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: 1. Communicate asset management strategies, objectives, policies and plans to stakeholders involved in the delivery of the asset management requirements, including contractors and consultants.	2.5

ID Determination Attachment A Clause	Commerce Commission Disclosure Contents Requirements	AMP Section
	2. Demonstrate staff engagement in the efficient and cost effective delivery of the asset management requirements.	
4.	The **AMP** must present all financial values in **constant New Zealand dollars** except where specified otherwise.	5, 6, 7 and 9
5.	*The* ***AMP*** *must be structured and presented in a way that the* ***GTB*** *considers will support the purposes of* ***AMP*** *disclosure set out in clause 2 of the* determination.	
Assets Covered		
6.	The **AMP** must provide details of the assets covered, including:	
6.1	A high level map indicating the geographic location of the network.	1.4 and 3.1
6.2	A diagram, with any cross-referenced information contained in an accompanying schedule, of each **transmission system** of the pipeline owner showing the following details:	
6.2.1	All assets in the system with notations showing: a) Internal, external, or nominal pipe diameters used (identifying whether internal, external, or nominal pipe diameters are used). b) Pipe design pressure ratings. c) All stations, main line valves, intake and offtake points, including a unique identifier for each item d) The distance between the items referred to in sub clause 6.2.1(c) of this attachment	Section 3 – Assets Covered
6.2.2	If applicable, the points where a significant change has occurred since the previous disclosure of the information referred to in sub clause 6.2.1 of this attachment, including: a) A clear description of every point on the network that is affected by the change. b) A statement as to whether the capacity of the network, at the points where the change has occurred, or other points, (as the case may be) has increased or decreased or is not affected. c) A description of the change.	n/a
6.3	The **AMP** must describe the **network** assets by providing the following information for each asset category:	

ID Determination Attachment A Clause		Commerce Commission Disclosure Contents Requirements	AMP Section
6.4		Description and quantity of assets.	Section 3 Assets Covered
6.5		Age profiles.	Section 3 Assets Covered
6.6		A discussion of the condition of the assets, further broken down into more detailed categories as appropriate. Systemic issues leading to the premature replacement of assets or parts of assets should be discussed.	Section 6
7		The asset categories discussed in clause 6.3 of this attachment should include at least the following:	
7.1		The categories listed in the Report on Forecast Capital Expenditure in Schedule 11a.	Section 3
7.2		Assets owned by the **GTB** but installed at facilities owned by others.	3.2 and 3.4.1
Transmission System Capacity			
8.		The **AMP** must include an assessment of the extent to which physical pipeline capacity is adequate to address the current and anticipated future needs of **consumers**, taking into account expected demands on the transmission system and the **GTB**'s investment plans.	5.3.2
8.1		The assessment must include the following:	
	8.1.1	Subject to clauses 8.2, 8.3 and 8.4 below, for each offtake point with a throughput of gas during the system peak flow period of 2,000 GJ or more, an analysis of available capacity, including a description of any potential transmission system constraints	Section 5
	8.1.2	a description of the extent to which the **GTB**'s planned investments will affect the constraints identified in sub clause 8.1.1 of this attachment	5.6-5.11
	8.1.3	a description of the extent to which constraints identified in sub clause 8.1.1 of this attachment are impacting upon the quality of service provided to existing **consumers.**	5.6-5.11
8.2		The analysis of available capacity disclosed pursuant to clause 8.1.1 of this attachment for each offtake point must separately assume that the throughput of gas or the gas pressure requirements at the other offtake points on the transmission system:	
	8.2.1	occurred during a recent system peak flow period	5.6-5.11

ID Determination Attachment A Clause	Commerce Commission Disclosure Contents Requirements	AMP Section
8.2.2	maintain observed trends, e.g. growth trends, peak demand factors and trend line adjustments, or other modelled behaviours	5.6-5.11
8.3	For the purposes of clause 8.1.1 of this attachment, the **AMP**:	
8.3.1	May treat offtake points that are supplied from a common physical connection to a pipeline as a single offtake point, provided that this is noted in the **AMP**.	5.3, 5.6-5.11
8.3.2	Must describe the modelling methodology and include all material assumptions, including peak flow period throughputs not contributing to capacity constraints (e.g. interruptible flows); physical boundaries of the transmission system; sources of data used; modelled representation of the transmission systems and its operational constraints.	5.4.4, 5.6-5.11
8.3.3	Must identify the recent system peak flow periods used in the clause 8.2.1 analysis, and must either set out the peak flow information specified in sub clauses 2.5.2(1)(a) and 2.5.2(1)(b) of the determination, or provide reference to a website at which interested persons can readily access the same information at no charge as specified in sub clause 2.5.2(4) of the determination.	5.6-5.11
8.3.4	Must include the name, version and source of any commercial computer software used to simulate the transmission system.	5.3.1
8.4	If the analysis specified in sub clause 8.1.1 of this attachment is posted on a website normally used by the **GTB** for the publication of information and can be readily accessed at no charge by interested persons, the analysis may be incorporated in the **AMP** by reference subject to the information being retained on such a website for a period of not less than five years.	N/A
Service Levels		
9	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.**	Section 4
10	Performance indicators for which targets have been defined in clause 9 above must include the DPP requirements required under the price quality path determination applying to the regulatory assessment period in which the next **disclosure year** falls. Performance indicators for which targets have been defined in clause 9 above should also include:	4.1.1, 4.1, 4.2

ID Determination Attachment A Clause	Commerce Commission Disclosure Contents Requirements	AMP Section
	1. Consumer oriented indicators that preferably differentiate between different consumer groups. 2. 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.	
11	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.	2.6.1, 4.1, 4.2
12	Targets should be compared to historic values where available to provide context and scale to the reader.	4.1, 4.2
13	Where forecast expenditure is expected to materially affect performance against a target defined in clause 9 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.**	4.1.1, 4.2.2, 4.2.4, 4.2.5, 4.2.6
14	**AMP**s must provide a detailed description of **network** development plans, including:	
14.1	A description of the planning criteria and assumptions for **network** development. 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, 5.3, 5.4, 5.5
14.2	A description of strategies or processes (if any) used by the **GTB** that promote cost efficiency including through the use of standardised assets and designs. The use of standardised designs may lead to improved cost efficiencies. This section should discuss: 1. The categories of assets and designs that are standardised. 2. The approach used to identify standard designs.	6.5.1
14.3	A description of the criteria used to determine the capacity of new equipment for different types of assets or different parts of the **network**. *The criteria described should relate to the **GTB**'s philosophy in managing planning risks.*	5.6-5.11, 6.1.2

ID Determination Attachment A Clause		Commerce Commission Disclosure Contents Requirements	AMP Section
14.4		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.	2.3.2, 5.5
	14.4.1	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.	5.6-5.11
	14.4.2	Explain the load forecasting methodology and indicate all the factors used in preparing the load estimates.	5.4.3
	14.4.3	Provide separate forecasts to at least off-take points covering at least a minimum 5 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.	5.3, 5.6-5.11
	14.4.4	Identify any network or equipment constraints that may arise due to the anticipated growth in demand during the **AMP planning period**.	5.6-5.11
14.5		Analysis of the significant **network** level development options identified and details of the decisions made to satisfy and meet target levels of service, including:	
	14.5.1	The reasons for choosing a selected option for projects where decisions have been made.	No significant development options
	14.5.2	The alternative options considered for projects that are planned to start in the next 5 years.	No significant development options
	14.5.3	Consideration of planned innovations that improve efficiencies within the **network**, such as improved utilisation, extended asset lives, and deferred investment.	No significant development options
14.6		A description and identification of the **network** development programme and actions to be taken, including associated expenditure projections. The **network** development plan must include:	
	14.6.1	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.	5.14
	14.6.2	A summary description of the programmes and projects planned for the following 4 years (where known).	5.14
	14.6.3	An overview of the material projects being considered for the remainder of the **AMP planning period**.	5.14

ID Determination Attachment A Clause		Commerce Commission Disclosure Contents Requirements	AMP Section
		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 5 years, alternative options should be discussed.	
14.7		A description of the extent to which the disclosed **network** development plans meet the loads anticipated in current gas demand forecasts prepared by the Gas Industry Company or any Government department or agency.	5.4.1.3
Lifecycle Asset Management Planning (Maintenance and Renewal)			
15		The **AMP** must provide a detailed description of the lifecycle asset management processes, including:	
15.1		The key drivers for maintenance planning and assumptions.	6.1, 6.2
15.2		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:	
	15.2.1	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.	Section 6
	15.2.2	Any systemic problems identified with any particular asset types and the proposed actions to address these problems.	Section 6
	15.2.3	Budgets for maintenance activities broken down by asset category for the **AMP planning period**.	Section 6
15.3		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:	
	15.3.1	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.	6.1.2
	15.3.2	A description of the projects currently underway or planned for the next 12 months.	Section 6 – Asset Integrity and Maintenance – refer 6.5.1 regarding work programmes

ID Determination Attachment A Clause	Commerce Commission Disclosure Contents Requirements	AMP Section
15.3.3	A summary of the projects planned for the following 4 years (where known).	Section 6 – Asset Integrity and Maintenance – refer 6.5.1 regarding work programmes
15.3.4	An overview of other work being considered for the remainder of the **AMP planning period**.	Section 6 – Asset Integrity and Maintenance – refer 6.5.1 regarding work programmes
15.4	The asset categories discussed in sub clauses 15.2 and 15.3 above should include at least the categories in sub clause 7.	
Non-network Development, Maintenance and Renewal		
16	**AMP**s must provide a summary description of material non-network development, maintenance and renewal plans, including:	
16.1	A description of non-network assets.	Section 7
16.2	Development, maintenance and renewal policies that cover them.	Section 7
16.3	A description of material capital expenditure projects (where known) planned for the next 5 years.	Section 7
16.4	A description of material maintenance and renewal projects (where known) planned for the next 5 years.	Section 7
Risk Management		
17	**AMP**s must provide details of risk policies, assessment, and mitigation, including:	Section 8
17.1	Methods, details and conclusions of risk analysis.	Section 8
17.2	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.	Section 8
17.3	A description of the policies to mitigate or manage the risks of events identified in sub clause 17.1 of this attachment.	Section 8
18	Details of emergency response and contingency plans.	Section 8

ID Determination Attachment A Clause	Commerce Commission Disclosure Contents Requirements	AMP Section
	Asset risk management forms a component of a **GTB**'s overall risk management plan or policy, focusing on the risks to assets and maintaining service levels. **AMP**s should demonstrate how the **GTB** 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.	
Evaluation of Performance		
19	**AMP**s must provide details of performance measurement, evaluation, and improvement, including:	
19.1	A review of progress against plan, both physical and financial. 3. Referring to the most recent disclosures made under Section 2.6 of this determination, discussing any significant differences and highlighting reasons for substantial variances. 4. 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. 5. Commenting on progress against maintenance initiatives and programmes and discuss the effectiveness of these programmes noted.	N/A - Future AMP
19.2	An evaluation and comparison of actual service level performance against targeted performance. In particular, comparing the actual and target service level performance for all the targets discussed under the 'service levels' section of the **AMP** over the previous 5 years and explain any significant variances.	N/A - Future AMP
19.3	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 **GTB**'s asset management and planning processes.	2.14.1
19.4	An analysis of gaps identified in sub clauses 19.2 and 19.3 above. Where significant gaps exist (not caused by one-off factors), the **AMP** must describe any planned initiatives to address the situation.	2.14.1
Capability to Deliver		
20	**AMP**s must describe the processes used by the **GTB** to ensure that:	
20.1	The **AMP** is realistic and the objectives set out in the plan can be achieved.	Section 2

ID Determination Attachment A Clause	Commerce Commission Disclosure Contents Requirements	AMP Section
20.2	The organisation structure and the processes for authorisation and business capabilities will support the implementation of the **AMP** plans.	Section 2

Table 2-7 : Cross reference between AMP and Attachment A

Clause 2.6.1 of the Gas Transmission Information Disclosure Determination 2012 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 and Explanatory Notes	1
Schedule 11b	Report on Forecast Operational Expenditure and Explanatory Notes	2
Schedule 12a	Report on Asset Condition and Explanatory Notes	3
Schedule 12b	Report on Forecast Demand and Explanatory Notes	4
Schedule 13	Report on Asset Management Maturity	5

Table 2-8 : Information schedules included in the AMP

Gas Transmission
Asset Management Plan
2013 – 2023

Assets Covered
Section 3

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3. Assets Covered

3.1 General Description of Assets

Vector owns and operates high pressure gas transmission system consisting of underground pipelines and above ground station facilities on the North Island of New Zealand.

The total pipeline length is approximately 2,200 km of which approximately 71 km are installed in urban areas and the remainder in rural areas. The nominal bore of the pipelines ranges from 50mm to 500mm diameter and are substantially installed below ground. The pipelines are constructed to recognised standards in accordance with appropriate legislation. In places sections of pipelines are installed above ground as special crossings of major natural features such as rivers or manmade features such as dams. Buried pipelines are both externally coated and protected by cathodic protection systems.

Stations contain a range of equipment designed to receive, transmit and deliver gas safely and efficiently to customers. Stations contain various asset components which are described individually in this section. Stations are sited in dedicated secure fenced compounds in safe positions relative to external threats identified during construction.

The assets were constructed and commissioned in accordance with the appropriate standards applicable at the time. From the mid-1960s to the mid-1980s assets were constructed to codes and standards under US Minimum Federal Safety Standards for Gas Lines - Part 192, US Department of Transport and UK Institute of Petroleum. From the mid-1980s and into the 1990s assets were constructed to the New Zealand gas pipeline code, NZS 5223 - Code of Practice for High Pressure Gas and Petroleum Liquids Pipelines. In the late 1990s the AS 2885 Pipelines - Gas and Liquid Petroleum suite of standards was adopted by Vector.

Gas is primarily produced in the Taranaki region of New Zealand. Gas is received into the Vector gas transmission system at a number of receipt points either direct from gas producers or from interconnections with the Maui pipeline. The majority of the Vector pipelines have a Maximum Allowable Operating Pressure (MAOP) of 8620 kPa with some sections having a MAOP of 6620 kPa or below. Some short sections of pipeline are limited to a Maximum Operating Pressure (MOP) of 2000 kPa for operational or safety/risk limiting factors. The pipelines usually operate below MAOP and pressure varies due to changing demand levels throughout each day (diurnal swing) and on a seasonal basis.

The system transmits gas to most of the major towns and cities on the North Island where the pressure is reduced at delivery points before entering connected downstream gas distribution networks. Some large industrial gas consumers are supplied direct from the system at dedicated delivery points.

A map showing Vector's high pressure gas transmission pipelines is shown in Figure 3-1. Diagrams of the system are shown in Section 3.6 - Schematic Diagram of Vector Gas Transmission Assets.

These diagrams show the relative locations of all stations including their type, name and reference number. They also show all pipeline segments and include their nominal bore (NB), reference number and MAOP rating. The distance between stations and the length of the various pipelines can be calculated [by subtracting reference numbers, the last digit being tenths of a km].

The maintenance, inspection, replacement and renewal of the assets covered in this section are included in Section 6 of the AMP.

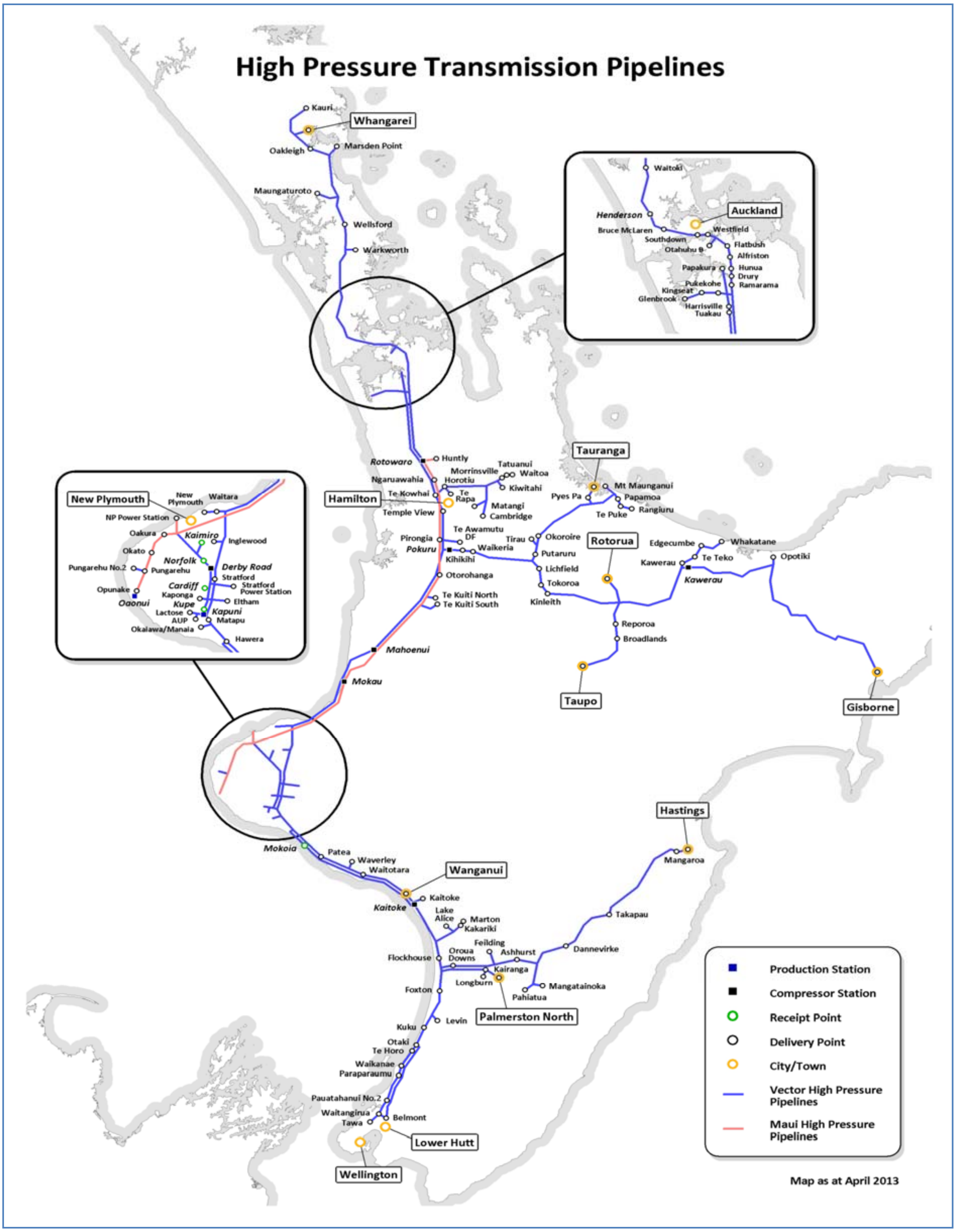

Figure 3-1 : Vector high pressure gas transmission pipelines

3.2 Pipelines

The high pressure gas transmission pipelines are constructed from steel having wall thickness and material grade specified by appropriate design codes. Pipeline nominal bore ranges from 50mm to 500 mm. Apart from above ground station facilities, a substantial majority of the pipelines are buried. At some locations, necessitated by geographical features, pipelines are installed above ground in a variety of methods including freely supported spans, attached to road bridges/dams and bespoke supporting structures.

Vector's underground pipelines are coated with various non-conductive materials intended to isolate the pipe metal from the soil and groundwater to prevent corrosion. In the 1960s/70s coal-tar enamel (CTE) or Polyken tape wrap coatings were used. Pipelines constructed in the 1980s and later have extruded polyethylene coatings ("yellow jacket") and in some cases fusion-bonded epoxy coatings.

Thicker wall pipe was used in areas where required by design codes eg. road, waterway or railway crossings. A dedicated impressed current cathodic protection system provides a back-up protection system to cover defects ("holidays") in the coating dating from construction, or damage incurred since.

Pipeline inspection gauge (PIG) launchers and receivers are located at some compressor stations, some delivery points and dedicated PIG launcher and receiver stations to facilitate pipeline cleaning and in-line inspection (ILI) surveys. It is presently not possible to survey all pipelines with ILI techniques due to technology availability for small diameter pipelines. It is not possible to conduct ILI surveys on some pipelines due to their original design or operational conditions.

The majority of pipelines are installed in land over which Vector has formal easement rights documented with landowners to ensure full and unimpeded access to the assets is maintained. Some pipelines are installed in council owned road without the need for an easement as Vector has statutory rights of access. However there are a number of instances where pipelines are installed at facilities owned by others or in land where Vector has no formal access rights. The landowners in these situations are private, government, Maori, business or local authorities, with a small number unknown. Vector is currently working through the establishment of formal access rights where rights of access are not provided by statue or regulation. There are currently no situations that pose significant risk that Vector would be prevented from carrying out normal maintenance and inspection of pipelines.

Pipeline segments with details of individual pipeline numbers, locations, lengths and MAOP rating are included in Section 3.7 – List of Pipelines.

3.2.1 Special Crossings

Special crossings of various designs are installed at a number of locations. The designs include aerial self-supporting pipelines, pipelines supported by aerial trussed structures, buried cased crossings where the pipeline is contained in a concentric steel sleeve and pipelines supported on flexible bearings.

Special crossings are listed in Section 3.8 - List of Special Crossings.

The largest aerial crossing structure is the Waikato River crossing near Tuakau on the 400Bline 350mm Nominal Bore (NB) and is shown in Figure 3-2.

Figure 3-2 : Waikato River crossing near Tuakau

The unique special crossing where the 100line (NB 200mm) and 605line (NB 300mm) cross Gibbs Fault, near Paekakariki where the pipelines rest on pipe supports designed to minimise any seismic ground movement being transferred to the pipelines is shown in Figure 3-3.

Figure 3-3 : Pipelines at Gibbs Fault near Wellington

3.2.2 Cathodic Protection Systems

In addition to their external coating, pipelines are connected to an impressed-current and cathodic protection (CP) system. This provides secondary protection against corrosion at coating breaches by holding the pipeline at a negative voltage, relative to the ground, at which corrosion is suppressed.

The CP system comprises the following plant:

- CP power supply (rectifier) sites.
- Test points to enable monitoring of cathodic protection levels.
- Electrical resistance probes for monitoring corrosion rates at critical locations.

- Insulating joints to electrically isolate the cathodically protected pipe.

The rectifier sites are spread over the pipeline network and have been selected to ensure full pipeline coverage. Power outage at a single rectifier can generally be compensated to some extent by the rectifiers either side of it. The majority of CP rectifiers are monitored from the Bell Block office via the Intelligent Power Supply (IPS) system. Rectifier outages are quickly identified and remediated.

A rectifier site consists of the following items of equipment:

- A rectifier unit that draws low-voltage DC current from the pipeline.
- A buried anode bed that discharges current to ground.
- An external ac power supply (generally a metered supply from the local electricity distribution network).
- Cables connecting the rectifier, anode bed and pipeline.
- The IPS remote control and monitoring unit.

Rectifier units are generally pole or ground mounted and secured in cabinets to prevent interference by the public.

The number and age of rectifier units is listed in Section 3.11 – Number and ages of asset classes.

A typical pole mounted rectifier unit is shown in Figure 3-4. The white box is the IPS unit.

Figure 3-4 : Typical pole mounted rectifier unit

3.3 Compressors

Gas is often transported over long distances, which causes gas pressure to decrease due to frictional losses in the pipeline. Gas pressure is increased by compressors to ensure that the required gas pressure and quantity is delivered to the extremities of the system. Compressor stations are situated at strategic locations in dedicated secure fenced compounds. Vector has eight compressor stations containing 21 compressor units. A list of the compressor units is included in Section 3.10 – List of Compressor Units.

Compressor units are either gas turbines driving centrifugal gas compressors or reciprocating engines driving reciprocating gas compressors. Fuel gas is taken from the pipeline for use in the prime movers and is heated in pre-heaters and is metered prior to being depressurised for use. The main isolation valves at compressor stations are powered by hydraulic or pneumatic valve actuators and all stations have automated emergency shutdown (ESD) systems.

Currently the three compressor stations at KGTP, Rotowaro and Pokuru are required to operate continuously, the two at Kaitoke and Mahoenui are operated as required, and the three at Kawerau, Henderson and Derby Road are infrequently used.

Compressor stations may contain a number of other assets for example: buildings, main line valves, water bath heaters, metering systems, chromatographs.

Each compressor unit comprises of a number of items of equipment including:

- Prime mover (reciprocating or turbine engine)
- Compressor (reciprocating or centrifugal)
- Control system (pneumatic or electronic)
- Gas coolers
- Pulsation bottles (where relevant)
- Fuel supply system
- Emergency shutdown system (ESD)
- Fire detection system
- Gas detection system.

A typical reciprocating gas compressor is shown in Figure 3-5.

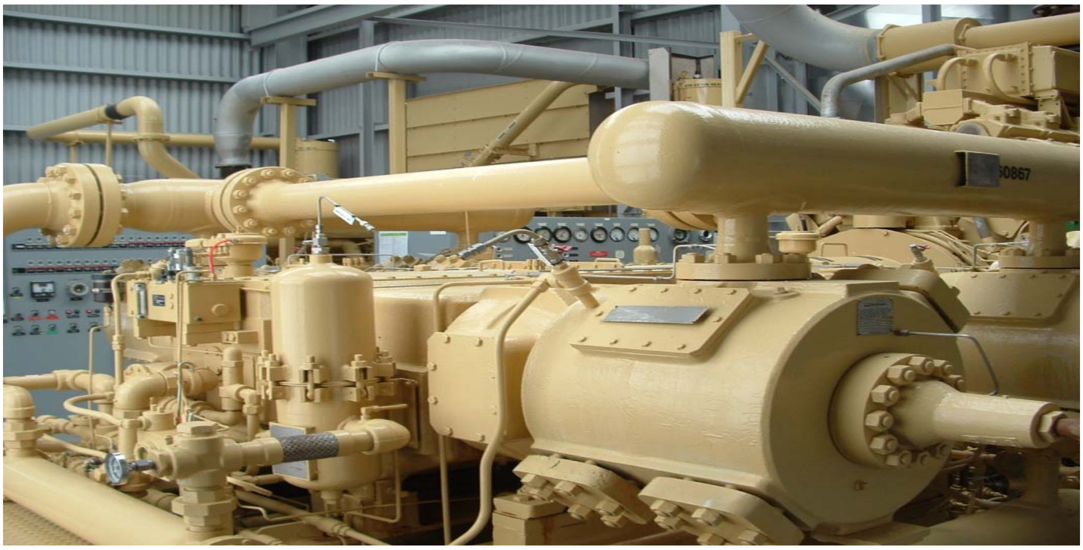

Figure 3-5 : Typical reciprocating gas compressor

3.4 Stations

3.4.1 General

Stations are above ground installations along the pipeline that contain a range of equipment designed to either receive, transmit or deliver gas safely and efficiently to customers. Stations contain various asset components which are described in more detail in this section. Equipment is located in dedicated secure fenced compounds in safe positions relative to external threats. Signage and access roads to compounds (where required) are provided. Some sites have mains power supply and security lighting.

Delivery points reduce the gas pressure in the transmission system prior to it being delivered direct to customers and/or into downstream gas distribution networks. Vector has 124 delivery points on the transmission system. Delivery point equipment can comprise of a number of components including:

- Filters
- Heating systems
- Isolation valves
- Pressure regulators and control valves
- Pressure safety valves and slam-shut valves
- Metering systems
- Pilot valves
- SCADA telemetry
- Ancillaries.

Vector's other stations contain other equipment associated with the operation and maintenance of the system and including:

- Compressor units
- Main line valves
- Metering systems
- Odorisation plant
- Coalescers and filter/separators
- Gas chromatographs
- PIG launchers and receivers.

Stations are listed in Section 3.9 – List of Stations.

The dates of installation included in the list are the dates the original station compounds were installed. Some components in stations may have different installation dates due to them being individually replaced or renewed. Stations may be named based on their primary purpose but also include other classes of asset.

The locations where Vector GTB station assets are installed at facilities owned by others are shown in the Table 3-1.

Station Number	Station Name	Facility Owner	Comments
0300021	Faull Road Mixing Station	Methanex	No formal rights
1000000	Kapuni Compressor Station	Vector Gas Trading	Within Kapuni Gas Treatment Plant site
1080068	Longburn Delivery Point	Fonterra	Part contained in easement
1120000	Ammonia Urea No.2 Offtake	Vector Gas Trading	Within Kapuni Gas Treatment Plant site
1140087	Feilding Delivery Point	Powerco	No formal rights
1150001	Kakariki Delivery Point	Powerco	No formal rights
3010002	Taranaki Combined Cycle Delivery Point	Contact Energy	Lease - indefinite term, 3 months notice by either party to terminate.

Station Number	Station Name	Facility Owner	Comments
3030086	Stratford Power Station Delivery Point	Contact Energy	Lease - expires 2028
3060000	Kapuni Offtake	Vector Gas Trading	Within Kapuni Gas Treatment Plant site
3070000	Ammonia Urea No 1 Offtake	Ballance	No formal rights
3080000	Kaimiro Meter Station	Greymouth	No formal rights
4000001	Opunake Delivery Point	STOS	No formal rights
4010054	Pungarehu No 2 Delivery Point	Ballance	No formal rights
4030086	Huntly Town Offtake	Genesis Energy	No formal rights
4030087	Huntly Power Station Delivery Point	Genesis Energy	No formal rights
4050230	Glenbrook Delivery Point	Glenbrook Steel Mill	No formal rights
4350215	Kauri Delivery Point	Fonterra	Lease - expires June 2013 but is currently being renegotiated
4370069	Marsden Point Delivery Point	NZRC	No formal rights
4420025	Otahuhu B Delivery Point	Contact Energy	No formal rights
5000611	Lichfield Offtake	Fonterra	No formal rights
5000938	Rahui MLV	Fonterra	No formal rights
5090005	Lichfield Delivery Point	Fonterra	Lease, expires 2015
5100001	Broadlands Delivery Point	Great Lakes Tomatoes	No formal rights
6500000	Mokoia Production Station	Origin Energy	No formal rights
7020212	Pahiatua Delivery Point	Fonterra	No formal rights
7030004	Mangatainoka Delivery Point	Lion Breweries	No formal rights
7050001	Ashhurst Delivery Point	Powerco	No formal rights
8020020	Tirau Delivery Point	Fonterra	No formal rights

Table 3-1 : Assets installed at facilities owned by others

A typical delivery point is shown in Figure 3-6.

Figure 3-6 : Typical delivery point

3.4.2 Main Line Valves (MLVs)

MLVs are principally designed to automatically isolate pipeline sections when pipeline failure occurs. MLVs are positioned at maximum intervals of 32 km throughout the length of the gas transmission system except in the Auckland metropolitan area where MLVs are nominally spaced at 13 km intervals, due to the higher consequence of pipeline failures. The majority of MLVs are underground with their associated actuators installed above ground; the drive to operate an underground valve is transmitted mechanically via an extended shaft.

MLVs are designed to operate in one of the following modes:

- Remotely operated via the SCADA system. In the event that the actuator fails to operate the valves can be operated manually by the use of a hand pump.
- Automatically operated via a local low pressure trip (LPT) unit which detects a line break. In the event that automatic operation fails, the valves can be operated manually by the use of a hand pump.
- Manually operated either by a gas/hydraulic or electric operator locally or via a hand wheel.

Electric power (where installed) for the control and communication systems comes from local mains supply if available. Otherwise, power is generated locally by solar power or wind generator backed up by batteries. If an electrical supply should fail the automatic low pressure trip remains active and manual hand pump operation is available.

A main-line valve unit comprises of the following main equipment items:

- Main line valve.
- Bypass valves and pipe work.
- Valve actuator which can be operated by local LPT, remote control or manual hand wheel with an associated gearbox.

Where a MLV is installed with remote operation facilities there will also be a remote terminal unit (RTU) installed for SCADA communications.

Main-line valves are typically incorporated in the following stations:

- Compressor stations
- Delivery points

- Receipt points
- PIG Launcher and Receiver stations
- Dedicated MLV stations.

The number and age of MLVs is listed in Section 3.11 – Number and ages of asset classes.

A typical MLV with remote operation and LPT facility is shown in Figure 3-7.

A typical NB 400mm manually operated MLV fitted with a gas over oil actuator is shown in Figure 3-8.

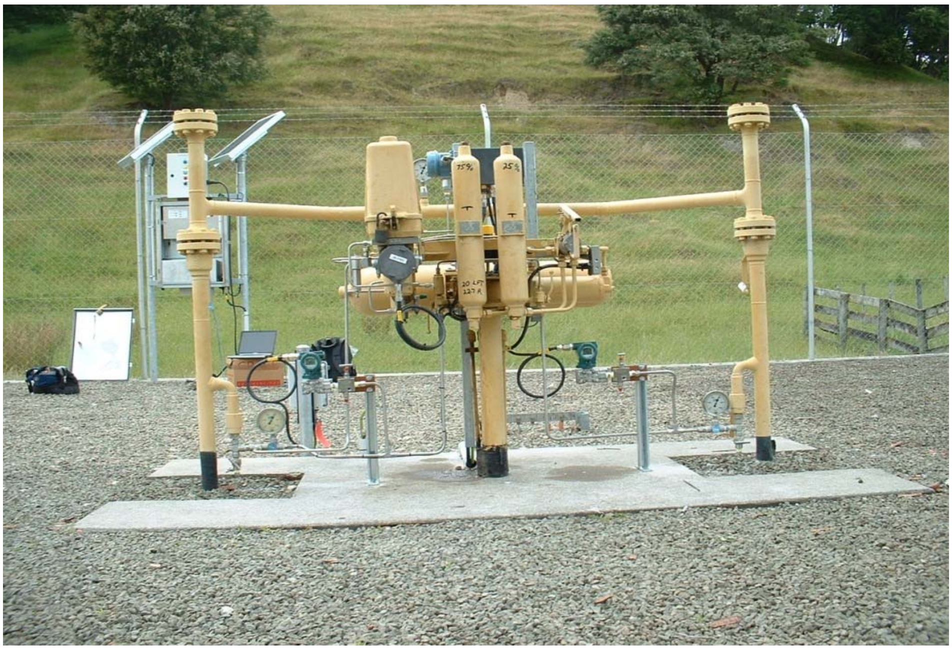

Figure 3-7 : Typical MLV with remote operation and LPT facility

Figure 3-8 : Typical NB 400mm manually operated MLV

3.4.3 Heating Systems

When gas pressure is reduced by pressure regulators at delivery points the gas temperature reduces due to the Joule-Thompson effect. To maintain gas temperature above the lower limit specified in NZS 5442 - Gas Specification for Reticulated Natural Gas and to prevent harm to and/or cause equipment to malfunction gas is heated to an appropriate temperature prior to the pressure being reduced. Heating systems are used for this purpose and are critical to the safe and reliable operation of gas pressure reduction equipment.

Heating systems are either gas-fired water bath heaters (WBHs) or electric heaters.

Gas-fired WBHs comprise of a number of components including:

- Water bath shell containing the water tank, fire tube and gas tube coil
- Gas-fired pilot and main burner unit
- Temperature controller
- Fuel gas train
- Fuel gas meter (where installed)
- Pilot burner pressure switch connected to SCADA (where installed)
- Low water level protection switches (where installed)
- Rain catchers.

Electric heaters are comprised of a number of components including:

- Electric heater pressure vessel including electric elements
- Control system.

Heating systems are typically incorporated within the following stations:

- Compressor stations
- Delivery points (some delivery points contain more than one heating system).

A WBH is a heat exchanger containing water in a vessel which is heated by combusting natural gas in a fire tube contained in the vessel to heat the surrounding water. Pressurised gas flow tubes are also contained in the vessel and act as heat exchangers to raise the temperature of the gas stream. Typical operating water temperature is 60ºC and typical process temperature gain of the flowing gas is 25ºC.

The number and age of heating systems is listed in Section 3.11 – Number and ages of asset classes.

The ages of the WBHs are based on the age of the water bath shell. The ages of electric heaters are based on the age of the heater pressure vessel. Some components of heating systems may be of different ages due to their individual replacement or renewal.

A typical WBH installation is shown in Figure 3-9.

An electric heater (foreground) installed in conjunction with a WBH is shown in Figure 3-10.

Figure 3-9 : Typical WBH installation

Figure 3-10 : Electric heater

3.4.4 Odorisation Plants

The purpose of gas odorisation is to provide a means for the detection and location of gas escapes. Gas must have a distinctive and unpleasant odour so that it can be readily detected in air by anyone with normal olfactory capability well before a combustible natural gas/air mix develops.

Under the Gas (Safety and Measurement) Regulations 2010 the legal obligations for gas odorisation are placed with the gas distribution network owners and gas retailers. Vector gas transmission provides gas odorisation services to gas distributors and retailers by odorising the gas in the transmission system. Odorant levels are regularly monitored at selected locations on the gas transmission system and gas distribution network to ensure satisfactory odorant levels are being maintained.

Gas transmitted through the Maui pipeline and the Vector 300line (Frankley Road Interchange with the Maui pipeline to Kapuni Gas Treatment Plant (KGTP)) is unodorised. Gas transmitted through all other pipelines is odorised. Vector odorises gas using electronic pumped odorant injection systems supported by bulk odorant storage tanks at KGTP and the major receipt points from the Maui pipeline, Rotowaro Compressor Station, Pokuru Compressor Station and Pirongia. Origin Energy Limited odorises gas before it enters the Vector assets at Mokoia receipt point. All pumped odorisation systems are monitored by the SCADA system. Some pumped odorisation plants incorporate two or more pumped systems to provide operational n-1 redundancy. Pumped systems operate by measuring gas flow and injecting proportional quantities of odorant into the gas stream to meet prescribed levels.

Minor receipt points along the Maui pipeline are installed with mobile bypass odorant vessels in which odorant is proportionally entrained into the gas stream using an orifice plate pressure differential.

Vector currently imports bulk supplies of gas odorant chemicals and distributes this to the bulk odorant tanks and re-fills rotable mobile bypass odorant vessels.

Pumped odorisation plants comprise of a number of components including:

- Odorant pump(s)
- Electronic control unit(s)
- Odorant tank.

Mobile bypass odorant plants are self-contained units.

The number and age of odorisation plans is listed in Section 3.11 – Number and ages of asset classes. The ages of odorisation plants are based on the age of the odorant tank. Some components may be of different ages due to their individual replacement or renewal.

A twin pumped odorant injection system is shown in Figure 3-11.

A bulk odorant storage vessel is shown in Figure 3-12.

A mobile bypass odorant unit is shown in Figure 3-13.

Figure 3-11 : Twin pumped odorant injection system

Figure 3-12 : Bulk odorant storage vessel

Figure 3-13 : Mobile bypass odorant unit

3.4.5 Coalescers and Filter / Separators

Coalescers and filter/separators are used to protect downstream facilities such as compressors, pressure regulators and meters from fine particles of liquid contaminants and impurities in the gas streams. Fine particles become trapped in the coalescer cartridge and are trapped by impingement. As these small liquid particles come in contact with each other they coalesce into larger droplets, eventually becoming large enough to drip or flow down to the liquid receiver tank where they remain until drained away. Coalescers vary in size and capacity.

Coalescers are generally distinguished from other filtration assets by their ability to separate and capture liquids from within the gas stream. Dry gas filters are significantly different to coalescers and filter/separators and are covered in Section 3.4.14.

Filter separators are very similar to coalescers due to their ability to separate out and capture liquids while also providing filtration of solid particles in the gas stream. They contain additional filtration for capturing particles but operate using a similar principle to a coalescer for capturing liquids.

Coalescers and filter separators also contribute to achieving compliance with NZS 5442:2008 – Specification for Reticulated Gas by reducing contaminants to within the specified limits.

Coalescers are installed on the discharge side of compressor stations to prevent oil mist carry over into the pipelines from compressor units. Filter separators are installed on the suction side of compressor units to protect the prime movers from contamination. Coalescers and filter separators are also installed at some large delivery points including those that supply power stations to where gas quality is an important factor.

Coalescers are typically incorporated in the following stations:

- Compressor stations
- Delivery points.

Coalescers are usually comprised of the following equipment items:

- Coalescer and filter separator pressure vessel
- Pressure safety valve
- Filtration elements
- Instrumentation
- Dump valves
- Liquid sump tank.

The number and age of coalescers is listed in Section 3.11 – Number and ages of asset classes.

The ages of the coalescers are based on the age of the main coalescer vessel. Some components of coalescers may be of different ages due to their individual replacement or renewal.

A typical coalescer at the discharge of Mahoenui compressor station is shown in Figure 3-14.

A typical filter separator installation is shown in Figure 3-15.

Figure 3-14 : Typical coalescer

Figure 3-15 : Typical filter separator

3.4.6 Metering Systems

Metering systems are required to provide accurate gas volume flow data. Meters have rotary-displacement, turbine, ultrasonic, mass flow or diaphragm gas volume measurement mechanisms. In most cases failure of metering equipment will not affect the flow of gas through the metering system.

Gas is measured in energy quantities for gas trading purposes. Meters measure gas in volume quantities which are converted to energy quantities by the additional components forming part of the metering system. Gas chromatographs provide gas composition data to the metering system (see Section 3.4.8) and transmitters provide pressure and temperature data. Data is compiled and stored in correctors or flow computers where the energy calculation is computed. In the majority of cases metering data is transmitted to Vector Gas Control at Bell Block by either remote terminal units (RTUs) connected to the SCADA system or by Autopoll telemetry units. A few minor sites rely on periodic manual download of data.

Energy quantities are calculated on site at some major delivery points and receipt points. In the majority of cases however, energy quantities are calculated using office based computer applications.

Metering systems comprise of a number of components and may include:

- Flow computers or correctors
- Pressure & temperature transmitters
- Interconnecting pipes (where the metering system comprises two meters)
- Interconnecting electric cables
- Metering power supply
- Autopoll telemetry unit (where fitted).

Metering systems are typically incorporated within the following stations:

- Compressor stations
- Delivery points
- Receipt points
- Metering stations.

Some metering systems incorporate two meters. These are termed primary and verification meters, and provide for redundancy and testing. Some stations have more than one metering system eg. where gas is delivered to separate downstream systems from the same delivery point.

The number and age of metering systems is listed in Section 3.11 – Number and ages of asset classes.

The ages of the metering systems are based on the age of the meter. Some components of metering systems may be of different ages due to their individual replacement or renewal.

A typical ultrasonic metering system, which incorporates two meters, is shown in Figure 3-16.

A typical rotary displacement metering system at a delivery point is shown in Figure 3-17.

Figure 3-16 : Typical ultrasonic metering system

Figure 3-17 : Typical rotary displacement metering system

3.4.7 SCADA and Communications

The gas transmission system is monitored and partially controlled by a supervisory control and data acquisition (SCADA) system on a 24/7 basis by Gas Control. The system is also used for other purposes including coordination the supply and delivery of gas through the pipelines, balancing available supply against forecast demand and receiving metering system data.

The system consists of a master station at Bell Block and RTUs installed at various stations to monitor the system. The master station communications tower is also located at Bell Block. The systems used are an Invensys Process Systems (IPS) Foxboro SCADA Rev-7 system communicating with remote field RTUs linked to station equipment and instrumentation. Communications are via the latest Telecom internet protocol (IP) and radio where Telecom service is not available.

The SCADA and communications system is shown Figure 3-18.

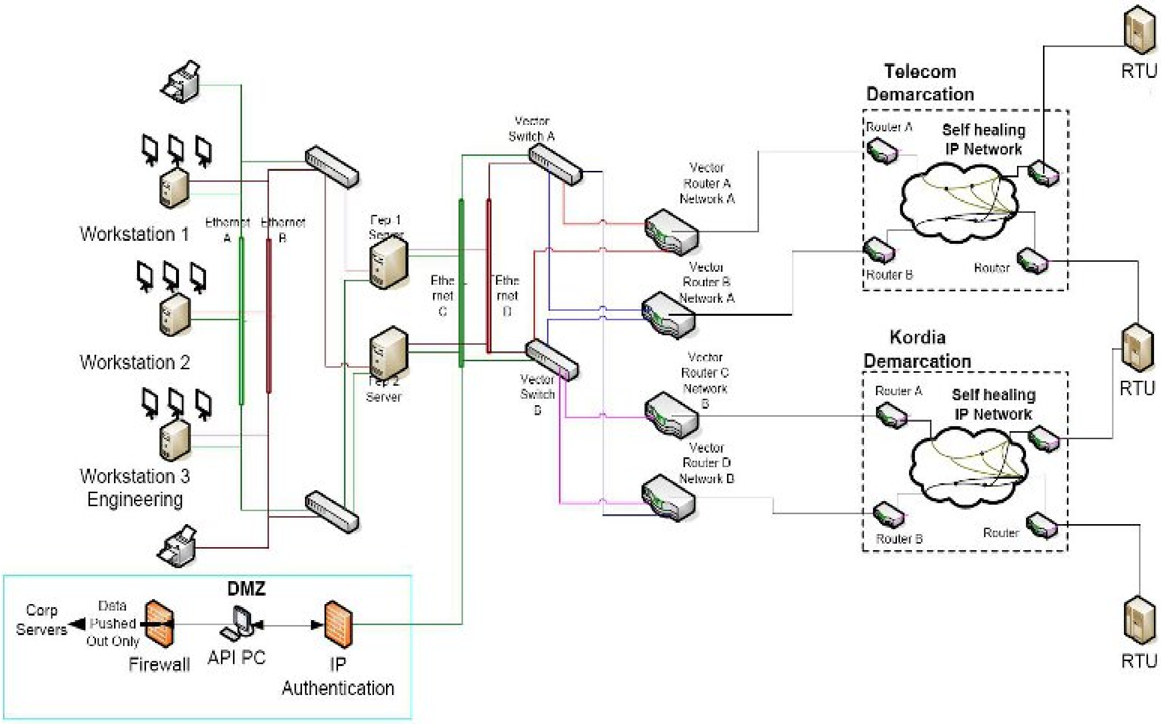

Figure 3-18 : SCADA and communications system

The SCADA system constantly monitors asset operating conditions at strategic pipeline locations including high volume delivery points, delivery points at pipeline extremities and provides remote control of compressor and some MLVs.

The SCADA system is fundamental to Vector's transmission system operations with the system designed to provide stability, security and high availability/reliability. A full set of SCADA hardware is maintained to support disaster recovery (DR) in accordance with business continuity planning procedures. Power supply is maintained through an uninterruptible supply system, which is backed up by two 6 hour reserve battery banks and an emergency generator.

Data gathered by SCADA is transferred to commercial allocation and billing systems. Hence SCADA is subject to strict security and confidentiality requirements and is regularly audited by independent parties.

The number and age of RTUs is listed in Section 3.11 – Number and ages of asset classes.

The Gas Control room and SCADA terminals are shown in Figure 3-19.

A typical remote RTU cabinet with spare racks is shown in Figure 3-20.

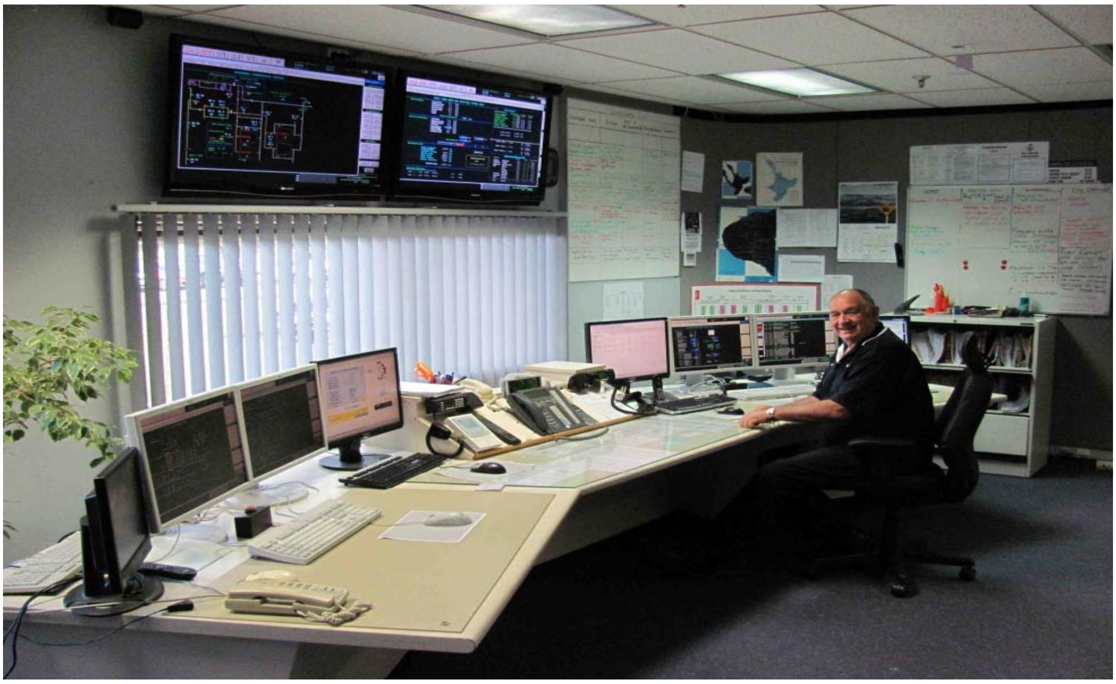

Figure 3-19 : Gas Control room and SCADA terminals

Figure 3-20 : Typical remote RTU cabinet

3.4.8 Gas Chromatographs (GCs)

The energy content of gas is calculated by flow computers using data obtained from the volume, pressure and temperature measurements and the gas composition date derived from the GC.

A GC is a chemical analysis instrument for analysing chemical components in a complex sample. It uses a flow through a narrow tube known as a column, through which different chemical constituents of a sample pass in a gas stream (carrier gas, mobile phase) at different rates depending on their chemical and physical properties and their interaction with a specific column filling (stationary phase). As the components exit from the end of the column, they are detected and identified electronically.

The GC thus determines the gas composition and properties, which are relayed to the flow computer to facilitate the calculation of gas energy flow. GCs comprise of a number of components including:

- Gas chromatograph unit
- Shelter
- Calibration gas and carrier gas bottles and regulators
- Gas sampling system
- Associated tubing.

GCs are typically incorporated in the following stations:

- Compressor stations
- Delivery points
- Mixing stations.

The number and age of GCs is listed in Section 3.11 – Number and ages of asset classes.

The ages of the GCs are based on the age of the GC instrument. Some components of GCs may be of different ages due to their individual replacement or renewal.

Figure 3-21 below shows a typical GC and its associated calibration gas and carrier gas bottles in the background.

Figure 3-21: Typical GC

3.4.9 PIG Launchers and Receivers

PIG launchers and receivers facilitate the use of ILI survey tools for pipeline condition monitoring and internal cleaning tools. PIG receivers also act to contain and facilitate safe disposal of debris which is removed from the pipeline by PIGs.

A PIG is a device which fits into the pipeline and is pushed along by the gas flow. PIGs can be used for internal cleaning (or scraping) of pipelines hence the term scraper stations. ILI survey tools can also be equipped with sophisticated sensors which examine the pipeline for corrosion, geometry and spatial positioning.

PIG launchers and receivers may be incorporated in the following stations:

- Compressor stations
- Delivery points
- Receipt points
- Dedicated PIG launcher and receiver stations.

A PIG launcher or receiver comprises of the following main equipment items:

- PIG launcher or receiver vessel both of which incorporate quick-release closure doors.
- Kicker lines, valves and pipe work to equalise pressure and vent or drain the launcher or receiver.

The number and age of PIG launchers and receivers is listed in Section 3.11 – Number and ages of asset classes.

A typical PIG launcher and receiver incorporating a MLV are shown in Figure 3-22.

Figure 3-22 : Typical PIG launcher and receiver

3.4.10 Pressure Regulators

Pressure regulators reduce the pressure of the flowing gas to a pre-determined downstream pressure. Pressure regulators form part of delivery point equipment that supplies gas at reduced pressure to gas distribution networks, directly to customers or to downstream parts of the transmission system. A variety of different makes and models of pressure regulators are installed to fulfil the requirements of the downstream system in order to provide the required capacity at the set pressure. The complexity of pressure regulators varies from relatively simple spring and diaphragm designs through pilot operated valves and more complex pressure control valves. Pressure regulators that utilise electronic or pneumatic valve positioning mechanisms are known as pressure control valves (PCVs).

Small pressure regulators are also contained within various instrumentation and control systems and are included in Section 3.4.16 – Station Ancillaries.

Pressure regulators provide the barrier between sections of pipeline with different MAOPs and are therefore an essential component for the prevention of over pressurisation of a downstream pipeline. Typically a second 'monitor' pressure regulator is fitted as back up to the working regulator should it malfunction. A second pair of regulators provides a standby stream to ensure gas supply is maintained should a fault occur on the working stream and to allow maintenance to be carried out without interrupting supply. AS 2885 requires secondary pressure protection which is provided by a monitor regulator and/or by slam-shut valves and pressure safety valves.

Pressure regulators are normally incorporated within the following stations:

- Compressor stations
- Delivery points.

The number and age of pressure regulators is listed in Section 3.11 – Number and ages of asset classes.

Two Fisher 630 pressure regulators in typical twin stream configuration are shown in Figure 3-23. These are the simplest type of pressure regulator installed.

Four pilot operated Gorter pressure regulators in typical twin steam active-monitor configuration are shown in Figure 3-24.

Four Fisher pressure control valves in typical twin steam active-monitor configuration are shown in Figure 3-25. This installation is housed in an acoustic enclosure to provide noise attenuation.

Figure 3-23 : Fisher 630 pressure regulators in typical twin stream configuration

Figure 3-24 : Gorter pressure regulators

Figure 3-25 : Fisher pressure control valves

3.4.11 Pressure Relief Valves

Pressure relief valves are installed to protect pipelines or pressure vessels from over pressurisation. Pressure relief valves limit the pressure to a pre-determined value by safely venting gas contained within the protected equipment to atmosphere. The specific requirements vary significantly due to varying pressure ranges and required flow rates, consequently a wide variety of valves are installed across the asset. Designs and complexity also vary from simple direct spring resistance to more complex pilot operated valves. Pressure relief valves are also known as pressure safety valves (PSVs).

Small pressure relief valves are also contained within various instrumentation and control systems and are included in Section 3.4.16 – Station Ancillaries.

Over pressure protection of downstream pipelines or gas distribution networks is normally incorporated with the pressure reduction arrangements at delivery points and therefore form part of the pressure control systems specified in AS 2885. These pressure control systems are designed to prevent protected systems from exceeding MAOP under steady state conditions and 110% of the MAOP under transient conditions. It is mandatory under AS 2885 for a secondary pressure limiting device such as a pressure relief valve to be installed.

Pressure relief valves are typically incorporated in the following stations:

- Compressor stations
- Delivery points
- Pig launcher and receiver stations.

The number and age of pressure relief valves is listed in Section 3.11 – Number and ages of asset classes.

A pilot operated Anderson Greenwood pressure relief valve installed at a delivery point is shown in Figure 3-26.

A Reliance pressure relief valve installed at a delivery point is shown circled in Figure 3-27. These are the least complex type of pressure relief valve installed on the asset.

A typical pressure relief valve fitted to a pressure vessel is shown circled in Figure 3-28.

Figure 3-26 : Pilot operated Anderson Greenwood pressure relief valve

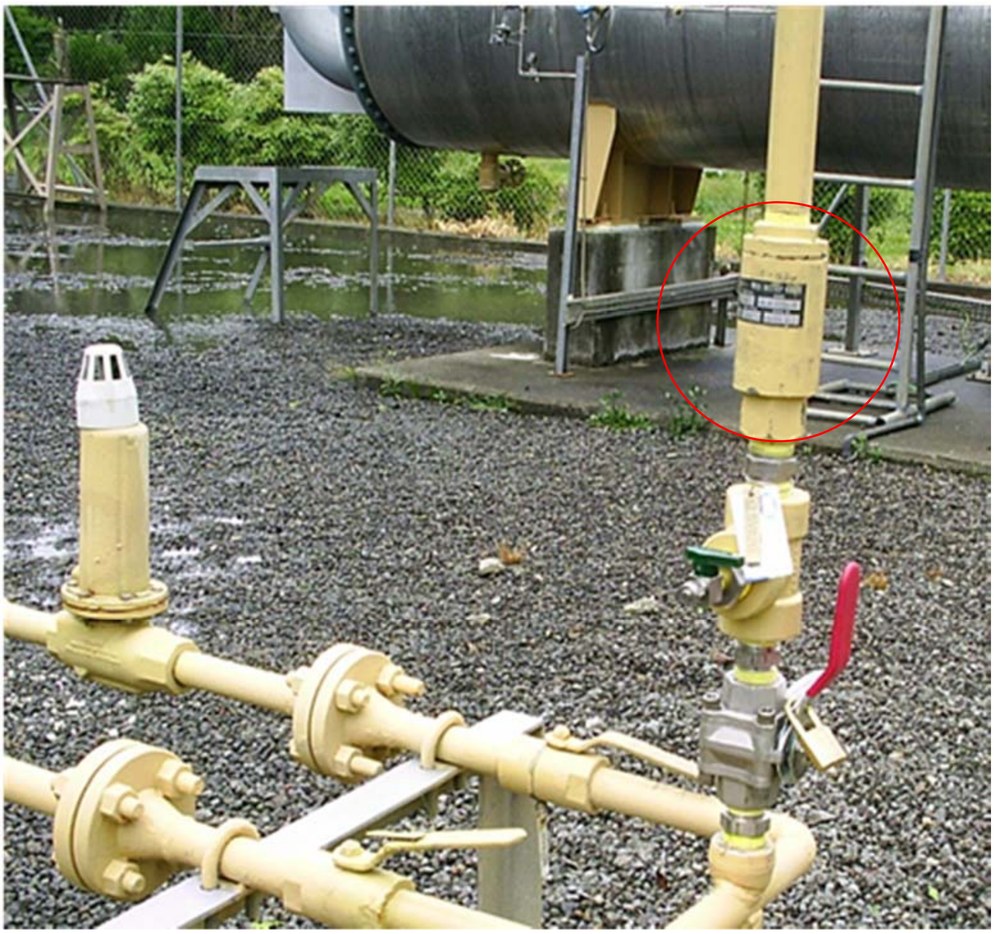

Figure 3-27 : Reliance pressure relief valve

Figure 3-28 : Typical pressure relief valve fitted to a pressure vessel

3.4.12 Pilot Valves

Pilot valves are installed on many pressure regulators to control the final gas supply pressure. They are also installed on some pressure relief valves to activate them. Whilst pilot valves are normally treated as a sub-assembly of the master valve they are often interchangeable with other valves and are not necessarily manufactured by the pressure regulator or pressure relief valve manufacturer. Consequently maintenance and obsolescence issues may be independent of the valve that they control.

Pilot valves are incorporated in the following stations:

- Compressor stations
- Delivery points
- Scraper stations.

The number and age of pilot valves is listed in Section 3.11 – Number and ages of asset classes.

Four Grove 829S pilot valves mounted on top of four Grove Flexflo pressure regulators in typical twin steam active-monitor configuration are shown circled in the Figure 3-29.

Two Anderson Greenwood pressure relief valves operated by two 400 series Anderson Greenwood pilot valves are shown in the Figure 3-30.

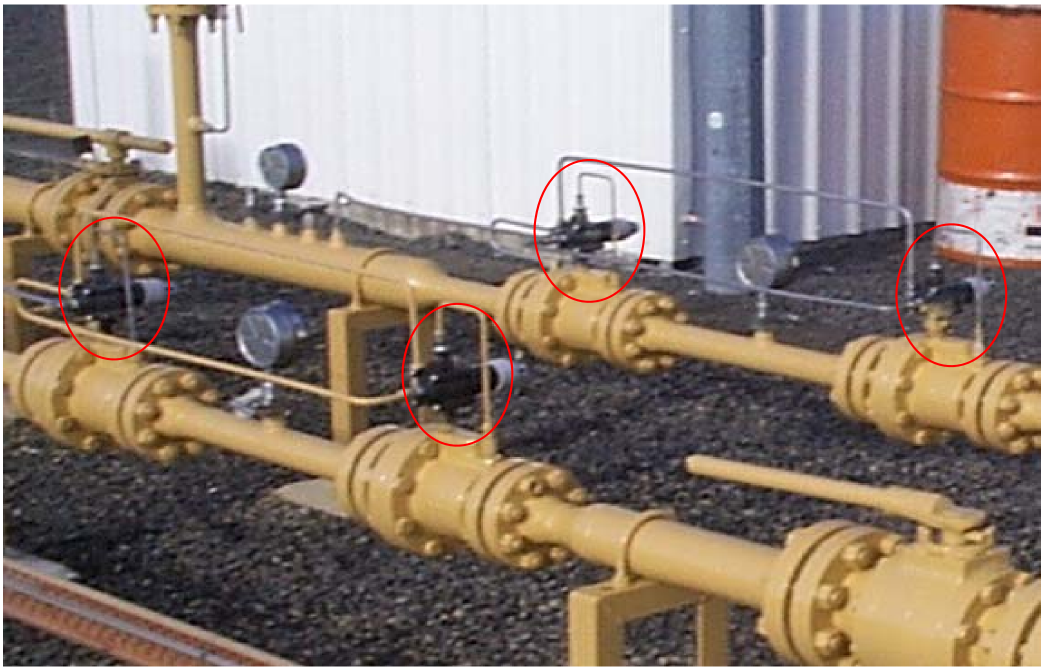

Figure 3-29 : Grove Flexflo pressure regulators

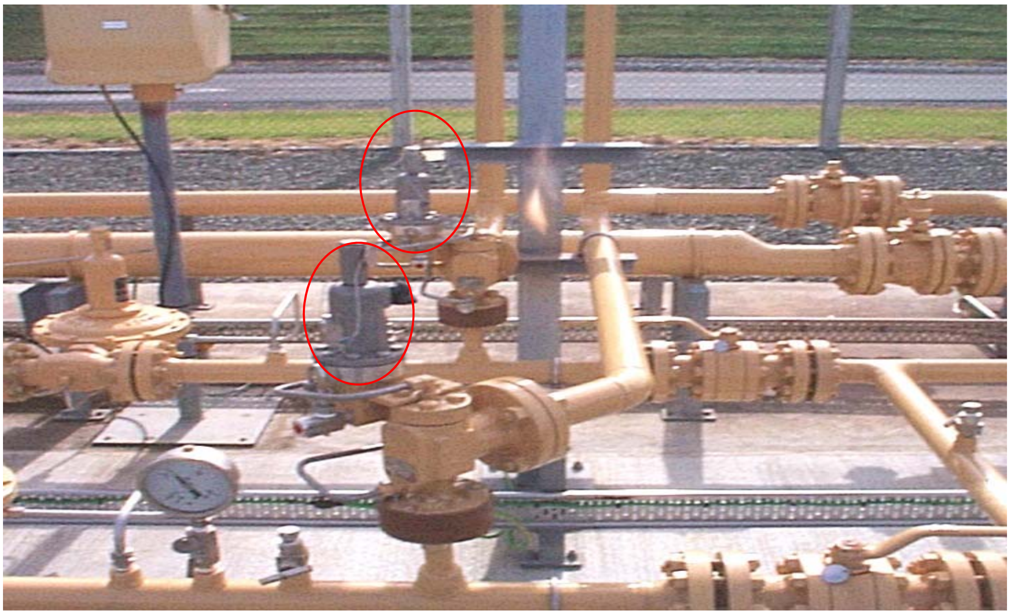

Figure 3-30 : Anderson Greenwood pressure relief valves

3.4.13 Isolation Valves

Isolation valves are used to isolate sections of station pipe work and equipment to facilitate maintenance, replacement or emergency shutdown.

Small isolation valves are also contained within various instrumentation and control systems and are included in Section 3.4.16 – Station Ancillaries.

Isolation valve types currently in use include ball valves, gate valves, plug valves, globe valves and needle valves. Isolation valves should be easily accessible and operable.

The majority of isolation valves are hand operated either via a lever or a rotary hand wheel via a gearbox. Some valves are actuated and may be operated via an electric motor, gas actuator or gas and oil actuator. Isolation valves are predominantly installed above ground.

Below ground isolation valves are operated by a purpose made valve key or by an above ground valve extension and hand wheel. Isolation valves are connected to pipeline systems by either bolted flanges or by welded connections or a combination of both.

Isolation valves are incorporated within all stations.

The number and age of isolation valves is listed in Section 3.11 – Number and ages of asset classes.

A typical NB 200mm ball type isolation valve with manual operation via a hand wheel and gearbox is shown in Figure 3-31.

A typical NB 50mm plug type isolation valve installed at a PIG launcher/receiver station is shown in Figure 3-32.

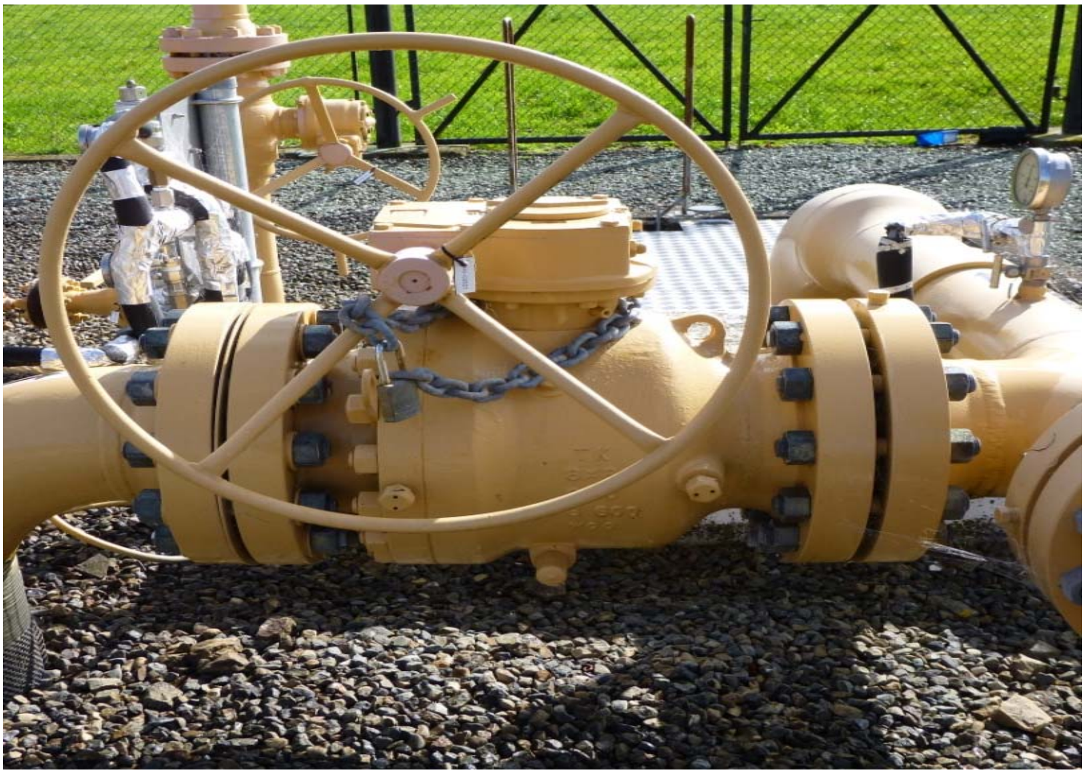

Figure 3-31 : A typical NB 200mm ball type isolation valve

Figure 3-32 : A typical NB 50mm plug type isolation valve

3.4.14 Filters

Filters are installed to remove solid particulate contamination from the system to protect downstream equipment from erosion by impingement and blockage from build up of contaminants. This is particularly important for equipment with small tolerances or clearances.

Filters also contribute to achieving compliance with NZS 5442 – Specification for Reticulated Gas by reducing contaminants to within the specified limits.

Small filters are also contained within various instrumentation and control systems and are included in Section 3.4.16 – Station Ancillaries.

A large variety of filters are installed across the system. The choice of filter installed depends largely upon the capacity and the desired filtration level required.

Filters are incorporated within stations of the following asset classes:

- Compressor station
- Delivery points
- Receipt points
- Metering stations.

The number and age of filters is listed in Section 3.11 – Number and ages of asset classes.

Two typical filters installed at a delivery point are shown in Figure 3-33.

Figure 3-33 : Two typical filters

3.4.15 Electrical Equipment in Hazardous Areas

In general, the gas industry uses the terms gas hazardous areas and explosive atmospheres interchangeably. Both terms refer to an area where there is likelihood of a flammable gas being present in air, such as in and around stations associated with the gas transmission system.

The Electricity Act 1992, Electricity (Safety) Regulations 2010 and the associated standards (listed below) and other international standards set out the requirements for the design and installation of electrical equipment to be used in explosive atmospheres.

There are approximately 15,000 electrical devices installed across the system that are located within explosive atmospheres defined by the standards. Devices are installed on the station components detailed in the preceding sections and also form part of the station ancillaries described in Section 3.4.16.

The design, installation and maintenance of electrical equipment in hazardous areas shall comply with AS/NZS 3000:2007 Electrical installations (known as the Australia/New Zealand Wiring Rules) (Section 7.7). This refers to:

- AS/NZS 60079.14 - Explosive atmospheres - Electrical installations design, selection and erection.
- AS/NZS 60079.17 - Explosive atmospheres - Electrical installations inspection and maintenance.

3.4.16 Station Ancillaries

A number of items of station equipment and assets are considered to be ancillary to the main station asset classes covered in this section. Ancillary equipment and assets are vital for the operation and security of assets and hence need to be considered separately for the purposes of identifying activities associated with maintenance, renewal and refurbishment. Station ancillary components comprise of the following:

- Land area secured by easement or lease, security fence including gates and locks, signage, lighting and building(s).
- Power, Earthing & Bonding systems comprising of:
  - Mains power supplies
  - Solar power supplies
  - Switchboards
  - Transformers
  - Uninterruptible Power Supply (UPS) units
  - Battery chargers
  - Battery bank
  - Power system earthing systems (electrodes)
  - Pipe work earthing systems (anodes)
  - Equipotential bonding
  - Earth potential rise (EPR) mitigation (zinc ribbon)
  - Flange insulating kits (FIKs)
  - Insulation Joint Protectors (IJPs)
  - Surge diverters.
- General cabling, cable trenches cable support systems & junction boxes comprising of:
  - Electrical distribution and systems
  - Instrumentation systems
  - Safety and alarm systems
  - Data/communications systems
  - Telecommunications systems.
- General instrumentation not associated with other asset categories comprising of:
  - Pressure regulators
  - Small bore piping
  - Gauges and transducers

  - Station inlet and outlet gas process measurements
  - Valves
  - Pressure safety valves
  - Filters
  - Alarm systems.
- Piping (below ground).
- Piping & pipe supports (above ground).
- Gas Detection Equipment (not associated with compressor units).

3.5 Critical Spares and Equipment

Vector owns a stock of critical spares and equipment for a reasonably anticipated range of pipeline repair options. Vector also holds critical spares and equipment for other pipeline owners under contractual arrangements.

Whenever new assets are introduced, an evaluation is made of the necessary critical spares and equipment items required to be retained to support the repair of any equipment failures.

The majority of the critical spares and equipment items are held in Vector's main stores facility in Bell Block, New Plymouth.

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.

Critical spares and equipment include:

- Steel pipes and fittings
- Composite repair materials
- Drilling equipment
- Stopple equipment
- Repair sleeves and clamps
- Spherical tees
- Valves.

3.6 Schematic Diagrams of Vector Gas Transmission Assets

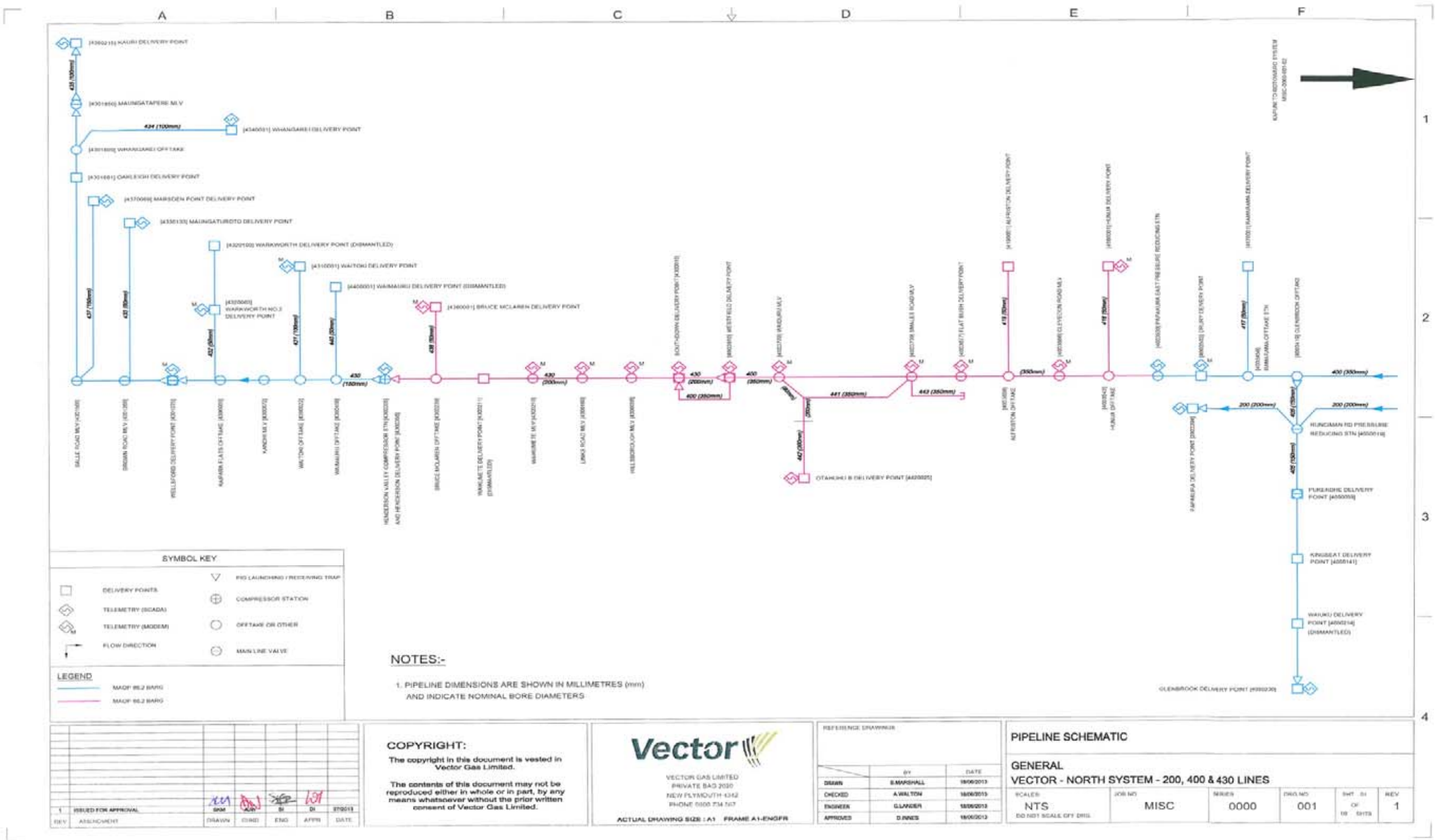

Figure 3-34 : Schematic Diagram of Vector Gas Transmission Assets (1)

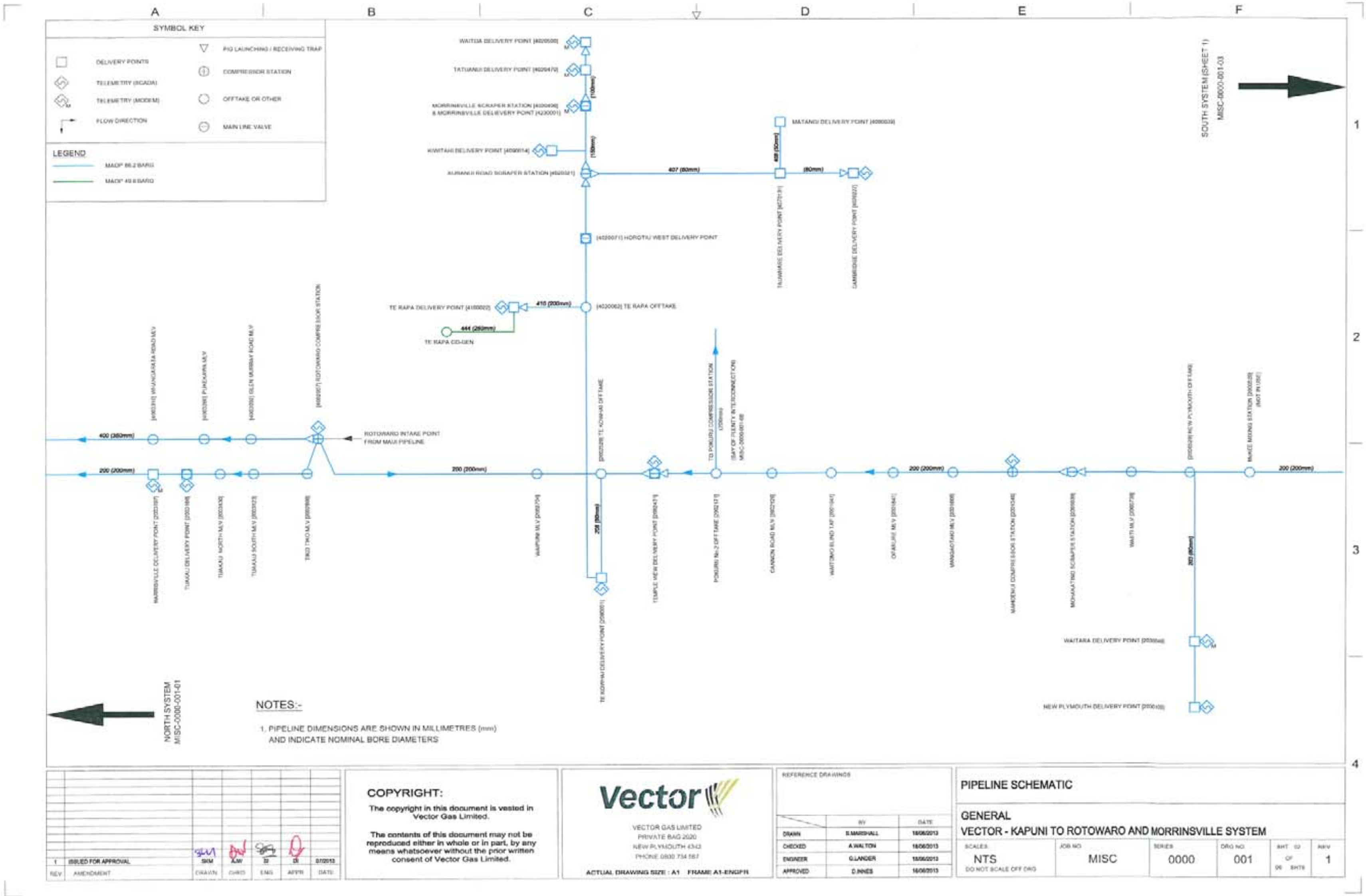

Figure 3-35 : Schematic Diagram of Vector Gas Transmission Assets (2)

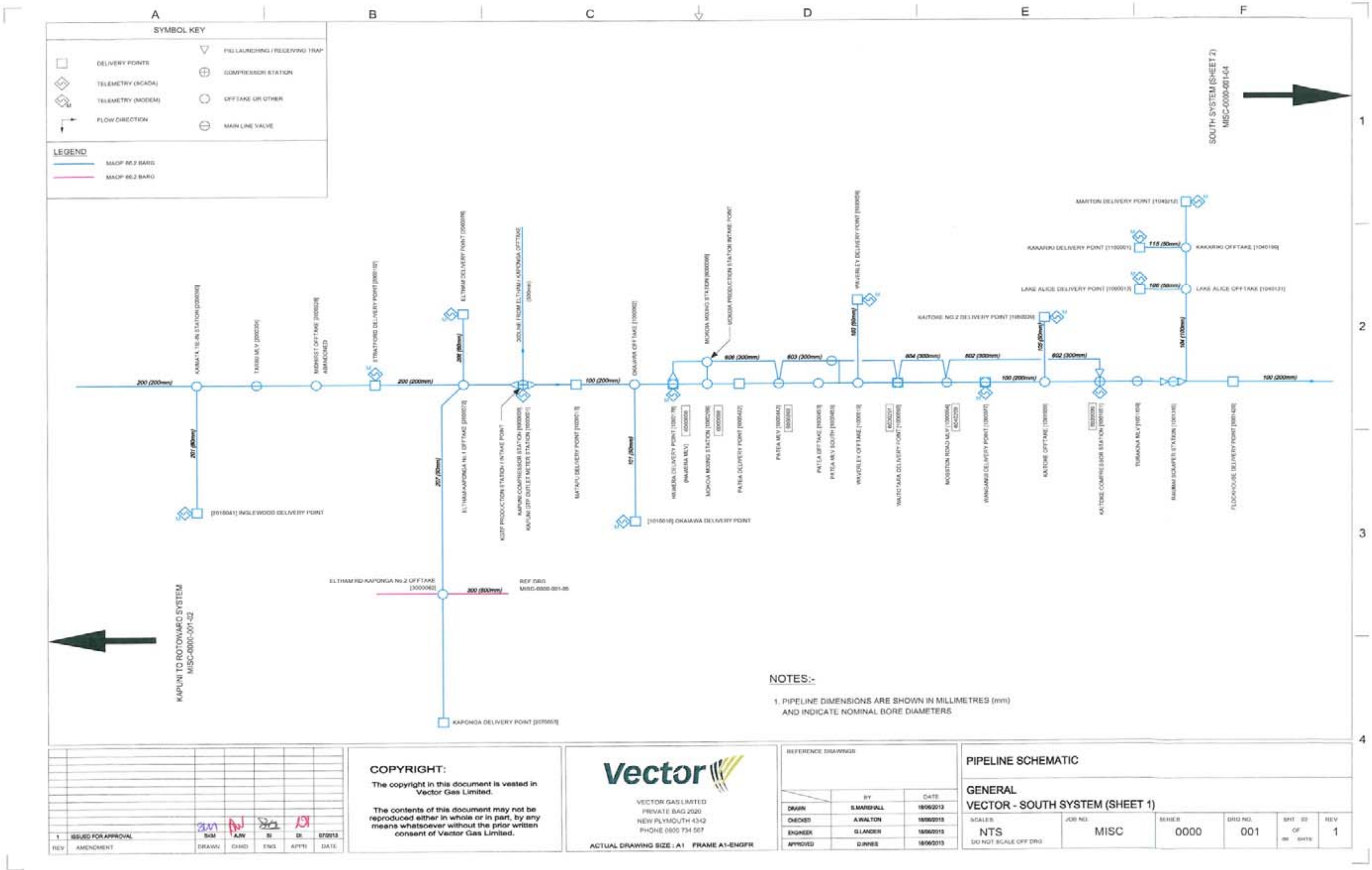

Figure 3-36 : Schematic Diagram of Vector Gas Transmission Assets (3)

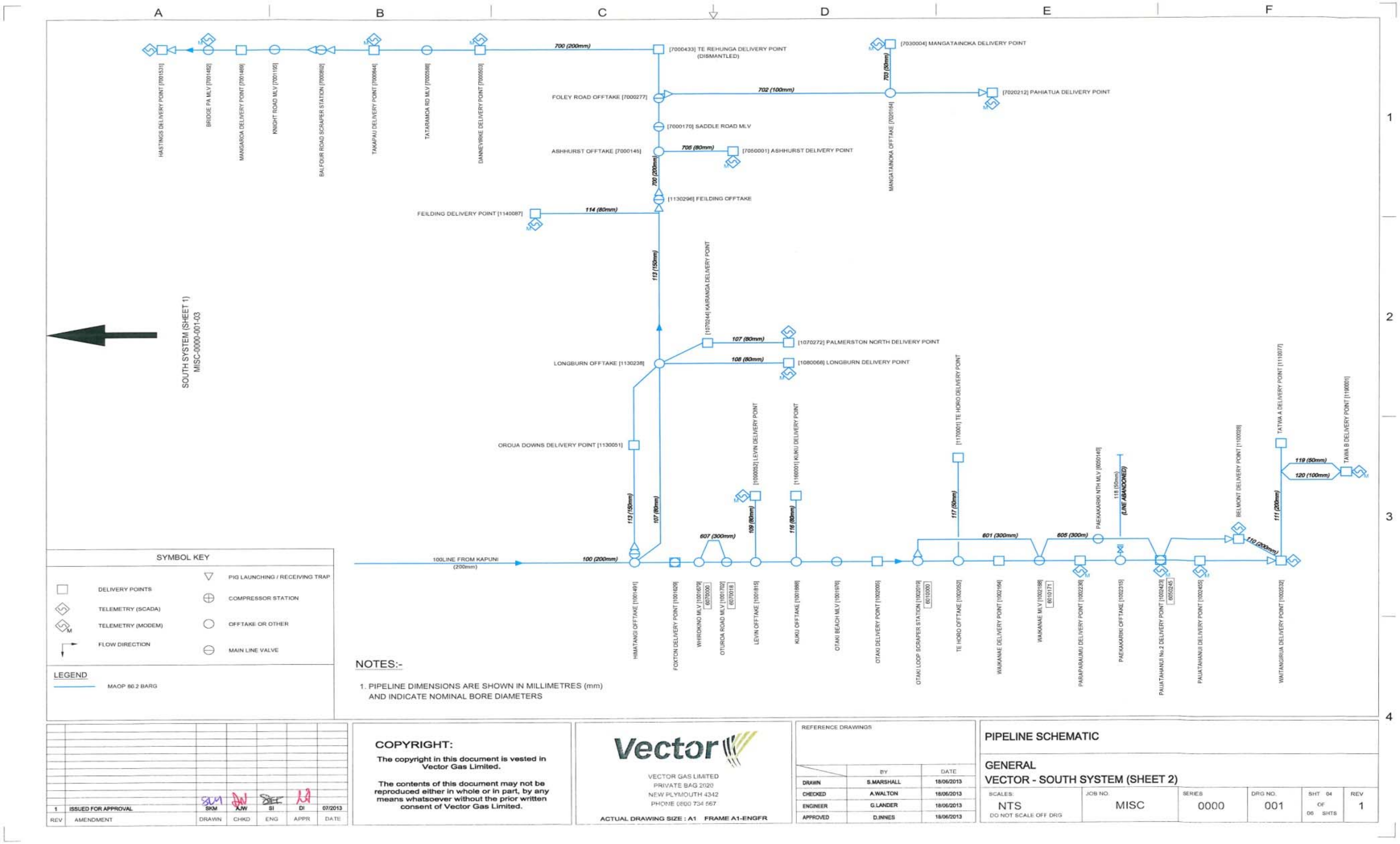

Figure 3-37 : Schematic Diagram of Vector Gas Transmission Assets (4)

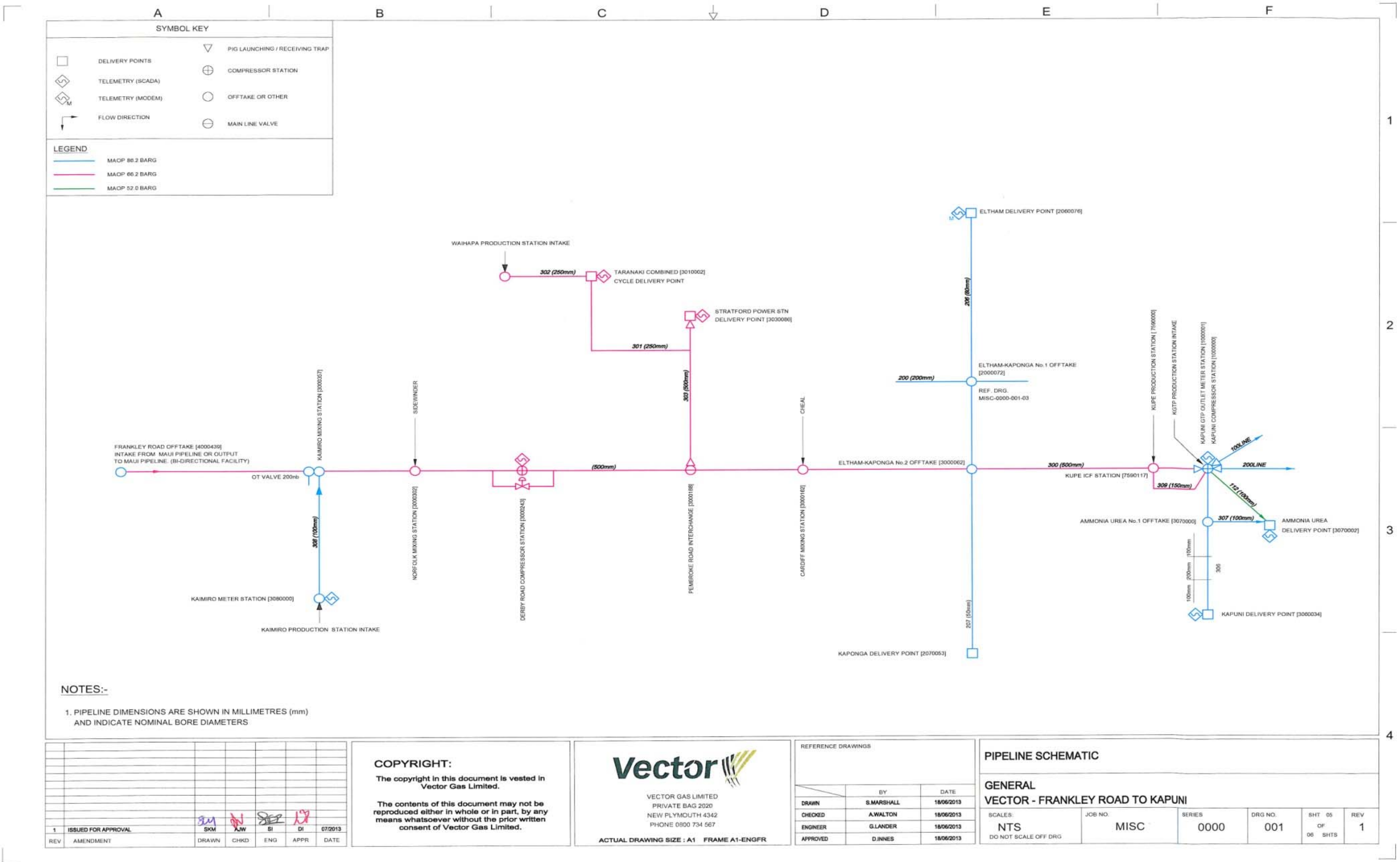

Figure 3-38 : Schematic Diagram of Vector Gas Transmission Assets (5)

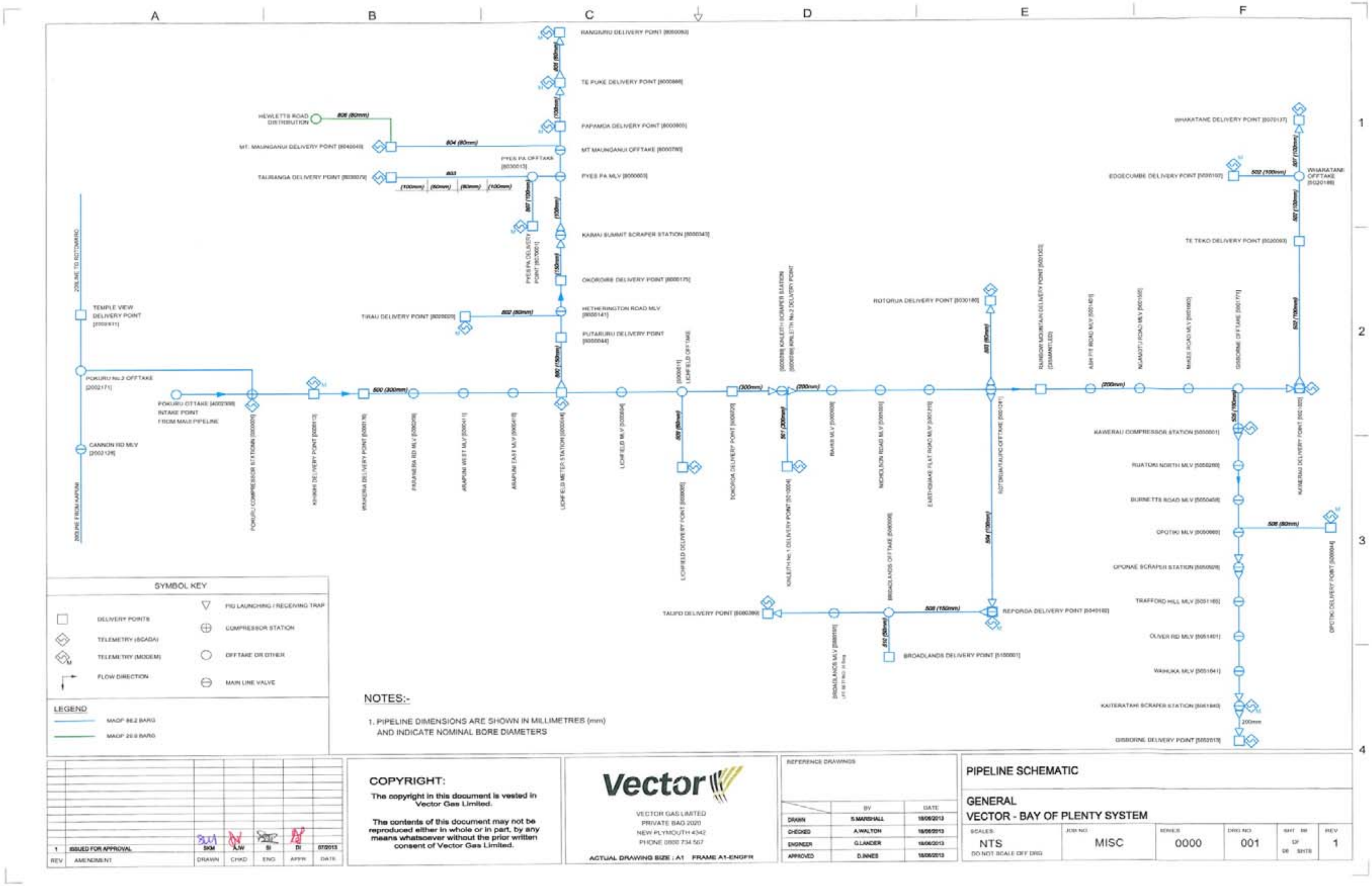

Figure 3-39 : Schematic Diagram of Vector Gas Transmission Assets (6)

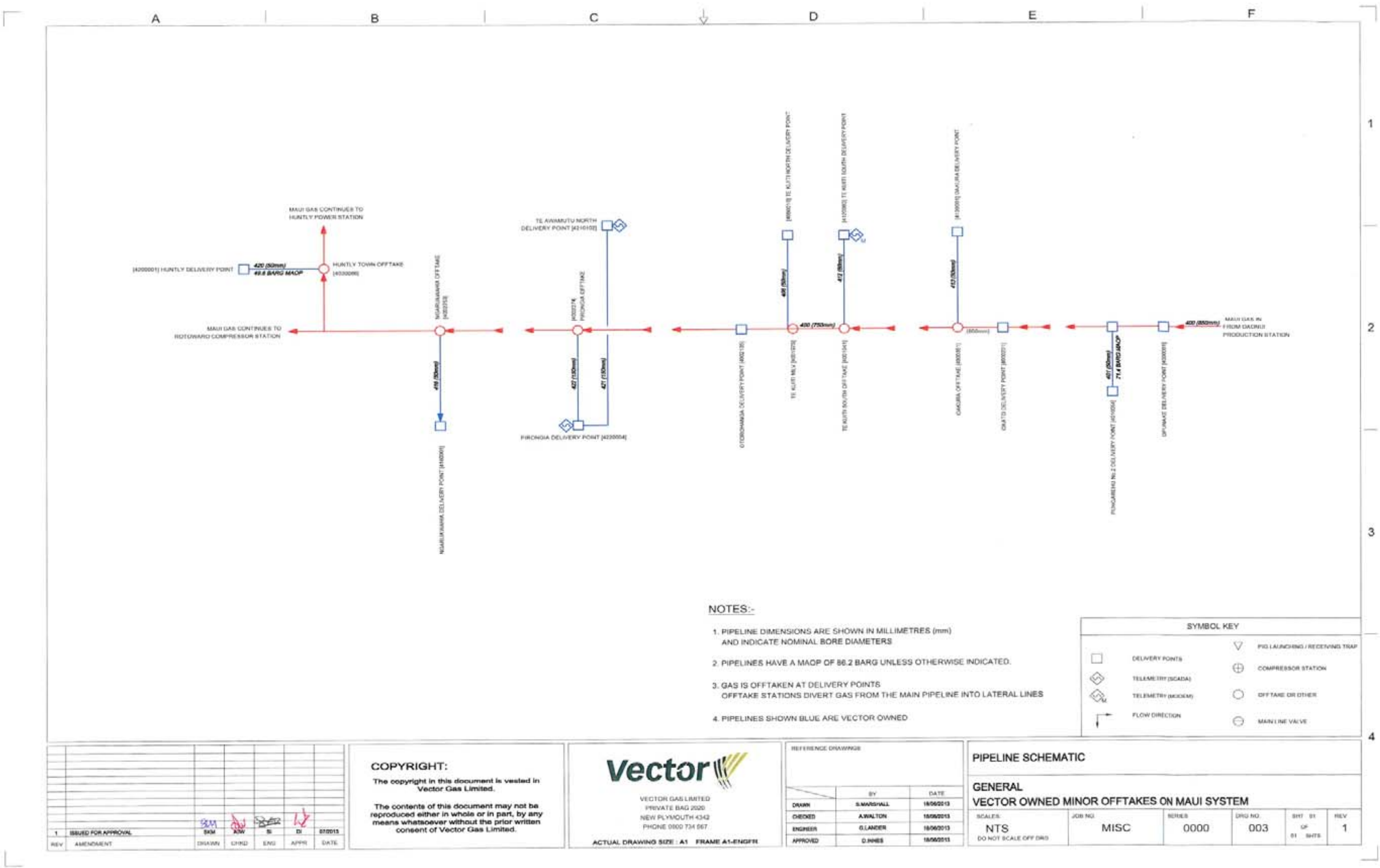

Figure 3-40 : Schematic Diagram of Vector Gas Transmission Assets (7)

3.7 List of Pipelines

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
100	Kapuni - Waitangirua	251.309	8620	Jan-68	219	200	5.56	API 5L X42	Coal Tar Enamel
100A	McKays Crossing Realignment	1.014	8620	Jan-04	219	200	5.56	API 5L X52	Extruded Polyethylene - High Density (HDPE)
100B	Ohau River Realignment	0.322	8620	Mar-07	219	200	8.18	API 5L X46	Dual FBE
100C	Whitby Realignment	0.427	8620	Nov-07	219	200	8.18	API 5L X42	Dual FBE
101	Okaiawa Lateral	1.665	8620	Jan-77	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
103	Waverley Lateral	5.793	8620	Jan-75	60	50	3.20	API 5L GrB	Coal Tar Enamel
104	Marton Lateral	21.118	8620	Jan-80	114	100	4.78	API 5L GrB	Extruded Polyethylene - Yellow
105	Kaitoke Lateral	3.682	8620	Jan-78	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
106	Lake Alice Lateral	1.356	8620	Jan-80	60	50	3.18	API 5L GrB	Extruded Polyethylene - Yellow
107	Himatangi - Palmerston North	27.155	8620	Jan-69	89	80	3.18	API 5L GrB	Coal Tar Enamel
108	Longburn Lateral	6.715	8620	Jan-74	89	80	3.20	API 5L GrB	Coal Tar Enamel
109	Levin Lateral	5.240	8620	Jan-68	89	80	3.20	API 5L GrB	Coal Tar Enamel
110	Waitangirua - Belmont	2.844	8620	Jan-69	219	200	7.90	API 5L GrB	Coal Tar Enamel
111	Waitangirua - Tawa	7.645	8620	Jan-69	219	200	5.56	API 5L X42	Coal Tar Enamel
112	Ammonia-Urea Lateral	0.502	5200	Jan-81	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
113	Himatangi - Feilding Stage I Dup	5.947	8620	Jan-80	168	150	7.11	API 5L GrB	Coal Tar Enamel
113A	Himatangi - Feilding Stage II	23.653	8620	Jan-80	168	150	7.11	API 5L GrB	Coal Tar Enamel
114	Feilding Lateral	8.720	8620	Jan-80	89	80	3.18	API 5L GrB	Extruded Polyethylene - Yellow
115	Kakariki Lateral	0.011	8620	Jan-84	60	50	3.20	API 5L GrB	Extruded Polyethylene
116	Kuku Lateral	0.062	8620	Jan-80	60	50	3.90	API 5L GrB	Extruded Polyethylene - Yellow
117	Te Horo Lateral	0.150	8620	Jan-80	60	50	3.90	API 5L GrB	Extruded Polyethylene - Yellow
119	Tawa B Lateral	0.020	8620	Nov-97	60	50	3.90	API 5L GrB	Polyken
120	Tawa B No 2	0.032	8620	Mar-99	114	100	6.02	A106 GR B	Polyken
200	Kapuni - Papakura	335.848	8620	Jan-68	219	200	5.60	API 5L X42	Coal Tar Enamel
200A	Whitecliffs Realignment	1.366	8620	Apr-78	219	200	5.60	API 5L X42	Coal Tar Enamel
200B	Rotowaro Tie In	0.469	8620	Nov-83	219	200	5.60	API 5L X42	Coal Tar Enamel
200C	Lincoln Road Realignment	0.997	8620	Jan-85	219	200	5.60	API 5L X42	Coal Tar Enamel
200D	Twin Creeks Realignment	1.278	8620	Oct-06	219	200	8.20	API 5L X42	Dual FBE - Naprock
201	Inglewood Lateral	4.246	8620	Jan-74	89	80	3.17	API 5L GrB	Extruded Polyethylene - Yellow
203	New Plymouth Lateral	10.318	8620	Jan-69	89	80	3.18	API 5L GrB	Coal Tar Enamel
203A	Waiongana River Realignment	0.197	8620	Nov-11	89	80	7.62	API 5L X42	Trilaminate HDPE (3LP)

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
206	Eltham Lateral	7.740	8620	Jan-77	89	80	3.17	API 5L GrB	Extruded Polyethylene - Green
207	Kaponga Lateral	5.374	8620	Jan-81	89	80	3.20	API 5L GrB	Extruded Polyethylene - Yellow
208	Te Kowhai Lateral	0.075	8620	Apr-99	219	200	8.18	A106 GR B	Extruded Polyethylene
209	Pokuru Connection	0.200	8620	Dec-99	219	200	7.80	API 5L GrB	Extruded Polyethylene - Yellow
300	Kapuni - Frankley Road	46.564	6620	Jan-74	508	500	6.35	API 5L X60	Coal Tar Enamel
301	Tar Combined Cycle Gas Supply	0.196	6620	Feb-97	268	250	6.40	API 5L X42	Extruded Polyethylene - Yellow
302	Tar Combined Cycle Gas Supply	0.196	8620	Feb-97	268	250	9.40	API 5L X42	Extruded Polyethylene - Yellow
303	Stratford Lateral	8.638	6620	Jan-74	508	500	6.35	API 5L X60	Coal Tar Enamel
306	Kapuni Dist Lateral (Section I)	1.468	8620	Mar-70	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
306A	Kapuni Dist Lateral (Section II)	1.347	8620	Mar-70	219	200	5.60	API 5L X42	Asphalt Enamel
306B	Kapuni Dist Lateral (Section III)	0.531	8620	Mar-70	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
307	Ammonia-Urea Lateral	0.172	8620	Jan-82	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
308	Kaimiro Lateral	3.361	8620	Jan-84	114	100	4.78	API 5L GrB	Extruded Polyethylene - Yellow
309	KGTP Export To 300 Line	0.244	6620	Apr-05	168	150	7.10	API 5L GrB	3 Layer Polyethylene - Orange
400B	Huntly OT - Mill Rd Pukekohe	48.615	8620	Jan-81	356	350	5.60	API 5L X60	Coal Tar Enamel
400C	Pukekohe - Papakura East PRS	13.830	8620	Jan-81	356	350	5.60	API 5L X60	Coal Tar Enamel

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
400D	Papakura - Boundary Rd	0.452	6620	Jan-81	356	350	5.60	API 5L X60	Coal Tar Enamel
400E	Papakura - Westfield	27.555	6620	Jan-81	356	350	11.90	API 5L X52	Coal Tar Enamel
400F	Westfield - Southdown	1.728	6620	May-09	356	350	9.52	API 5L X52	3 Layer Polyethylene - Orange
401	Pungarehu Lateral	5.574	7140	Jan-80	60	50	3.90	API 5L GrB	Extruded Polyethylene - Yellow
402	Te Kowhai - Horotiu East	7.237	8620	Jan-81	168	150	4.80	API 5L GrB	Extruded Polyethylene - Yellow
402A	Horotiu East - Kuranui Rd	24.285	8620	Jan-81	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
402B	Kuranui Rd - Morrinsville	8.290	8620	Jan-81	168	150	4.80	API 5L GrB	Extruded Polyethylene - Yellow
402C	Morrinsville - Tatuanui	6.461	8620	Jan-85	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
402D	Tatuanui - Waitoa	3.259	8620	Jan-85	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
402E	Waikato River Realignment	0.196	8620	Jan-01	168	150	7.11	API 5L GrB	Extruded Polyethylene - Yellow
402F	Ngaruawahia Realignment	0.681	8620	Jan-11	114	100	8.56	API 5L X52	3 Layer Polyethylene- Yellow 3.2mm thick
405	Glenbrook Lateral	23.132	8620	Jan-84	168	150	7.11	API 5L GrB	DCTW and Coal Tar
406	Te Kuiti North Lateral	1.563	8620	Jan-82	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
407	Cambridge Lateral	0.107	8620	Jan-82	114	100	4.78	API 5L GrB	Extruded Polyethylene - Yellow
407A	Cambridge Lateral	22.586	8620	Jan-82	89	80	3.17	API 5L GrB	Extruded Polyethylene - Yellow
408	Matangi Lateral	3.845	8620	Jan-82	60	50	3.18	API 5L GrB	Extruded Polyethylene - Yellow

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
409	Kiwitahi Lateral	1.395	8620	May-90	89	80	3.96	API 5L GrB	Extruded Polyethylene - Yellow
410	Te Rapa Lateral	1.311	8620	Feb-99	219	200	8.20	API 5L GrB	Extruded Polyethylene - Yellow
412	Te Kuiti South Lateral	8.236	8620	Jan-83	89	80	3.20	API 5L GrB	Extruded Polyethylene - Yellow
412A	Te Kuiti South Realignment	0.128	8620	May-86	89	80	3.20	API 5L GrB	Extruded Polyethylene - Yellow
413	Oakura Lateral	0.025	8620	Jan-93	60	50	3.90	API 5L GrB	Extruded Polyethylene - Yellow
416	Ngaruawahia Lateral	0.100	8620	Apr-85	60	50	3.90	API 5L GrB	Extruded Polyethylene - Yellow
417	Ramarama Lateral	0.073	8620	Jan-83	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
418	Papakura Lateral	0.074	6620	Jan-83	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
419	Alfriston Lateral	0.057	6620	Jan-83	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
420	Huntly Town Lateral	0.029	4960	Dec-80	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
421	Te Awamutu North Lateral	10.248	8620	Jan-95	168	150	6.40	API 5L GrB	Extruded Polyethylene - Yellow
422	Pirongia Lateral	0.380	8620	Jan-95	168	150	6.40	API 5L GrB	Extruded Polyethylene - Yellow
430	Westfield - Henderson Vly CS	35.074	6620	Jan-82	219	200	6.40	API 5L X42	Extruded Polyethylene - Yellow
430B	Henderson Vly CS - Ruakaka	120.473	8620	Jan-82	168	150	4.80	API 5L GrB	Extruded Polyethylene - Yellow
430C	Ruakaka - Maungatapere	29.020	8620	Jan-82	168	150	5.60	API 5L GrB	Extruded Polyethylene - Yellow
430D	Southdown Realignment	0.306	6620	Dec-95	219	200	6.40	API 5L X42	HDPE

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
430E	Onehunga Realignment	0.229	8620	Oct-09	219	200	6.35	API 5L X42	HDPE (17mm thick) Yellow Jacket
430F	Mt Wellington Rail	0.048	6620	Aug-10	219	200	6.35	API 5L X42	Trilaminate (2.5mm thick) yellow
431	Waitoki Lateral	0.008	8620	Nov-98	114	100	5.50	API 5L GrB	Extruded Polyethylene - Yellow
432	Kaipara Flats - Warkworth	10.013	8620	Jan-83	60	50	3.18	API 5L GrB	Extruded Polyethylene - Yellow
433	Maungaturoto Lateral	13.295	8620	Jan-83	89	80	3.18	API 5L GrB	Extruded Polyethylene - Yellow
434	Whangarei Lateral	9.225	8620	Jan-83	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
435	Kauri Lateral	21.491	8620	Jan-88	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
437	Marsden Point Lateral	6.900	8620	Jan-93	168	150	4.80	API 5L GrB	Extruded Polyethylene - Yellow
438	Bruce McLaren Lateral	0.090	6620	Mar-85	60	50	3.20	API 5L GrB	Extruded Polyethylene
440	Waimauku Lateral	0.028	8620	Sep-85	60	50	3.90	API 5L GrB	Extruded Polyethylene - Yellow
441	Smales Rd - Waiouru Rd Loop	3.107	6620	Jan-98	356	350	11.90	API 5L X65	Polyken - Plant Applied (Synergy)
442	Otara Lateral	2.410	6620	Jan-98	323	300	11.10	API 5L X65	Extruded Polyethylene - Yellow
443	ETCART Extension	0.488	6620	Jan-98	356	350	11.90	API 5L X65	Polyken - Plant Applied (Synergy)
444	Te Rapa Co-Gen	0.515	4960	Feb-99	273	250	7.80	API 5L GrB	Polyken - YGIII
500	Te Awamutu - Kinleith	78.880	8620	Jan-82	324	300	5.16	API 5L X60	Coal Tar Enamel
500A	Kinleith - Kawerau	103.160	8620	Jan-82	219	200	5.56	API 5L GrB	Coal Tar Enamel

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
501	Kinleith Lateral	0.140	8620	Jan-82	324	300	5.20	API 5L X60	Polyken
502	Edgecumbe Lateral	18.762	8620	Jan-82	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
502A	Edgecumbe Realignment	0.502	8620	Jun-11	114	100	8.60	API FLB PSL1	3 Layer Polyethylene - Yellow
503	Rotorua Lateral	16.894	8620	Jan-83	89	80	3.96	API 5L GrB	Fusion Bonded Epoxy
503A	Rotorua - Tumunui Deviation	1.113	8620	Mar-97	89	80	5.40	API 5L GrB	Extruded Polyethylene - Yellow
504	Reporoa Lateral	18.229	8620	Jan-84	114	100	4.78	API 5L GrB	Extruded Polyethylene - Yellow
505	Kawerau - Gisborne	183.749	8620	Jan-84	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow
505A	Waipaoa River - Gisborne	17.285	8620	Jan-84	219	200	5.60	API 5L GrB	Extruded Polyethylene - Yellow
505B	Waikohu River Realignment	0.249	8620	May-09	114	100	8.56	API 5L GRB	3 Layer Polyethylene - Orange
506	Opotiki Lateral	4.439	8620	Jan-84	89	80	3.96	API 5L GrB	Extruded Polyethylene - Yellow
507	Whakatane Lateral	13.200	8620	Jan-86	114	100	4.78	API 5L GrB	Extruded Polyethylene - Yellow
507A	Edgecumbe Realignment	0.213	8620	Jun-11	114	100	8.60	API 5LB PSL1	3 Layer Polyethylene - Yellow
508	Taupo Lateral	38.910	8620	Jan-87	168	150	4.80	API 5L GrB	Extruded Polyethylene - Yellow
509	Lichfield Lateral	0.520	8620	Jan-95	89	80	4.00	API 5L GrB	Extruded Polyethylene - Yellow
510	Broadlands Lateral	0.022	8620	Apr-05	60	50	3.91	A106 GR B	Polyken
601	Waikanae - Te Horo Loop	16.829	8620	Jan-81	324	300	5.16	API 5L X60	Coal Tar Enamel

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
602	Wanganui Kaitoke Loop	9.935	8620	Jan-84	324	300	7.90	API 5L X60	Unknown
603	Patea - Waitotara Loop	25.084	8620	Jan-84	324	300	7.90	API 5L X52	Extruded Polyethylene - Yellow
604	Wanganui Mosston Loop (II)	26.933	8620	Jan-83	324	300	7.92	API 5L X52	Extruded Polyethylene - Yellow
605	Waikanae - Belmont Loop	38.547	8620	Jan-85	324	300	6.30	API 5L X60	Fusion Bonded Epoxy
606	Hawera - Patea Loop	26.300	8620	Jan-86	323	300	5.16	API 5L X60	Extruded Polyethylene - Yellow
607	Foxton Loop	1.839	8620	Jan-94	323	300	5.60	API 5L X52	Extruded Polyethylene - Yellow
700	Feilding OT - Hastings (SH 2)	150.524	8620	Jan-82	219	200	5.56	API 5L GrB	Extruded Polyethylene - Yellow
700A	SH 2 - Hastings	1.984	8620	Jan-82	219	200	9.50	API 5L X52	Extruded Polyethylene - Yellow
700B	Pohangina Realignment	0.439	8620	May-04	219	200	8.18	API 5L X42	Extruded Polyethylene - Yellow
700C	Hawkes Bay Expressway Realignment	0.175	8620	Apr-10	219	200	8.56	API 5L X52	Polyurea k5, 2000µm min thickness
702	Pahiatua Lateral	21.209	8620	Jan-83	114	100	4.78	API 5L GrB	Extruded Polyethylene - Yellow
703	Mangatainoka Lateral	0.424	8620	Jan-83	60	50	3.18	API 5L GrB	Extruded Polyethylene - Yellow
705	Ashhurst Lateral	0.037	8620	Jan-90	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
800	Lichfield - Tirau	14.055	8620	Jan-80	168	150	7.10	API 5L GrB	Extruded Polyethylene - Yellow
800A	Tirau - Kaimai Summit	20.274	8620	Jan-80	168	150	4.80	API 5L GrB	Extruded Polyethylene - Yellow
800B	Kaimai Summit - Te Puke	52.503	8620	Jan-80	114	100	4.80	API 5L GrB	Extruded Polyethylene - Yellow

Pipe #	Pipe Name	Length (km)	MAOP (kPa)	Date Commissioned	Outside Diam. (mm)	Nominal Bore (mm)	Wall Thick (mm)	Material Grade	Coating System
800C	Pyes Pa Realignment	0.972	8620	Sep-06	114	100	8.56	API 5L X42	3 Layer Polyethylene
800D	Pyes Pa Realignment 2	0.216	8620	May-09	114	100	8.56	API 5L X42	3 Layer Polyethylene 1.7mm thick
802	Tirau Lateral	2.004	8620	Jan-80	89	80	3.18	API 5L GrB	Extruded Polyethylene - Yellow
803	Tauranga Lateral (Sect I)	1.185	8620	Jun-83	89	80	3.20	API 5L GrB	Extruded Polyethylene - Yellow
803A	Tauranga Lateral (Sect II)	2.964	8620	Jun-83	60	50	3.20	API 5L GrB	Extruded Polyethylene - Yellow
803B	Tauranga Lateral (Section B)	1.233	8620	Oct-99	114	100	6.02	API 5L GrB	2 Layer Extruded Polyethylene - High Density (Yellow Jacket)
803C	Tauranga Lat (Pyes Pa Realignment)	1.604	8620	Mar-06	114	100	8.56	API 5L X42	3 Layer Polyethylene
804	Mt Maunganui Lateral	4.822	8620	Jan-80	89	80	3.20	API 5L GrB	Extruded Polyethylene - Yellow
804A	Te Maunga Realignment	0.300	8620	Jan-95	89	80	3.20	API 5L GrB	Extruded polyethylene - Yellow
805	Rangiuru Lateral	8.307	8620	Jan-80	89	80	3.20	API 5L GrB	Extruded Polyethylene - Yellow
806	Mt Maunganui Loop	3.593	2000	Apr-83	89	80	3.18	API 5L GrB	Extruded Polyethylene - Yellow
807	Pyes Pa Lateral	0.035	8620	Apr-07	114	100	8.56	API 5L X42	Extruded Polyethylene - Yellow

Table 3-2 : List of Pipelines

3.8 List of Special Crossings

Line	Meterage	Type	Location	Year Commissioned
100	168758	Aerial Crossing	Manawatu River Bridge	1968
100	236300	Aerial Crossing	Gibbs Fault	1968
104	19604	Aerial Crossing	Tutaenui Stream Bridge	1980
200	81452	Aerial Crossing	Gilbert Stream	1968
200	145013	Aerial Crossing	Waipapa Stream	1968
200	312443	Aerial Crossing	Waikato River	1968
201	362	Aerial Crossing	Maketawa Stream	1974
201	2249	Aerial Crossing	Ngatoro Stream	1974
300	12764	Aerial Crossing	Waingongoro Tributary	1974
300	15075	Aerial Crossing	Waingongoro River	1974
300	15274	Aerial Crossing	Waingongoro Tributary	1974
300	15422	Aerial Crossing	Waingongoro Tributary	1974
300	16984	Aerial Crossing	Paetahi Stream	1974
300	17407	Aerial Crossing	Konini Stream	1974
300	17908	Aerial Crossing	Patea River	1974
300	20706	Aerial Crossing	Kahouri Stream	1974
300	29662	Aerial Crossing	Piakau Tributary	1974
300	30131	Aerial Crossing	Piakau Stream	1974
300	34263	Aerial Crossing	Waiongana Stream	1974
300	37098	Aerial Crossing	Kai Auahi Tributary	1974
300	37450	Aerial Crossing	Kai Auahi Stream	1974
300	38435	Aerial Crossing	Mangakotukutuku Stream	1974
300	39170	Aerial Crossing	Mangawarawara Stream	1974
300	41844	Aerial Crossing	Mangorei Stream	1974
300	44470	Aerial Crossing	Te Henui Stream	1974
400B	327471	Aerial Crossing	Waikato River	1981
500	41225	Aerial Crossing	Waikato River	1982
500	41360	Aerial Crossing	Arapuni Dam	1982
605	18538	Aerial Crossing	Gibbs Fault	1985
606	13932	Aerial Crossing	Waikaikai Stream	1986
100	1264	Cased crossing	Skeet Road	1968

Line	Meterage	Type	Location	Year Commissioned
100	14058	Cased crossing	South Road SH 45	1968
100	95337	Cased crossing	Mosston Rd	1968
100	96071	Cased crossing	Puriri Street	1968
100	97435	Cased crossing	Castlecliff Industrial Line & Heads Road	1968
100	144701	Cased crossing	Tangimoana - Longburn Road	1968
100	153906	Cased crossing	Himitangi Beach Rd	1968
100	162971	Cased crossing	Foxton Beach Rd	1968
100	198849	Cased crossing	Tasman Road	1968
100	199660	Cased crossing	Rangiuru Road	1968
100	215283	Cased crossing	Te Moana Road	1968
100	217927	Cased crossing	North Island Main Trunk	1968
100	218525	Cased crossing	SH 1	1968
100	230895	Cased crossing	SH 1 (Paraparaumu-Paekakariki)	1968
100	231889	Cased crossing	SH 1	1968
104	14285	Cased crossing	SH 3	1980
104	21070	Cased crossing	North Island Main Trunk, Marton	1980
107	5129	Cased crossing	SH 1	1969
107	20074	Cased crossing	Rongotea Road	1969
107	27105	Cased crossing	Rangitikei Line SH 3	1969
108	4954	Cased crossing	No 1 Line Longburn	1974
108	5346	Cased crossing	Longburn Rongotea Road	1974
108	6306	Cased crossing	North Island Main Trunk	1974
111	7392	Cased crossing	Motorway Off-Ramp SH 1, Tawa	1969
111	7433	Cased crossing	Johnsonville Porirua Motorway SH 1, Tawa	1969
111	7590	Cased crossing	Takapu Road, Tawa	1969
112	116	Cased crossing	Palmer Road	1981
113	5135	Cased crossing	SH 1	1980
113	26302	Cased crossing	SH 3	1980
114	7719	Cased crossing	Camerons Line (SH 54), Feilding	1980
114	8644	Cased crossing	SH 54 & NIMT Railway, Feilding	1980
200	855	Cased crossing	Kapuni Branch	1968
200	7219	Cased crossing	Eltham Road	1968
200	14402	Cased crossing	Opunake Road	1968

Line	Meterage	Type	Location	Year Commissioned
200	30536	Cased crossing	Marton-New Plymouth Line & SH 3	1968
200	59565	Cased crossing	Inland North Road	1968
200	63445	Cased crossing	Kaipikari Road	1968
200	66691	Cased crossing	SH 3	1968
200	72035	Cased crossing	Pukearuhe Road	1968
200	98678	Cased crossing	Mokau Road SH 3	1968
200	103177	Cased crossing	Mokau Road SH 3	1968
200	106746	Cased crossing	SH 3	1968
200	115302	Cased crossing	SH 3	1968
200	129245	Cased crossing	SH 3	1968
200	131157	Cased crossing	SH 3	1968
200	132487	Cased crossing	SH 3	1968
200	141647	Cased crossing	SH 3	1968
200	191980	Cased crossing	Waitomo Caves Road SH 37	1968
200	210752	Cased crossing	Kawhia Road SH 31	1968
200	224127	Cased crossing	Pirongia Road	1968
200	231061	Cased crossing	Kakaramea Road SH 39	1968
200	232995	Cased crossing	Kakaramea Road SH 39	1968
200	239592	Cased crossing	Tuhikaramea Road	1968
200	247216	Cased crossing	Whatawhata Road SH 23	1968
200	274234	Cased crossing	Waikokowai Road	1968
200	274676	Cased crossing	Rotowaro Industrial Line	1968
200	294249	Cased crossing	SH 22	1968
200	312211	Cased crossing	Highway 22	1968
200	315935	Cased crossing	Whangarata Road	1968
200	316785	Cased crossing	Bollard Road	1968
200	317214	Cased crossing	North Island Main Trunk	1968
200	319714	Cased crossing	Harrisville Road	1968
200	322401	Cased crossing	Harrisville Road	1968
200	324656	Cased crossing	Pukekohe East Road	1968
200	327626	Cased crossing	Runciman Road	1968
200	333355	Cased crossing	North Island Main Trunk	1968
200	333801	Cased crossing	Karaka Road (SH 22), Drury	1968

Line	Meterage	Type	Location	Year Commissioned
200	339282	Cased crossing	Hingaia Road	1968
203	6640	Cased crossing	Waitara Industrial Line	1969
203	7649	Cased crossing	Mountain Road SH 3A	1969
207	4	Cased crossing	Eltham Road	1981
300	468	Cased crossing	Kapuni Branch Railway	1974
300	6135	Cased crossing	Eltham Road	1974
300	14053	Cased crossing	Opunake Road	1974
303	4905	Cased crossing	Marton-New Plymouth Line & SH 3	1974
306	130	Cased crossing	Palmer Road, Kapuni	1970
400B	331666	Cased crossing	North Island Main Trunk	1981
400B	347555	Cased crossing	Auckland-Hamilton Motorway	1981
400B	379659	Cased crossing	Carbine Road	1981
400B	379993	Cased crossing	Auckland-Hamilton Motorway SH 1	1981
400B	380786	Cased crossing	Mount Wellington Highway	1981
402	5630	Cased crossing	North Island Main Trunk	1981
402	6018	Cased crossing	SH 1	1981
402	28650	Cased crossing	East Coast Main Trunk Railway	1981
402	32233	Cased crossing	SH 26	1981
402	34103	Cased crossing	Kuranui Road	1981
402	38217	Cased crossing	Scott Road	1981
402	39333	Cased crossing	Morrinsville-Walton Road	1981
402	39964	Cased crossing	East Coast Main Trunk Railway	1981
402	47492	Cased crossing	SH 27	1981
405	5739	Cased crossing	North Island Main Trunk	1984
405	6144	Cased crossing	Paerata Road (SH 22)	1984
405	8800	Cased crossing	Mission Bush Branch	1984
405	19729	Cased crossing	Mission Bush Branch	1984
407	211	Cased crossing	Kuranui Road	1982
412	5028	Cased crossing	SH 3	1983
412	8038	Cased crossing	North Island Main Trunk	1983
412	8343	Cased crossing	SH 30	1983
430	15	Cased crossing	North Island Main Trunk	1982
430	96	Cased crossing	Sylvia Park Road	1982

Line	Meterage	Type	Location	Year Commissioned
430	1036	Cased crossing	Great South Road	1982
430	1384	Cased crossing	North Auckland Railway	1982
430	1708	Cased crossing	Southdown Freight Terminal Railway	1982
430	5510	Cased crossing	Onehunga Port Railway	1982
430	6069	Cased crossing	Gloucester Park Road	1982
430	6316	Cased crossing	SH 20 Motorway	1982
430	19610	Cased crossing	West Coast Road	1982
430	19751	Cased crossing	North Auckland Line	1982
430	22268	Cased crossing	North Auckland Line	1982
430	31422	Cased crossing	North Auckland Line	1982
430	36994	Cased crossing	North Auckland Line	1982
430	45580	Cased crossing	North Auckland Line & SH 16	1982
430	71633	Cased crossing	North Auckland Line	1982
430	90123	Cased crossing	North Auckland Line	1982
430	99851	Cased crossing	SH 1	1982
430	158545	Cased crossing	SH 1	1982
430	172216	Cased crossing	North Auckland Line	1982
433	6532	Cased crossing	SH 1	1983
433	13256	Cased crossing	SH 12	1983
434	8712	Cased crossing	SH 1	1983
438	0	Cased crossing	Parrs Cross Road	1985
500	8414	Cased crossing	North Island Main Trunk	1982
500	12770	Cased crossing	SH 3	1982
500	80711	Cased crossing	Kinleith Branch Railway	1982
500	81644	Cased crossing	SH 1	1982
500	93773	Cased crossing	Rahui Road	1982
500	105761	Cased crossing	SH 30	1982
500	127438	Cased crossing	SH 5	1982
502	7676	Cased crossing	Murupara Branch Railway	1982
502	11045	Cased crossing	Galatea Road	1982
502	13636	Cased crossing	SH 30	1982
503	9915	Cased crossing	Tumunui Road	1983
505	2666	Cased crossing	Murupara Branch	1984

Line	Meterage	Type	Location	Year Commissioned
505	42842	Cased crossing	SH 2	1984
505	47775	Cased crossing	SH 2	1984
505	69499	Cased crossing	SH 2	1984
505	164543	Cased crossing	SH 2	1984
505	167149	Cased crossing	SH 2	1984
505	171986	Cased crossing	Whatatutu Road	1984
505	175294	Cased crossing	Cliff Road	1984
505	175979	Cased crossing	Matawai Road SH 2	1984
505	183931	Cased crossing	Matawai Road SH 2	1984
505	185557	Cased crossing	Shaw Orchard	1984
506	3756	Cased crossing	Waioeka Road SH 2	1984
507	4090	Cased crossing	Awakeri Road SH 2	1986
507	6246	Cased crossing	Railway Track & SH 30	1986
507	12877	Cased crossing	Kopeopeo Canal Outlet Pipe	1986
507	12932	Cased crossing	Patuwai Road	1986
508	1461	Cased crossing	SH 5	1987
601	13564	Cased crossing	Te Moana Road	1981
601	16224	Cased crossing	North Island Main Trunk	1981
601	16820	Cased crossing	SH 1	1981
602	680	Cased crossing	Pururi Street	1984
602	2042	Cased crossing	Castlecliff Industrial Line & Heads Road	1984
605	11151	Cased crossing	North Island Main Trunk & SH 1	1985
605	13790	Cased crossing	North Island Main Trunk	1985
605	14131	Cased crossing	SH 1 (Paraparaumu-Paekakariki)	1985
605	31313	Cased crossing	Paremata Haywards Road SH 58	1985
700	1900	Cased crossing	North Island Main Trunk, Railway Road	1982
700	75367	Cased crossing	SH 2	1982
700	84398	Cased crossing	SH 2	1982
700	151184	Cased crossing	Palmerston North-Gisborne Line & SH 2	1982
702	6137	Cased crossing	Napier Road SH 2	1983
702	6603	Cased crossing	Palmerston North-Gisborne Line	1983
702	7773	Cased crossing	Wairarapa Line	1983
702	9690	Cased crossing	Masterton Road SH 2	1983

Line	Meterage	Type	Location	Year Commissioned
702	14920	Cased crossing	Wairarapa Line	1983
703	226	Cased crossing	SH 2	1983
800	4263	Cased crossing	SH 1	1980
800	12880	Cased crossing	SH 5	1980
800	37750	Cased crossing	SH 29	1980
800	40165	Cased crossing	SH 29	1980
800	42390	Cased crossing	SH 29	1980
800	55098	Cased crossing	SH 29	1980
800	80560	Cased crossing	SH 2	1980
800	81500	Cased crossing	East Coast Main Trunk Railway	1980
803	1753	Cased crossing	SH 29	1982
805	7915	Cased crossing	East Coast Main Trunk Railway & SH 2	1980
806	699	Cased crossing	SH 2	1983
806	952	Cased crossing	East Coast Main Trunk Railway	1983
806	1320	Cased crossing	Old Railway Corridor	1983

Table 3-3 : List of Special Crossings

3.9 List of Stations

Station Number	Station Name	Address	Install Year
1000013	Matapu Delivery Point	Skeet Road, Kapuni	1982
1000455	Patea MLV South	Lower Kaharoa Road, Patea	1990
1001051	Kaitoke Compressor Station	Pauri Road, Kaitoke	1984
1060013	Lake Alice Delivery Point	Lake Alice Road, Lake Alice	1980
1160001	Kuku Delivery Point	630 Kuku Beach Road, Horowhenua	1980
1170001	Te Horo Delivery Point	Te Horo Beach Road, Te Horo	1980
1190001	Tawa B Delivery Point	S H 1, Tawa	1997
2001346	Mahoenui Compressor Station	Papakauri Road, Mahoenui	1979
3000188	Pembroke Rd interchange	541R Pembroke Road, Stratford	1976
4000132	Pungarehu 1 Delivery Point	Parihaka Road, Pungarehu	1983
4000439	Frankley Rd Offtake	814 Frankley Road, New Plymouth	1977
4002907	Rotowaro Compressor Station	575 Waikokowai Road, Rotowaro	1981
4010054	Pungarehu 2 Delivery Point	Pungarehu Road, Pungarehu	1983
4020406	Morrinsville Scraper Station	Access via railway yards at Morrinsville	1981

Station Number	Station Name	Address	Install Year
4050214	Waiuku Delivery Point	Glenbrook Road, Glenbrook	1984
4210102	Te Awamutu North Delivery Point	Factory Road, Te Awamutu	1995
4301075	Wellsford Delivery Point	Worthington Road, Wellsford	1983
4301681	Oakleigh Delivery Point	Whittle Road, Oakleigh	1983
4310001	Waitoki Delivery Point	1341 Kahikatea Flat Road, Waitoki	1998
4400001	Waimauku Delivery Point	S H 16, Waimauku	1985
5000176	Waikeria Delivery Point	Higham Road, Kihikihi	1985
5000788	Kinleith Scraper station	Off Old Taupo Road, Kinleith	1983
5010004	Kinleith No. 1 Delivery Point	Off Old Taupo Road, Kinleith	1983
5100001	Broadlands Delivery Point	Vaile Road, Broadlands	2005
5111001	Broadlands GMS	Vaile Road, Broadlands	2005
6060088	Mokoia Mixing Station	Mokoia Road, Mokoia	2001
6500000	Mokoia Production Station	Mokoia Road, Mokoia	2001
7000433	Te Rehunga Delivery Point	Kumeti Road, Dannevirke	1983
7000892	Balfour Rd Scraper Station	Balfour Road, Ashcott	1983
8000175	Okoroire Delivery Point	73R Somerville Road, Okoroire	1982
8000888	Te Puke Dist. Delivery Point	Washer Road, Te Puke	1984
1000001	Ammonia Urea (Maui/Treated into KGTP Mixing) Delivery Point	297 Palmer Road, Kapuni	1969
1000001	Kapuni GTP Compressors	298 Palmer Road, Kapuni	1969
1000001	KGTP North & South & 300 line check	298 Palmer Road, Kapuni	1969
1000062	Okaiawa Offtake	462 Normanby Road, Okaiawa	1982
1000178	Hawera Delivery Point	Fairfield Road, Hawera	1972
1000422	Patea Delivery Point	Victoria Road, Patea	1976
1000442	Patea MLV	Taranaki Road, Patea	1969
1000453	Patea Offtake	Lower Kaharoa Road, Patea	1976
1000619	Waverley Offtake	Lennox Road, Waverley	1976
1000692	Waitotara Delivery Point	270 Waiinu Beach Road, Waitotara	1969
1000954	Mosston Rd MLV	Mosston Road, Wanganui	1969
1000977	Wanganui Delivery Point	5 Karoro Road, Wanganui	1969
1001050	Kaitoke Offtake	Pauri Road, Kaitoke	1977
1001159	Turakina MLV	Turakina Beach Road, Turakina	1969
1001315	Raumai Rd Scraper Station	Raumai Road, Bulls	1969

Station Number	Station Name	Address	Install Year
1001420	Flockhouse Delivery Point	Parewanui Road, Bulls	1985
1001491	Himatangi Offtake	Puke Puke Road, Foxton	1969
1001629	Foxton Delivery Point	80 Foxton Beach Road, Foxton	1971
1001679	Whirokino MLV	32 Matakarapa Road, Foxton	1994
1001702	Oturoa MLV	142 Oturoa Road, Foxton	1969
1001815	Levin Offtake	South of Hokio Beach Road, Levin	1969
1001976	Otaki Beach MLV	85-91 Old Coach Road, Otaki Beach	1969
1002005	Otaki Delivery Point	Unnamed Road next to Otaki River	1981
1002019	Otaki Loop Scraper Station	South of Swamp Road, Otaki	1969
1002164	Waikanae Delivery Point	Kauri Road, Waikanae	1982
1002188	Waikanae MLV	S H 1, Waikanae	1969
1002236	Paraparaumu Delivery Point	Valley Road, Paraparaumu	1980
1002423	Pauatahanui No.2 (Horsfields) Delivery Point	Paekakariki Hill Road, Pauatahanui	1973
1002455	Pauatahanui No.1 Delivery Point	209 Paekakariki Hill Road, Pauatahanui	1969
1002532	Waitangarua Delivery Point	7A1 Takapu Road, Porirua	1969
1010016	Okaiawa Delivery Point	Kohiti Road, Okaiawa	1982
1030058	Waverley Delivery Point	Lower Okotuku Road, Moumahaki, Waverley	1976
1040212	Marton Delivery Point	Wings Line, Marton (behind Malting Company)	1983
1050039	Kaitoke # 2 Delivery Point	Pauri Road, Kaitoke	2005
1070244	Kairanga Delivery Point	Gillespies Line, Palmerston North	1972
1070272	Palmerston North Delivery Point	606 Rangitikei Line, Palmerston North	1972
1080068	Longburn Delivery Point	Reserve Road, Longburn	1979
1090052	Levin Delivery Point	Hokio Beach Road, Levin	1978
1100028	Belmont No.1 Delivery Point	Belmont Road, Lower Hutt	1985
1120000	Ammonia Urea No 2 Offtake	Off Compressor at KGTP, Palmer Road, Kapuni	1981
1130051	Oroua Downs Delivery Point	S H 1 near Omanuka Road, Oroua Downs	1983
1130238	Longburn Offtake	Kairanga Bunnythorpe Road, Palmerston North	1983
1130296	Feilding Offtake	Setters Line, Palmerston North	1980
1140087	Feilding Delivery Point	Campbell Road, Feilding	1980
1150001	Kakariki Delivery Point	Cnr Makirikiri Road & Goldings Line, Marton	1984
2000072	Eltham-Kaponga No 1 Offtake	Eltham Road, Kaponga	1981
2000192	Stratford Delivery Point	517R Pembroke Road, Stratford	1978

Station Number	Station Name	Address	Install Year
2000304	Tariki MLV	744A Mountain Road S H 3, Tariki	1981
2000390	Kaimata Tie-In Station	428 Tarata Road, Inglewood	1969
2000520	McKee Mixing Station	Tikorangi Road West, Waitara	1969
2000529	New Plymouth Offtake	177A Ngatimaru Road	1972
2000738	Wai-iti MLV	8 Nopera Road, Waiiti	1981
2001039	Mohakatino Scraper Station	1443 Moaku Road S H 3, Mohakatino	1969
2001606	Mangaotaki MLV	Mangaotaki Road, Piopio	1969
2001841	Oparure MLV	Oparure Road, Te Kuiti	1969
2001941	Waitomo Blind Tap	Golf Road, Waitomo	1969
2002128	Cannon Rd MLV	Cannon Road, Otorohanga	1969
2002431	Temple View Delivery Point	Foster Road, Temple View, Hamilton	1969
2002704	Waipuna MLV	Waipuna Road, Rotowaro	1969
2002898	TikoTiko MLV	Tikotiko Road, Glen Murray	1969
2003123	Tuakau South MLV	Highway 22, Tuakau	1969
2003130	Tuakau North MLV	River Road Highway 22, Tuakau	1969
2003168	Tuakau Delivery Point	Bollard Road, Tuakau	1995
2003197	Harrisville Delivery Point	Harrisville Road, Harrisville	1998
2003394	Papakura Delivery Point	14 Hilldene Road, Papakura	1970
2010041	Inglewood Delivery Point	34 Tarata Road, Inglewood	1975
2030046	Waitara Delivery Point	Waitara Road, Waitara	1976
2030105	New Plymouth Delivery Point	195A Connett Road East, Bell Block	1972
2060076	Eltham Delivery Point	North Street, Eltham	1979
2070053	Kaponga Delivery Point	1502 Manaia Road, Kaponga	1981
2080001	Te Kowhai Delivery Point (incl Te Kowhai OT 2002529)	Limmer Road, Hamilton	1983
3000000	KGTP "Maui bypass"	298 Palmer Road, Kapuni	1969
3000062	Eltham-Kaponga No 2 Offtake	Eltham Road, Kaponga	1976
3000243	Derby Rd Compressor Station	Derby Road South, Stratford	1976
3000357	Kaimiro Mixing Station	686A Egmont Road, Kaimiro	1994
3010002	TCC Power Station Delivery Point	189 East Road, Stratford	1997
3030086	Stratford PS (2&3) Delivery Point	189 East Road, Stratford	1976
3060000	Kapuni Offtake	Palmer Road, Kapuni	1970
3060034	Kapuni (Lactose) Delivery Point	880 Manaia Road, Kapuni	1970

Station Number	Station Name	Address	Install Year
3070000	Ammonia Urea No 1 Offtake	Palmer Road, Kapuni	1982
3070002	Ammonia Urea Maui/Treated Delivery Point	Palmer Road, Kapuni	1986
4000001	Opunake Delivery Point	S H 45, Oaonui	1984
4000231	Okato Delivery Point	188A Oxford Road, Okato	1980
4001941	Te Kuiti South Offtake	Mangatea Road, Te Kuiti	1977
4002135	Otorohonga Delivery Point	Waitomo Valley Road, Otorohanga	1982
4002308	Pokuru Offtake	Candy Road, Te Awamutu	1980
4002652	Te Kowhai MLV	Limmer Road, Hamilton	1977
4003092	Glen Murray MLV	Highway 22, Glen Murray	1970
4003260	Pukekawa MLV	Murray Road, Pukekawa	1970
4003310	Whangarata MLV	Whangarata Road, Tuakau	1970
4003419	Glenbrook Offtake	Ingram Road, Pukekohe East	1981
4003503	Drury Delivery Point	211 Waihoehoe Road, Drury	1981
4003530	Papakura East Pressure Red.St.	101 Walker Road, Opaheke	1970
4003566	Clevedon MLV	3602 Papakura-Clevedon Road, Papakura	1981
4003677	Flat Bush Delivery Point	131 Murphys Road, Flat Bush	1997
4003739	Smales Rd MLV	94 Smales Road, East Tamaki	1970
4003770	Waiouru Rd MLV	105 Highbrook Drive, East Tamaki	1970
4003810	Westfield No.1 Delivery Point	453 Mt Wellington Highway, Westfield	1981
4020071	Horotiu Delivery Point	Horotiu Bridge Road, Horotiu	1981
4020321	Kuranui Rd Scraper Station	Kuranui Road, Morrinsville	1981
4020470	Tatuanui Delivery Point	3438 S H 26, Tatuanui	1985
4020500	Waitoa Delivery Point	Wood Road, Waitoa	1985
4050019	Runciman Road Pressure Reducing Station	Runciman Road, Pukekohe East	1984
4050059	Pukekohe Delivery Point	Butcher Road, Pukekohe	1981
4050141	Kingseat Delivery Point	Kingseat Road, Patumahoe	1982
4050230	Glenbrook Delivery Point	Mission Bush Road, Glenbrook	1984
4060016	Te Kuiti North Delivery Point	S H 3, Te Kuiti	1982
4070131	Tauwhare Delivery Point	825 Tauwhare Road, Tauwhare	1982
4070227	Cambridge Delivery Point	Bruntwood Road, Cambridge	1982
4080039	Matangi Delivery Point	Tauwhare Road, Matangi	1982
4090014	Kiwitahi Delivery Point	Morrinsville-Walton Road, Morrinsville	1991

Station Number	Station Name	Address	Install Year
4100022	Te Rapa Delivery Point	S H 1, Te Rapa	1999
4120083	Te Kuiti South Delivery Point	S H 30, Waitete Road, Te Kuiti	1982
4130001	Oakura Delivery Point	Wairau Road, Oakura	1993
4160001	Ngaruawahia Delivery Point	Brownlee Avenue, Ngaruawahia	1986
4170001	Ramarama Delivery Point	Ararimu Road, Ramarama	1983
4180001	Hunua Delivery Point	31A Hunua Road, Papakura	1970
4190001	Alfriston Delivery Point	109 Phillip Road, Manukau City	1983
4200001	Huntly Delivery Point	Hetherington Road, Huntly	1980
4210000	Te Awamutu North Offtake	Pirongia Road, Pirongia	1995
4220004	Pirongia Delivery Point	Pirongia Road, Pirongia	1995
4230001	Morrinsville Delivery Point	Haig Street, Morrinsville	1981
4300015	Southdown Delivery Point	Hugo Johnston Drive, Penrose	1996
4300098	Hillsborough MLV	Hillsborough Road, Hillsborough	1983
4300160	Links Rd MLV	Links Road, Titirangi	1983
4300210	Waikumete Rd MLV	Waikumete Cemetry, Waikumete Road, Glen Eden	1983
4300355	Henderson Valley Compressor St.	Off 110 Amreins Road, Taupaki	1983
4300356	Henderson Delivery Point	Off 110 Amreins Road, Taupaki	1996
4300672	Kanohi Rd MLV	Hellyer Road, Kaukapakapa	1983
4300903	Kaipara Flats Offtake Station	Woodcocks Road, Kaipara Flats	1983
4301268	Browns Rd MLV	Brown Road, Kaiwaka	1983
4301560	Salle Rd MLV	Salle Road, Ruakaka	1983
4301809	Whangarei Offtake	Otaika Valley Road, Whangarei	1983
4301850	Maungatapere MLV	S H 14, Maungatapere	1983
4320063	Warkworth No.2 Delivery Point	Woodcocks Road, Warkworth	2007
4320100	Warkworth Delivery Point	Woodcocks Road, Warkworth	1983
4330133	Maungaturoto Delivery Point	S H 12, Maungaturoto	1983
4340091	Whangarei Delivery Point	Dyer Street, Whangarei	1983
4350215	Kauri Delivery Point	S H 1, Near Vinegar Hill Road, Kauri	1989
4370069	Marsden Point Delivery Point	Mair Road, Marsden Point	1993
4380001	Bruce McLaren Rd Delivery Point	177 Bruce McLaren Road, Glen Eden	1985
4420025	Otahuhu B Power Station Delivery Point	Hellabys Road, Otara	1998
5000001	Pokuru Compressor Station	Candy Road, Te Awamutu	1983

Station Number	Station Name	Address	Install Year
5000113	Kihikihi Delivery Point	275 St Leger Road, Kihikihi	1983
5000209	Parawera MLV	Parawera Road, Parawera	1979
5000411	Arapuni West MLV	Arapuni Road, Arapuni	1983
5000416	Arapuni East MLV	Oreipunga Road, Arapuni	1983
5000544	Lichfield Meter Station	404R Lichfield Road, Lichfield	1983
5000594	Lichfield MLV	Pepperill Road, Lichfield	1983
5000720	Tokoroa Delivery Point	Baird Road, Tokoroa	1983
5000938	Rahui Rd MLV	Rahui Road (private forestry road), Kinleith	1979
5001091	Nicholson Rd MLV	450 Nicholson Road, Ngakuru	1985
5001215	Earthquake Flat Rd MLV	226 Earthquake Flat Road, Rotorua	1981
5001241	Rotorua/Taupo Offtake Station	Earthquake Flat Road, Rotorua	1985
5001401	Ash Pit Rd MLV	Ash Pit Road, Rerewhakaaitu	1985
5001555	Ngamotu Rd MLV	Ngamotu Road	1985
5001663	McKee Rd MLV	McKee Road (private forestry road), Matahina	1985
5001820	Kawerau Delivery Point	East Bank Road, Kawerau	1985
5020093	Te Teko Delivery Point	51 Tahuna Road, Te Teko	1985
5020192	Edgecumbe Delivery Point	492 Awakeri Road, Edgecumbe	1982
5030180	Rotorua Delivery Point	S H 5, Rotorua	1984
5040182	Reporoa Delivery Point	S H 5, Reporoa	1984
5050001	Kawerau Compressor Station	Hydro Road, off Matata East Road	1985
5050280	Ruatoki North MLV	Rewarau Road, Ruatoki	1985
5050458	Burnetts Rd MLV	Burnett Road, Nukuhou North	1985
5050665	Opotiki MLV	Pile Road, Opotiki	1985
5050928	Oponae Scraper Station	S H 2, Waioeka	1985
5051165	Trafford Hill MLV	S H 2, Waioeka	1985
5051401	Olliver Rd MLV	Oliver Road, Matawai	1985
5051641	Waihuka MLV	Waihuka Road, Te Karaka	1985
5051840	Kaiteratahi Scraper Station	S H 2, Kaitaratahi	1985
5052013	Gisborne Delivery Point	566 Back Ormond Road, Gisborne	1985
5060044	Opotiki Delivery Point	Factory Road, Opotiki	1984
5070137	Whakatane Delivery Point	64 Mill Road, Whakatane	1986
5080191	Broadlands MLV	Broadlands Road, Reporoa	1987

Station Number	Station Name	Address	Install Year
5080389	Taupo Delivery Point	269 Rakaunui Road, Taupo	1987
5090005	Lichfield Dairy No.1 Delivery Point	S H 1, Lichfield	1995
6050140	Paekakariki North MLV	Off S H 1, Paekakariki	1985
7000170	Saddle Rd MLV	Saddle Road, Ashhurst	1983
7000277	Foley Rd Offtake	Foley Road, Woodville	1983
7000503	Dannevirke Delivery Point	Rule Road, Dannevirke	1983
7000588	Tataramoa MLV	Tataramoa Road, Matamau	1983
7000844	Takapau Delivery Point	Nancy Street, S H 2, Takapau	1983
7001195	Knights Rd MLV	2752 Raukawa Road, Hastings	1983
7001469	Mangaroa Delivery Point	Mangaroa Road, Mangaroa	1983
7001482	Bridge Pa MLV	Maraekakaho Road, Hastings	1983
7001531	Hastings Delivery Point	Karamu Road South, Hastings	1983
7020212	Pahiatua Delivery Point	Mangahao Road, Pahiatua	1984
7030004	Mangatainoka Delivery Point	Kohinui Road, Mangatainoka	1984
7050001	Ashhurst Delivery Point	Saddle Road, Ashhurst	1990
8000044	Putaruru Delivery Point	Bridge Street, S H 1, Putaruru	1981
8000141	Hetherington Rd MLV	143R Hetherington Road, Matamata	1984
8000343	Kaimai Summit Scraper Station	3159 S H 29, Kaimai	1984
8000603	Pyes Pa MLV	Bathurst Crescent, Tauranga	1982
8000780	Mt Manganui Offtake station	172 L Kairua Road, Mt Maunganui	1984
8000805	Papamoa Delivery Point	S H 2, Te Puke	1984
8020020	Tirau Delivery Point	Okoroire Road, Tirau	1981
8030079	Tauranga Delivery Point	116B Birch Avenue, Tauranga	1982
8040049	Mt Maunganui Delivery Point	Truman Road, Mt Maunganui	1984
8050083	Rangiuru Delivery Point	S H 2, Te Puke	1984
8070001	Pyes Pa Delivery Point	Lakes Boulevard, Pyes Pa, Tauranga	2007

Table 3-4 : List of stations

3.10 List of Compressor Units

Station / Unit	Prime mover	Rating Power of Prime Mover (kW)	Compressor model	Capacity (scmh)	Install Date
Henderson 1	Waukesha F1197G Reciprocating	139	Ariel JGP2	3 520	1983
Rotowaro 3	Waukesha P9390 GSI Reciprocating	1,200	Worthington OF6XH4	61 300	1985
Rotowaro 4	Waukesha P9390 GSI Reciprocating	1,200	Worthington OF6XH4	61 300	1985
Rotowaro 5	Siemens SGT-1002S Gas Turbine	4,700	Delaval Stork 06MV4A Centrifugal	150 000	1998
Rotowaro 6	Siemens SGT-1002S Gas Turbine	4,700	Delaval Stork 06MV4A Centrifugal	150 000	1998
Pokuru 1	Waukesha L7042GSIU Reciprocating	746	Ariel JGR-4	29 900	1983
Pokuru 2	Waukesha L7042GSIU Reciprocating	746	Ariel JGR-4	29 900	1983
Kawerau 1	Waukesha F1197G Reciprocating	139	Ariel JG2	6 170	1985
Kawerau 2	Waukesha F1197G Reciprocating	139	Ariel JG2	6 170	1985
Mahoenui 1	Waukesha L7042GU Reciprocating	746	Worthington OF6SU-2	24 700	1979
Mahoenui 2	Waukesha L7042GU Reciprocating	746	Worthington OF6SU-2	24 700	1979
Mahoenui 3	Waukesha L7042GU Reciprocating	746	Worthington OF6SU-2	24 700	1979
Derby Rd 1	MEP 8 Reciprocating	1,340	Worthington Cub 6XH-1	61 000	1976
Derby Rd 2	MEP 8 Reciprocating	1,340	Worthington Cub 6XH-1	61 000	1976
Derby Rd 3	Waukesha P9390GSIU Reciprocating	1,250	Worthington OF6H4	59 900	1976
Kapuni 2	Waukesha P9390GSIU Reciprocating	1,250	Worthington OF6H4	61 300	1969
Kapuni 3	Waukesha P9390GSIU Reciprocating	1,250	Worthington OF6H4	61 300	1969
Kapuni 4	MEP 8 Reciprocating	1,340	Ingersoll-Rand 4RD S	37 800	1969
Kapuni 5	MEP 8 Reciprocating	1,340	Ingersoll-Rand 4RD S	37 800	1969
Kaitoke 1	Waukesha L7042GU Reciprocating	746	Ingersoll-Rand IR2D	21 400	1984
Kaitoke 2	Waukesha P9390GSIU Reciprocating	1,250	Worthington OF6H4	54 000	1984

Table 3-5 : List of compressor units

3.11 Number and Ages of Asset Classes

The definitions of asset classes and asset categories used in the AMP and shown below differ from those definitions described in the ID Determination and those reported in Schedules 9a, 9b and 12a. Most of the asset classes and categories use in the AMP map directly to the ID Determination definitions, eg. heating systems, compressors but some do not, eg. pressure regulators, pressure safety valves.

Section	Description	Pre 74	75 - 79	80 - 84	85 - 89	90 - 94	95 - 99	00 - 04	05 - 09	10 - 14	Total
3.2.2	Rectifier units	2	1	5	5	2	1	6	2	8	**32**
3.3	Compressors	4	6	5	4	0	2	0	0	0	**21**
3.4	Stations	48	21	106	30	7	14	0	5	0	**231**
3.4.2	Main line valves	39	6	42	17	1	3	0	0	0	**108**
3.4.3	Heating systems	12	9	51	15	2	9	0	4	1	**103**
3.4.4	Odorisation plants	0	0	0	2	1	3	14	1	2	**23**
3.4.5	Coalescers & filter/separators	4	7	13	5	0	5	0	0	0	**34**
3.4.6	Meters	0	0	26	48	10	19	5	33	19	**160**
3.4.7	SCADA & Communications - RTUs	0	0	0	0	0	0	0	51	15	**66**
3.4.8	Chromatographs	0	0	0	0	0	1	2	5	1	**9**
3.4.9	Pig Launchers & Receivers	13	4	36	9	0	2	0	0	0	**64**
3.4.10	Pressure Regulators	38	26	230	64	8	68	15	31	53	**533**
3.4.11	Pressure Safety Valves	39	31	157	37	12	55	7	33	44	**415**
3.4.12	Pilot Valves	27	14	145	38	10	54	85	21	54	**448**
3.4.13	Isolation Valves	801	343	1786	553	121	231	21	86	82	**4024**
3.4.14	Filters	85	38	186	58	13	22	4	12	6	**424**

Table 3-6 : Number and ages of asset classes

Gas Transmission Asset Management Plan 2013 – 2023

Service Levels
Section 4

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4. Service Levels

This section describes the Vector's GTB performance targets set under Vector's asset management strategy. As stated in Section 2.3.3, a key premise for the AMP is that existing reliability and supply quality levels will be maintained. Accordingly, these targets are presently set at a constant value for the current AMP planning period. Performance against these targets is also discussed.

Where appropriate the targets have been developed to align with the definitions developed by the Commerce Commission for Information Disclosure[1]. Vector has developed new procedures for recording and verifying data for performance against these targets from 1 July 2012. Data prior to this is based on analysis of available historical incident and compressor records.

4.1 Consumer Oriented Performance Indicators

The Commerce Commission has defined the consumer as:

> "a person that consumes or acquires gas transmission services".[2]

Consumers of Vector gas transmissions services are known as shippers.

In determining a set of relevant consumer oriented performance indicators, it is necessary to understand the business model adopted by Vector and the business relationship with the consumers of its gas transmission services.

Vector operates an open-access high-pressure pipeline system for the transportation of natural gas that complies with the Gas Specification (NZS 5442).

A party becomes a shipper by signing and meeting the requirements of a transmission services agreement which incorporates the Vector Transmission Code (VTC) and sets out the terms and conditions applicable to the use of the transmission system. Specifically with regards to gas quality, shippers are responsible for ensuring the gas they provide to Vector to have transported through Vector's gas transmission system meets NZS 5442. Vector's responsibility in respect of gas quality is limited to ensuring that the gas is not contaminated whilst it is transported by Vector.

The maximum amount of gas that Vector is required to receive at a receipt point and make available at a delivery point is the shipper's "transmission capacity". A shipper may have different types of transmission capacity, including: reserved capacity, supplementary capacity, legacy capacity and interruptible capacity. The first three types are "firm," that is, Vector may curtail such capacity only in the event of an emergency, or maintenance of the relevant parts of the transmission system. Vector may curtail interruptible capacity without notice at any time.

All transmission capacity is defined in terms of Maximum Daily Quantity (MDQ) and Maximum Hourly Quantity (MHQ), between a specific receipt point and delivery point. Vector is not required to receive and deliver gas in excess of the relevant MDQ and MHQ, although it may do so at its sole discretion.

A shipper requires gas to be shipped to a delivery point in order to supply it to one or more end-users downstream of that point. The required delivery pressure at most delivery points is a matter of concern to the relevant interconnected party rather than the shipper. At most delivery points the interconnected party is either a distribution network owner or a (direct-connected) consumer. In a few cases the consumer and the shipper are the same party.

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[1] Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Section 1.4.

[2] Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Section 1.4.

In most cases Vector does not have any direct contractual relationship with (or visibility of) consumers downstream of a delivery point. Clearly any issues that interrupt or curtail supply from the Vector transmission system can have a significant adverse effect on these consumers, as distribution companies do not have alternate sources of gas supply.

On some parts of the transmission system Vector undertakes gas odorisation on behalf of shippers (i.e. in respect of their role as gas suppliers). Vector's obligations in relation to odorisation are set out in the VTC.

Based on this present model, it follows that the key areas for consumer performance focus are:

- High standard of health, safety and environmental performance to reduce likelihood and severity of incidents occurring that would adversely affect the operation of the asset or harm people or the environment.
- Reliably receipting and delivering gas, including rapid resolution of interruptions due to an issue on the asset, should they occur.
- Accurately accounting for gas transported through the asset.
- Maintaining good contractual and day-to-day relationships with gas shippers.

The measures that follow are based on driving high levels of performance in relation to these areas. They are also consistent with other stakeholder needs as defined in Section 2.6.1. They are also presented with the intention of being consistent with the data required for Schedule 10 to the Gas Transmission Information Disclosure Determination 2012.

4.1.1 Response Time to Emergencies (RTE)

Vector Target

Respond to all emergencies in less than 180 minutes

Vector takes the safety of the public and its work force very seriously. Vector's aim is to attend to emergencies occurring on its transmission system as soon as practical to prevent any damage or harm to the public, employees, contractors and neighbouring properties.

The Vector target and definition are aligned to the quality standard specified by the Commerce Commission for the Default Price-Quality Path[3].

Definition of Performance Measure

The Gas Transmission Services Default Price-Quality Path Determination 2013 (NZCC 5) defines emergencies as follows:

"Emergency means an incident:

a. That is required to be reported under the "Guidelines for a Certificate of Fitness for High-Pressure Gas and Liquids Transmission Pipelines."

b. For which the GTB considers a representative of the GTB is required to immediately respond to"[4].

---

[3] Gas Transmission Services Default Price-Quality Path Determination 2013 [2013] NZCC 5.

[4] Gas Transmission Services Default Price-Quality Path Determination 2013 [2013] NZCC 5 Section 4.2.

The “Guidelines for a Certificate of Fitness for High-Pressure Gas and Liquids Transmission Pipelines”[5] define incidents to be reported as:

> “…all incidents that have occurred on or in the near vicinity of the pipeline, including leaks, third party damage, near-miss incidents, equipment failure, overpressure, etc.”

Vector has an Emergency Response Plan (ERP-SD-001) and has determined that it is the responsibility of the designated Duty Manager[6] to declare an emergency (and therefore the need for a Vector representative to attend site).

Possible emergency situations can be identified and communicated to Vector through a number of channels including service providers, staff, emergency services, customers, retailers, media, public or other stakeholders.

An initial assessment will be made by a control room operator and/or escalated to the Duty Manager as appropriate. Having assessed the information available, the Duty Manager may:

- Declare an emergency, and activate the emergency response team.
- Declare a potential emergency and put the emergency response team on standby.

or

- Declare there is no emergency and maintain a business as usual response.

The Response time to an Emergency (RTE) is the time elapsed from when an emergency is reported to Vector until Vector Gas Transmission personnel arrive at the location of the emergency.

RTE is the quality standard for the Gas Transmission Services Default Price-Quality Path Determination 2013 [2013] NZCC 5. The RTE should not exceed 180 minutes (Fig 4.1), unless the emergency is “excluded”.

9.1 Compliance with annual quality assessment formula

(a) A GTB’s RTE values for an Assessment Period must be such that:

$$\frac{RTE180}{(RTE_t - RTE_{excl})} = 1$$

(b) For the purposes of calculating the RTE values in clause 9.1(a):

$RTE180$ is the total number of Emergencies in the Assessment Period where the GTB’s RTE was less than or equal to 180 minutes;

RTE_t is the total number of Emergencies in the Assessment Period; and

RTE_{excl} is the total number of Emergencies in the Assessment Period for which the Commission has granted an exclusion in writing.

Figure 4-1 : Extract from Gas Transmission Service Default Price-Quality Path Determination 2013 [2013] NZCC 5

[5] Published by the Ministry of Business, Innovation and Employment (then Department of Labour) in 2002. These requirements form Section 4.9 of the Guideline.

[6] Duty Manager may also be referred to as Duty Officer – these are one and the same role.

Exclusions to the quality standard may be made when the standard cannot be met due to reasons beyond Vector's control. The requirements of the Gas Transmission Services Default Price-Quality Path Determination 2013 [2013] NZCC 5 are set out below:

"9.2 Exclusion of certain emergencies

a. If a GTB has a reasonable excuse for not responding to an emergency within 180 minutes, the GTB may apply to the Commission to be treated as having complied with the quality standard for that emergency by having the emergency excluded from the total number of emergencies in clause 9.1(a).

b. An exclusion request must:

   i. Be submitted to the Commission in writing within 30 working days of the emergency.

   ii. Include sufficient evidence demonstrating why it was reasonable that the GTB's RTE was greater than 180 minutes.

c. A GTB may exclude an emergency from the calculations of RTE values for the GTB's Compliance Statement only where the Commission has determined in writing that the emergency may be excluded."

Process for Measuring Performance

The control room operator records details of incidents and in the call log. The time a potential emergency event is reported to Vector, the time a Vector Gas Transmission representative arrives on site, and the time an event is declared an emergency by the Duty Manager will all be recorded. The RTE will be calculated in all cases where an emergency is declared.

Historic Performance

Vector's gas transmission system is operated and maintained to minimise the chance of an emergency occurring. Data has been collated for years[7] 2008 to 2012 by an analysis of reported incidents and is shown in Table 4-1. Historical incident data from legacy systems has been analysed to determine how many would have met the new criteria for an emergency. It should be noted that prior to 2012, Vector systems were not set up to record a verifiable response time.

The declaration of an emergency is a rare event, as the following analysis displays.

Year	2008	2009	2010	2011	2012
Number of Emergencies	1*	0	0	1*	1**

* No verifiable record of response time. ** Vector staff working on site.

Table 4-1 : Historical emergency and response time data

[7] Please note that all years referred to in this section refer to the 12 months ended 30 June of that year. For instance, '2008' refers to the period 1 July 2007 to 30 June 2008 inclusive. This is to ensure consistency with data provided for disclosure years going forward as defined in Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Section 1.4.

Future Performance

Two projects are currently being investigated which have the potential to improve future assurance of performance in relation to RTE. These are briefly outlined:

- **Digital Radio in Vehicles:** This is a digital radio project to completely replace the existing 20-year old conventional analogue voice network with a digital network. Among a variety of benefits, this would improve communication and the quality of data received from field personnel. It will also enable the implementation of GPS data monitoring in full to provide greater accuracy for vehicle location, provide "canned" messaging (ie. other information data packets) between vehicle and gas control (and office).
- **Global Positioning Systems (GPS) in Field Vehicles:** Vector currently utilises a GPS system running over the analogue Radio Telephone (RT) system. The GPS system is not fully operative due to the limitations of the analogue radio network. The GPS upgrade will address moving the GPS platform to a digital radio network and activating additional features within the GPS platform. Greater accuracy in respect of location of field personnel will provide a better response to maintenance break-downs, incidents and emergencies.

The significance of these projects for RTE is that they will allow the Gas Controller to readily see the position of, and communicate with, the field staff most closely located to the site of an emergency at the time it is called in. This gives a substantially improved confidence of within-target-time RTE response over the present use of last known locations and call-out rosters together with staff location planning.

4.2 Asset Performance Indicators

The performance indicators and associated targets in this section have been selected based on the limitations placed on Vector by the current regulatory framework. Any required mandatory changes that may arise would be subject to a review of quality/cost trade-offs.

4.2.1 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 put in place with the Field Service Providers (FSPs), Vector monitors gas transmission related public safety incidents and incidents notified by its employees. These incidents are reviewed monthly to ensure lessons are captured and where appropriate, corrective actions are implemented.

Performance Target

Vector Target

Vector's overall health and safety target is to achieve zero lost time injuries.

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

Figure 4-2~~Figure 4-2~~ below shows the long-term trend in lost time injuries at Vector. The figures are for Vector and include both electricity and gas activities.

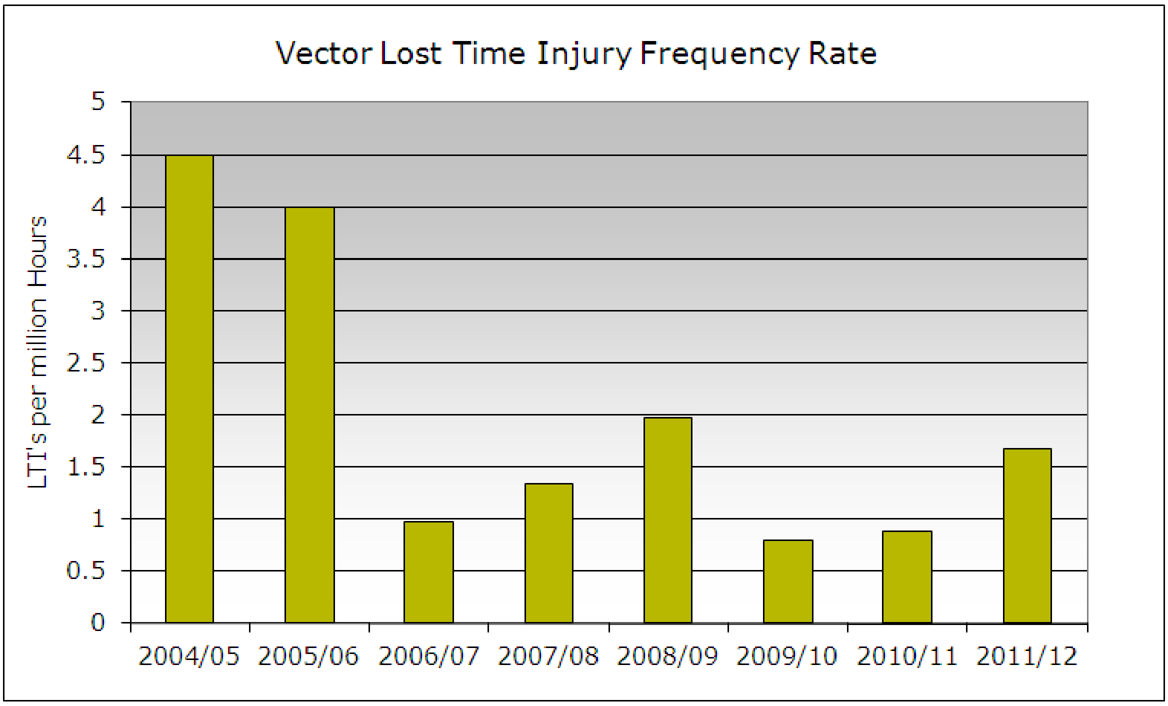

Figure 4-2: Lost time injuries at Vector

Note that activities performed in the Wellington electricity network (divested on 23 July 2008) are also included in this data.

Vector's health and safety policy states Vector'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 employees, contractors, members of the public and visitors in and within the vicinity of Vector's work environment and those people in the vicinity of its assets. Vector is committed to continual and progressive improvement in its health and safety performance and ensures it has sufficient, competent resources and effective systems at all levels of Vector to fulfil this commitment.

Any work conducted on and around Vector's assets by external parties, including its service providers, is also required to be conducted in line with the Vector health and safety policy and the Vector HSE management system.

Vector's health and safety policy objectives are to:

- Provide a safe and healthy work place for all staff, contractors, the public and visitors.
- Ensure health and safety considerations are part of all business decisions.
- Monitor and continuously improve health and safety performance.
- Communicate with staff, contractors, customers, and stakeholders on health and safety matters.
- Operate in a manner that minimises health and safety hazards.
- Encourage safe and healthy lifestyles, both at work and at home.

To achieve this Vector:

- As a minimum, meets all relevant legislation, standards and codes of practice for the management of health and safety.
- Identifies, assesses and controls workplace hazards.
- Accurately reports, records and learns from all incidents and near misses.

- Has established health and safety goals at all levels within Vector, and regularly monitors and reviews the effectiveness of Vector's health and safety management system.
- Consults, supports and encourages participation from its people on issues that have the potential to affect their health and safety.
- Promotes its leaders', employees' and contractors' understanding of the health and safety responsibilities relevant to their roles.
- Provides information and advice on the safe and responsible use of Vector's products and services.
- Suspends activities if safety would be compromised.
- Takes all practicable steps to ensure Vector's contractors work in line with this policy.

4.2.2 Unplanned Interruptions to Supply

Vector's strategic goal is to ensure supply reliability targets are achieved in accordance with business strategies and customer/consumer expectations. Supply interruptions provide an indication of the transmission system's reliability performance.

In the context of reliability performance, relevant matters include:

- Whether supply interruptions occur and if so, how often.
- The cause of any supply interruption.
- The duration of any supply interruption.
- The effect on consumers.

In general, supply interruptions can be categorised as either planned or unplanned. Planned interruptions may be required for Vector to carry out planned work (such as connecting a new customer) in a timely manner. Planned interruptions are usually carried out at a time to minimise inconvenience to consumers, after consultation with them.

Unplanned interruptions are usually the result of equipment failure or other events outside of Vector's control. Vector takes all reasonable and prudent steps to prevent such events. If an unplanned interruption should occur, Vector will endeavour to restore supply as soon as practicable consistent with its overriding health and safety obligations towards its staff, the public and the environment.

Performance Target

Vector will endeavour to not create any planned interruptions, however it is not feasible to set a target of zero as physical and/or commercial constraints may necessitate an interruption to allow planned maintenance to proceed. Unplanned interruptions due to asset performance should be exceptionally rare events and the target is set at no more than once per year.

Vector Target

No more than 1 Unplanned Interruption per year.

Definition of Performance Measure

The following definitions apply to the supply reliability to a consumer:

- An **interruption** is the cessation of the supply of gas for a period of 1 minute or longer, other than by reason of disconnection in accordance with the terms of the contract under which the gas is supplied[8].
- A **planned interruption** is any interruption in respect of which not less than 10 days notice was given, either to the public or to all consumers affected by the interruption[8].
- An **unplanned interruption** is any interruption in respect of which not less than 10 days notice, or no notice, was given, either to the public or to all consumers affected by the interruption[8].

For the purpose of clarity, Vector in this context, excludes the following from the above definitions:

- Interruptions that occur in accordance with the terms on a Vector Transmission (VT) interruptible contract.
- Disconnections for the purposes of safety due to third party interference.

Process for Measuring Performance

Performance in relation to unplanned interruptions is measured in terms of:

- The frequency of interruptions (the number of interruptions in one reporting year).
- The duration of the unplanned interruptions (the weighted average time from when interruption is reported to when the supply is reinstated).

Sub-Categories

Unplanned interruptions can be caused by a range of issues. A set of sub-categories relating to the cause of the unplanned interruption event will be recorded in order to facilitate the identification, analysis and understanding of any potential performance issues. The sub-categories associated with unplanned interruption events are as follows:

Cause Sub-Category

Sub-Category	Definition
Third Party Event	This is an interruption to supply caused by a third party event (or events) including: • Unauthorised access by a non-Vector transmission representative that interferes with normal pipeline operation. • An event on a third party pipeline that affects normal VT pipeline operation. • These do not count towards the target as they are not within Vector's control, but must be recorded so their exclusion can be explained.
Equipment Failure	This is an interruption to supply due to the failure of a Vector pipeline, compressor, or other key equipment.
Customer Flows	Customer flows exceeding contracted quantities such as when a delivery point exceeds its Maximum Daily Quantity (MDQ)[9].

[8] Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Section 1.4.

[9] It is important to note the following qualification: a shipper has no contractual right to exceed MDQ/MHQ. If it does so it is in Unauthorised overrun and is liable for any loss suffered by the GTB. By definition, any such Loss (most likely an interruption to another shipper) is not a GTB performance failure.

Sub-Category	Definition
Insufficient Pipeline Capacity	This is an interruption to supply due to pipeline pressure reduced for repair.

Table 4-2 : Unplanned incident sub-cause category table

Historic Performance

Data has been collated for years 2008 to 2012 by an analysis of Vector's reported incidents.

Year	2008	2009	2010	2011	2012
Number of Unplanned Interruptions	0	0	0	1	1

Table 4-3 : Historical number of unplanned interruptions

Future Performance

There are two programmes presently being evaluated which are expected to maintain or improve performance specifically in relation to unplanned interruptions. These are briefly outlined below

- **Pipeline Replacement and Renewal**

  As part of routine monitoring, Vector has identified several likely projects need to assure or improve system integrity. The projects will address known hazards to reduce the consequence or frequency of occurrence. Alternatively they may also provide significantly improved information on which to base further risk assessments and future investment decisions (such as enhanced in-line monitoring and geotechnical risk monitoring and assessments). Refer to Section 6.3.4 Pipeline Replacement and Renewal for more detail.

- **Pressure Regulator Replacement Programme**

  Where pressure regulators have poor reliability, maintainability, performance or are obsolete they will be programmed for replacement. Refer to Section 6.5.10 Pressure Regulators for further detail.

4.2.3 Incidents and Emergencies

Vector's gas transmission system covers a significant part of the North Island. In some areas it traverses extremely rugged terrain with difficult access, while in other areas it extends into highly populated urban areas. A significant part of the system is installed in areas accessible by the public.

The system is therefore exposed to a variety of risks including the risk of damage by land owners, contractors and members of the public. In addition there are environmental factors such as land erosion or landslide potential which increase the risks to the overall network. There are also a number of hazards or risks that the transmission system can impose on neighbouring properties, personnel or live stock.

Vector's goal is to ensure safety of the public, staff and contractors in relation to its gas transmission facilities and to maintain the integrity of its assets. For this reason, Vector treats the recording, monitoring and analysis of emergency events very seriously. It is through this monitoring that improvement initiatives can be developed and implemented.

Performance Target

The ratios of non-significant events to significant events and non-significant events to emergencies have been chosen as the performance metrics for the asset. This should give a good indication of the strength of the reporting culture as well as indicating the number of significant events and emergencies. The targets are the expected minimum sustainable performance based on the last 5 years of data.

Vector Target

Ratio of non-significant events to significant events > 30:1

Ratio of non-significant events to emergencies > 220:1

Definition of Performance Measure

A non-significant event is an Incident which has either no impact, minor or moderate consequence.

A significant event is an Incident where the consequence was considered greater than moderate.[10]

Incidents and emergencies have previously been defined in Section 4.1.1.

Process for Measuring Performance

The information relating to the incident or emergency will be recorded by Vector gas control. The event will be assessed and categorised as an incident, emergency or RTE event in accordance with established definitions and procedures. The event will be notified (e.g. via OATIS or escalation to Duty Manager) and responded to as appropriate. A second Gas Controller will confirm the assessment of the unplanned interruption and all other relevant facts associated with the record. The records will also be subject to regular internal audit.

Details relating to the incident or emergency will also be entered into Vector's risk and incident management system. This is Vector's primary tool for managing performance of internal reporting, analysis and tracking the timely completion of remedial actions.

Historic Performance

Data has been collated for years 2008 to 2012 by an analysis of Vector's reported incidents.

[10] Vector categorises consequences as Minor, Moderate, Serious, Major and Catastrophic – all are defined in detail in the Vector Health, Safety and Environmental Management System Element 9: Incident Reporting, Investigation and Management page 9.

Gas Year	2008	2009	2010	2011	2012
Number of Incidents	66	135	182	240	234
Ratio of Non-significant Events to Significant Events	21:1	26:1	25:1	29:1	32:1
Number of emergencies	1	0	0	1	1
Ratio of Non-significant Events to emergencies[11]	63:1	-	-	232:1	227:1

Table 4-4 : Historical incident and emergency performance

4.2.4 Compressor Reliability and Availability

Compressors are critical to the performance of Vector's transmission system. Without them, the system is not able to consistently deliver consumers' contractual capacity. Compressors, being rotating equipment, are expected to have a lower availability compared to pipelines (which are more robust and have no moving parts). It is therefore important to monitor the reliability performance of compressors to ensure the reliability performance of the system.

Performance Target

For the year 2013 onwards Vector will be recording verifiable compressor information to meet the requirements for information disclosure[12]. This will allow reporting by compressor of number of hours compressor ran, number of hours compressor available for service and number of instances where the compressor failed to start[13]. The number of instances where a compressor was required but unavailable for service will also be reported by compressor station.

Vector's internal performance targets are given below. The targets are the expected best sustainable performance based on the last 5 years of data.

Vector Target

Maintain compressor fleet reliability (excl. planned outages) >= 97%

Vector Target

Maintain compressor fleet availability (incl. planned outages) >= 95%

Definition of Performance Measure

Compressor reliability and availability is monitored and reported. Two measures are monitored and formally recorded on a monthly basis, with the annual figures reported here, i.e.:

- Annual reliability (excl. planned outages) is the percentage of hours that the compressor fleet was unaffected by unplanned outages. This is a measure of the effect of breakdowns and the resulting unexpected maintenance.

[11] Note that if an emergency is declared as per 4.1.1, the consequence would always be rated at least serious. Hence an emergency would never also be counted a non-significant event.

[12] Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Schedule 10a.

[13] This applies to both remote and local starts. If the start is not successful first time, then it is counted.

- Annual total availability is the percentage of hours that the compressor fleet was unaffected by unplanned and planned outages. This measure also includes planned maintenance and is the overall measure of fleet management effectiveness.

Process for Measuring Performance

Compressor starts, stops and malfunctions are recorded with a time stamp on the SCADA system.

Gas control will record details (including times) of the starts, stops and malfunctions for each compressor in the compressor event log.

Historical Performance

Data has been collated for years 2009 to 2012 by an analysis of compressor up time records.

Data was not recorded for year 2008 and is available from the last 9 months of year 2009 onwards. This information is based on historical records which were reported in a manner which prevents thorough verification. For the 2013 year onwards improved recording processes have been put in place. The historic reliability and availability performance of the compressors is shown in the following graphs and tables:

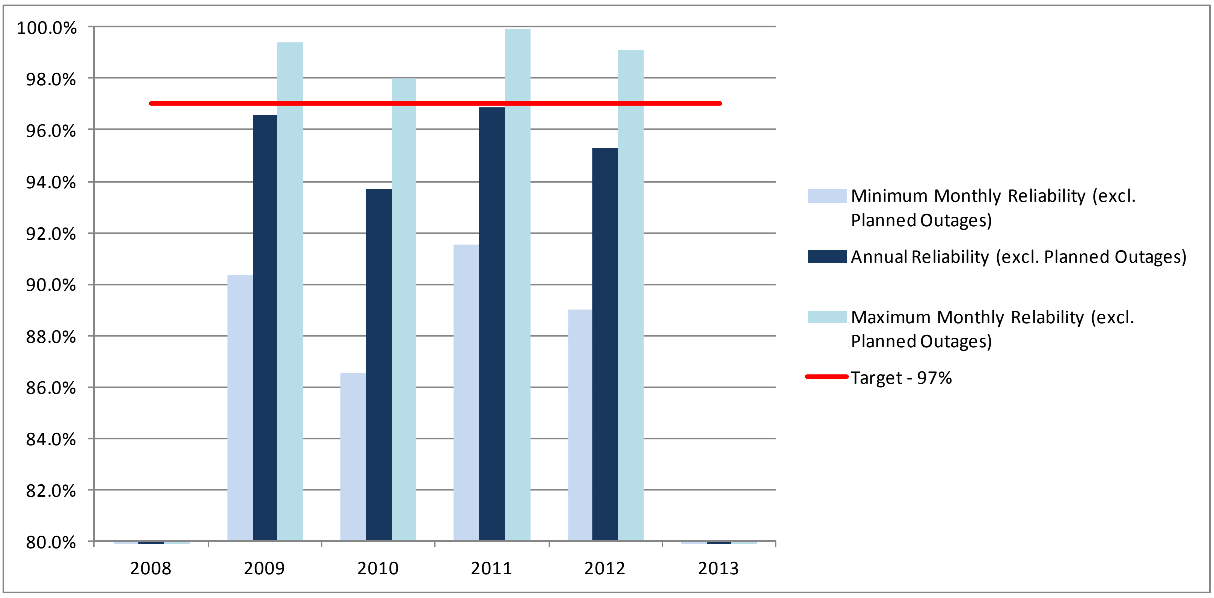

Figure 4-3 : Compressor annual reliability (excl. planned outages)

Year	2008	2009**	2010	2011	2012
Annual Reliability (excl. Planned)	ND*	96.6%	93.7%	96.9%	95.3%
Minimum Monthly Reliability (excl. Planned)	ND*	90.3%	86.6%	91.5%	89.0%
Maximum Monthly Reliability (excl. Planned Outages)	ND*	99.4%	98.0%	100.0%	99.1%

*ND = No data recorded for year 2008. ** Based on 9 months of data recorded for year 2009

Table 4-5 : Compressor reliability historical performance

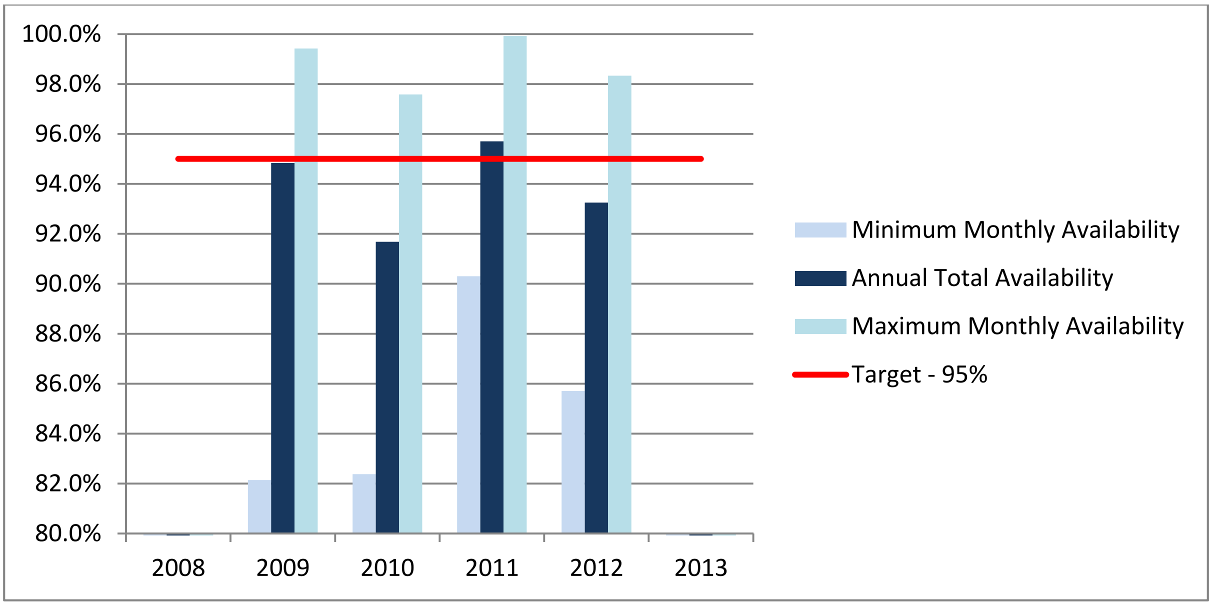

Figure 4-4 : Compressor annual total availability (incl. planned outages)

Year	2008	2009**	2010	2011	2012
Annual Total Availability	ND*	94.8%	91.7%	95.7%	93.3%
Minimum Monthly Availability by Gas Year	ND*	82.1%	82.4%	90.3%	85.7%
Maximum Monthly Availability by Gas Year	ND*	99.4%	97.6%	99.9%	98.3%

*ND = No data recorded for year 2008

** Based on 9 months of data recorded for year 2009

Table 4-6 : Compressor availability historical performance

Future Performance

Two main initiatives are currently underway which have the potential to improve future performance in terms of compressor availability. These are briefly outlined below:

- **Control System Upgrade Programme**

  The control systems of the compressors are obsolete, and a programme for their phased replacement has been initiated. The control systems are critical to the start and operating reliability of the machines, with faults requiring a technician to attend site to manually reconfigure the systems. Replacement digital control systems will allow the collection of real-time data, which will facilitate early detection of abnormal conditions and developing faults, which will help reduce both the incidents of unplanned outages and minimise repair time and cost.

- **Gas Coolers**

  These can have a significant impact on the availability of compressors. Cooling is a critical part of compression since excessively hot gas can damage the coating of any pipeline that receives it. Lack of cooling can prevent a station from being operated at all. Insufficient cooling can prevent a compressor from achieving its full capacity.

  Coolers are necessarily exposed to outdoors environments (often very corrosive marine type environments). A review of available operating data has highlighted that coolers are becoming less reliable through natural deterioration despite rigorous maintenance programmes being in place.

A cooler replacement programme, utilising “state of the art” coating technologies is currently underway. It is anticipated that this programme of work will improve the availability of compression systems. Further programme detail may be found in Section 6.4.2.5 Gas Coolers.

4.2.5 Public Reported Escapes and Gas Leaks

Public Reported Escapes (PRE) is commonly used in New Zealand and Australia to measure the integrity of gas distribution systems. From 2013 onwards Vector will be recording verifiable gas escape and leak information to meet the requirements for information disclosure[14] for its Gas Transmission system.

There are very few instances when gas has escaped due to transmission pipeline rupture. An escape is much more likely to be gas due to venting from a pressure relief valve at a station such as a compressor station or delivery point (which may be because the valve itself has malfunctioned).

There are also a number of controlled gas venting scenarios such as stopping and starting of compressors. Planned or unplanned maintenance may also require gas to be vented to allow work to proceed safely. These can occasionally lead to false alarms from third parties who are not familiar with these types of operations.

Performance Target

Vector’s target is determined by a combination of historical performance and previous internal performance targets. The target is the expected minimum sustainable performance based on the last 5 years of data.

Vector Target

No more than 13 confirmed public reported escapes per 1000 km per year.

Definition of Performance Measure

Escapes are defined as any escapes of gas confirmed by Vector excluding third party damage events, routine survey findings and no traces events[15].

PRE is reported per 1,000 km of pipeline and is calculated by dividing the total number of confirmed public reported escapes of gas on the transmission system (including delivery points and compressor stations) by the total length of Vector’s Gas Transmission system (2,200km) and multiplying by 1,000.

Categories of Gas Leaks

As well as PRE, Vector is required to disclose a number of other categories of gas leaks[16]. They are included here for completeness and are defined in Table 4-7 below:

[14] The disclosure requirements are set out in Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Schedule 10b.

[15] This aligns with the disclosure requirements set out in Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Schedule 10b. No traces means those events where a smell of gas was reported, but no trace of a leak could be found.

[16] Decision No. NZCC 24 Gas Transmission Information Disclosure Determination 2012 Schedule 10b ref 18.

Gas Leak Category	Definition
Gas Leak	A reported uncontrolled release of gas from the Vector Gas Transmission System.
Number of Confirmed Gas Leaks caused by Third Parties	Count of gas leaks caused by a third party interfering with a Vector pipeline that is confirmed by Vector.
Number of Gas Leaks detected by Vector	Count of all gas leaks detected by Vector.
Number of Gas Leaks that did not result in disruption to supply	Count of all gas Leaks that did not result in an Interruption[17].

Table 4-7 : Gas leak sub-category definition summary

Historical Performance

Data has been collated for years 2008 to 2012 by an analysis of Vector's reported incidents. The historical performance in relation to PRE is shown in Table 4-8 below:

Category	Year				
	2008	2009	2010	2011	2012
Number of confirmed public reported gas escapes *	5	12	29	29	26
Number of confirmed public reported gas escapes per 1000 km of pipeline	2.2	5.2	12.6	12.6	11.3
Number of Gas Vents **	2	9	16	14	17
Number of Gas Leaks	3	3	13	15	9
Number of Gas Leaks that did not disrupt supply	3	3	13	15	9
Number of Gas Leaks Detected by Vector	2	3	11	12	5
Number of Confirmed Gas Leaks caused by Third Parties	0	0	0	0	0

* This is the sum of the number of gas vents and gas leaks in the year.

**A Gas Vent is a controlled release of gas from the Vector Gas Transmission System.

Table 4-8 : PRE historical data

17 Interruption is defined in Section 4.2.2.

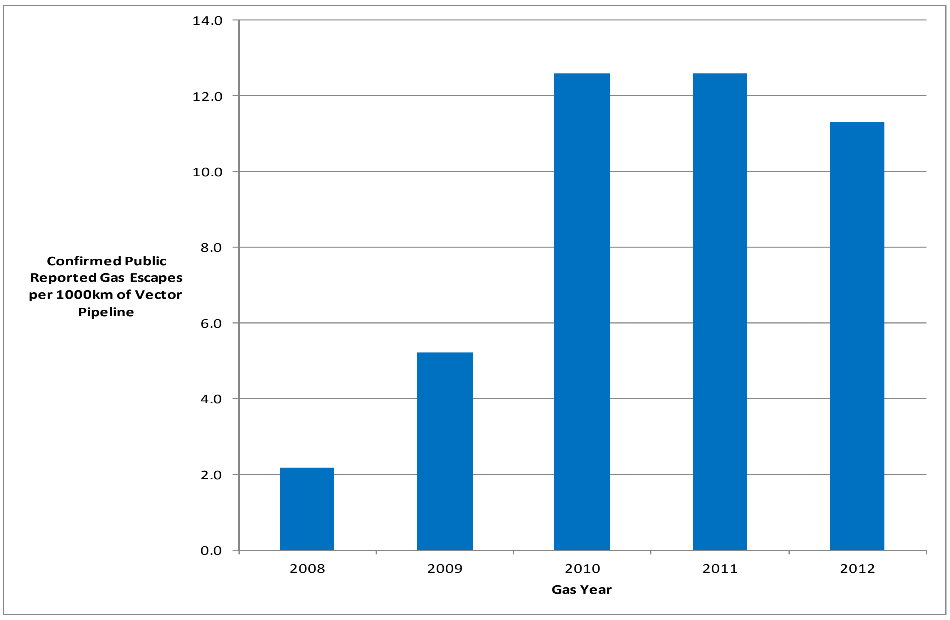

Figure 4-5 : Confirmed public reported gas escapes per 1000 Km of Vector pipeline

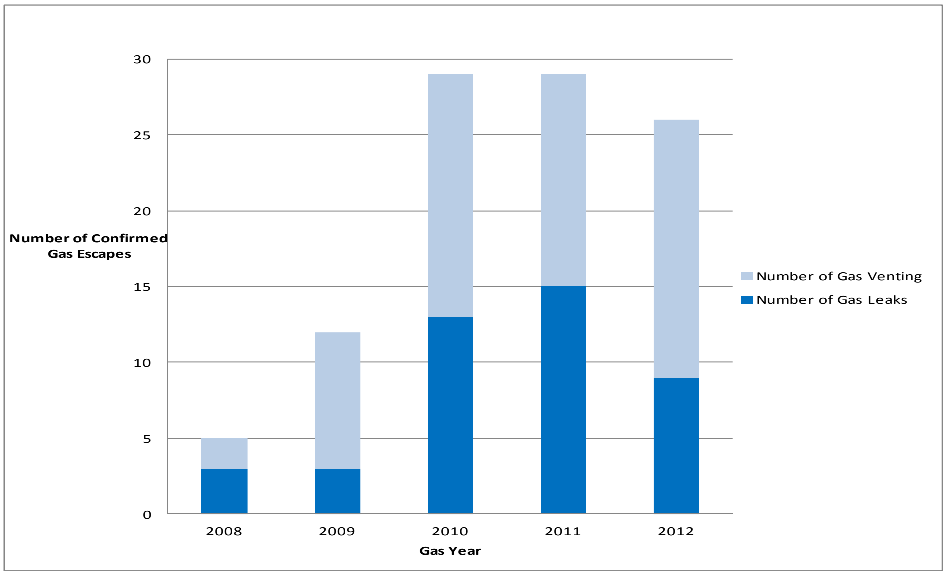

Figure 4-6 : Confirmed public reported gas escapes, showing proportion of gas leaks and gas venting

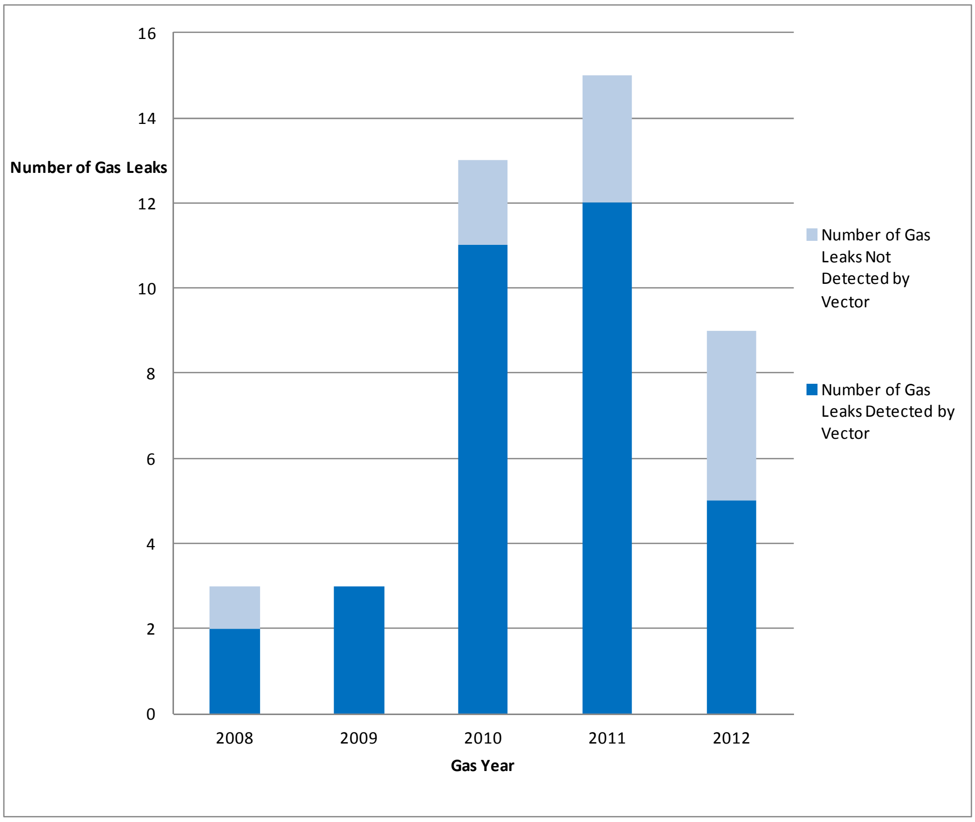

Figure 4-7 : Gas leaks, showing proportion of gas leaks detected by Vector

Future Performance

There is presently one programme which is currently underway which has the potential to improve future performance in relation to PRE. This is briefly outlined below:

- **Regulator Replacement Programme**

  There have been a number of cases where regulators at DP stations have failed to lock up under low or no-flow conditions, causing a pressure relief valve to operate and discharge gas. These issues combined with improved reporting methodology account for the increased rate of gas leaks from 2010. Vector has a programme underway to replace regulators and pressure relief valves and their associated pilot valves that have poor performance or are obsolete. Refer to Section 6.5.10 Pressure Regulators for further detail.

  This programme will as a minimum allow Vector to maintain its existing performance, if not improve it with respect to gas leaks and venting at stations.

4.2.6 Unaccounted for Gas

Unaccounted For Gas (UFG) arises from a combination of many unrelated factors. UFG has been used as a measure of gas transmission system efficiency internationally.

UFG provides a measure of the effectiveness of the methods used to manage the physical integrity of a gas transmission system and its gas measurement systems.

UFG results primarily from uncertainties in gas measurement systems. UFG may also arise from gas escapes (however caused). A key means of minimising UFG is to identify and quantify potential sources of UFG.

Vector has measured and reported UFG for the Gas (Information Disclosure) Regulations 1997 for the following four pipeline systems: North and Central, Bay of Plenty, Frankley Rd-Kapuni and South.

For year 2013 the reported pipeline systems have been changed to align them with the UFG and balancing costs reported in “Notice to supply information to the Commerce Commission under s53ZD of the Commerce Act 1986”. The new pipeline systems are: North, Bay of Plenty, and South–Kapuni–Frankley-Road (SKF).

Such historical information provides guidance concerning UFG performance and trends. It is not possible to eliminate UFG entirely. In relation to gas measurement specifically:

- All gas measurement devices have their own inherent uncertainty (“tolerance”).
- The population of gas measurement devices has a very diverse age profile: older devices of a given type generally have greater uncertainty than more modern devices of the same type.
- While gas measurement devices are all subject to periodic testing, they cannot all be tested simultaneously: some devices will have been recently tested (and if necessary serviced and recalibrated) while the rest will have been in service for varying periods of time since previously tested.
- If a gas measurement device is found by testing to have an unacceptable uncertainty, it may not be possible to determine when that first occurred or fully correct for that excessive uncertainty.
- Conversion of measured quantities (e.g. volume) to energy quantities inevitably entails a level of uncertainty.

Reducing UFG beyond a certain point becomes “exponentially” more expensive, both in terms of capital expenditure and (in particular) operating expenditure and is therefore not cost effective. Vector’s objective is therefore to keep UFG within an acceptable minimum range.

Performance Target

Vector’s goal is to keep UFG within a practical minimum range, as set out below. The target is the expected best sustainable performance based on the last 5 years of data.

Vector Target

Maintain calculated UFG in each pipeline to within an annual range of +/- 1%

Definition of Performance Measure

The definition of UFG below is from the Vector Transmission Code (VTC), Section 1 Definitions and Construction.

UFG means the quantity of gas calculated in accordance with the following formula:

$$\mathbf{UFG = \sum Receipts - \sum Offtakes + Line\ Pack_{start} - Line\ Pack_{end} - Fuel - Gas\ Vented}$$

Where, in respect of the same time period:

Receipts means the aggregate quantities of gas measured as having entered a pipeline at all receipt points on that pipeline within that period.

Offtakes means the aggregate quantities of gas measured as having been taken at all delivery points on that pipeline within that period.

Line Pack$_{start}$ means the line pack[18] at the start of that period.

Line Pack$_{end}$ means the line pack at the end of that period.

Fuel means the quantity of gas used in the operation of equipment on or near a Pipeline (including compressors and line heaters) during that period.

Gas Vented means any quantity of gas estimated to have been (deliberately or otherwise) vented during that period.

UFG can therefore be seen as the residual quantity required to ensure "closure" of an energy balance across a given pipeline over any given period of time (accepting that a degree of uncertainty attaches to each variable in the UFG calculation)

UFG may be a positive or a negative number. Based on the formula above, a positive number represents a "loss", a negative number a "gain". It must be stressed that, absent any venting, UFG does not represent a physical loss or gain, notwithstanding that it may be commercially treated as such.

Process for Measuring Performance

Data is collected from gas measurement systems by SCADA, Autopoll or manual reading. Such data is collated and converted into energy quantities in Vector's "Flow2E" system before being uploaded into OATIS.

Energy quantities (daily and hourly GJ) initially uploaded into OATIS may be not be validated. Once the metering team has reviewed it they will validate the energy quantities. Validated data may be subject to correction later if and when new information comes to hand.

Pressure and gas property data is used to calculate line packs.

UFG is estimated daily for each pipeline system, and publicly reported on a monthly basis once all the necessary data has been received and processed.

UFG is currently calculated in a spreadsheet maintained by the metering team.

Sub-Categories

As implied by the above equation, UFG for a given pipeline is calculated from a line balance for that pipeline.

A line balance may be performed, and hence UFG calculated, for any part of the transmission system for which both receipts and deliveries can be determined. Hence it is possible to calculate UFG for some parts of the above pipelines. In the event that UFG for the pipeline as a whole is showing an adverse trend this may assist in isolating the source of the problem.

It should also be noted that some of Vector's pipelines may be reconfigured for maintenance or due to an emergency event. This may cause a change in UFG for a period of time. For example, if the normally closed connection between the 200 line and the North pipeline system is opened, UFG may shift between the SKF pipeline system and the North pipeline system.

[18] Line Pack means, in relation to a Pipeline, the total quantity of Gas in that Pipeline at any time.

Transmission System Sub-Category

Sub-Category	Definition
South System (2008-2012)	This includes the pipeline from Kapuni to Wellington. It also includes the pipeline from Himatangi to Hastings
Frankley Rd- Kapuni System (2008-2012)	This includes the pipeline from and including the Frankley Road Off take station to Kapuni.
Bay of Plenty System	This includes the pipeline from and including Pokuru Compressor Station to Gisborne and the pipeline to Tauranga and Mt Maunganui.
North and Central System (2008-2012)	This includes all of the Vector pipelines and stations north of and including Rotowaro Compressor Station. It also includes the pipeline from Kapuni to Papakura and the Morrinsville system between Temple View and Rotowaro.
South Kapuni Frankley Road (SKF) System (new 2013)	This includes the pipeline from and including the Frankley Road Off take station to Kapuni and the pipelines from Kapuni to Wellington. It also includes the pipeline from Himatangi to Hastings, and the pipeline from Kapuni to Pokuru
North System (new 2013)	This includes all of the Vector pipelines and stations north of and including Rotowaro Compressor Station. It also includes the pipeline from Pokuru to Papakura and the Morrinsville system between Temple View and Rotowaro.

Table 4-9 : Transmission System Sub-Category

Historical Performance

The historical performance in relation to UFG is shown in the following tables.

South System

Year	2008	2009	2010	2011	2012
Unaccounted for gas [a] (GJ p.a.)	32,645	43,210	43,156	6,432	152,808
Gas into System [b] (GJ p.a.)	10,537,176	10,692,344	10,710,092	10,416,050	10,701,067
UFG % $\frac{a \times 100}{b}$	0.31	0.40	0.40	0.06	1.43

NOTE: The >1% value for South system exceeds the performance target. This was investigated and while no single factor was identified metering discrepancy at Belmont and issues with the Kapuni North check meter were contributing factors. In 2013 the South and Frankley Rd- Kapuni Systems will be combined and reported as the SKF pool. Recalculating on this basis gives a UFG of approximately 0.22%.

Table 4-10 : South system

Frankley Rd- Kapuni System

Year	2008	2009	2010	2011	2012
Unaccounted for gas [a] (GJ p.a.)	(157,248)	(188,084)	(167,043)	(115,659)	(73,379)
Gas into System [b] (GJ p.a.)	20,399,390	23,194,720	24,821,335	25,225,638	25,095,614
UFG % $\frac{a \times 100}{b}$	(0.77)	(0.81)	(0.67)	(0.46)	(0.29)

Table 4-11 : Frankley Rd- Kapuni system

Bay of Plenty System

Year	2008	2009	2010	2011	2012
Unaccounted for gas [a] (GJ p.a.)	26,763	(7,750)	41,622	(2,120)	20,558
Gas into System [b] (GJ p.a.)	9,763,970	8,931,816	8,937,851	8,426,870	9,116,794
UFG % $\frac{a \times 100}{b}$	0.27	(0.09)	0.47	(0.03)	0.23

Table 4-12 : Bay of Plenty system

North and Central System

Year	2008	2009	2010	2011	2012
Unaccounted for gas [a] (GJ p.a.)	184,596	328,004	120,579	292,335	340,176
Gas into System [b] (GJ p.a.)	64,613,328	49,300,737	49,758,988	50,166,682	54,779,478
UFG % $\frac{a \times 100}{b}$	0.29	0.67	0.24	0.58	0.62

Table 4-13 : North and Central system

Future Performance

Ongoing system modelling (Refer to Section 5 System Development Planning) identifies locations for ongoing metering upgrades and replacements throughout the Transmission system. The AMP presently identifies plans for potential meter upgrades/replacements at Harrisville, Temple View and Kinleith No. 2 delivery points.

Vector is presently developing a proposal for a project to upgrade OATIS to calculate UFG directly, as opposed to using the current spreadsheet-based methodology. The benefits are expected to be a more robust, repeatable validation of line pack and more accurate granular (i.e. daily) data.

Gas Transmission Asset Management Plan 2013 – 2023

System Development Planning

Section 5

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5. System Development Planning

In the context of this AMP, system development refers specifically to projects that result in changes to system capacity and/or configuration – and include those projects which will:

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

5.1 System Development Processes

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

5.1.1 System Planning Process

Vector's primary objectives in system planning are to identify and prevent foreseeable transmission system related capacity constraints and design compliance issues caused by the plans of third parties, in a safe, technically efficient and cost-effective manner. The planning process involves identifying and resolving:

- Potential breaches of the Vector transmission System Security[2] Standard.
- Supply to new developments or areas requiring gas connections.
- Supply to existing connections requiring increased capacity.
- Relocating assets, when reasonably required by third parties.

These situations are identified through system measurement and monitoring (system pressure and flows), assessing customer feedback, and gas flow modelling under future load growth scenarios, or under credible contingency scenarios.

Relocations are identified following third party works notifications to Vector.

Effective system modelling requires a sound understanding of the system configuration under normal and credible contingency situations, asset capacity and capability, and a reasonable demand forecast, including actual gas usage trends. The demand forecast model is based on analysis of past demand and usage trends, anticipated customer growth (including known customer intentions), technology trends, demographics, population growth, and industry trends.

Solutions addressing system capacity and security constraints may be asset or non-asset based, and the optimal solution may not necessarily result in system augmentation. In evaluating the solution options, the following are considered:

- A review of the asset capacity and capability if required using actual site data.

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1 The main requiring authorities are local authorities, KiwiRail and NZTA.

2 "Security" as used in a planning context means the security of the gas supply – ie. likelihood that supply may be lost or not delivered at the required pressure.

- Use of risk assessment criteria to ascertain risk tolerability, and to test that the solution cost is not disproportionate to the benefits obtained.
- Removing capacity constraints caused by a specific asset so as to improve the overall capacity of an asset (for example, upgrade a heater, filter, meter or pressure regulator to increase the overall capacity of a gate station).
- Ensuring that where possible and practical, any solution to a short-term issue will also meet the long-term needs and so avoid asset stranding.
- System development efficiency improvements[3] or non-asset solutions[4] where possible and practical to defer system expenditures. If asset solutions are inevitable, smaller projects are chosen over larger projects, wherever feasible, to reduce the risk of stranded assets. Early investment is avoided unless there are good reasons to do otherwise (for example, to take advantage of the synergy of implementing in conjunction with other projects).
- Aligning the system development programme with other work programmes such as asset maintenance to achieve synergy benefits where possible and practical.
- Avoiding reputation damage and consequential financial loss arising from the loss of supply to customers.
- Ensuring recommended solutions are commercially sustainable.
- Achieving an appropriate return on investment under the regulatory regime.

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

[3] Refer Section 5.5.5.

[4] For example, integrated solutions with customers – sometimes their initial requirements can be relaxed without any major consequence. This can lead to substantial cost savings.

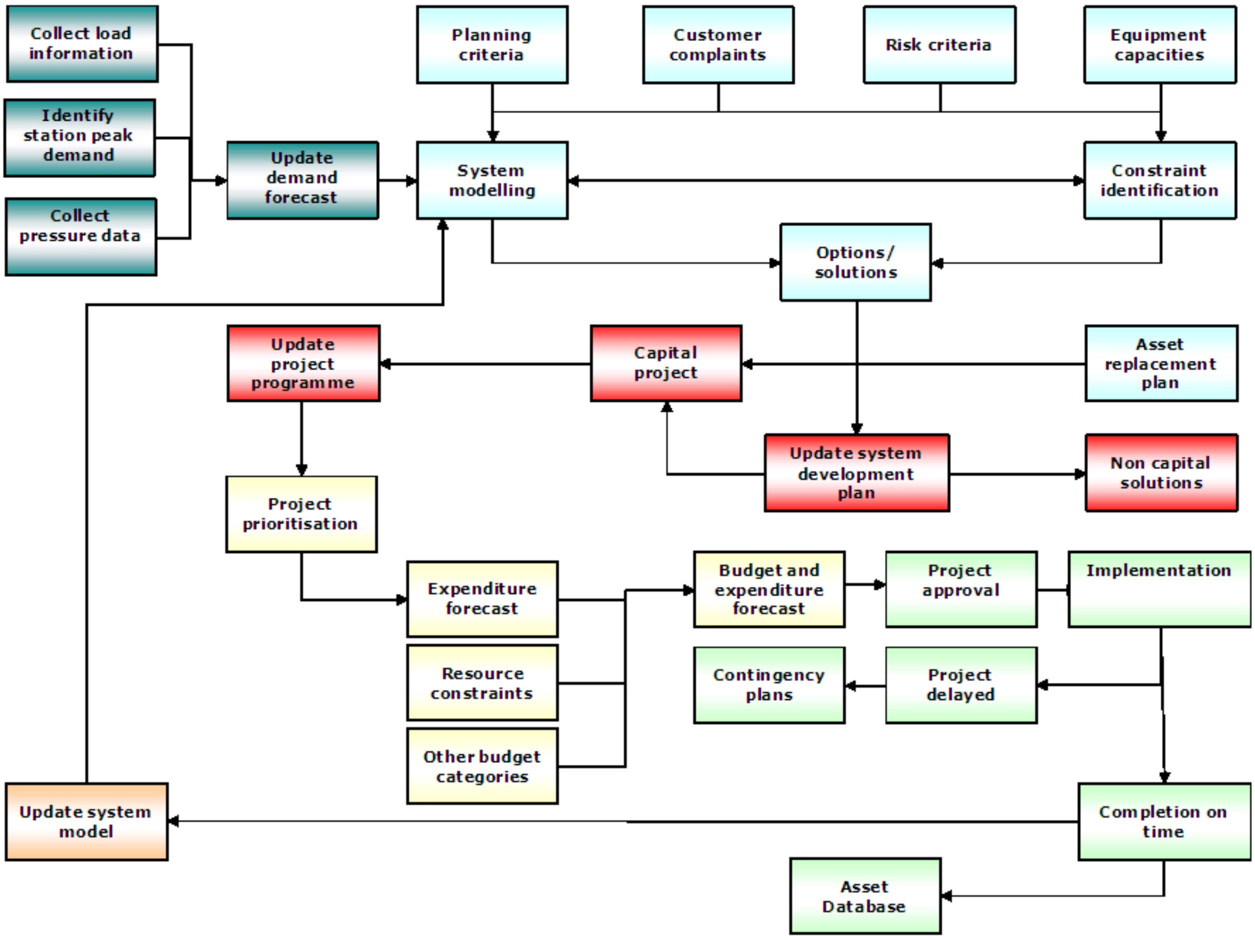

Figure 5-1 : System development and implementation process

5.1.2 Planning Principles

Vector's gas transmission system is regulated under the Health and Safety in Employment (Pipelines) Regulations (1999), which requires that the pipelines be issued with a certificate of fitness by an independent certifying authority. In order to meet the requirements for certificate of fitness, Vector designs, operates and maintains the transmission system in accordance with the Australian standard AS 2885 suite of Standards for High Pressure Pipelines.

In order to meet these statutory requirements, as well as Vector's commercial imperatives, the planning principles for the transmission system ensure that:

- All transmission system assets will be operated within their design rating.
- The design and operation of the system will not present a safety risk to staff, contractors or the public.
- The system is designed to meet Vector's Transmission System Security Standard[5], which includes requirements set out in the Critical Contingency Management Regulations.

[5] The Gas Transmission System Security Standard (GTS-01), Nov 2012 is publicly disclosed at the following web site http://www.vector.co.nz/gas/pipeline-capacity-consultation/documents under supporting documents to capacity determination consultation - 29th November 2012 and included in Section 5.16.

- Customers' reasonable gas supply (hence transmission capacity) requirements will be met.[6] In addition, that the transmission system is designed to include a prudent capacity margin to cater for foreseeable short to medium-term load growth.
- Equipment is purchased and installed in accordance with high pressure gas transmission standards to ensure optimal asset life and performance.
- Gas transmission system investment will provide an appropriate commercial return for the business.

5.1.3 Project Implementation

To enable effective delivery of the capital works programme, Vector has an end-to-end delivery process within the Asset Investment (AI) group. The process tracks each project from conceptual design and project definition through to detailed design and site construction. Before a project is approved, the level and skills of resources are assessed, both within the Vector team and externally (in terms of available contractors) to ensure that the project is achievable within the existing programme.

Where required, existing projects already within the delivery programme may be deferred in order to design and deliver a higher priority project[7]. Once a project is approved, the project is entered into the delivery programme.

Detailed project designs are undertaken either by Vector's in-house engineering team, or by outsourcing to approved external design consultants.

The vast majority of transmission projects are executed by third-party contractors, appointed after a tendering process. Contract oversight is provided by Vector's Transmission Development team, who also provide project management services. On some projects, project management is outsourced to approved external consultants.

5.2 Gas Transmission System Security Standard

The purpose of the Vector Gas Transmission System Security Standard (GTS-01) (Section 5.16) is to define the minimum level of system security and transmission system performance to be applied in the operation and development of the Vector gas transmission system, under all reasonably anticipated operating conditions.

The System Security Standard fulfils a threefold function, providing:

- A clear measure for acceptable transmission system output performance, allowing easy identification of mal-operation or areas requiring attention.
- A clear design standard that identifies when investments may be required to augment the transmission system capacity to deal with increased gas demand.
- A clear means of communicating to internal and external stakeholders the level of service they can reasonably expect from the Vector gas transmission system.
- The System Security Standard sets the high level design requirements for the transmission system to ensure that gas fed into the system can be conveyed to consumers taking gas from the system at appropriate capacity and reliability levels, under all *reasonably anticipated operating conditions*. The primary trigger point for a transmission system reinforcement investment is when the forecast peak gas

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

[7] See 5.5 for project prioritisation

demand profile under such operating conditions would create a situation where one or more of the system requirements defined in the standard can no longer be met.[8]

- It does not refer to the technical and safety aspects of transmission asset performance.

5.3 Establishing the Physical Capacity of a Transmission Pipeline

A gas transmission pipeline operator needs an accurate view of the available capacity of its pipeline system. In particular, this information is essential to provide a strong basis for the allocation of capacity to shippers and to signal capacity congestion. Vector uses a specialist modelling software to determine the capacity of its pipeline systems.[9]

5.3.1 Capacity Modelling

Capacity modelling requires an understanding of a number of factors, the most important being the:

- Physical configuration of a pipeline – its various key components and the manner in which these are connected.
- Operating limits of key components.
- Profile of historical gas usage, in particular peak demand gas flows.
- Main factors that influence peak demand and gas usage.
- Likely future gas usage.

Some of these factors, such as actual gas consumption and the physical configuration of pipelines, are observable or matters of fact. Others, such as the operating limits of physical components, or forecast gas usage, must be determined by analysis. Such analyses in turn rely to a significant degree on informed assumptions and judgements, based on a combination of observation, experience and generally accepted good industry practice.

All of these factors are brought together in a sophisticated dynamic pipeline modelling tool – a computer simulation programme (the “model”) that represents expected pipeline performance under different operating and gas demand scenarios. The model uses SynerGEE (v 4.4.2) software, which is a leading, internationally recognised product.

Vector has previously consulted with the industry on the inputs and assumptions used in its system modelling. Vector has also had independent external reviews that confirmed that these inputs and assumptions, the modelling of system performance and the security standards to which the system is designed and operated, are in line with what is expected from a reasonable and prudent transmission system operator.[10]

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[8] Alternatively, Vector may decide to avoid a forecast breach of the System Security Standard by limiting the allocation of new gas capacity to shippers, until an acceptable commercial and/or regulatory arrangement is reached that would allow Vector to recover the cost of reinforcing the transmission system at an appropriate rate of return.

[9] Vector’s pipelines are not all directly connected, so they are operated (and modelled) as six discrete pipeline systems. These are North (Rotowaro-north), Central North (Rotowaro to Hamilton + Te Kowhai east), Central South (Kapuni to Pokuru), Bay of Plenty, Frankley Road to Kapuni and South (all pipelines south of Kapuni).

[10] Elenchus Research Associates Inc (Canada) carried out a review of Vector’s gas demand analysis and forecasting, as well as the manner in which this is used in network reinforcement decisions. GL Noble Denton (UK) carried out a review of Vector’s System Security Standard and the manner in which the SynerGEE product is applied to model system performance.

The physical capacity of a pipeline is determined by the operating and design limits of the pipeline's components[11], the pressures[12] that must be maintained within the pipeline and the volume of gas that can be made available at the receipt point(s).

5.3.2 Transmission Capacity and Pipeline Pressures

It is not possible to instantaneously replace all gas taken from a pipeline at delivery points. This is due to factors such as the length of a pipeline, the time it takes for gas to reach the delivery points, and constraints on the rate at which gas can be injected into the pipeline.

The extent to which pressure at a delivery point[13] varies depends on differences between the rate that gas is taken from the pipeline and the rate at which it is replenished in the relevant section of the pipeline. In any event, pressure recovery generally lags behind offtake. Hence, in a complex pipeline, pressures (and therefore line-pack) generally cycle up and down rather than remaining constant. The more heavily loaded a pipeline the greater the amplitude of the pressure variations observed.

In pipelines operating comfortably within their physical capacity, pressures tend to recover within shorter, more predictable time periods.

5.3.3 Gas Demand Profiles

Pressures within a pipeline are influenced by the overall gas demand profile. A physical capacity determination must take into account the gas demand profile at each delivery point over a period and not just the instantaneous coincident gas demand peak. The period within which demand profiles on a pipeline should be considered for capacity modelling purposes, depends on the time it takes for pressures in the pipeline to recover. In some pipelines, pressure recovery may occur within a 24-hour period, in which case it may be sufficient to model gas demand profiles on the peak day only. Generally however it is necessary to model demand profiles over a longer period of time, particularly since the objective of modelling is usually to determine how much more gas the pipeline could deliver[14] at one or more delivery points.

Demand profiles for the appropriate period, with necessary adjustments for factors such as changing demand trends, or connection of new large customers, are then used to determine the available pipeline capacity. This process is described in more detail in Section 5.4.

5.3.4 Prudent Operating Limits

Prudent pipeline operation requires that under reasonably anticipated demand and operating conditions, the physical capacity of a pipeline is not to be exceeded, so that the minimum pressures prescribed in the Vector System Security Standard (which are based on the minimum required pressure levels set by the Critical Contingency Operator[15]) are not breached.

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[11] i.e. their physical capacity and prudent operating limits.

[12] The highest possible pressure at any point in a pipeline is the maximum allowable operating pressure (MAOP). Since pressure falls due to friction whenever gas flows, MAOP cannot be achieved everywhere unless there is zero flow. A pipeline is not always operated at MAOP even at its receipt point(s).

[13] That is, in the pipeline, at the inlet to a delivery point. The delivery pressure (ie. at the outlet of the delivery point) is almost always regulated to a substantially lower level.

[14] Corresponding to the "uncommitted" transmission capacity at the relevant delivery point(s).

[15] This role is established under the Gas Governance (Critical Contingency Management) Regulations 2008.

5.3.5 Capacity Determination Methodology

Vector's approach to determining the physical capacity of its pipeline systems is based on the factors discussed above. The steps followed, and the assumptions made are described below. To aid in this description, reference is made to Figure 5.2 throughout this Section. Each of the following steps in the process is indicated by a circled number on Figure 5.2.

In essence, the process followed is:

1. Determine the time period sufficient to reveal the pipeline's performance, in particular the cycle of pressure depletion and recovery.
2. Obtain actual demand profiles for variable demands during the selected time period.
3. Determine "fixed" demands.
4. Normalise the variable demand profiles to reflect the long-term trend.
5. Run the model to determine the maximum physical demand that can be sustained without breaching the System Security Standard.

6&7. Allow for an "operational reserve" to cover severe year winter demands as well as an appropriate "survival time" for the pipeline. This establishes the available "operational capacity"[16].

8. Deduct existing normalised peak demand at a delivery point from the operational capacity to determine the unused operational capacity at that delivery point.

The above steps are explained more fully below.

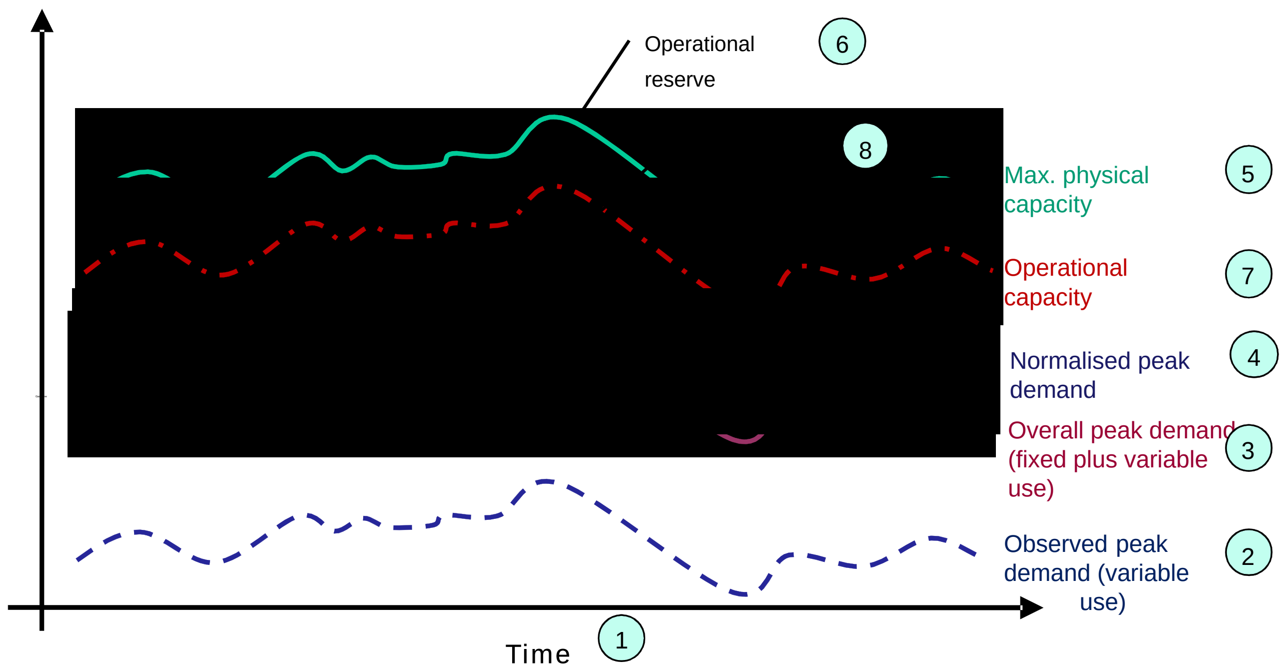

Figure 5-2 : Transmission System Security Standard criteria - overview schematic

[16] The drivers of, and extent of operational reserve may differ from pipeline to pipeline.

5.3.5.1 Step 1 – Time (1)

The peak demand period relevant to the determination of physical pipeline capacity should be the period of greatest offtake from the pipeline where pipeline pressures: (a) do not fall below the minimum acceptable level at any point; and (b) following any depletion, recover to at least their starting levels[17]. For most pipelines the peak demand period is usually a sequence of high demand days (which may or may not include the peak demand day).

Peak demand on Vector's pipelines occurs during the working week. Overall demand on most pipelines (although not necessarily at all delivery points) is invariably lower on weekends. For this reason, modelling is generally based on the 5 days (Monday – Friday, inclusive) in which the highest aggregate offtake occurs (the "5-day peak[18]").

At the start of the 5-day peak pressures are generally at their highest. Through the period, should more gas be drawn from the pipeline than can be replenished on a day, pressures in the pipeline will fall[19]. To determine the pipeline's sustainable capacity, pressures must fully recover.

It is noted that in many international gas regimes, peak demand profiles are considered over a 24-hour period only, and gas consumption is limited to ensure that pressures fully recover within this period. Vector has evaluated that option, but since it would materially reduce the transmission capacity that could be allocated and given that the system can still be operated within prudent operating levels, Vector has decided to maintain its 5-day peak approach. The system security standard also reflects this operating approach.

5.3.5.2 Step 2 - Observed (Variable) Peak Demand (2)

The second step in a physical capacity determination is to assemble gas demand profiles[20] by observing actual variable demand patterns during the 5-day peak (or, potentially, other peak demand period) for all delivery points on the pipeline. Generation loads are excluded at this point as they are assumed to be "fixed".

This effectively captures the actual diversity in the offtakes from the pipeline including, in the case of delivery points supplying distribution networks, the diversity exhibited by often large populations of individual gas consumers. The benefit of this approach is that, for the purpose of determining the available physical capacity of a pipeline, Vector does not need to forecast diversity[21], with the implicit assumption being that this is the best predictor of diversity to apply when modelling usage at a level that hits the maximum physical limits of the system. Accordingly, the physical capacity determination is based on the most recent observed 5-day peak, as this best reflects the latest demand profile on a pipeline.

[17] Indicating that a further such peak demand period would be sustainable.

[18] The Saturday and Sunday immediately following are also modelled in order to check that pressures recover sufficiently before the start of the next week. Hence any reference in this paper to modelling the 5-day peak should be understood to mean that the relevant 7 days are considered.

[19] Meaning that, while the pressure at different points in the pipeline will cycle up and down within a day, the minimum and maximum levels reached may trend lower from day to day. This may occur for a number of reasons, including operational reasons, coincident peak demand being higher than anticipated or shippers exceeding their capacity entitlements. Where there is compression at the inlet to a pipeline, Vector generally operates it in a constant pressure mode (maintaining inlet pressure at relatively constant level).

[20] The Model uses hourly gas flow rates at each delivery point. In this context therefore, "demand profiles" refers to hourly offtake quantities for the days comprising the 5-day peak (or other peak demand period). Collectively, such hourly offtakes are also referred to as the "flow profile" for the relevant delivery point.

[21] The counterfactual is that, if Vector used gas demand profiles representing the peak demand of each individual delivery point on the pipeline, it would need to apply "artificial" diversity factors.

This approach does mean however that should capacity be allocated equivalent to a pipeline's maximum physical capacity:

- Then, if all shippers simultaneously consumed their full contractual gas capacity, this could exceed the pipeline's physical capacity leading to a critical contingency event[22].
- Future demand profiles may differ from those previously observed, which in severe cases could also cause the pipeline's physical capacity to be exceeded.

When modelling to determine pipeline capacity, all contractually interruptible load on a pipeline is set to zero.

Dairy factories' peak demand periods do not generally coincide with the 5-day peak of the pipelines from which they are supplied. They are modelled as variable loads, which is generally when they are in their off-peak periods. Other large directly-connected customers (excluding power stations) are modelled as variable loads according to their actual demand during the 5-day peak, unless their offtake in that period was so unusually low as to justify an adjustment factor being applied to simulate more typical operation.

5.3.5.3 Step 3 - Overall Modelled Peak Demand (3)

To determine the overall demand on a pipeline, fixed loads (if any) need to be added into the model.

Currently, only power stations are treated as fixed loads. While their demand is not literally fixed, when power stations are operating at maximum generating capacity they represent both near-constant and very substantial loads on the relevant pipeline. Power stations can operate at full capacity at any time of the year and, if they were not actually operating at peak load during the 5-day peak, it is clear that they could have been, or might in the future.

Accordingly, Vector models each power station's demand as its maximum contractual entitlement rather than its actual demand in the 5-day peak.

5.3.5.4 **Step 4 - Normalised Peak Demand** (4)

The 4th step in the capacity determination process is to "normalise" 5-day peaks to the relevant long-term trend, where appropriate.

While actual demand peaks may vary materially from year to year, long-term trends can be discerned for some delivery points. On most of Vector's pipelines[23] this annual variance correlates closely with winter weather patterns, for delivery points to distribution networks, which supply large numbers of smaller consumers (amongst others).

A capacity allocation requires an understanding of the underlying demand growth trend. To determine this trend, it is necessary to normalise out annual demand fluctuations that are caused by unpredictable external events (such as minimum temperature levels). This normalisation is done by adjusting the relevant observed 5-day peak profile to the average trend in 5-day peak values observed over time. Such an adjustment can be both upwards (in a milder-than-average year, where peak consumption was lower than the long-term trend), or downwards (in a colder-than-average year, where peak consumption was higher than the long-term trend). The adjustment is applied to the 5-day peak demand profile by means of a single multiplication factor: in other words the shape of the consumption profile

[22] As discussed in the Vector System Security Standard

[23] The Bay of Plenty pipeline does not display a strong overall winter peak.

remains as observed, but the actual hourly consumption levels are moved up or down as determined by the normalising factor.

If relevant, where the 5-day peak is not predominantly weather-driven, other adjustment factors are applied.

5.3.5.5 Step 5 - Maximum Physical System Capacity (5)

The 5th step is to determine the maximum physical capacity that a pipeline system can deliver, based on the most recent 5-day peak demand profiles (normalised where appropriate) and including fixed loads.

Prudent pipeline operation requires that under all reasonably anticipated consumption and operating conditions, the design capacity of pipeline components should not be exceeded, and that the System Security Standard will be complied with.

Modelling to determine the maximum physical capacity of a pipeline system necessitates simulating increased demand. This involves applying one or more of the following three methods at a delivery point (or more than one delivery point):

1. Applying a factor to the (normalised) 5-day peak.
2. Adding a constant flow rate to the (normalised) 5-day peak.
3. Configuring a separate flow profile that adds to the (normalised) 5-day peak.

The method(s) used depends on the scenario being modelled, the information available and whether the modelling is being undertaken to provide an indication of the general level of unused physical capacity on the pipeline or in response to a specific request from a shipper. Method 1 is the most commonly used by Vector. The factor is increased to the point immediately before the system security standard would be breached, which is usually when an unacceptably-low minimum pressure occurs at a delivery point on the pipeline.

Method 2 is used to simulate fixed demand[24]. The fixed flow rate is increased until the maximum flow rate short of breaching the system security standard is found.

Method 3 is used to simulate a different flow profile from the observed 5-day peak. Having determined the "base" profile, an increasing factor is applied to it until the point immediately before the system security standard would be breached.

When modelling "organic growth", generally a relatively small percentage increase in demand is expected to more or less follow the existing flow profile, method 1 is used.

Method 1 can also be used to give an indication of spare capacity where that is very large (in other words, where the factor is a large number, 5, 10 or 20.) It would need to be borne in mind, however, that if such a large new load were to materialise, it might well exhibit a flow profile materially different from the existing one, which might change the factor.

Method 2 is often used as a first, conservative go/no-go test of a pipeline's ability to supply a new load. For example, a prospective new load might be set at a constant flow rate, set at the rate of its maximum hourly quantity ("MHQ"). If the pipeline can sustain that, then there is probably no need for more refined or realistic modelling.

Method 3 can be used where the flow profile of a new load is known and is materially different from the profile of the existing load. Another use might be to test additional load complying with contractual criteria of MHQ and maximum daily quantity ("MDQ"), on a

[24] It is also used, with the flow rate set at the estimated MHQ (maximum hourly quantity), as a conservative first-cut test of a pipeline's ability to support a prospective new load. That is not to imply such an amount of contractual capacity would be allocated.

continuous basis, so as to be sure of the amount of additional contractual capacity that could be allocated at the delivery point.

5.3.5.6 Step 6 & 7- Operational Capacity and Operational Reserve 6

7

Prudent operation of a gas transmission pipeline system requires that it is not operated at a level exceeding its maximum physical capacity. As a reasonable and prudent operator, Vector must operate the pipeline at "safe" levels, including ensuring that the System Security Standard (which sets out the limits of operation) is not breached other than as a result of events beyond its reasonable control.

The "safe" level of physical capacity is termed the "operational capacity" of a pipeline system. It is determined by reducing the maximum physical capacity by an amount known as the "operational reserve".

In practice the operational reserve is necessary to allow for two main factors:

1. **Winter severity**: As noted above, winter ambient temperatures are a key determinant of overall peak gas demand on most of Vector's pipelines[25]. Vector has adopted a 1-in-20 year winter incidence (ie. severity) level, to ensure that transmission capacity shortfalls do not occur at an unacceptably high frequency. (While this is our current standard, and is a common standard in many other jurisdictions, future economic testing may identify a requirement to revise this.)
2. **Survival time**: Compression is a key to creating capacity on most pipeline systems. Vector's compressor stations are designed with N-1[26] redundancy (as set out in the System Security Standard). However, a redundant compressor may also fail, or fail to start[27], and additional time therefore needs to be allowed during which such a failure may be remedied – the so-called survival time. This margin is determined based on the likely time it would take a technician to attend a site, fault-find and manually start a compressor. (Again, future economic testing may identify a need to amend this.)

The practical effect of the operational reserve is to reduce the total quantity of transmission capacity available that may be allocated as contractual capacity at delivery points on a pipeline. The amount of such reduction is different for each pipeline and has to be determined for each pipeline individually. (This applies also to any pipeline where the 5-day peak is not determined by winter conditions.)

5.3.5.7 Step 8– Unused Operational Capacity 8

The amount of the operational capacity that shippers are not currently using represents additional gas that could have been conveyed through the pipeline system to delivery points during the 5-day peak without reasonably being expected to result in a breach of the System Security Standard, even in the event of a 1-in-20 year winter occurring.

Unused operational capacity is calculated simply by subtracting normalised peak demand from the operational capacity, for a delivery point.

[25] The exception, the Bay of Plenty pipeline, has in recent years experienced early summer peaks, which appear to correlate with the offtake of dairy factories.

[26] An N-1 redundancy level means that a failure on any single component will not affect the ability of the system to deliver its required output.

[27] The availability of compressors, which are complex mechanical units, while still high, is an order of magnitude lower than that of most other components of the transmission system. Compressor failures therefore can occur at a relatively high frequency.

As noted above, the amount of such capacity is directly affected by the assumptions made about the additional load at that, and other delivery points during modelling.

It is necessary to distinguish "unused" operational capacity from "uncommitted" operational capacity.

5.3.5.8 Contractual Capacity

The above sections have been concerned with the determination of physical and operational capacity. What Vector allocates to shippers is contractual capacity (mainly "Reserved Capacity").

In common with international practice, Vector defines contractual capacity by a maximum daily quantity ("MDQ") and a maximum hourly quantity ("MHQ"). A shipper is entitled to use its contractual capacity every day, 365 days per year.

Once it has allocated capacity therefore, it is prudent of Vector to assume that it will be used, and continuously.

The process for obtaining a continuously sustainable value for operational capacity is described in detail above. From that, it is a straightforward matter to calculate "uncommitted operational capacity". This commercial process is described in general terms below.

5.3.5.9 Determination of Uncommitted Operational Capacity

Unused operational capacity is a measure of the remaining physical capacity that is usable. However, not all of the (currently) unused operational capacity may be commercially available. Shippers' existing contractual capacity holdings must be considered when determining uncommitted operational capacity. Uncommitted operational capacity is the operational capacity that prudently may be allocated as additional contractual capacity for a specific Receipt Point – Delivery Point ("RP-DP"). For example, shippers in aggregate may hold more contractual capacity for an RP-DP than has been used to date. However, given the current market design and the fact that such capacity was issued as firm capacity, Vector assumes that at any time, including during the peak period, shippers may exercise their contractual right and utilise all their contracted capacity.

The uncommitted operational capacity for an RP-DP is therefore calculated as the relevant operational capacity minus the aggregate (firm) contractual capacity for that RP-DP.

Where a shipper requests additional capacity during the capacity confirmation and allocation process prior to the start of the contract year (1 October – 30 September), Vector will assume that such increased demand will coincide with the previous peak demand period. If a request for additional contractual capacity exceeds the uncommitted operational capacity, Vector will allocate the amount available so that the additional contractual capacity allocated does not exceed the uncommitted operational capacity.

In summary, in assessing the amount of uncommitted operational capacity for an RP-DP, if the operational capacity:

1. Exceeds the aggregate contractual capacity already held by shippers then, all other things being equal, Vector should be able to allocate more contractual capacity to shippers.
2. Is less than the aggregate contractual capacity already held by shippers then, absent other factors, Vector may not be able to allocate any more contractual capacity to Shippers.[28]

[28] This may also constrain the amount of contractual capacity that can be allocated at other delivery points.

5.3.5.10 Investment Consideration Trigger

Where Vector identifies, using the above methodology, that the uncommitted operational capacity at any transmission gate station is zero, then there will be an investment consideration. This will consider potential options and risks. Specifically, if load was allowed to grow without load reductions elsewhere.

The investment decision will consider the following requirements:

- Will there be a commercial return?
- Is the regulatory environment conducive?
- Is there anticipated growth?

5.4 Demand Forecasting and Modelling

Having a reasonable view on expected peak gas demand is essential for planning the future state of Vector's transmission system. In Section 5.2 Vector's Transmission System Security Standard is described, defining the operational output measures to which the gas transmission system should conform. Demand forecasting determines when those criteria are likely to be breached – a critical decision point for planning system augmentation. The gas transmission system is designed to cater for reasonably expected peak demand conditions, and capacity must be sufficient to ensure that the Security Standard is met under these conditions.[29]

In order to consider the required capacity of the pipeline system and the individual gate stations, two completely separate dimensions of peak demand are considered:

- Transmission System Demand Forecasting Methodology – extrapolated from previous peak demand over a 5 day period.

  Based on observation of gas demand on the Vector transmission system, peak demands typically occur during weekdays and can extend anywhere from two to five days. For forecasting purposes, Vector therefore forecasts peak demand as the volume of gas flowing through a pipeline system over five consecutive weekdays. This is referred to as the 5-day peak (weekend demand can be included, but since it does not normally lead to system security issues, it normally has no impact on the modelling). Demand growth is measured by comparing the five-day gas flow during the peak demand week in a year with that of the peak week in other years.

- Transmission Gate Station Demand Forecasting Methodology - based on the peak hourly flow at each gate station.

  Individual station components must be able to meet the maximum hourly flows through the station, otherwise they will restrict the flow. The hourly flow peak is therefore the driver for considering station capacity upgrades and the gate station analysis e.g. Table 5-1 shows the forecast peak hourly flow growth for gate stations on the North System.

5.4.1 Transmission System Demand Forecasting Methodology

Demand forecasting for the transmission system relies on a combination of observed and forecast trends.

[29] The Security Standard relates to the minimum acceptable pressure and flow levels that the transmission system has to maintain, which occur at periods of maximum gas demand. From a system design perspective, the most important gas consumption measure is therefore the demand over the peak period, not the overall volume of gas transported.

5.4.1.1 Key Demand Forecasting Assumptions

In forecasting the gas transmission peak demand and consumption pattern, the following major assumptions are made (mainly based on observation):

- The transmission system has to be designed to ensure that the Security Standard pressures and flows are maintained under all *reasonably anticipated operating conditions*. Since the highest sustained demand on the system leads to the lowest pressure levels, the peak demand periods are therefore the critical consideration.
- Peak demand is viewed as the total gas flow over the 5-day peak[30]. Gas consumption peaks during normal working days, generally occurs in the winter (but this can vary between different pipeline systems). Peak consumption can occur over up to five consecutive days, which has the biggest impact on system pressure. This is excluding power station flat loads and interruptible demands.
- The peak instantaneous gas demand of most consumers will remain the same over time – it is determined by the gas-fed equipment connected at the customer premises and the manner in which it is used. This is especially important for large consumers with fixed equipment (for example large electricity generators, where peak instantaneous demand is based on the turbines driving the generators). Where the instantaneous peak consumption of a large consumer remains consistent over time, and such consumption has been observed to occur during the peak demand week, for forecasting purposes such loads will be assumed to be present, at the peak instantaneous rate, during normal operating hours[31] [32]e.g. a flat load profile at the maximum observed demand is assumed.
- Diversity between the consumption patterns of all connected customers is implicit in the observed conditions. The current diversity is assumed to continue. Pipeline systems might not be able to cope with contractual coincident peak demands, i.e. with all connected customers drawing peak demand at the same time[33].
- Interruptible loads are assumed to be zero for system modelling purposes, as these loads will be shed during peak demand periods to avoid unacceptably low pressures being experienced.

5.4.1.2 Observed Demand

Observed demand on a pipeline system is generally made up of three main components:

- Large, directly connected, fixed-demand customers

  Although the actual consumption levels of these customers does vary over time, the same peak consumption level is repeatedly observed – this is dictated either by the connected customers gas using equipment or the way in which it is operated. Where such instantaneous peaks are historically observed (or, in the case of new plant, are expected based on advice from the customer) during peak demand periods, for modelling purposes these customers are assumed to represent a fixed load during such peak consumption periods, with the level set at their instantaneous (hourly)

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[30] Vector has also modelled and observed peak demand periods ranging from two to four days. While major pressure drops can occur after only two to three peak demand days, the worst case scenario is generally after five days of high consumption.

[31] The modelled peak will be amended if a customer installation changes.

[32] Actual consumption patterns will be modelled as far as practical – for example, if a power station is observed to generally reduce consumption materially during night-time periods, this will be reflected in the assumed demand profile.

[33] Basing utility services capacity on the observed level of diversity is widely accepted as best practice – the alternative would give rise to highly under-utilised networks and would be economically inefficient.

peak demand (loads may be modelled to fall off after hours, based on actual observed behaviour).

- Mass-market customers, variable demand

  Distribution networks represent the combined load by (usually) large numbers of relatively small consumers. Consumption patterns for these consumers tend to fluctuate considerably over time, and form the bulk of the variable portion of the observed demand.

- Large, directly connected, variable-demand customers

  A minority of directly -connected large customers do not demonstrate repeatable peak consumption trends, or alternatively, demonstrate below-peak, variable consumption levels during the peak demand week[34]. Their load is therefore included in the variable portion of the observed demand (which is dominated by the distribution network loads).

Peak demand is measured over the 5-day peak-consumption period (or peak week).

5.4.1.3 Demand Growth

Gas transmission demand growth is driven at two main levels – (a) through new major customers and (b) through organic growth (mainly new connections) at a gas distribution network level (demand changes can also arise from changes in consumption patterns by existing customers, but this is less frequent and normally has less impact on overall demand).

For the purpose of forecasting the peak demand, fixed demand customers are assumed to contribute a constant portion to the overall demand. These loads are therefore not considered for the purposes of forecasting demand growth.

Major New Customers

Demand growth from major new connections is forecast based on the declared intentions of customers. When Vector is approached to provide a new connection (or upgrade an existing one), the anticipated consumption levels are contractually agreed. Where the new consumption is likely to overlap with peak demand periods, this is added to the forecast peak load growth rate. If the potential load does not eventuate, it will subsequently be removed from the forecast.

Organic Growth

For each system the peak demand week is identified for each year for which data is available. The 5-day peak demand of each gate station is then obtained for each of these years. This then allows trending of the 5-day peak over the relevant historical period for each individual gate station within the system.

If individual gate station demand shows a positive growth trend, then this is used to forecast future growth. If a static or negative demand trend is observed, then future growth is not assumed, and future peak demand is taken as the most recent normalised 5-day peak[35].

[34] For example, the peak season for most dairy factories currently fall outside the winter period, when peak demand on the system as a whole is normally observed. While the actual instantaneous peak of these factories can be quite repeatable, their (low) consumption during the peak week is variable.

[35] As the analysis will be repeated yearly, the effect of (say) a large consumer shutting down will be taken into account when assessing demand trends at delivery points in future years.

Hence, each gate station in the transmission system will have its own growth assumptions for the purposes of transmission pipeline system modelling based on the relevant historical trend.

Where previously separate distribution systems are integrated and significant pressure (and hence demand) rebalancing between these systems has occurred over the trend period, then both gate station demands are added together to reach a growth trend that applies to both stations e.g. Papakura DP and Westfield DP.

If a gate station supplies a single large consumer and the peak demand is considered to be fixed, then that maximum demand is used as the future demand profile.

5.4.2 Transmission System Modelling Analysis

Transmission network analysis is carried out using Synergee software, which incorporates pipeline and station configuration data extracted from as-built and operational equipment records. The transmission system is split into six discrete pipeline models:

- North System (Rotowaro-north)
- Central North System (Rotowaro to Hamilton + Te Kowhai east)
- Central South System (Kapuni to Pokuru)
- Bay of Plenty System
- Frankley Road System
- South System (all pipelines south of Kapuni).

This analysis software uses transient flow analysis, which is crucial given that the flow at most gate stations varies significantly over time.

Each pipeline is assumed to operate in an isothermal state for the purposes of modelling, at the single ground temperature input into the software.

Individual gas compositions are input at each receipt point. The software takes differences in gas composition and receipt flows into account during the analysis.

Each network analysis model (above) has been validated against real operationally recorded pressures to check for accuracy and the models have each been found to be in good agreement with real data, within a tolerance of 200kPa pressure at any point.

Model specific assumptions are identified in each later section of this AMP.

5.4.3 Transmission Station Demand Modelling Analysis

Load data is collected at all of the Vector transmission gate stations. Some gate stations are equipped with two or three meters resulting in multiple meter readings. At these sites, depending on configuration the metered flows are either summed, or the maximum value is used.

All available earlier years of actual gate station peak hourly flow data has been used to develop future demand projections based on straight line trends for each Transmission gate station. For the purpose of analysing available capacity at a gate station level, the forecast maximum demand was determined for three future years - 2014, 2017 and 2023. Where the forecast indicates a decreasing demand, 2010 actual flow data has been used as the demand forecast for years 2014, 2017 and 2023.

These growth trends in terms of peak hourly flows have been developed by and are used for demand modelling in the Vector gas distribution system.

5.4.3.1 Non Vector Owned Distribution Networks

Less detailed information is available for analysis of non-Vector owned distribution networks. Demand trends are therefore based on measured annual peak flow demand for the previous 4 years (2009 to 2012).

5.4.4 Sources of Data for System and Station Modelling

Metered data from the Open Access Transmission information System (OATIS) is used for both station demand modelling analysis and System modelling analysis. For stations, data is extracted over many years to identify growth trends and for system analysis, hourly metered data profiles are extracted from OATIS and loaded directly into Synergee.

Station equipment capacity is either extracted from manufacturers' data or calculated from performance and asset information located in Vector SAP and Meridien systems.

Pipeline data is taken from Vector SAP and the Vector Geographical Information System (GIS).

5.5 Project Planning and Prioritisation

Forecasting of future transmission capacity requirements as described above, identifies potential transmission system augmentation projects. These projects, along with other proposed projects for different asset investment purposes (e.g. asset replacement) are prioritised using a risk based system named NRAMS (Non Routine Activity Management System (see Figure 5-3).

NRAMS is used to prioritise most capital and operational work with consideration for the available resources both internally and externally to deliver the work required.

NRAMS also describes the consequences of not undertaking a given project, through considering wider issues such as operational, health and safety, environmental, legal, financial and regulatory risk. Based on this, a priority rating for each project is determined.

NRAMS risks are split into business risks and code compliance risks which are ranged in severity from extreme to negligible.

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

- Avoiding loss of supply issues that could lead to unsafe situations.
- Ensuring compliance with security standards.
- Meeting 3rd party requests.
- Enhancing system efficiency (including works programme synergy).
- Implementation of long-term development opportunities.

NRAMS project prioritisation processes support the business objective of cost efficiency in the following ways:

- Directing the design and delivery teams efforts onto the projects that either deliver the greatest benefits or mitigate the largest risks.
- Allowing multiple problems at the same site to be collected together and delivered as a single project (project delivery synergy).
- Allowing multiple problems to be considered at a single site to ensure that the recommended solution meets all requirements (design efficiency).

Figure 5-3 : NRAMS inputs and outputs

5.5.1 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 to mitigate the risks associated with investing in networks include the following.

- Act prudently – where safety is not compromised make small incremental investments and defer large investments as long as reasonably practical (e.g. replace gate station components rather than an entire station). The small investments must, however, conform with 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 allows sufficient time for planning, approval and network construction to be implemented ahead of the new system demand.
- The medium-term plan looks out ten years, capturing regional development trends such as land rezoning, new transport routes and larger infrastructure projects. It also captures changes such as the adoption of new technologies or behavioural trends (e.g. consumers' response to issues such as climate change, increased energy conservation, etc.).
- Review significant replacement projects – for large system assets (e.g. compressors), rather than automatically replacing 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 system configuration that will meet Vector's needs for the next asset lifecycle.

- Continuously review system performance to identify and apply remedial action in respect of poorly performing assets.

5.5.2 Large Development Projects

Vector, as a requiring authority, generally 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 their potential gas supply needs. For larger projects, in particular, the earlier the planning commences, the more ability Vector has to optimise design and procurement, and maximise synergy benefits.

Such potential loads are captured in the demand forecast, based on a best estimate of when they will occur, and hence the optimal point at which system augmentation will be required. Regular re-forecasting allows the timing of the large projects to be re-evaluated and to adjust the forecasts accordingly.

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

5.5.3 Approach to Pipeline System and Station Upgrades

Station Capacity Upgrades

Tables are shown for each pipeline subsystem in the following sections of this document and also lists the growth assumptions for each gas transmission station from the current time to 2023.

The maximum design capacity for individual station components at each of these stations has been calculated using manufacturer data and operating conditions. This information is retained in a controlled database.

To meet the system security standard requirements defined in Section 5.2, the station should be able to meet the peak hourly flow predicted.

The station component or components that limit a station's ability to meet the design flow assumptions will be identified and options considered to alleviate the limitation or to manage the increased flow in an alternative manner.

The station upgrade solution will be suitable, as a minimum, to meet the design conditions for the term of this Asset Management Plan ie. FY23.

Station upgrades will be implemented if there is a suitable business case.

Project upgrade costs will be estimated based on historical unit costs sourced from similar upgrades on the transmission system.

Station upgrades if required, will be planned to occur prior to the year when the flow limitation is expected to be reached.

Where the high velocity of gas in station pipework is identified as a potential problem, the recommendation will be to undertake a review of the impact prior to the year in which excessive velocity is expected to occur.

In all cases where a case for a station upgrade is identified, the first stage of the project design will be to confirm the component limitations and performance against the current control database calculated levels.[36]

Pipeline System Upgrades

Pipeline system demand growth rates are calculated as defined in Section 5.4 and are retained in a control database.

The pipeline systems are individually analysed using the demand growth data and the normal system operating conditions.

Each transmission pipeline system must be designed and operated to meet the system security standard requirements (defined in GTS-01).

Where pipeline system uncommitted operational capacity is forecast to be at or approaching zero, then system reinforcement options and a recommended solution will be identified or other appropriate steps recommended.

The system reinforcement solution will be suitable as a minimum to meet the design conditions for the term of this Asset Management Plan i.e. FY23.

Pipeline upgrade solutions will be considered if there is a suitable business case.

Project upgrade costs will be estimated based on historical unit costs sourced from similar reinforcement projects on the transmission system. This level of estimating is used solely for prioritisation. Business cases will always be prepared based on FEED design estimation, which will establish P50 and P90 levels of accuracy.

System reinforcement solutions may include pipeline options and/or compressor options.

5.5.4 Development Options

Once a pipeline or station upgrade has been identified as necessary, the project objectives are identified and a number of options to achieve these objectives are evaluated both financially and on a risk basis to identify the optimum investment decision in order to meet the new requirements and maintain the current service level to existing customers. The options considered are summarised in the business case submitted for each significant project identified.

5.5.5 Development Efficiencies

Significant efficiencies can often result from solutions that allow conventional system investment to be considerably deferred without compromising capacity or supply pressure. In evaluating possible solutions, the following factors are amongst those considered to ensure an optimal investment decision:

- Review the asset capacity rating for currency and accuracy of data.
- Where more than one gate station supplies a network, determine whether it is possible to transfer load from a more heavily-loaded to a less heavily-loaded gate station.
- Determine whether a change in delivery pressure would alleviate the limitation and whether such a change could be implemented.

[36] The station control database contains calculated and manufacturer declared maximum design capacity levels of heaters, meters, regulators, filters and station pipework. This database is updated following station modifications to remain current.

- Look for load diversity opportunities (mixing commercial and residential loads sometimes allows load diversity).
- Leverage off other projects to gain synergies, e.g. asset replacement (or asset relocation relating to road re-alignment or new road construction activities).

5.6 North System

Figure 5-4 shows a simplified schematic of the North System.

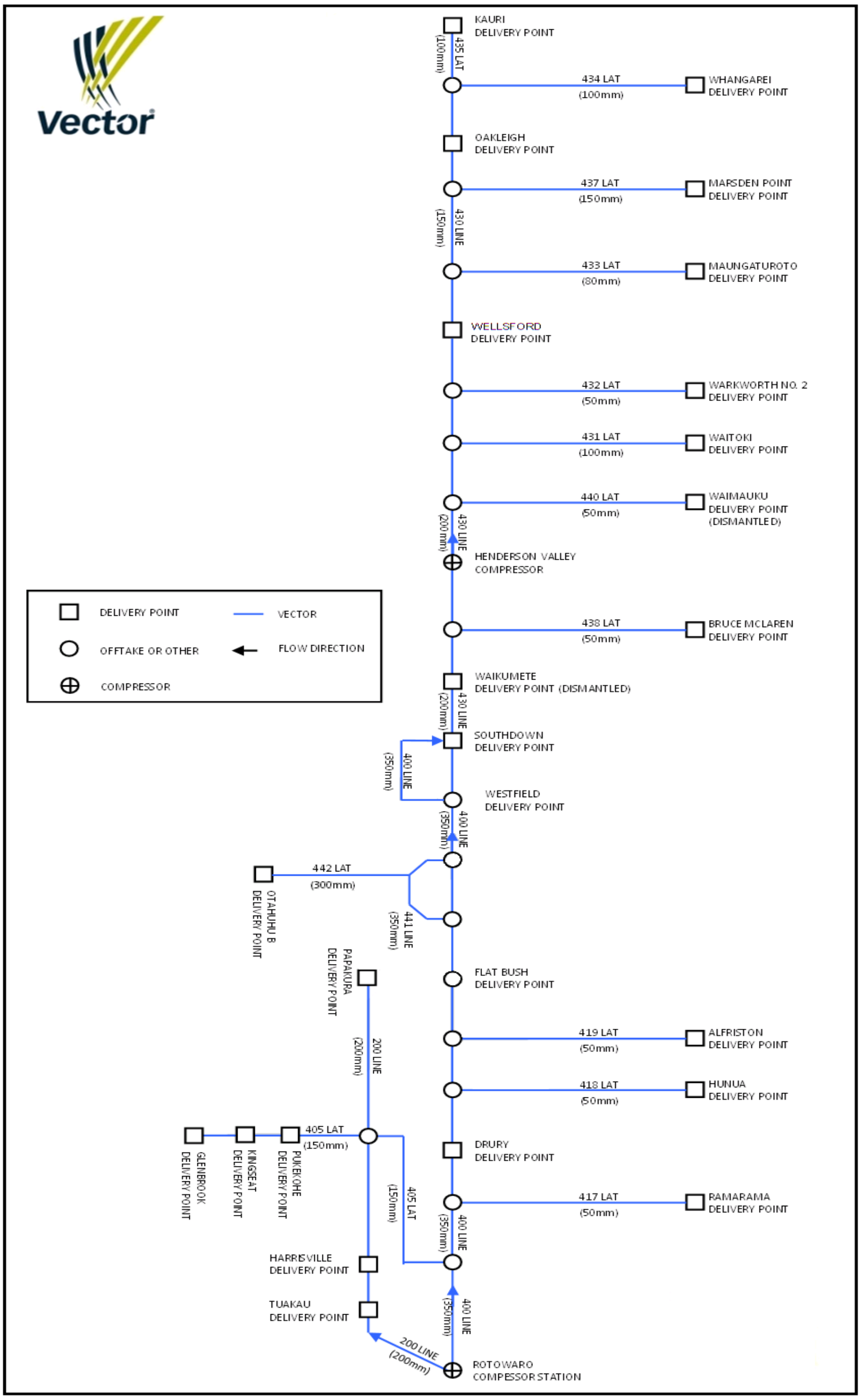

Figure 5-4 : Basic schematic of the North System

There is only a single Intake Point to this system, from the Maui pipeline at Rotowaro. System demand is currently dominated by the Otahuhu and Southdown power stations which can provide a large percentage of the electricity consumed in the central Auckland area. Future demand growth on this system is expected to be driven mainly by Auckland's population growth. Statistics New Zealand's forecast population growth, and the principles described in Section 5.4, were used to derive the forecast demand figures stated below. They represent an average annual peak demand growth of 0.85% within Greater Auckland over the planning period.

5.6.1 Gate Station Analysis

In* Flows are in standard cubic metres per hour (scm/h)

Table 5-1 a summary is provided of the expected peak gas demand over the ten-year planning period (based on calendar years.)

Delivery Point	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Tuakau	1,544	1,506	1,581	1,730	1,730		
Harrisville	3,068	4,475	5,192	6,628	3,200	2013	Heater/meter
Pukekohe	626	403	406	411	1450		
Kingseat	19	22	22	22	50		
Glenbrook	11,501	10,826	10,826	10,826	12,000		
Papakura	20,203	20,074	20,591	21,681	24,600		
Ramarama	255	255	264	284	390		
Drury 1,2	2,246	2,654	2,842	3,256	3,280		
Hunua 1	801	858	858	858	1,170		
Hunua 2	538	548	562	591	920		
Hunua 3	91	1550	1550	1550	3,780		
Alfriston	140	194	194	194	430		
Flat Bush	4,321	2,415	2,415	2,415	6,590		
Otahuhu B	69,744	68,750	68,750	68,750	119,730		
Westfield	48,431	44,707	45,858	48,285	72,850		
Southdown	39,280	40,860	40,860	40,860	118,100		
Bruce McLaren	2,142	1,970	2,021	2,128	2,378		
Henderson	10,802	10,980	11,262	11,859	13,500		

Delivery Point	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Waitoki	1,568	1,620	1,798	2,175	4,300		
Warkworth	1,871	2,244	2,504	3,025	2,280	2015	Regulator
Wellsford	0	4	4	4	50		
Maungaturoto	2,558	2,604	2,604	2,604	2,530	2012	Pipework velocity
Marsden Point CHH	168	207	207	207	8,500		
Marsden Point NZRC	11,997	10,000	10,000	10,000	8,500	2012	Heater
Oakleigh	0	1	1	1	50		
Whangarei	984	1,068	1,028	1,028	2,930		
Kauri	3,278	2,995	2,995	2,995	3,810		

* Flows are in standard cubic metres per hour (scm/h)

Table 5-1 : Gate station capacity forecasts: North System

Also indicated in Table 5-1, are the components (if any) that limit gate station capacity and are anticipated to lead to a design breach within the planning period. These are discussed in more detail below.

a. Tuakau

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

b. Harrisville

This station is running close to the design limits of both the water bath heater and the meter, and is anticipated to breach their limits by FY13. Provision has been made to upgrade the station during the period FY12-14 (an allowance of $700k is included in the 10-year capex forecast).

c. Pukekohe

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

d. Kingseat

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

e. Glenbrook

This station is dedicated to supplying Bluescope Steel. It is intended to remove pipeline pressure regulation at Pukekohe during FY13, which will increase the inlet pressure at Glenbrook. A second heater was installed and commissioned in FY13 to allow the station to manage this higher inlet pressure. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

f. Papakura

This station was upgraded during FY11/12, including the regulators, meters and coalescer. A new heater was installed in FY09. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

g. Ramarama

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

h. Drury 1, 2

The station meter was upgraded in FY11/12 and the heater was upgraded in FY12/13. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

i. Hunua 1,2 & 3

The stations can meet the maximum predicted flows to FY23 and will not require upgrade.

j. Alfriston

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

k. Flat Bush

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

l. Otahuhu B

This station supplies only the Otahuhu power station. There is no load growth expected at this station. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

m. Westfield

This station is the dominant supply for industrial, commercial and domestic loads in the centre of Auckland. It supplies approximately 43,000 scmh of the Auckland average total flow of 70,000 scmh. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

n. Southdown

This station supplies only the Southdown power station. There is no load growth associated with this station. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

o. Bruce McLaren

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

p. Henderson

The station is the dominant supply for residential and commercial customers in the northern part of Auckland and was upgraded in FY12. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

q. Waitoki

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

r. Warkworth

This station will need a regulator upgrade in FY16. An allowance of $200k is included for the work in the 10-year capex forecast.

s. Wellsford

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

t. Maungaturoto

This station solely supplies a dairy factory where the largest demand is during Oct/Nov each year (outside peak week). Although pipework capacity is theoretically exceeded, actual operating data suggests that pipework velocity is not presenting any problems at current flowrates. Upgrade is not scheduled.

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

u. Oakleigh

It is intended to decommission this station in the near future, as the demand is negligible.

v. Marsden Point CHH

This is the load to Carter Holt Harvey board mill. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

w. Marsden Point (Refining NZ)

This is the interruptible supply to the New Zealand Refinery which typically uses around 7000 scmh, but can nominate to take volumes in excess of 10,000 scmh for small periods of time (less than a few hours each day). Although heater capacity is theoretically exceeded, actual operating data suggests that heater performance is adequate at current flowrates. Upgrade is not scheduled.

x. Whangarei

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

y. Kauri

This station supplies a dairy factory, where the largest demand is during Oct/Nov each year (outside peak week). There is no load growth associated with this station. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

5.6.2 Pipeline Analysis

The North System pipeline consists of the main sections noted in Table 5-2, extending from the end of the Maui pipeline at Rotowaro (near Huntly) to Auckland, through to Kauri, north of Whangarei:

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa)
Rotowaro – Papakura East Pressure Reducing Station	350	60.8	8620
Papakura East Pressure Reducing Station - Southdown	350	28.4	6620
Rotowaro - Papakura West	200	60.8	8620
Ingram Rd - Glenbrook	150	23.0	8620
Westfield - Henderson	200	35.5	6620
Henderson - Maungatapere	150	145.4	8620
Maungatapere - Kauri	100	21.5	8620

Table 5-2 : North System main sections

System modelling was conducted for the peak weeks in FY12, FY17 and extrapolated to FY23, with the key results described below.

5.6.2.1 Modelling Assumptions

As noted, the North System is fed from the Rotowaro compressor station. The capacity of this compressor station is dependent on the pressure available from the Maui pipeline. The station comprises two gas turbine-driven centrifugal units plus two gas engine-driven 4-cylinder reciprocating units. These units are able to run with a suction pressure as low as 3000kPa, and still achieve a discharge pressure up to the MAOP of the downstream pipeline (8620kPa)[37].

In modelling the expected performance of the North System, for the sake of simplicity the Rotowaro output pressure is taken as a fixed value of 8400kPa. The peak throughput of

[37] In practice, the maximum discharge pressure set-point is 8400kpa, to allow for the operation of overpressure protection devices under fault conditions without exceeding MAOP.

the Rotowaro Intake Point is added to the peak throughput of the Central (North) System for which Rotowaro is also the Intake Point.

As the supply to Refining NZ is interruptible, the refinery's load is removed from the system while modelling.

The largest loads on this system are currently the Otahuhu and Southdown power stations. It is assumed for modelling purposes that both power stations operate at maximum firm contractual capacity during the peak week. A small power generation load from Hunua gate station is added to the Hunua demand as a flat load across the peak week.

Otahuhu's firm contractual capacity was reduced for FY12-13, with offtake above that being supplied on an interruptible basis. Only the firm contractual capacity is modelled. Otahuhu's demand has been kept at this current level for the duration of this AMP planning period.

The ten year growth for the central Auckland Delivery Points of Westfield and Papakura was applied to the sum of their demands. This is because there was a displacement of load from Westfield DP to Papakura DP that was engineered in FY07, to maximise available transmission capacity on the North pipeline.

An average peak week temperature and gas composition were used for the analysis.

5.6.2.2 Minimum Pressure Criteria

The Gas Transmission System Security Standard (GTS-01) defines triggers for this system at:

Westfield DP : not less than 4 hours to reach 4200kPa

Whangarei DP : not less than 5 hours to reach 2500kPa

As Kauri and Maungaturoto are close together and are both dairy loads which peak outside the normal system peak week, modelling is undertaken during the system peak week to ensure that the above criteria are not triggered.

Additional criteria applied in the case of the North System are, the contracted pipeline pressures at the Otahuhu B (not less than 4800kPa(+/- 2000kPa)) and Southdown offtake Points (not less than 4900kPa).

5.6.3 North System – Capacity Analysis

Delivery Point	Aggregate Contractual Capacity (GJ/day)	Uncommitted Operational Capacity (GY/day)		
		FY12	FY17	FY23
Tuakau	786	13,540	13,336	13,092
Harrisville	1,916	28,077	27,908	27,706
Ramarama	105	13,267	13,176	13,067
Drury (Total)	1,352	19,327	13,977	7,557
Pukekohe	227	21,359	21,089	20,766
Glenbrook	7,500	5,489	5,489	5,489
Greater Auckland	53,581	6,972	5,554	3,852
Hunua (Total)	2,598	4,295	2,572	504
Flat Bush	1,825	10,650	7,018	2,660
Waitoki	381	7,239	5,712	3,880
Whangarei	576	4,172	3,862	3,491

Delivery Point	Aggregate Contractual Capacity (GJ/day)	Uncommitted Operational Capacity (GY/day)		
		FY12	FY17	FY23
Kauri + Maungaturoto	5,000	420	329	221
Otahuhu B + Southdown	87,800	10,348	9,456	8,385

Table 5-3 : Pipeline capacity forecasts: North System

5.6.4 North System - Recommended Reinforcement Projects

5.6.4.1 Gate Station Investment Summary

The proposed gate station augmentation capital expenditure for the 10-year planning period is indicated in Table 5-4. The year quoted in the table refers to the disclosure year.

Projects	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Harrisville (bath heater, meter)	700									
Warkworth (Regulator)			200							
Totals	**700**		**200**							

* Figures are in 2014 real New Zealand dollars ($000)

Table 5-4 : North System gate station investment summary

5.6.4.2 Pipeline Investment Summary

There are no identified pipeline capacity constraints in the North system over the 10-year planning period.

5.7 Central (North) System

Figure 5-5 shows a simplified schematic of the Central (North) System.

This subsystem is also fed from the Rotowaro compressor station.

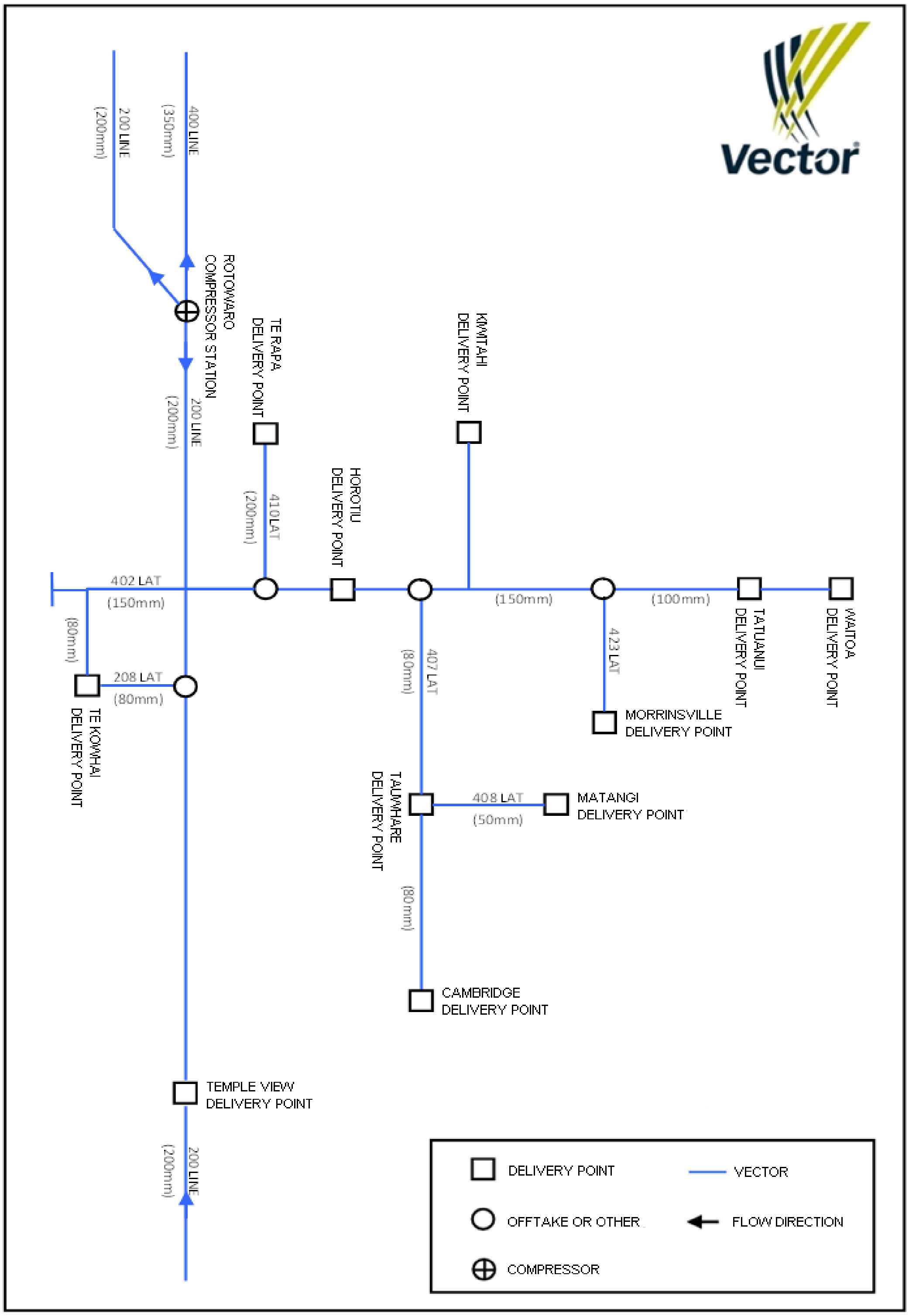

Figure 5-5 : Basic schematic of the Central (North) System

5.7.1 Gate Stations Analysis

In Table 5-5, a summary is provided of the expected peak gas demand over the ten-year planning period, based on a calendar year time frame.

Delivery Point Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Te Kowhai	4,978	5,935	6,174	6,653	8,128		
Temple View	9,698	10,407	10,827	11,666	10,800	2017	Meter
Te Rapa	23,704	26,563	26,563	26,563	28,000		
Horotiu West	983	1,271	1,329	1,445	2,700		
Matangi	0	4	4	4	50		
Cambridge	3,047	2,951	2,951	3,082	3,400		
Kiwitahi 1	1,100	1,062	1,062	1,062	3,100		
Kiwitahi 2	154	144	144	144	340		
Morrinsville (Dairy)	2,248	2,246	2,246	2,246	4,200		
Morrinsville	459	580	591	615	1,370		
Tatuanui (Dairy)	1,397	1,037	1,037	1,037	1,550		
Waitoa	2,119	2,250	2,440	2,820	3,200		

* Flows are in standard cubic metres per hour (scm/h)

Table 5-5 : Limitations of the gate stations of the Central (North) System

Also indicated in Table 5-5, are the components (if any) that limit gate station capacity and anticipated to lead to a design breach within the planning period. These are discussed in more detail below.

a. Te Kowhai

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

b. Temple View

This station was completely replaced in FY08, with new heater, regulators and filters and was designed to accommodate a maximum future load of 15,000scmh. The meters were sized for the current demand and hence will need to be upgraded in FY17/18 to cater for the forecast demand. An allowance of $400k is made for the work in the 10-year capex forecast.

c. Te Rapa

Te Rapa supplies a dairy and Cogen plant and the regulators were replaced due to condition during FY09-11. No load growth is currently forecast at this station and historic peak demand has been well under the contractual maximum capacity. The existing heater and meters are sufficient for future loads. Upgrade is not scheduled.

d. Horotiu West

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

e. Matangi

It is anticipated that this station can meet the current and future flows. There is no water bath heater at this station, but given the limited load, no installation is recommended.

f. Cambridge

There is a dairy load at this site. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

g. Kiwitahi 1 (Hydrogen Peroxide Plant)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

h. Kiwitahi 2 (Distribution Network)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

i. Morrinsville 1 (Dairy)

This dairy load is forecast to remain constant to FY23 and the station will not require upgrade.

j. Morrinsville 2 (Town)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

k. Tatuanui (Dairy)

This dairy load is forecast to remain constant to FY23 and the station will not require upgrade.

l. Waitoa

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

5.7.2 Pipeline Analysis

The Central (North) System pipeline consists of the main sections listed in Table 5-6, extending from Rotowaro to Hamilton (Temple View) and including the Morrinsville sub-system:

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa)
Rotowaro - Te Kowhai	200	25.8	8620
Te Kowhai - Te Rapa Offtake	150	6.3	8620
Te Rapa Lateral	200	1.3	8620
Te Rapa Offtake - Horotiu East	150	1.0	8620
Horotiu East - Kuranui Rd	100	24.8	8620
Kuranui Rd - Cambridge	80	22.7	8620
Kuranui Rd - Morrinsville	150	8.5	8620
Morrinsville - Waitoa	100	9.4	8620

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa)
Te Kowhai – Temple View	200	9.7	8620

Table 5-6 : Central (North) System main sections

To analyse the expected performance of the Central (North) System, system modelling was conducted for the peak weeks in FY12, FY17 and extrapolated to FY23, with the key results described below.

5.7.2.1 Modelling Assumptions

Rotowaro is the intake Point for the Central (North) System. As noted above, compression at Rotowaro was not modelled. A fixed pressure of 8400kPa at the Intake Point was assumed in all simulations. It should be noted that a control valve at Rotowaro site currently reduces the supply pressure from 8400kPa to approximately 7000kPa. This pressure could be increased back to 8400kPa to meet any identified increase in demand growth.

The cogen plant at Te Rapa site is modelled as a flat load profile during the peak week.

5-day peak average temperatures and gas compositions were used.

5.7.2.2 Minimum Pressure Criteria

The Gas Transmission System Security Standard (GTS-01) defines triggers for this system at:

Cambridge DP: not less than 5 hours to reach 3200kPa

Analysis indicates that managing the minimum available pressure at Cambridge DP when considering new load requests, as detailed above, will ensure that the Critical Contingency trigger will not be reached anywhere on the subsystem during normal operation.

5.7.3 Central (North) System – Capacity Analysis

Delivery Point	Aggregate Contractual Capacity (GJ/day)	Uncommitted Operational Capacity (GJ/day)		
		FY12	FY17	FY23
Cambridge	2,125	533	449	349
Greater Hamilton	8,731	4,730	4,641	4,534
Horotiu	881	5,234	4,741	4,149
Kiwitahi	1,005	2,170	1,669	1,067
Morrinsville	2,049	2,209	2,206	2,201
Tatuanui	928	1,938	1,611	1,218
Te Rapa Cogen	25,500	7,648	7,393	7,087
Waitoa	2,012	490	284	38

Table 5-7 : Pipeline capacity forecasts - Central (North) System

5.7.4 Central (North) System – Recommended Reinforcement Projects

5.7.4.1 Gate Station Investment Summary

The proposed gate station augmentation capital expenditure for the 10-year planning period is indicated in Table 5-8. The year quoted in the table refers to the disclosure year.

Projects	FY14	FY 15	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23
Temple View (meters)					400					
Totals					**400**					

*Figures are in 2014 real New Zealand dollars ($000)

Table 5-8 : Central (North) System gate station investment summary

5.7.4.2 Pipeline Investment Summary

There are no identified pipeline capacity constraints in the Central North system over the 10-year planning period.

5.8 Central (South) System

Figure 5-6 shows a simplified schematic of the Central (South) System.

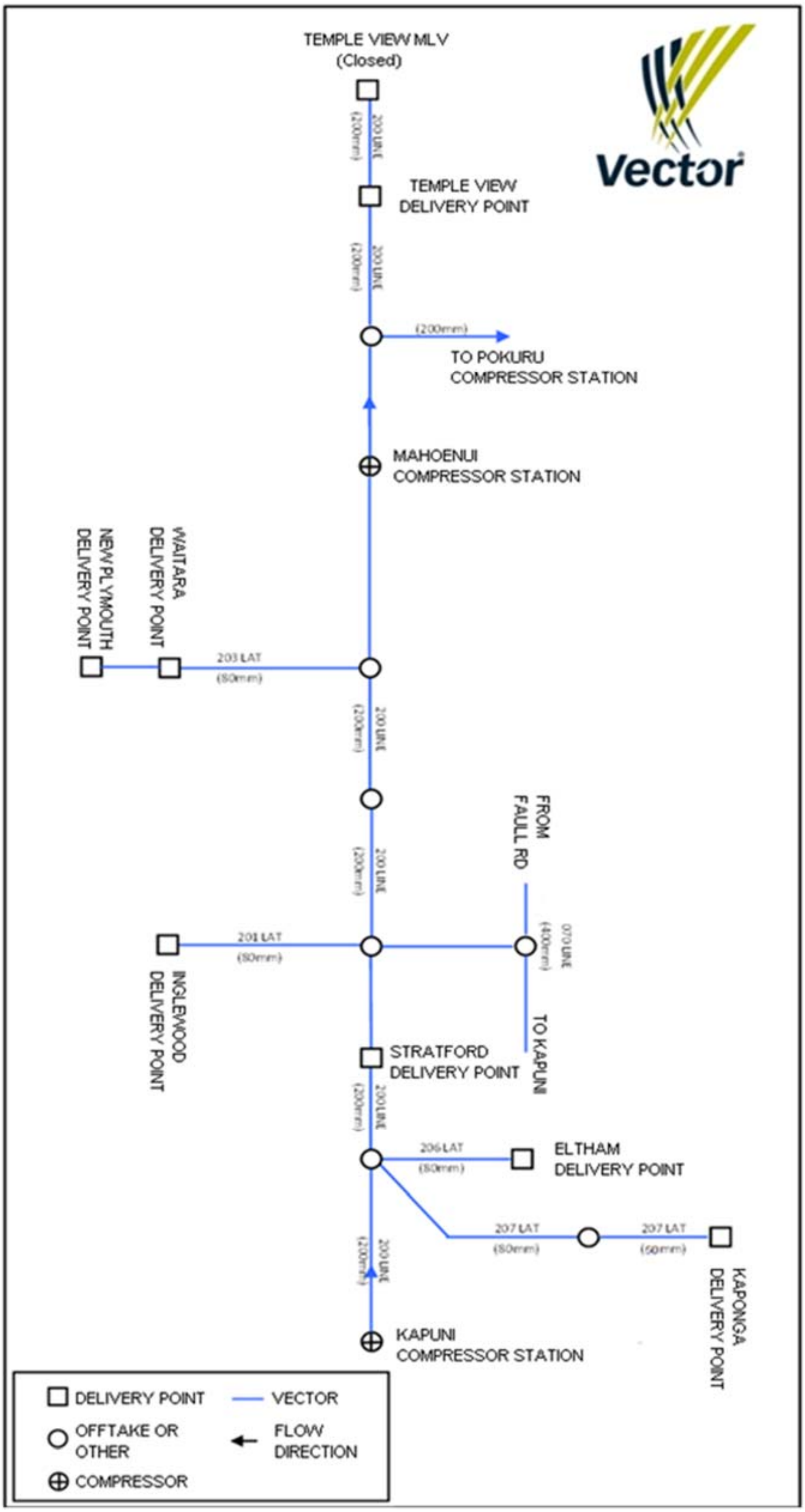

Figure 5-6 : Basic schematic of the Central (South) system

The sole intake Point for the Central (South) System is at the Kapuni Compressor Station.

5.8.1 Gate Stations Analysis

In Table 5-9 a summary is provided of the expected peak gas demand over the ten-year planning period, based on a calendar year time frame.

Delivery Point Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Eltham	900	902	902	902	2,310		
Stratford	732	681	681	681	2,610		
Kaponga	23	30	36	48	200		
Inglewood	321	321	321	321	1,010		
Waitara	718	648	648	648	1,700		
New Plymouth	5,924	5,862	5,862	5,862	7,000		

* Flows are in standard cubic metres per hour (scm/h)

Table 5-9 : Limitations of the gate stations on the Central (South) system

Also indicated in Table 5-9, are the components (if any) that limit gate station capacity and anticipated to lead to a design breach within the planning period. These are discussed in more detail below.

a. Eltham

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

b. Stratford

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

c. Kaponga

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

d. Inglewood

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

e. Waitara

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

f. New Plymouth

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

5.8.2 Pipeline Analysis

The Central (South) System pipeline consists of the main sections listed in Table 5-10 extending from the Kapuni Gas Treatment Plant to the interconnection to the Bay of Plenty System at Pokuru ("Pokuru No.2 Offtake").

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa)
Kapuni - New Plymouth Offtake	200	52.9	8620
New Plymouth Lateral	80	10.5	8620
New Plymouth - Mahoenui Compressor	200	81.7	8620
Mahoenui Compressor – Pokuru #2 Offtake	200	84.0	8620
Pokuru No.2 Offtake – Temple View MLV (closed)	200	24.5	8620

Table 5-10 : Central (South) system main pipeline sections

To analyse the expected performance of the Central (South) System, system modelling was conducted for the peak weeks in FY12, FY17 and extrapolated to FY23, with the key results described below.

5.8.2.1 Modelling Assumptions

Installed compression at the Kapuni Gas Treatment Plant, Intake Point for the Central (South) System, is adequate to meet system requirements over the planning period. Therefore for simplicity compression at Kapuni was not modelled. A fixed pressure of 8400kPa at the intake point was assumed in all simulations.

The only existing offtake point north of New Plymouth is the interconnection to the Bay of Plenty System (BOP), ie. Pokuru. Compression at Mahoenui was modelled as a fixed discharge pressure of 8400kPa.The demand at Pokuru offtake is assumed to be zero as this is fully interruptible. The Pokuru Offtake incorporates piping connections to both the suction side and the discharge side of the Pokuru compressors. Simulations to determine the maximum throughput were based on a discharge-side connection.

Compression at Mahoenui is only required for deliveries of gas into the BOP System, on those days when Kapuni compression is insufficient.

There are three compressors at Mahoenui. One has a capacity of 9 scm/s and the other two units each have capacities of 6 scm/s (at a suction pressure of 5200kPa). Mahoenui is typically only run for limited periods of time to deliver nominations of gas into the Bay of Plenty System. There is no requirement for increased compressor capacity at Mahoenui based on load forecasts to 2023.

An average peak week temperature was assumed for the Central (south) System, as well as an average Kapuni gas composition for the same period.

5.8.2.2 Minimum Pressure Criteria

There are no specific gate station minimum pressure thresholds declared in the Gas Transmission System Security Standard (GTS-01). However, Vector manages the minimum pressure at all gate stations to achieve at least 3200kPa.

5.8.3 Central (South) System – Capacity Analysis

Delivery Point	Aggregate Contractual Capacity (GJ/day)	Uncommitted Operational Capacity (GJ/day)		
		FY12	FY17	FY23
Eltham	670	6,945	6,927	6,905
Inglewood	177	8,513	8,511	8,509
Kaponga	11	3,602	3,587	3,570
New Plymouth	3,793	2,697	2,697	2,697
Stratford	456	11,825	11,795	11,759
Waitara	446	5,474	5,457	5,436

Table 5-11 : Pipeline capacity forecasts: Central (South) System

5.8.4 Central (South) System – Recommended Reinforcement Projects

5.8.4.1 Gate Station Investment Summary

There are no identified station capacity constraints in the Central South system over the 10-year planning period.

5.8.4.2 Pipeline Investment Summary

There are no identified pipeline capacity constraints in the Central South system over the 10-year planning period.

5.9 Bay of Plenty System

Figure 5-7 shows a simplified schematic of the Bay of Plenty System.

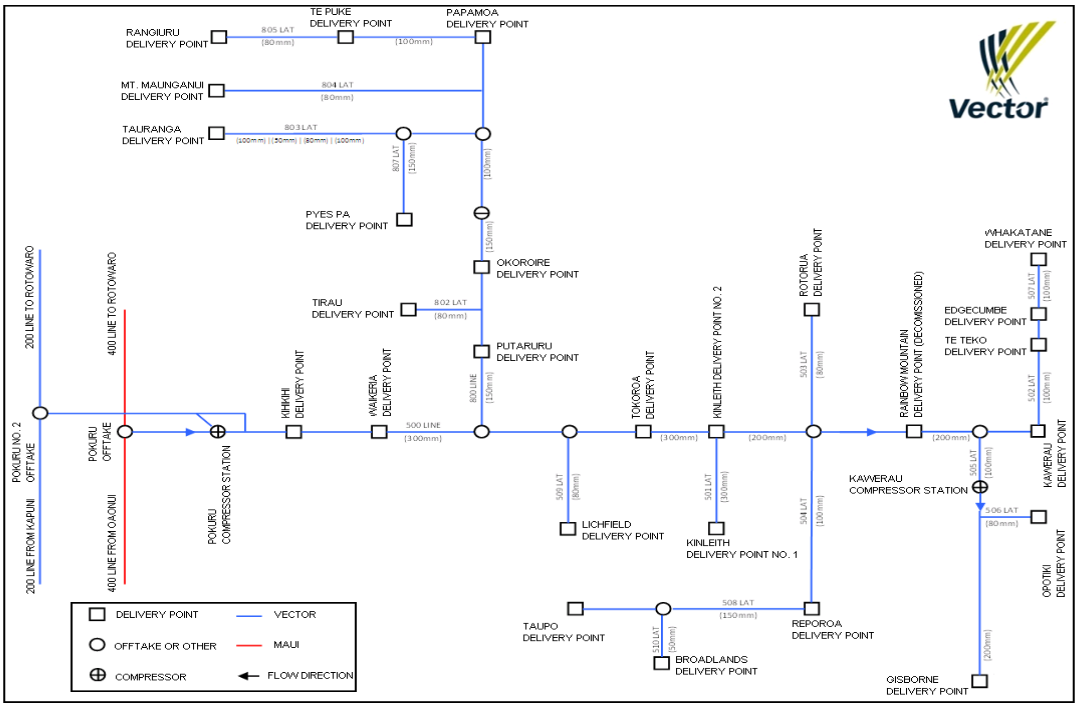

Figure 5-7 : Basic schematic of the Bay of Plenty system

Gas enters the Bay of Plenty System either through the Pokuru No.1 Intake Point (from the Maui pipeline) or the Pokuru No.2 Intake Point (from the Central South System).

The Pokuru No.1 and Pokuru No.2 Intake Points are located approximately within a hundred metres of each other, adjacent to the Pokuru compressor station.

5.9.1 Gate Stations Analysis

In Table 5-12 a summary is provided of the expected peak gas demand over the ten-year planning period, based on a calendar year time frame.

Delivery Poin Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Kihikihi	692	1,229	1,229	1,229	2,090		
Waikeria	206	170	176	187	790		
Putaruru	507	599	599	599	1000		
Tirau 1 (Dairy)	2,192	2,122	2,122	2,122	5,800		
Tirau 2 (Town)	55	71	82	103	600		
Okoroire Springs	0	3	3	3	50		
Pyes Pa	777	331	344	371	1,790		
Tauranga	1,745	2,245	2,335	2,517	2,580		
Mt. Maunganui	3,087	2,677	2,677	2,677	4,680		
Papamoa	792	1,234	1,427	1,813	2,730		
Te Puke	456	619	736	970	900	2022	Meter
Rangiuru	927	932	932	932	950		
Lichfield (Dairy)	2,712	2,776	2,900	3,146	4,970		
Tokoroa	803	812	812	812	2,320		
Kinleith No.1	28,122	27,184	27,184	27,184	19,670	2012	Pipework velocity
Kinleith No.2	252	256	261	270	370		
Rotorua	3,587	3,650	3,588	3,547	2,494	2012	Regulator
Reporoa	2,646	2,827	2,827	2,827	2,627	2012	Pipework velocity
Taupo	1,186	1,450	1,584	1,853	2,494		

Delivery Point Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Broadlands	451	593	593	593	2,730		
Rainbow Mountain		0	0	0			Decommissioned
Kawerau (Town)	141	139	139	139	740		
Kawerau (Caxton)	779	2,282	2,282	2,282	6,920		
Kawerau (Tasman)	2,067	2,014	2,014	2,014	6,930		
Te Teko	0	33	33	33	440		
Edgecumbe (Dairy)	5,903	5,769	5,769	5,769	5,600	2012	Heater
Edgecumbe 2	10	10	10	10	230		
Whakatane	3,410	3,061	3,061	3,061	2,730	2012	Filter
Opotiki	210	214	215	218	850		
Gisborne	3,489	3,307	3,384	3,536	6,235		

* Flows are in standard cubic metres per hour (scm/h)

Table 5-12 : Limitations of the gate stations on the Bay of Plenty system

Also indicated in Table 5-12, are the components (if any) that limit gate station capacity and anticipated to lead to a design breach within the planning period. These are discussed in more detail below.

a. Kihikihi

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

b. Waikeria

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

c. Putaruru

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

d. Tirau 1 (Dairy)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

e. Tirau 2 (Town)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

f. Okoroire Springs

The station can meet the maximum predicted flow to FY23 and will not require upgrade. There is no water bath heater at this station, but given the limited load, no installation is recommended.

g. Pyes Pa

This station was constructed in FY07 and is anticipated to meet the required gas flow to FY23. It is located adjacent to a large domestic development and a future industrial development site. This is a high growth area and the station demand should be monitored for increases above the expected trend.

h. Tauranga

The station can meet the maximum predicted flow to FY23 and will not require upgrade. This is a high growth area and the station demand should be monitored for increases above the anticipated trend. The Vector gas distribution group is looking at options for increasing the outlet pressure from this gate from 1050 kPa to approximately 1700 kPa, which may require some transmission investment in the future.

i. Mt. Maunganui

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

j. Papamoa

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

k. Te Puke

The station meter capacity may be exceeded in FY22 if the forecast demand increase occurs. It is planned to monitor this situation and reassess at the next AMP review.

l. Rangiuru

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

m. Lichfield (Dairy)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

n. Tokoroa

The station can meet the maximum predicted flow to FY23 and will not require upgrade. The Vector gas distribution group is looking at options for increasing the outlet pressure from this gate from 1050 kPa to approximately 1700 kPa, which may require some transmission investment in the future.

o. Kinleith No.1

Although pipework capacity is theoretically exceeded, actual operating data suggests that pipework performance is adequate at current flowrates. Upgrade is not scheduled.

p. Kinleith No.2

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

q. Rotorua

The regulators at this station are operating above their design flowrate and it is planned to replace these in FY14.

r. Reporoa

Although pipework capacity is theoretically exceeded, actual operating data suggests that pipework performance is adequate at current flowrates. Upgrade is not scheduled.

s. Taupo

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

t. Broadlands

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

u. Rainbow Mountain

This gate station has now been removed.

v. Kawerau (Town)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

w. Kawerau (Caxton)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

x. Kawerau (Tasman)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

y. Te Teko

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

z. Edgecumbe (Dairy)

This dairy load is assumed to be flat although it has reached 6000 scmh in FY09 and may reach this level again. The water bath heater was analysed. Although heater capacity is theoretically exceeded, actual operating data suggests that heater performance is adequate at current flowrates. Upgrade is not scheduled.

aa. Edgecumbe 2 (Town)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

bb. Whakatane

The filtration capacity of the station was analysed and requires upgrade. An allowance of $150k is made for the work in the 10 year capex forecast.

cc. Opotiki

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

dd. Gisborne

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

5.9.2 Pipeline Analysis

The Bay of Plenty System pipeline consists of the main sections listed Table 5-13, extending east from Pokuru (near Te Awamutu) on the Maui line to Tauranga, Taupo and Gisborne, etc.

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa g)
Pokuru - Kinleith	300	78.8	8620
Kinleith - Kawerau	200	103.1	8620
Kawerau - Whakatane	100	13.7	8620
Kawerau - Gisborne	100/200	184/17.3	8620
Lichfield - Mt Maunganui Offtake	150/100	34.3/43.7	8620
Taupo lateral	100/150	18.2/20.7	8620
Rotorua lateral	80	18	8620

Table 5-13 : Bay of Plenty system main sections

To analyse the expected performance of the Bay of Plenty System, modelling was conducted for the peak weeks in FY12, FY17 and extrapolated to FY23, with the key results described below.

5.9.2.1 Modelling Assumptions

A fixed pressure of 7400 kPa at the system Intake Point (Pokuru compressor outlet) was assumed in all simulations. The discharge pressure required to meet current peak Bay of Plenty system demand is well under this level.

The two compressors at Pokuru can only deliver a flow of between 7 – 10 scm/s each (depending on Maui pressure), but the 200 line can deliver a further 8-9scm/s if Mahoenui compression is running. Collectively the Pokuru compressors and the 200 line provide N-1 redundancy for the Bay of Plenty pipeline intake point. Hence, subject to the continued availability of the 200 line, no requirement to upgrade compression at Pokuru is forecast before FY23.

Compressors are also available at Kawerau if needed to supply Gisborne. Kawerau compression is not currently required due to a substantial reduction in peak demand load at Gisborne since the compressors were installed.

An average of Maui gas composition for the Bay of Plenty System's 5-day peak, as well as an average weekly temperature were used for the analysis.

5.9.2.2 Minimum Pressure Criteria

The Gas Transmission System Security Standard (GTS-01) defines triggers for this system at:

Gisborne DP:	not less than 5 hours to reach 3200kPa
Taupo DP:	not less than 5 hours to reach 3200kPa
Tauranga DP:	not less than 6 hours to reach 3200kPa
Whakatane DP:	not less than 5 hours to reach 3200kPa

5.9.3 Bay of Plenty System – Capacity Analysis

Delivery Point	Aggregate Contractual Capacity (GJ/day)	Uncommitted Operational Capacity (GJ/day)		
		FY12	FY17	FY23
Broadlands	960	3,516	3,400	3,261
Edgecumbe	4,846	3,943	3,734	3,484
Gisborne	2,606	806	806	806
Mt Maunganui	2,538	2,372	2,197	1,986
Tauranga	1,101	1,400	1,336	1,259
Kawerau	3,747	14,547	14,046	13,444
Kihikihi	1,292	16,061	15,571	14,983
Kinleith	10,086	7,482	6,876	6,149
Lichfield	1,750	31,867	31,608	31,297
Opotiki	24	583	583	583
Putaruru	366	24,752	23,849	22,765
Rangiuru	500	3,079	2,970	2,838
Reporoa	2,337	5,928	5,583	5,168
Rotorua	1,744	1,826	1,826	1,826
Taupo	568	3,516	3,319	3,083
Te Puke	319	3,253	3,084	2,880
Tirau	1,484	13,833	13,702	13,544
Tokoroa	369	20,816	19,536	18,001
Waikeria	45	21,695	20,696	19,498
Whakatane	2,616	2,481	2,331	2,152

Table 5-14 : Pipeline capacity forecasts: Bay of Plenty System

5.9.4 Bay of Plenty System - Recommended Reinforcement Projects

5.9.4.1 Gate Station Investment Summary

The proposed gate station augmentation capital expenditure for the 10-year planning period is indicated in Table 5-15. The year quoted in the table refers to the disclosure year.

Projects	FY14	FY 15	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23
Whakatane (filter)	150									
Rotorua (regulators)	250									
Totals	**400**									

* Figures are in 2014 real New Zealand dollars ($000)

Table 5-15 : Bay of Plenty System gate station investment summary

5.9.4.2 Pipeline Investment Summary

There are no identified pipeline capacity constraints in the Bay of Plenty system over the 10-year planning period.

5.10 South System

Figure 5-8 shows a simplified schematic of the South System.

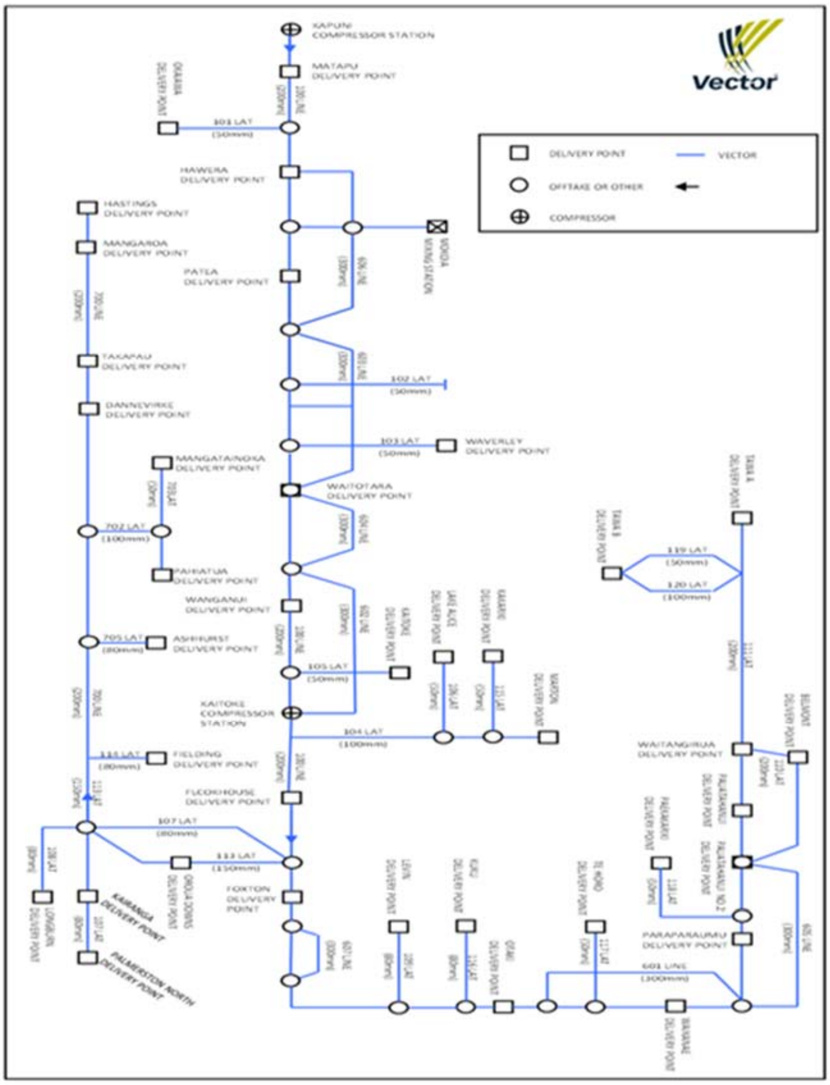

Figure 5-8 : Basic schematic of the South System

There are two major Intake Points for the South System, at the Kapuni Compressor Station and the Mokoia Mixing Station, south of Hawera.

5.10.1 Gate Stations Analysis

In Table 5-16 a summary is provided of the expected peak gas demand over the ten-year planning period, based on a calendar year.

Delivery Point Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Matapu	0	2	2	2	50		
Okaiawa (By Products)	2,030	2,153	2,153	2,153	1,030	2012	Pipework velocity
Manaia	217	185	185	185	340		
Hawera (Dairy)	3,757	3,134	3,134	3,134	3,800		
Hawera	752	868	868	868	990		
Patea	175	243	260	293	140	2012	Heater
Waverley	163	207	207	207	300		
Waitotara	285	246	256	276	130	2012	Heater
Wanganui	5,956	6,775	7,331	8,443	6,170	2014	Pipework velocity/heater
Kaitoke	175	174	182	197	280		
Lake Alice	224	224	225	226	160	2012	Heater
Kakariki	367	367	367	367	710		
Marton	1,299	1,343	1,343	1,343	3,400		
Flockhouse	0	2	2	2	160		To be removed
Foxton	654	352	352	352	1,810		
Levin	2,337	2,462	2,462	2,462	2,340	2014	Meter
Kuku	0	4	4	4	50		
Otaki	270	314	335	378	1,080		
Te Horo	0	3	3	3	50		
Waikanae	807	706	753	849	480	2012	Heater
Paraparaumu	1,493	1,718	1,863	2,157	1,170	2012	Pipework velocity

Delivery Point Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Paekakariki	0	5	5	5	230		
Pauatahanui No.2	0	5	5	5	50		
Pauatahanui	644	598	598	598	2,000		
Waitangirua (for Tawa A and B)	23,037	23,315	23,737	24,604	33,690		
Waitangirua (Porirua)	3,477	3,519	3,582	3,713	4,233		
Belmont	14,064	14,234	14,491	15,021	18,310		
Tawa B	3,986	4,034	4,107	4,257	11,130		
Oroua Downs	213	238	251	276	290		
Kairanga	78	10	10	10	50		
Palmerston North	8,471	8,488	8,513	8,565	3,400	2012	Filter
Longburn	1,714	1,644	1,644	1,644	3,400		
Fielding	1,572	1,376	1,376	1,376	3,400		
Ashhurst	92	94	94	94	137		
Pahiatua	2,049	2,053	2,059	2,071	1500	2012	Filter
Mangatainoka	373	503	547	635	1,510		
Dannevirke	356	405	405	405	1,450		
Takapau	777	652	652	652	1,510		
Mangaroa	144	146	146	146	180		
Hastings 1	9,687	9,726	9,784	9,902	10,830		
Hastings 3	991	995	1,001	1,013	10,830		

* Flows are in standard cubic metres per hour (scm/h)

Table 5-16 : Limitations of the gate stations of the South System

Also indicated in Table 5-16, are the components (if any) that limit gate station capacity, anticipated to lead to a design breach within the planning period. These are discussed in more detail below.

a. Matapu

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

b. Okaiawa 1 DP (By Products)

This is a process load and the station has been working above its normal capacity for a few years. Although pipework capacity is theoretically exceeded, actual operating data suggests that pipework performance is adequate at current flowrates. Upgrade is not scheduled.

c. Okaiawa 2 DP (Manaia)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

d. Hawera 1 (Dairy) & Hawera 2

The major dairy load does not coincide with the peak of the non-dairy load, so the bath heater does not need to meet a combined peak. The current water bath heater, installed in FY10 is forecast to be sufficient until FY23.

e. Patea

Although heater capacity is theoretically exceeded, actual operating data suggests that heater performance is adequate at current flowrates. Upgrade has been deferred until FY15. An allowance of $200k is made for the work in the 10-year capex forecast.

f. Waverley

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

g. Waitotara

Although heater capacity is theoretically exceeded, actual operating data suggests that heater performance is adequate at current flowrates. Upgrade has been deferred until FY16. An allowance of $200k is made for the work in the 10-year capex forecast.

h. Wanganui

The pipework velocity at this station already exceeds design levels and the water bath heater will reach its design limit by FY16. It is recommended to replace pipework and heater during FY17. An allowance of $700k is made for replacement in the 10-year capex forecast.

i. Kaitoke

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

j. Lake Alice

Although heater capacity is theoretically exceeded, actual operating data determines that an upgrade can be deferred until FY16. An allowance of $200k has been made for the work in the 10-year capex forecast.

k. Kakariki

Although the station flow exceeded the meter capacity in FY11, the last two years station flows have significantly reduced to a level where the meter is adequate. It is proposed to monitor station demands over the coming years rather than upgrade the meter.

l. Marton

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

m. Flockhouse

The station can meet the maximum predicted flow to FY23 and will not require upgrade. It is possible that this station will be decommissioned due to very low demand.

n. Foxton

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

o. Levin

The station meter will exceed its design condition by FY13. However, significant growth is not anticipated and the flow rate for the meter is only marginally high. Hence, the station will be monitored over the coming years prior to a decision on meter upgrade.

p. Kuku

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

q. Otaki

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

r. Te Horo

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

s. Waikanae

Although heater capacity is theoretically exceeded, actual operating data suggests that heater performance is adequate at current flowrates. Upgrade has been deferred until FY16. An allowance of $200k is made for the work in the 10-year capex forecast.

t. Paraparaumu

Although pipework capacity is theoretically exceeded, actual operating data suggests that pipework performance is adequate at current flowrates. Upgrade has been deferred until FY17. An allowance of $50k is made for the work in the 10-year capex forecast.

u. Paekakariki

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

v. Pauatahanui No.2

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

w. Pauatahanui

This station was upgraded in FY13.

x. Waitangirua 1 DP (For Tawa A and B)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

y. Waitangirua 3 DP (Porirua)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

z. Belmont

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

aa. Tawa B

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

bb. Oroua Downs

This station has been upgraded with a new heater in FY13

cc. Kairanga

The major gas user at Kairanga has ceased using gas as a process load and the remaining demand comprises only minor residential load. The existing equipment can meet this load. Hence, no investment is planned.

dd. Palmerston North

Although filter capacity is theoretically exceeded, it is planned to investigate the filter performance before consideration of upgrade. Growth at this location is currently flat.

ee. Longburn

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

ff. Fielding

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

gg. Ashhurst

A new electric heater was installed at this site in FY11. The station can now meet the maximum predicted flow to FY23 and will not require further upgrade.

hh. Pahiatua

The station filter capacity has been exceeded and an allowance of $100k is made in FY16 for upgrade. The dairy factory has indicated the potential for a significant load increase at this gate station during FY15 and the filter upgrade is planned to occur at the same time.

ii. Mangatainoka

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

jj. Dannevirke

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

kk. Takapau

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

ll. Mangaroa

The station can meet the maximum predicted flow to FY23 and will not require upgrade mm. Hastings 1 and Hastings 3

The meters at this site were replaced in FY09 and are adequate for the predicted demands. The water bath heater is at the limit of its design capacity. It is recommended to monitor the outlet temperature over the coming years to assess if an upgrade is necessary.

5.10.2 Pipeline Analysis

The South System pipeline consists of the main sections listed in Table 5-17, extending south from the Kapuni Gas Treatment Plant to Wellington and Hastings. This system is extensively looped. Loops are tabulated separately.

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa g)
Kapuni GTP – Hawera	200	17.8	8620
Hawera – Wanganui	200	79.9	8620
Wanganui – Himatangi	200	51.4	8620
Himatangi - Palmerston North O/T	150/80	23.8/23.8	8620
Palmerston North – Hastings	150/200	5.8/123.5	8620
Himatangi – Wellington	200	104.1	8620

Table 5-17 : South system main pipeline sections

The looped sections of the system are shown in Table 5-18.

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa g)
Hawera – Kaitoke Compressor	300	87.3	8620
Otaki Tie-In – Belmont	300	55.7	8620

Table 5-18 : South system looped pipeline sections

To analyse the expected performance of the South System, modelling was conducted for the peak weeks in FY13, FY16 and extrapolated to FY23, with the key results described below.

5.10.2.1 Modelling Assumptions

A fixed pressure of 8400kPa at the Intake Point was assumed in all simulations.

In simulations of the existing system requiring compression at Kaitoke, the smaller (No.1) unit was modelled. The discharge pressure set point at Kaitoke was assumed at 8400kPa.

The Offtake Points that supply Wellington city are Tawa A (for Powerco's distribution network) and Tawa B (for Nova's distribution network). However many years ago, the South transmission system was reconfigured to end at Waitangirua, some 7.7 km north of Tawa. Since then, the section of the original (200 mm) transmission pipeline from Waitangirua to Tawa has operated at a nominal pressure of 1900kPa.

5.10.2.2 Minimum Pressure Criteria

The Gas Transmission System Security Standard (GTS-01) defines triggers for this system at:

Waitangirua DP: not less than 10 hours to reach 3700kPa

Hastings DP: not less than 5 hours to reach 3200kPa

Managing the minimum available pressure at Waitangirua DP when considering new load requests will ensure that the Critical Contingency trigger will not be reached in normal operations.

In addition, Vector also manages the minimum pressure at all other gate stations to achieve at least 3200kPa.

5.10.3 South System – Capacity Analysis

Delivery Point	Aggregate Contractual Capacity (GJ/day)	Uncommitted Operational Capacity (GJ/day)		
		FY12	FY17	FY23
Ashurst	64	5,705	4,832	3,784
Belmont	7,901	5,940	5,171	4,248
Dannevirke	322	5,665	4,922	4,030
Feilding	1,114	4,217	4,150	4,069
Foxton	209	6,023	4,763	3,251
Hastings	11,726	1,014	157	No Spare Capacity
Hawera	2,230	4,199	3,159	1,911
Kaitoki	100	3,920	3,915	3,909
Kakariki	213	3,815	3,145	2,341
Lake Alice	218	1,887	1,625	1,310
Levin	1,041	5,025	4,576	4,036
Longburn	992	5,835	4,815	3,591
Manaia	199	5,416	5,021	4,548
Mangaroa	100	5,987	5,294	4,462
Mangatainoka	110	901	897	893
Marton	1,006	3,581	3,072	2,460
Okaiawa	1,680	1,411	932	357
Otaki	101	6,188	5,122	3,843
Pahiatua	1,592	4,133	3,201	2,083
Palmerston North	4,895	4,131	4,081	4,021
Paraparaumu	693	6,256	5,420	4,416
Patea	137	5,154	3,656	1,857
Takapau	609	5,749	4,894	3,868
Tawa	11,281	No Spare Capacity	No Spare Capacity	No Spare Capacity
Waikanae	242	6,145	5,226	4,123
Greater Waitangirua	1,647	6,427	5,564	4,528
Waitotara	105	5,473	4,538	3,415

Delivery Point	Aggregate Contractual Capacity (GJ/day)	Uncommitted Operational Capacity (GJ/day)		
		FY12	FY17	FY23
Whanganui	4,411	4,162	2,479	459
Waverley	162	1,020	1,016	1,011

Table 5-19 : Pipeline capacity forecasts - South System

5.10.4 South System – Recommended Reinforcement Projects

5.10.4.1 Gate Station Investment Summary

The proposed gate station augmentation capital expenditure for the 10-year planning period is indicated in Table 5-20. The year quoted in the table refers to the disclosure year.

Projects	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Patea (heater)		200								
Waitotara (heater)			200							
Wanganui (pipework and heater)				700						
Lake Alice (heater)			200							
Pahiatua			100							
Waikanae (heater)			200							
Paraparaumu (pipework)				50						
Totals		**200**	**700**	**750**						

* Figures are in 2014 real New Zealand dollars ($000)

Table 5-20 : South System station investment summary

5.10.4.2 Pipeline Investment Summary

The issue of lack of spare capacity at Tawa is addressed in Section 6.3.4 of this Asset Management Plan.

The issue of lack of spare capacity at Hastings by FY23 will be further monitored over the next period before making an investment decision.

Figure 5-9 shows a simplified schematic of the Frankley Rd to Kapuni System.

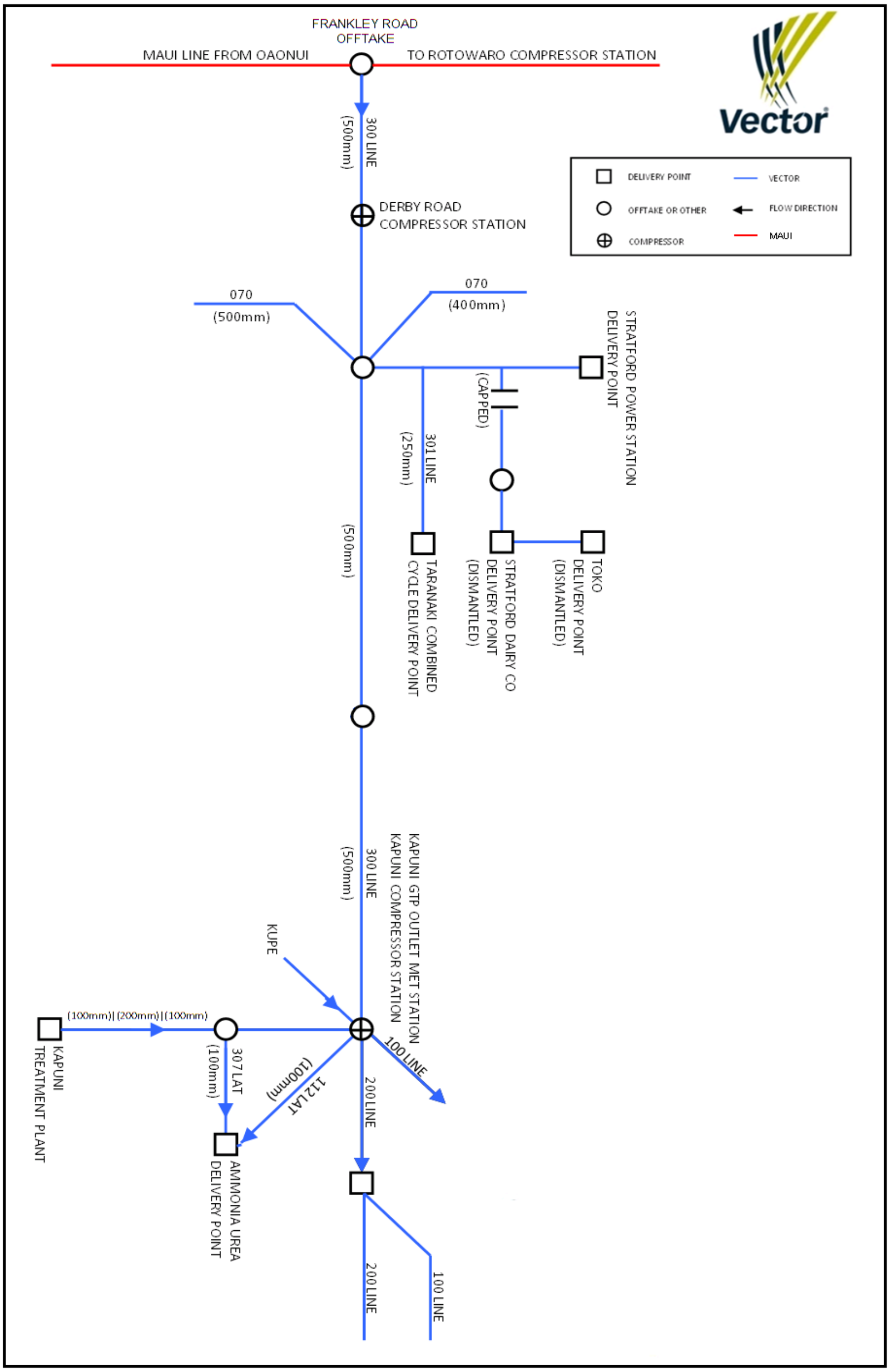

Figure 5-9 : Basic schematic of the Frankley Road to Kapuni system

Frankley Rd is both an Intake Point and an Offtake Point as Frankley Rd has “bi-directional” two-way flow metering. In practice however, the bulk of the gas which enters the Frankley Rd System does so via the Intake Point from the Kupe injection point which was added in 2009.

The TAW Intake Point only passes low to negligible flow into this system each year.

It is also possible for KGTP gas to enter the Frankley Rd system if required.

5.10.5 Gate Stations Analysis

Table 5-21 lists the Delivery Points of Frankley Road to Kapuni System. A summary is provided of the expected peak gas demand over a Jan-Dec ten-year planning period.

Delivery Point Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Stratford Power	31,542	52,083	52,083	52,083			
Stratford Storage	57,333	55360	55360	55360			To be built in 2013
TCC DP	69,640	69,640	69,640	69,640	110,530		
Ammonia Urea Plant	23,180	23,180	23,180	23,180	20,000	2012	Heater
Kapuni	210	271	271	271	980		

* Flows are in standard cubic metres per hour (scm/h)

Table 5-21 : Limitations of gate stations on the Frankley Road to Kapuni system

Also indicated in Table 5-21 are the components (if any) that limit gate station capacity anticipated to lead to a design breach within the planning period. These are discussed in more detail below.

a. Stratford Power Station

There are no regulators or heaters for this delivery point and the supply is directly from the high pressure system. New meters have been installed which are sized for the peak demand. It is not anticipated that this station will need upgrading during the planning period to FY23.

b. Stratford Storage

This station was commissioned in late 2009 as a temporary facility and will be replaced by a much larger capacity bi-directional station in FY13. There are no regulators or heaters and the supply is directly from the high pressure system. New meters will be installed which are sized for the peak demand and hence, this station will not need to be upgraded when considering the peak demand to FY23. The new stations capacity of 177,083scm/h will be sufficient during the planning period to 2023.

c. Taranaki Combined Cycle (TCC)

This gate station was sized for the power station demand and is not expected to need upgrading during the planning period to FY23.

d. Ammonia Urea DP

Although the heater capacity (together with the regulators) are operating near their limits, demand is not forecast to increase. Therefore equipment performance will continue to be monitored before any upgrade is considered.

e. Kapuni (Lactose) DP

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

5.10.6 Pipeline Analysis

The Frankley Road to Kapuni System pipeline consists of the main sections listed in Table 5-22, extending from the Frankley Road Offtake Station on the Maui pipeline near New Plymouth to the Kapuni Gas Treatment Plant, including laterals to the TCC Power Station and the Ammonia-Urea Plant.

Pipeline Segment	Nominal Bore (mm)	Length (km)	MAOP (kPa g)
Frankley Road - Derby Rd Compressor	500	22.3	6620
Derby Road – Pembroke Road	500	5.5	6620
Pembroke Road – TCC Power Station	500	8.6	6620
Pembroke Road – Kapuni GTP	500	18.8	6620
Kapuni – Ammonia Urea Offtake	100	0.4	8620
Ammonia Urea Offtake - Lactose	100/200	1.8/1.3	8620

Table 5-22 : Frankley Road to Kapuni system main sections

To analyse the expected performance of the Frankley Road to Kapuni System, modelling was conducted for the peak weeks in FY12, FY17 and extrapolated to FY23, with the key results described below.

5.10.6.1 Modelling Assumptions

A fixed pressure of 4400kPa was assumed to be available from the Maui pipeline at the Frankley Rd Intake Point. This pressure is typical of pressures normally available from the Maui line.

Kupe is the most significant intake point currently. There is generally a large Kupe production flow into the pipeline close to Kapuni, which tends to keep the pressure there within the range of 4200-4800kPa.

Currently Derby Rd compressor station is not required and is not operational. Significant work would be required to bring it back to service. Compression at Derby Road was therefore not considered during analysis of this system.

An additional criterion in all simulations was to maintain a minimum delivery pressure of 3750kPa to the Kapuni Gas Treatment Plant.

An average of the Frankley Rd System's peak week temperature, and an average Maui gas composition has been assumed for modelling.

5.10.6.2 Minimum Pressure Criteria

At the Stratford site there are now three major gas consumers, Stratford Power Station, TCC and Stratford Storage. The maximum contractual capacity of these three loads collectively is 170 TJ/day and so a single flat load of this size (49 scm/s) was modelled.

There are no specific gate station minimum pressure thresholds declared in the Gas Transmission System Security Standard (GTS-01). However, Vector manages the minimum pressure at all gate stations to achieve at least 3200kPa. As noted above, Vector also endeavours to maintain a minimum pressure in the 300 line at Kapuni of 3750kPa, in order to maximise the capacity of the Kapuni compressors (and hence, the South and Central South Systems.)

5.10.7 Frankley Road System - Capacity Analysis

Delivery Point	Aggregate Contractual Capacity	Uncommitted Operational Capacity		
		FY12	FY17	FY23
AUP	22,500	29,027	29,027	29,027
Kapuni (Lactose)	144	1,730	1,717	1,701
TCC+Stratford Power+Stratford storage	170,000	33,213	33,213	33,213

Table 5-23 : Pipeline Capacity Forecasts: Frankley Road System

5.10.8 Frankley Road System – Recommended Reinforcement Projects

5.10.8.1 Gate Station Investment Summary

There are no identified gate station investments in the Frankley Road system over the planning period to FY23.

5.10.8.2 Pipeline Investment Summary

There are no identified pipeline capacity constraints in the Frankley Road system over the planning period to FY23. The continuance of current pressure from the Maui pipeline at Frankley Road is noted as a critical factor in maintaining this situation.

5.11 Other Vector Assets

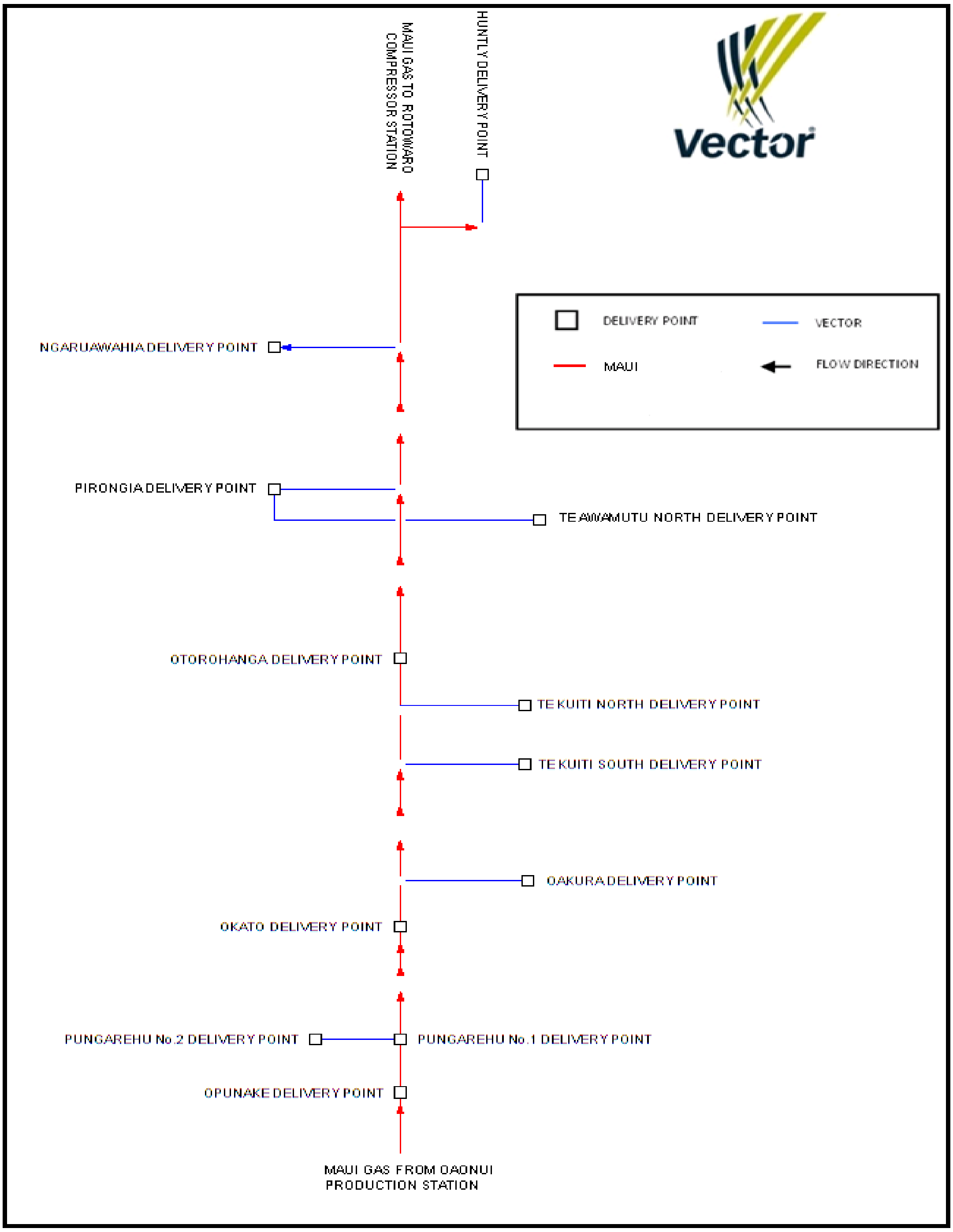

Figure 5-10 : Schematic of Vector assets on the Maui pipeline system

5.11.1 Gate Stations Analysis

Table 5-24 lists the Vector owned delivery points on the Maui Pipeline. A summary is provided of the expected peak gas demand over a Jan-Dec ten-year planning period

Delivery Point Name	Actual Max Flow (2012)	Predicted Max Flow (2014)	Predicted Max Flow (2017)	Predicted Max Flow (2023)	Station Max Flow Capacity	Year of breach of design capacity	Comments
Huntly	581	547	547	547	730		
Ngaruawahia	67	77	84	96	130		
Pirongia	30	31	34	39	50		
Te Awamutu North (Town)	613	631	631	631	860		
Otorohanga	163	174	174	174	220		
Te Kuiti North	241	368	368	368	450		
Te Kuiti South	933	910	910	910	1,050		
Oakura	104	87	87	87	50	2014	No Heater
Okato	49	76	76	76	190		
Pungarehu No.2	0	2	2	2	50		
Pungarehu No.1	0	3	3	3	50		
Opunake	101	101	101	101	650		

Table 5-24 : Limitations of the Vector owned delivery points on the Maui pipeline

Also indicated in Table 5-24, are the components (if any) that limit gate station capacity anticipated to lead to a design breach within the planning period. These are discussed in more detail below.

a. Huntly

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

b. Ngaruawahia

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

c. Pirongia

There is no water bath heater at this station. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

d. Te Awamutu North (Town)

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

e. Otorohanga

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

f. Te Kuiti North

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

g. Te Kuiti South

There is no water bath heater at this station. The station can meet the maximum predicted flow to FY23 and will not require upgrade.

h. Oakura

An assessment of this station was undertaken and it is recommended to install a new heater in FY16. An allowance of $200k is made for the work in the 10-year Capex forecast.

i. Okato

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

j. Pungarehu No.2

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

k. Pungarehu No.1

The station can meet the maximum predicted flow to FY23 and will not require upgrade. There is no water bath heater at this station, but given the limited load, no installation is recommended.

l. Opunake

The station can meet the maximum predicted flow to FY23 and will not require upgrade.

5.11.2 Other Vector Assets – Recommended Reinforcement Projects

5.11.2.1 Gate Station Investment Summary

The proposed gate station augmentation capital expenditure for the 10-year planning period is indicated in Table 5-25. The year quoted in the table refers to the disclosure year.

Projects	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Oakura (heater)			200							
Totals			**200**							

* Figures are in 2014 real New Zealand dollars ($000)

Table 5-25 : Other Vector assets investment summary

5.11.2.2 Pipeline Investment Summary

The individual pipelines have not been modelled for capacity and hence, there are no identified pipeline capacity constraints in this System over the 10-year planning period.

5.12 Third Party Pipeline Relocation

Under the requirements of Section 33 of the Gas Act 1992 and later amendments, Vector is required to relocate fittings, including pipelines when requested by New Zealand Transport Agency (NZTA) and Local Authorities. In addition to these central and local government entities, private developers may also establish that an existing pipeline presents an obstacle to the industrial or residential development of a site. Any number of these parties may request that Vector considers potential pipeline realignments, many of which result in protection works, such as concrete slab protection or occasionally stress modelling to establish whether the depth of the existing pipeline is sufficient to nullify the risk of installing infrastructure above the pipeline.

In a small number of cases each year, there is no alternative but to relocate the pipeline to a position which maintains the pipeline asset integrity. In general, these projects are recharged fully to the initiator of the work and the pipeline section is realigned.

The following is a summary of future potential projects which are already planned.

5.12.1 Future Potential Third Party Requested Pipeline Relocation Projects

Waikanae Expressway (also known as M2PP)

NZTA are planning to construct a new highway through Waikanae with a new road bridge. The new alignment crosses two transmission pipelines and impacts the existing gate station in Waikanae. It is planned to realign both pipelines and relocate the gate station to a new site. This work is fully rechargeable and will commence construction during FY14.

Transmission Gully (Wellington New Expressway)

NZTA have asked Vector to evaluate up to 30 separate points where the proposed new road route will cross the existing pipeline. It is unknown how many of these impacts will require the pipeline to be relocated, but an allowance has been made each year from FY14 for these potential works, commencing with initial design and FEED studies.

Soldiers Road, Pyes Pa

NZTA commissioned Vector to undertake the concept design of this pipeline realignment, which involves up to 700m of 100mm pipeline. The NZTA programme of work has now deferred this roading improvement until an estimated FY16.

5.12.1.1 Summary of Anticipated Investment Required for Relocation Projects

In Table 5-26, a summary is given of the anticipated relocation projects for the planning period. It will be noted that an allowance is made in future years, without details being known. This is considered reasonable, based on historical expenditure levels.

Pipeline realignment estimates have been based on historical unit costs as none of the identified potential schemes have completed FEED studies which would be used to identify advanced P90 estimates.

Projects	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Waikanae Expressway	6800	2600								
Transmission Gully	300	500	1500	1500	1500	1500	1500	1500	1500	1500
Other NZTA	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Totals	**8100**	**4100**	**2500**	**2500**	**2500**	**2500**	**2500**	**2500**	**2500**	**2500**

* Figures are in 2014 real New Zealand dollars ($000)

Table 5-26 : Pipeline relocation investment summary

5.13 Potential Large New Consumer Connections

Vector is aware of a number of potential new loads that may be connected to the transmission system over the planning window. These are summarised below. At this stage, no provision is made in the 10-year capex forecasts for any of these specific projects.

It is expected that any further large new connections due for construction in the 2014 disclosure year would already be known and identified in our modelled demand growth rates, and hence no further allowance for expenditure in this area has been made until FY14.

However, due to the potential number of new connections proposed and considered each year, and based on the historical trend of expenditure for these new connections, an allowance has been made of $1M per annum from FY14 to FY23 to support new connections which are outside the normal demand growth trends identified.

a. Pahiatua Station

Vector has been requested to analyse the gas transmission system at Pahiatua in consideration of a potential new spray drier, with a potential requirement during FY15. No specific demand growth allowance has been made.

b. Pokeno Dairy

Vector has been approached by a developer on behalf of a dairy company regarding a new supply of gas to an industrial and residential development at Pokeno. This would potentially involve milk powder manufacture. The closest station is likely to be Tuakau. There is no commitment at this stage, but the customer may require gas in 12-18 months time. No specific demand growth allowance has been made.

In addition to the above information concerning new customer loads, there is the potential for gas producers to request interconnections to the gas transmission system. If an interconnection contract is signed with Vector, then a new welded connection will be constructed, where Vector will own some or all of the assets. The assumed growth allowances below also allow for any new welded points.

Vector Gas Distribution have requested a new transmission delivery point at Waikumete to allow them to meet their system security standard in regards to minimum system pressures. This work commenced in FY13, and a further allowance has been made in FY14 of $1.0M to complete this new station.

5.13.1 Summary of Anticipated Investment Required for Consumer Connections

In Table 5-27, a summary is given of the anticipated growth projects for the planning period. It will be noted that an allowance is made in future years, without details being known. This is considered reasonable, based on historical expenditure levels.

Projects	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Assumed Growth	2000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Totals	**2000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**

* Figures are in 2014 real New Zealand dollars ($000)

Table 5-27 : Anticipated growth investment summary

5.14 Summary of System Development CAPEX Expenditure Forecast

	Projects	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
North System	Harrisville (bath heater, meter)	700									
	Warkworth No2 (Regulator)			200							
	Sub-Total	**700**		**200**							
Central North System	Temple View (meters)					400					
	Sub-Total					**400**					
Central South System											
	Sub-Total										
Bay of Plenty System	Whakatane (filter)	150									
	Rotorua (regulator)	250									
	Sub-Total	**400**									
South System	Patea (heater)		200								
	Waitotara (heater)			200							
	Wanganui (pipework and heater)				700						
	Lake Alice (heater)			200							
	Pahiatua			100							
	Waikanae (heater)			200							
	Paraparaumu (pipework)				50						
	Sub-Total		**200**	**700**	**750**						
Frankley Road System											
	Sub-Total										
Other Vector Assets	Oakura (heater)			200							
	Sub-Total			**200**							
System Growth	**Total**	**1100**	**200**	**1100**	**750**	**400**	**0**	**0**	**0**	**0**	**0**

	Projects	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Pipeline Relocations	Waikanae Expressway	6800	2600								
	Transmission Gully	300	500	1500	1500	1500	1500	1500	1500	1500	1500
	Other NZTA	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	Total	**8100**	**4100**	**2500**	**2500**	**2500**	**2500**	**2500**	**2500**	**2500**	**2500**
Consumer Connections	Assumed Growth	2000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	Total	**2000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**

- Figures are in 2014 real New Zealand dollars ($000).
- The year reference indicates the end of the Vector financial year.
- The forecasts are inclusive of the cost of finance and in line with Vector's business practice.

Table 5-28 : Summary of System Development CAPEX expenditure forecast

5.15 Gas Transmission: System Security Standard

GTS–01

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Gas Transmission:
System Security Standard

Compiled by:	Signature:	
	Name:	David Innes
	Position:	Manager : Transmission System Development
	Date:	14 September 2012
Reviewed by:	Signature:	
	Name:	
	Position:	
	Date:	
Authorised by:	Signature:	
	Name:	Ryno Verster
	Position:	Manager of Engineering
	Date:	14 September 2012

Revision Register				
Revision	**Issued**	**Reason for revision**	**Change reference**	**Supersedes**
End				

Contents

1. Purpose

The purpose of this standard is to define the minimum level of system security and transmission system performance to be applied in the operation and development of the Vector gas transmission system, under all *reasonably anticipated operating conditions*.

2. General

2.1 Scope

This standard applies to the Vector gas transmission system and covers its high-pressure pipeline system (normal operating pressure higher than 20barg). This system conveys gas from several bulk receipt points to various bulk delivery points. Receipt points are at gas production plants, or at several locations on the independent Maui pipeline, with the demarcation point between the Vector transmission system and producer plants generally at the first valve downstream from the metering point.[38] Delivery points are where consumers (including gas distribution network owners) take supply from the Vector pipelines, and the demarcation point is at the first valve downstream from the (Vector-owned) metering system.

Some dedicated consumer supplies may be designed to different security levels, as contractually agreed to with consumers. these are excluded from this standard.

2.2 Purpose

The System Security Standard fulfils a threefold function, providing:

- A clear measure for the minimum acceptable transmission system output performance, allowing easy identification of areas where attention may be required.
- A clear design standard that identifies when investments may be required to augment the transmission system capacity.
- A clear means of communicating to internal and external stakeholders the level of service they can reasonably expect from the Vector gas transmission system.

The System Security Standard sets the high level design requirements for the transmission system to ensure that gas fed into the system can be conveyed to consumers taking gas from the system at appropriate capacity and reliability levels, under all *reasonably anticipated operating conditions*. The primary trigger point for a transmission system reinforcement investment is when the forecast peak gas demand profile under such operating conditions would create a situation where one of more of the system requirements discussed in Section 3 can no longer be met.[39]

It does not refer to the technical and safety aspects of transmission asset performance.[40]

[38] At several receipt points from the Maui pipeline, Vector owns the metering system and the demarcation point is the first flange after the connection to the Maui pipeline.
[39] Alternatively, Vector may decide to avoid a forecast breach of the System Security Standard by limiting the allocation of new gas capacity to shippers, until an acceptable commercial and/or regulatory arrangement is reached that would allow Vector to recover the cost of reinforcing the transmission system at an appropriate rate of return.
[40] The Vector transmission system is regulated under the Health and Safety (Pipelines) Regulations (1999), which requires that the pipelines should be issued with a Certificate of Fitness by an independent Certifying Authority. In order to meet the requirements for Certificate of Fitness, Vector designs, operates and maintains the transmission system in accordance with the Australian and New Zealand standard (AS/NZS) 2885 suite of Standards for High Pressure Pipelines.

2.3 Definitions

The following terms are defined for the purpose of this standard:

A **Critical Contingency** is defined in terms of The Gas Governance (Critical Contingency Management) Regulations, 2008. A *Critical Contingency* is declared when, based on observed operating and gas consumption conditions, there is a reasonable likelihood or an actual breach of a specified threshold at one or more of the points on the transmission system defined by the regulations. Specified thresholds are defined as a minimum operating pressure and a time before the minimum operating pressure is reached. Critical contingency conditions are identified by the *Critical Contingency Operator* (CCO), who is also responsible for formally declaring a *Critical Contingency*.

The **Critical Contingency Operator (CCO)** is a role established in terms of The Gas Governance (Critical Contingency Management) Regulations, 2008. The CCO oversees the operations of the gas transmission system in order to avoid unsafe, unbalanced or unstable operating conditions and to ensure long term security of supply. One of the duties of the CCO is to declare a *Critical Contingency* when there is a likelihood or actual breach of the thresholds set in the Transmission System Owners[41] (TSOs) Critical Contingency Management Plans. The Critical Contingency Operator Communications Plan (document CCO-003) has been prepared in accordance with the Gas Governance (Critical Contingency Management) Regulations 2008, and describes the required actions of the CCO during a contingency, as well as the required communication to industry and the sequence of demand curtailment where required.

The **design capacity** of an asset is the maximum rated output the asset is capable of delivering over an extended period without excessive loss of life of the asset, taking into account the peak profile of gas demand and the operating environment of the asset.

A **pipeline system** refers to a part of the overall Vector gas transmission system, where one or more pipelines can be logically grouped together as a geographically contiguous unit.

Reasonably anticipated operating conditions refer to conditions where:

- A *pipeline system* is operating in its normal design configuration, with all assets fully functional (including where redundant assets are operating following any failure for which they are the back-up). (Asset redundancy is covered in Section 0 of this System Security Standard.).
- The gas demand on the *pipeline system* does not exceed that which could be reasonably forecast to occur under normal demand conditions (ie. temperature conditions not being more extreme than a 1-in-20 winter), where such forecast is based on the volume of gas that is contracted to be delivered through the system, and applying Vector's gas demand forecasting methodology. (This demand forecasting methodology is described in the Vector Gas Transmission Asset Management Plan.).
- Gas supply or production levels are sufficient to meet the gas demand on the *pipeline system*. and
- No *Critical Contingency* has been declared.

[41] Vector Gas Transmission is defined as a Transmission System Owner in the Gas Governance (Critical Contingency Management) Regulations 2008.

3. Security Standards

The Vector gas transmission system and all its *pipeline systems* shall be designed, constructed and operated to ensure that the following conditions are met under *reasonably anticipated operating conditions*.

3.1 Physical System Capacity

The *design capacity* of any component of the gas transmission system shall not be exceeded. Specifically:

a. For gas pipelines – 100% of the maximum allowable operating pressure level (MAOP) shall not be exceeded under stable operating conditions, or 110% of MAOP under transient operating conditions (as defined in AS2885/1, 2007).

b. Rotating equipment - the maximum design gas flow rate or pressure levels (inlet and output) shall not be exceeded.

c. Delivery point components (including heaters, valves, metering systems, regulators, etc.) – under stable operating conditions the design capacity of any component shall not be exceeded.

3.2 Minimum Transmission System Pressure

The minimum operating gas pressure on any part of the transmission system shall not fall below the greater of the following levels:

a. The minimum operating pressure defined under the Critical Contingency Management requirements set out in the Gas Governance (Critical Contingency Management) Regulations, 2008 R25(1)(a) as interpreted by the Transmission System Owner[42]. or

b. The minimum contractually agreed pressure that Vector has to deliver at a specific customer inlet point.

Critical contingency threshold values are defined as minimum operating pressures and time before these minimum operating pressures are reached and are listed in table 1 below[43]. A material likelihood or actual breach of one or more of these threshold values will give rise to the declaration of a Critical Contingency by the CCO.

Table 1 : Critical Contingency Threshold

Delivery Point	Minimum Operating Pressure (at inlet)	Time before Minimum Operating Pressure is reached
Cambridge DP	32 barg	5 hours
Gisborne DP	32 barg	5 hours
Hastings DP	32 barg	5 hours

[42] R25(1)(a) specifies the permissible limits for thresholds to be specified in the Critical Contingency Management Plan. This is specified as a range. Vector Gas Transmission as the Transmission System Owner has defined, in consultation with the gas industry, a series of fixed pressure values and times that fall within these ranges, that would give rise to a *Critical Contingency* being declared.

[43] Over-pressure situations at delivery points is not considered a design standard, as these are unlikely to arise and, in addition, protection against over-pressure is provided at all delivery points.

Delivery Point	Minimum Operating Pressure (at inlet)	Time before Minimum Operating Pressure is reached
KGTP	37.5 barg	3 hours
Tauranga DP	32 barg	6 hours
Taupo DP	32 barg	5 hours
Waitangirua DP	37 barg	10 hours
Westfield DP	42 barg	4 hours
Whakatane DP	32 barg	5 hours
Whangarei DP	25 barg	5 hours

At all other delivery points, the minimum acceptable pressure level at the inlet is 32 barg.

Exceptions

The minimum acceptable pressure level at the Kauri delivery point inlet, which is downstream from the Whangarei DP, is 25 barg.

3.3 Component Redundancy Levels

The following minimum redundancy levels are required for the various components making up the gas transmission system[44]:

a. Pipelines : N

b. Rotating equipment [a] : N-1

c. Pressure regulation streams at delivery points (peak gas delivery >= 20GJ per day) : N-1

d. Other delivery point equipment (including pressure regulation streams at delivery points with peak gas delivery < 20GJ per day) : N

Note (a) : The transmission system must have sufficient capacity to allow for a maximum of 1 hour delay (or 3 hours if located in a remote rural location) between the outage of a primary gas compressor unit and achieving full operational status of the stand-by unit, without breaching minimum pressure criteria.

Exceptions

a. N-1 redundancy for rotating equipment at customer connections is not required, unless specifically contracted for.

b. N-1 redundancy for rotating equipment is not required at low-demand compressor stations. currently limited to the Derby Rd, Kawerau and Henderson compressor stations.

End of document

[44] An N redundancy level means that no redundancy is built into the system and that a single component outage can compromise the ability of a *pipeline system* to deliver its required output. An N-1 redundancy level means that a failure on any single component will not affect the ability of the system to deliver its required output.

Gas Transmission
Asset Management Plan
2013 – 2023

Asset Maintenance, Renewal and Replacement
Section 6

Table of Contents

List of Tables

6. Asset Maintenance, Renewal and Replacement

6.1 Overview

This section covers Vector's life cycle asset maintenance, renewal and replacement plans, and the policies, criteria, assumptions, data and processes used to prepare these.

Vector's high pressure gas transmission pipeline asset is designed and built to deliver gas to the service levels set out in GTS-01 Gas Transmission Security Standard[1], as reflected in the connection agreements with Vector's customers[2]. In order to achieve the required 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), refurbishing and maintaining assets (regular maintenance). Vector's long-term asset maintenance strategy is to achieve the most cost effective trade-off between capital expenditure (capex) and operational expenditure (opex), while maintaining a safe, efficient and reliable pipeline system. Achieving this requires a balance between effective maintenance and judicious asset renewal.

Safety is the key consideration in the design, construction and maintenance of Vector's gas transmission system and accordingly Vector manages its gas transmission asset in accordance with relevant acts, regulations and industry standards. In particular the Health and Safety in Employment (Pipelines) Regulations 1999 and the AS 2885 standard require Vector to operate and maintain a safe and reliable gas transmission asset.

The last period of significant investment on Vector's gas transmission asset occurred in the mid-1980s. Therefore an increasing emphasis is being placed on assessing asset condition, performance and risk to determine the optimum time for planned repairs, refurbishments or replacements.

All expenditure forecasts included in this section of the AMP are in 2014 real New Zealand dollars.

6.1.1 Maintenance and Inspection Approach

Vector has a maintenance strategy and Pipeline Integrity Management Plan (PIMP) which describes the approach to maintaining and inspecting various asset categories. A comprehensive suite of maintenance and inspection check sheets support the delivery and monitoring of the maintenance strategy. There are significant differences required in the approach to different asset types, but as a broad rule the maintenance strategy defines the following:

- Outline of maintenance practices to be applied.
- The circumstances under which different maintenance practices are to be applied.
- The management of maintenance practices using the Maintenance Management System (MMS).

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 replacement policies support this goal by intervening to ensure optimal performance.

At the time an asset is designed, it is necessary to define its expected design life. This is based on actual field experience and is aligned to the assumed depreciated life for this type of asset. Once commissioned, the asset depreciation commences and the

[1] The Gas Transmission Security Standard is discussed in more detail in Section 5 of the AMP.

[2] Security levels higher than that described in the standards may be available to consumers, in which case dedicated commercial arrangements will be entered into.

maintenance cycle begins. The maintenance regime is designed to achieve at least the intended design life.

Ongoing monitoring of condition throughout the asset's life is used to identify the optimal point when the asset should be decommissioned. As an asset ages and its condition worsens, the cost of repairs to maintain fitness for purpose will escalate until it becomes more economically efficient to decommission or replace it.

To maximise the value from, and to inform decisions and policy regarding asset lifecycle management, the following factors are taken into consideration:

- An informed and justified view based on research, practice, experience and knowledge of the expected life of all asset types.
- An up to date optimised maintenance approach for all asset types.
- A feedback cycle from the maintenance activities to inform on current asset condition and to continually refine the maintenance approach.
- A business funding plan aligned to the anticipated replacement or decommissioning of assets.

Pipelines

Detailed philosophy and guidelines for pipeline maintenance and renewal are contained in the PIMP. The PIMP sets out the pipeline monitoring and maintenance activities to be undertaken to support the safe and reliable operation of the asset.

The PIMP is reviewed annually and considers monitoring data and pipeline activities from the previous year and identifies any change in risks associated with the pipelines from a wide range of threats, which can be broadly categorised as:

- Third party interference
- Corrosion
- Natural events (flooding, earthquakes, slips etc).

A Safety Management Study (SMS) of the asset was conducted in 2011 in accordance with AS 2885. There are a number of events or changes which can impact on the pipeline system which may result in a change of the identified risk level and hence maintenance routines. Such changes include:

- Urban encroachment
- Pipeline related incidents
- Findings from routine monitoring
- System improvements
- System modifications
- Inspections and audits.

Any required changes to routine maintenance activities identified by the SMS are incorporated into maintenance schedules.

Any required non-routine activities identified by the SMS are assessed, prioritised and assigned in the Non Routine Activity Management System (NRAMS).

In 2011 Vector implemented and populated a new Pipeline Integrity Management System for the management and analysis of pipeline condition data. The system employed is Rosen Asset Integrity Management Support (ROAIMS) which enables Vector to record and store information gained from routine maintenance and inspection of pipelines and has made large improvements to the processes employed to determine and manage pipeline data to clearly identify pipeline issues and to assist in advising maintenance activities.

Stations

The philosophy and guidelines for maintenance on all station facilities is outlined in Vector document 3205250 - Maintenance Strategy. This document describes the general approach to maintenance, maintenance management model, planning, KPIs, processes, additional strategy elements, performance measurement and spare parts management. All maintenance on stations facilities including individual components is scheduled in a maintenance plan and monitored through the Systems Applications and Processes Plant Maintenance (SAP-PM) maintenance management system.

Where applicable, pressure vessels are subject to the requirements of the Pressure Equipment, Cranes and Passenger Ropeways (PECPR) Regulations and are inspected in accordance with AS/NZS 3778: 2006 Pressure Equipment In-Service Inspection and maintained in accordance with Vector document 3206146 - Pressure Equipment Management Plan. This documents sets out the requirements for inspection intervals, competent person requirements, non-conformance reporting and standards to be applied.

Vector monitors developments in asset maintenance practices and techniques. Based on these surveys and advice from experts Vector has identified that substantial benefits can be achieved by adopting enhanced maintenance practices.

A Reliability Centred Maintenance (RCM) based approach to maintenance was adopted by Vector in 2002 aimed at optimising maintenance being performed on station assets and to improve reliability and availability. The results of the RCM programme identified a number of improvements that have been implemented. To date approximately 70% of the mechanical preventative, proactive and predictive maintenance practices have been reviewed using RCM. Vector commenced a maintenance strategy review in late 2012 which will re-evaluate the RCM approach and consider alternative methodologies such as Maintenance Task Analysis (MTA) and fully review predictive maintenance tools and techniques.

Collecting asset condition data will also allow Vector to accurately assess the health of individual assets on an ongoing basis. By tracking this information over time and assessing this in conjunction with pipeline system reliability performance, the effectiveness of Vector's renewal and maintenance investment can be continually assessed and optimised. This initiative commenced in 2012 with new and improved practices planned for implementation throughout 2013 and 2014.

Systems Applications and Processes Plant Maintenance (SAP-PM) module is used to gather information about asset condition and is used to analyse data and trends to assist in advising maintenance activities.

6.1.2 Renewal and Replacement Approach

Optimisation of capital investment and maintenance and inspection costs is a key component of the approach to renewal and replacement. 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 asset life to beyond normal predicted asset life, by servicing or refurbishing the assets. Asset renewal is therefore in general condition-based rather than age-based with the exception of metering systems, SCADA/communications equipment and gas chromatographs and which are discussed in Sections 6.5.6, 6.5.7 and 6.5.8 respectively.

Assets are only replaced when:

- They are irreparably damaged.
- The operational and/or maintenance costs over the remaining life of the asset will exceed that of replacement.
- There is an imminent risk of asset-failure.

- Assets become obsolete and hence impossible or inefficient to operate and maintain.
- Reliability and performance has become unacceptable.

Asset condition evaluation is based on:

- Results of field surveys, observations, tests and defect work schedules.
- Analysis of data associated with equipment condition eg. ILI results, compressor oil analysis, vibration monitoring of rotating equipment and water bath heater water sampling.

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
- The impact should the asset fail and the likelihood of such failure
- Health and safety risks
- Risk to other assets
- Risk to Vector's reputation
- Potential financial impacts
- Potential effects on the environment.

The final project prioritisation list (that incorporates scoring based on condition and performance as well as risk assessment), along with budgetary estimates, forms the basis of the annual renewal budgets for each fiscal year.

The original design basis of all assets identified for replacement or renewal is reviewed for current validity prior to confirming replacement asset design, capacity and size. Opportunities to gain efficiencies by installing replacement assets of different design specifications to original assets are identified and implemented wherever possible.

When assessing the need to replace or renew assets other alternatives such as decommissioning and abandonment are considered. The availability and feasibility of these types of options depends on a range of factors. Vector is currently investigating the possibility of decommissioning a number of smaller delivery points where the cost of required capex for renewal and replacement may be greater than projected revenue. The effect on customers and associated supply contracts will be considered on a case-by-case basis before making investment decisions.

6.2 Maintenance Planning, Processes, Policies and Criteria

Strategic focus

This section presents the planning processes, policies and criteria for managing Vector's assets. The combination of processes polices and criteria align with Vector's strategic drivers. The strategic drivers and how they translate into long-term asset management, maintenance and asset renewal approaches are presented as follows:

Operational Excellence

- Maintain the existing assets in good and safe working order until new assets are built or until they are no longer required.
- Ensure pipeline system operation is reliable.
- Ensure pipeline system investments and operating activities are efficient.
- Strive for continual innovation and efficiency improvements on how assets are maintained and operated.

- Comply with relevant acts, regulations and industry standards.

Customer and Regulatory Outcomes

- Ensure the safety of the public, employees and contractors.
- Ensure the pipeline system is designed, operated and maintained to the required standard to provide the agreed level of service.
- Ensure an appropriate level of response to customer concerns, requests and enquiries taking into account any pricing and regulatory tradeoffs.

Disciplined Growth

- Strive to achieve the optimal balance between capital and operational costs.
- Coordinate asset replacement and new asset creation programmes.
- Apply innovative approaches to solutions, development and projects execution.

6.2.1 Asset Maintenance and Inspection Standards and Schedules

The over-arching maintenance philosophy adopted for the asset is to provide timely, quality and cost effective maintenance services to ensure that assets are maintained to support the required level of safety and reliability, availability, output capacity and service quality.

The pipeline Certificates of Fitness (CoF) prescribes mandatory conditions for the performance of operations and maintenance. Other mandatory requirements are included in various Acts, Regulations and Standards.

Asset maintenance practices for the asset have largely evolved over the past 40 years. AS 2885.3 covers gas pipeline operation and maintenance, and is essentially Vector's main reference document for these activities. Other obligations fall into the category of best industry practice and are to be found in various Australian and overseas Standards and Codes.

Vector's asset maintenance strategy is described for above ground stations in the Maintenance Strategy and Pressure Equipment Management Plan (PEMP) and for underground pipelines the Pipeline Integrity Management Plan (PIMP). These documents set out what is necessary to maintain the asset at the required levels of service, while optimising life cycle costs.

Vector has developed maintenance regimes for each class of asset. The regimes form a key part of Vector's schedule for planned maintenance. The purpose of these regimes, 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. Vector's asset maintenance regimes are prepared by the Asset Investment (AI) group in collaboration with the Service Delivery (SD) group who carry out maintenance and inspection in the field.

Assets are maintained to a level that maximises the availability of the equipment for remote and unmanned operation. The asset maintenance strategy defines the required frequency of inspection and maintenance for each asset class based on statutory requirements, knowledge of equipment performance and manufacturers recommendations. This forms the basis of Vector's asset maintenance schedule.

The strategy is reviewed and updated based on any new available information. The Transmission Services team contributes to, and forms an integral part of, this continual improvement process.

Progress against the maintenance schedules and the associated maintenance costs are monitored on a monthly basis. Defects identified during asset maintenance and inspections are recorded and prioritised based on risk assessment for remedial works. Maintenance priorities are based on costs, risks and safety criteria.

In making decisions on repairing or replacing the assets, 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 may be undertaken when significant defects occur. This is also supplemented by fault trend analysis. If performance issues with a particular type of asset are identified, and if the risk exposure warrants it, a project will be developed to carry out the appropriate remedial actions. The maintenance strategy is reviewed periodically reviewed and the findings from root cause analysis and fault trend analysis are used during the review process.

6.2.2 Maintenance Categories

Planning, controlling and monitoring maintenance activities are essential to ensure activities are effectively and efficiently performed. Maintenance categories are defined as:

Reactive Maintenance

- Action undertaken directly following incidents or any other work that is required to rectify asset failure or damage to assets caused by unplanned or unforeseen circumstances.
- Safety response and repair or replacement of any part of the asset damaged due to environmental factors or third party interference.
- Response to any fault at a station where safety or supply integrity could be compromised.

Preventative Maintenance

- Provision of pipeline patrols, inspection and condition detection tasks and maintenance service work.
- The coordination of shutdowns of station facilities, restoration of supply along with the capture and management of all defined data.

Corrective Maintenance

- Assets identified from planned inspections or service work to be in poor condition, requiring repair.
- Poor condition or unserviceable assets identified via one-off or programmed inspections or identified through coincident capital works.
- 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.

Predictive Maintenance

- Technology based methodologies to determine an asset’s condition without disturbing normal operation, using vibration analysis, thermography, tribology, ultrasonics, motor current or flux analysis, process performance, metrology, rotating equipment oil analysis, MLV hydraulic oil analysis and water bath heater water sampling or computerised calibrations.

Proactive Maintenance

- Advanced investigative and corrective technologies to extend machinery life such as root cause failure analysis, borescope inspections, alignment and balancing, installation / commissioning performance verification, purchase specification, spare parts management and reliability engineering and research.

Value Added Maintenance

- Issuing maps and site plans to indicate the location of assets.
- Asset location services, including the marking out of assets, safe work practice site briefings, work site observer, urgent safety checks and issuing close proximity permits.

In addition to the above, there are maintenance activities that are necessary to comply with statutory and licensing requirements. Taking all of the above into account, maintenance strategies and plans are developed. These determine maintenance activities and frequencies. The plans are updated as required on a monthly basis.

The frequencies defined in the Maintenance Plans are encapsulated in SAP-PM. This system provides schedules and frequency guidelines for maintenance on Vector's transmission pipeline assets.

6.2.3 Asset Maintenance Field Services

Asset inspections and maintenance work is delivered by Vector's Transmission Services team in the SD group to the standards and inspection schedules for each class of asset defined by the AI group.

The resources employed by the Transmission Services team are mainly in-house and are supplemented by the use of external contractors to balance work load requirement as required. The Transmission Services team is responsible for planning and scheduling maintenance requirements and ensuring that sufficient skilled resources are available to deliver against requirements.

Progress against the maintenance schedules and the associated maintenance costs are monitored on a monthly basis and discussed between SD and AI. Standards and maintenance inspection schedules also form part of the maintenance contract with which external contractors must comply when performing their duties.

6.3 Pipelines

The first of Vector's underground pipelines was commissioned in 1968. In a valuation prepared in 2003, a standard economic life of 65 years for protected steel pipe has been used. In comparison, the NZ Infrastructure Asset Management Manual gives the base life of steel pipe as 80 years. Regardless of which approach is used, the pipe assets will not reach the end of their economic/base life within the timeframe covered by this AMP.

A technical assessment with respect to the remaining life of the major pipelines was last carried out in 2007 (an initial assessment was carried out in 2000). The general outcome of the 2007 assessment was a negative adjustment to the older pipelines (30 years or older), and a positive adjustment to the newer pipelines (less than 30 years old assets).

Condition based assessments to date indicate that all pipelines are in reasonable condition and that no excessive deterioration has occurred. Despite the condition assessment investigations and work activities carried out in accordance with the PIMP process, it is possible that a section of pipeline in poor condition could fail prematurely and compromise the integrity of the gas transmission system. The latest Safety Management Study (SMS) conducted in 2011 in accordance with AS 2885 addressed any issues that could impact on pipeline condition and a number of actions were identified and implemented to either change or improve maintenance routines or renewal/replacement programmes. The SMS process uses a Standard Threat Assessment (STA) to assess all threats to the gas transmission system and applying them to hypothetical base-case pipelines in both rural and urban areas. The STA has been used as the base-case for carrying out the Safety Management Studies. Any areas of the line that differ from the base-case were reviewed and appropriate mitigating measures determined. The SMS reports and STA process were independently assessed by Lloyds Register who provided comments which were also included in the documentation.

There are no major pipeline renewal projects identified at this stage for the gas transmission system based on condition. Current renewal projects are driven by external requirements, such as pipeline realignments required for proposed highway construction projects initiated by the NZTA or other requiring authorities.

Overall, the asset ages are now approaching mid-life but are considered appropriate for a mature, well-functioning gas transmission pipeline business.

6.3.1 Pipeline Maintenance and Inspection

The current controls, monitoring and maintenance activities were originally established from the 2006 Pipeline Risk Assessment for the purposes of maintaining an appropriate level of pipeline integrity. These controls were considered appropriate in the 2011 SMS to ensure the level of risk is maintained at a low level or as low as reasonably practicable (ALARP). Existing routine maintenance and surveillance activities are summarized below.

Cathodic Protection (CP)

- Week day CP rectifier monitoring.
- Three monthly CP ‘on’ monitoring for selected test points.
- 12 monthly CP test point ‘on-off’ survey of entire system (with the exception of test points to which access was not available at the time eg. landowner restrictions).
- Six monthly CP Test Point ‘on-off’ surveys in selected T1 areas.
- Annual cased crossing electrical isolation testing.

Preventive Maintenance Inspections

- Stress Corrosion Cracking (SCC) investigation/survey.
- Coating defect surveys of unpiggable pipelines using Direct Current Voltage Gradient (DCVG) and Alternative Current Voltage Gradient (ACVG) techniques.
- Above ground pipe work coating inspections.

Monitoring

- Erosion monitoring and surveying at selected waterways.
- Geotechnical surveys.
- Ground movement monitoring.

Reactive Maintenance – Faults and Defects

- Coating faults – inspection, repair and rectification of selected defect indications.
- CP - structures and equipment.
- Minor third party damage repairs.

Pipeline Authorisation Requirements

There are a number of specific pipeline authorisation conditions required as part of the routine maintenance plan. Each of the specific requirements is scheduled as a routine activity in a similar way to other routine maintenance activities.

In Line Inspection Programme

The normal frequency for In Line Inspection (ILI) surveys of pipelines in rural location is 10 yearly intervals and in urban locations 5 yearly intervals. An overview of the timing for ILI surveys defined in the PIMP is shown in Table 6-1.

Excavations to verify ILI data and repair any found defects follow ILI surveys.

Cleaning Pipeline Inspection Gauge (PIG) runs are conducted at varying interim intervals for each pipeline based on operational knowledge and history of each pipeline's requirements.

Line	Location	NB (mm)	Dist (km)	Inter (yrs)	DY14	DY15	DY16	DY17	DY18	DY19	DY20	DY21	DY22	DY23
113	Himatangi-Feilding	150	29	10								■		
405	Glenbrook Lateral	150	23	10								■		
430[II & III]	Henderson-Maungatapere	150	150	10								■		
800	Lichfield-Kaimai SS	150	35	10								■		
100	KGTP-Waitangirua	200	255	5		■					■			
200 [III]	Temple View-Papakura	200	96	5		■					■			
200[I & II]	KGTP-Temple View	200	243	10							■			
430[I]	Westfield- Henderson	200	35	5	■						■			
700	Feilding Offtake-Hastings	200	153	10							■			
500[II]	Kinleith-Kawerau	200	103	10							■			
500 [I]	Pokuru-Kinleith	300	79	10						■				
601/605	Otaki SS-Belmont	300	17	10						■				
602/603/604/606	Hawera-Kaitoke	300	88	5	■					■				
400N	Rotowaro-Southdown	350	92	5	■					■				■
300	Frankley Rd-KGTP	500	47	10							■			

Table 6-1 : ILI Survey Schedule

Expenditure Forecast

Opex forecast for pipeline maintenance and inspection comprising of cathodic protection, preventative maintenance inspections, monitoring, reactive maintenance – faults and defects and pipeline authorisation requirements, based on operational experience is shown in Table 6-2.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
2,349	2,461	2,461	2,461	2,461	2,461	2,461	2,461	2,461	2,461

Table 6-2 : Opex forecast for pipeline maintenance and inspection ($000)

Opex forecast for ILI surveys, associated excavations and interim interval cleaning pigging based on a combination of the proposed ILI programme and operational experience is shown in Table 6-3.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
783	645	59	59	59	1,231	1,817	1,231	59	352

Table 6-3 : Opex forecast for ILI surveys ($000)

6.3.2 Easement Activity

Pipeline Surveillance

Regular inspections, aerial surveillance and vehicle/foot patrols are conducted and are scheduled in SAP-PM. Non-routine patrols such as post flood/storm and post seismic event inspections are carried out as determined by Vector field technicians and the Transmission Services Manager. Pipeline easement surveillance reports are completed for all patrols. These reports form part of the annual integrity management review.

Pipeline surveillance is used to monitor activities over or near the assets, and in particular, to ensure that no unauthorised activity is occurring or has occurred.

The frequency of pipeline patrols is higher in urban areas. Daily road patrols are the primary surveillance mode in Auckland due to the fact that the majority of the pipeline route is located within the road reserves across the isthmus. Road patrols are also carried out weekly in the Whitby area in greater Wellington because of the increased risk of urban developments.

Aerial surveillance features more prominently in the other regions given the rural nature of the pipeline environment.

Aerial inspections of pipelines using helicopters and fixed-wing aircraft are performed in accordance with the PIMP to check for land disturbances, evidence of gas escapes or any unauthorised building, tree planting or construction work over the pipeline easements.

Activities are show in Table 6-4.

Frequency	Activity
Daily	Road patrols in Auckland urban area
Weekly	Road patrols in the Whitby area
Monthly	Road patrols Line flights Surveillance of special areas of interest
Three Monthly	Line flights Surveillance of special areas of interest
Ad hoc	Post storm , flood or seismic event pipeline route inspections

Table 6-4 : Pipeline surveillance activities

Pipeline Awareness

The number of incidents and unauthorised activities across Vector owned and managed pipelines are relatively high when compared against other international pipeline systems. An initiative to assess the effectiveness of current awareness and education systems (mail-outs and liaison) and to determine more robust strategies was undertaken in 2010. A number of initiatives are in progress to improve the level of pipeline safety awareness across the pipeline footprints. Significant progress has been made to date with a planned safety awareness programme in place.

Initiatives in progress include the issuing of pipeline safety posters to Local Authorities and contractors and issuing an individual plan to landowners / occupiers showing an aerial image of their property with the route of the pipeline identified on it.

The procedure for handling unauthorised third party incidents has also been revised with AI's land management team coordinating all communications with each party including landowners, occupiers and contractors.

A review of the programme was conducted in February 2011. This has now resulted in a new Pipeline Safety Awareness Plan being implemented from April 2011.

Pipeline awareness activities include:

- Signage replacement (AS 2885.1 2007 requirements were assessed as part of 2009/10 safety management study process)
- Fence post painting (indicating route of pipeline)
- Landowner liaison through 6 monthly postal correspondence
- Development of landowner/occupier visit policy
- Communications with councils to raise awareness of the pipeline and their obligations regarding land development
- Yearly postal communications with contractors
- Pipeline safety seminars
- Contractor trade displays.

Control of Works Adjacent to Pipelines

Vector's pipeline integrity engineers have formalised the process by which proposals for activities on or adjacent to the pipeline easement are investigated and suitable responses formulated - Vector document 1317 Communication and Assessment of Works Adjacent to Pipelines.

Pipeline control activities include:

- 24/7 one-call number
- Permit to work system
- "Dial B4U Dig" Initiative
- Works Adjacent to Pipeline (WAP) proposal reviews.

Expenditure Forecast

Opex forecast for easement activity comprising of pipeline surveillance, pipeline awareness and control of work adjacent to pipelines based on historical trends and operational experience is shown Table 6-5.

Category	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Pipeline surveillance (SD)	1,181	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242
Pipeline awareness & control of works adjacent to pipelines (AI)	134	141	141	141	141	141	141	141	141	141
Total	**1,322**	**1,383**	**1,383**	**1,383**	**1,383**	**1,383**	**1,383**	**1,383**	**1,383**	**1,383**

Table 6-5 : Opex forecast for easement activities ($000)

Capex forecast for easement activity comprising of pipeline signage replacement is show in Table 6-6.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
100	50	50	50	50	50	50	50	50	50

Table 6-6 : Capex forecast for easement activities ($000)

6.3.3 Exceptional Pipeline Maintenance Projects

Based on historical data from recent events and activity levels it is expected that a number of exceptional maintenance activities associated with pipeline protection works will occur each year. These works are generally associated with protecting pipelines from river bank erosion or replacing cover due to scouring etc. Also included is an annualised provision for extreme events from natural causes (eg. bridge wash out, earthquake, landslide etc.) and external interference causes eg. (mechanical excavator/bulldozer, directional drilling etc.).

Opex forecast for exceptional pipeline maintenance projects based on historical trends and operational experience is shown in the Table 6-7. This does not include any provision for major unpredictable one-off events which may cause significant disruption to the pipelines and require significant reactive investment to repair.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
705	738	738	738	738	738	738	738	738	738

Table 6-7 : Opex forecast for exceptional pipeline maintenance ($000)

6.3.4 Pipeline Replacement and Renewal

The activities identified as part of the SMS are established as routine activities and incorporated into maintenance schedules. There are a number of subsequent events or changes which can impact on the pipeline system which may result in a change of the identified risk level. Such changes include:

- Urban encroachment
- Pipeline related incidents
- Findings from routine monitoring
- System improvements
- System modifications
- Inspections & audits.

Such changes are categorised as non-routine activities and are assessed, prioritised and assigned in the Non Routine Activity Management System (NRAMS). All risks are assigned a Risk Owner and the appropriate solutions are assigned to an Activity Manager.

Land Movement and Erosion Issues

Monitoring of threats to the pipeline from ground instability slips and/or erosion is detailed in the PIMP and works are scheduled in the planned maintenance system.

Current known locations where remedial works are planned to address bank erosion or exposed pipes are listed Table 6-8. Additional sites requiring remedial works may be identified due to the dynamic nature of this type of threat.

Location	Description
Nukuhou River, Opotiki (505 Line)	Currently being regularly monitored by Vector field staff. Remedial works may be required and commenced in next 5 years.
Waiotahi River, Opotiki (505 Line)	Currently being regularly monitored by Vector field staff. Remedial works may be required and commenced in next 5 years.
Mangatainoka River, Wairarapa (703 Line)	AI has prepared a business case to undertake remedial works at this location that includes a short realignment of the pipeline supplying gas to the brewery. This area is currently being regularly monitored by Vector field staff. Remedial works are expected to start in FY14.
Waikaikai Stream, Taranaki (606 Line)	Currently being regularly monitored by Vector field staff. Remedial works may be required and commenced in next 5 years.
Ohaaki geothermal subsidence, Taupo (508 Line)	Currently being regularly monitored by and surveyed. Additional land survey and pipeline monitoring points are to be installed. Site works need to be agreed with landowners and may need legal team assistance. The proposed works will be commenced in FY14.

Table 6-8 : Pipeline locations requiring land remediation

In recent years, at least two projects have been initiated to carry out remedial works at river crossings following a flood event or loss of cover through scouring of the river bed in river and stream crossings. Extreme weather events impact on parts of the gas transmission system resulting in bank erosion or slumping and in some areas, land slippage resulting in reduced cover over the pipe. As a consequence, provision has been made in expenditure forecasts to address future events as described above.

Active erosion of the coastline adjacent to the Whitecliffs walkway at Tongaporutu has been occurring for a number of years and poses a risk to the ongoing integrity of the 200 Line. The erosion is occurring at two separate erosion zones at Mangapukatea and Mackenzie Cove. The pipeline runs parallel with the Maui pipeline at this location which is also affected by the active coastal erosion. Vector has investigated various options to mitigate the risk to the affected section of pipeline including relocating approximately 2.5 km to a new alignment or isolating and abandoning with or without interconnecting to the Maui pipeline at locations either side of the erosion zones. The option for relocation the pipeline has been considered using the horizontal directional drilling (HDD) method with minimal trenching at the tie-in points as this would be environmentally and culturally less intrusive than conventional trenching techniques. The expenditure forecast for the location work is approximately $23.0m. The option to isolate and abandon the affected section of pipeline would potentially cost less than relocating the pipeline but would remove a level of redundancy from the overall transmission system, the significance of which was realised during the Maui pipeline outage in October 2011. Further commentary on this issue is included in Section 9.4 of the AMP.

Pipeline Condition Issues

Condition based assessments to date indicate that all pipelines are in reasonable condition and that no excessive deterioration has occurred. However, routine maintenance and inspection of pipelines has revealed a number of specific instances where remedial work will be required to maintain pipeline integrity. These are listed in Table 6-9.

Location	Description
Waitangirua – Tawa A (111 Line)	Coating failure and Cathodic protection performance issue in T1 area. The pipeline is critical for maintaining supply to Wellington and is currently unpiggable. A piggability study is due for completion in 2013 after which a remediation solution will be developed and implemented in FY14 and FY15.
KGTP - Waitangirua (100 Line)	Areas of coating disbondment identified. Frequency of ILI survey was increased from 10 yearly to 5 yearly intervals to more closely monitor corrosion growth rates. Prioritisation of the remedial actions identified by next ILI survey in FY15.
Rotorua lateral (503 Line)	Cathodic protection performance issue due to high soil resistivity at Tumunui Hill. Alternating Current Voltage Gradient (ACVG) survey method to be utilised and remediation solution to be developed in FY14.
Kapuni (100/200Line)	Areas of coating disbondment identified due to historic higher operation temperature at compressor discharge and aging CTE coating system. The CP system hasn't been operating effectively as a result of foreign pipelines' interference. Prioritisation of the remedial actions was identified in 2011 and coating refurbishment works were completed on 100line in FY13. Similar remediation works on the 200line will be carried out in FY14.
Cased crossings	Cased crossings are known to be areas where accelerated corrosion and CP shielding takes place. These will be removed where affected by modifications to roads or railways and remediation will be undertaken if pipeline corrosion is detected within cases.

Table 6-9 : Pipeline locations requiring integrity remediation

A number of initiatives aimed at improving monitoring pipeline condition and identifying areas requiring specific remedial works are to be considered. These include:

- Review piggability options for small diameter pipelines (NB 100mm or less). The review will consider new technology developments and international industry practices. Considerations will include determination of inspection requirements and upgrading currently unpiggable lines to piggable status.
- Investigation of suitable methods to measure pipeline corrosion at cased crossings.
- Investigation of suitable methods to inspect unpiggable pipelines and short laterals.

Expenditure Forecast

Capex forecast for pipeline renewal and replacement comprising of land movement/erosion and pipeline condition is shown in Table 6-10.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
1,000	1,300	1,100	1,000	900	1,000	1,000	1,000	1,000	1,000

Table 6-10 : Capex forecast for pipeline renewal and replacement ($000s)

6.3.5 Emergency Response to Pipeline Incidents

Even though Vector takes every reasonably practicable precaution to prevent third party interference with pipelines and carries out rigorous inspection and maintenance practices, experience and history has shown that emergency situations arise from time to time. In most circumstances pipeline integrity breaches do not result in catastrophic failure or rupture of the pipeline and suitable repair methodology and techniques can be applied. In more serious cases pipelines may have to be isolated and sections of pipeline replaced.

Expenditure Forecast

Opex forecast for response to emergencies to pipeline incidents based on previous operational experience and annualised is shown in Table 6-11.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
492	516	516	516	516	516	516	516	516	516

Table 6-11 : Opex forecast for response to emergencies ($000s)

6.3.6 Special Crossings

Inspection and Maintenance

Aerial crossings are inspected annually.

Opex for the routine maintenance and inspection of aerial crossings is included in the Opex forecast for pipeline routine maintenance and inspection in Section 6.3.1.

Renewal and Replacement

An inspection and survey of all major aerial crossings was undertaken by Beca Consultants in December 2010 and January 2011. Several issues were identified during the inspection phase and documented in the final report issued in April 2011. The report recommended further investigation of the following:

- The ground/air interface around the pipe at a number of crossings.
- The design of the support structures at the Gibbs Fault crossing.
- The design of the road bridge at the Gibbs Fault crossing.
- The corrosion in the repair saddles at the Gibbs Fault crossing.
- The structural integrity of access platforms at a number of crossings.
- The structural integrity of several access bridges on several landowners' properties.
- The design of pipes affixed to several highway bridge crossings.

Additional reinforcement work has also been identified at a number of truss structures and re-bracketing of aerial pipeline sections affixed to several highway bridge structures has also been identified as being required. Further engineering assessment of each of these issues was carried out by Plant and Platform consultants on a case-by-case basis in 2011 to determine the scope of required remedial works. The majority of the remedial works have already been completed.

Expenditure Forecast

Capex forecast for renewal and replacement works at special crossings is shown in Table 6-12.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
250	100	100	300	100	300	100	300	100	300

Table 6-12 : Capex forecast for renewal and replacement of special crossings ($000)

6.3.7 Cathodic Protection Systems

Maintenance and Inspection

Refer to Section 6.3.1 for the summary of routine CP system performance monitoring. Routine inspection and maintenance of CP plant and equipment is summarised in Table 6-13. In general this is carried out during routine system performance monitoring.

Frequency	Activity
Daily (week days)	Monitoring of transformer rectifier readings
Yearly	Rectifier unit integrity and verification Anode bed integrity checks Test point inspections ER Probe inspections

Table 6-13 : CP system inspection and maintenance activity

Replacement and Renewal

The CP system includes a large number of test points and several ER Probes, a number of which are repaired or replaced each year.

New test points are required on the network to meet the maximum recommended spacing in T1 and T2 class locations in recent years. A programme for installation will be developed in 2014.

Insulating joints, including Monolithic Insulation Joints (MIJs) and Flange Insulation Kits (FIKs) are indirectly monitored via CP system performance testing. Testing of insulating joints is included in investigations into loss of protection. The majority of insulating joints are located at stations.

A significant number of the rectifiers have exceeded their design life, and in some cases temporary measures have been put in place to ensure continued operation and compliance with current electrical regulations. A programme of replacement is included in the expenditure forecasts.

Anode beds deteriorate with time, as they discharge current into the ground. Under normal operation rectifier output current will decrease and voltage increase as the anodes are consumed. From this trend Vector can determine which anode beds are reaching the end of their life. This is normally observed over years not days or months so there is sufficient lead time to plan replacement. Replacement of failing anode beds is included in the rectifier replacement expenditure forecast.

CP system current demand is increasing as the pipeline coating deteriorates with time. On some pipeline sections the current demand will increase to an amount where additional rectifiers are required at the mid-points between the existing rectifiers. A programme for installation of new rectifier sites is included in the expenditure forecasts.

The Intelligent Power Supply (IPS) units have exceeded their design life, and the technology on which the system is based is now 20 years old. A review of the IPS system and alternative systems for remote control and monitoring of the rectifiers is planned for 2014, in conjunction with a review of the standard rectifier design.

Expenditure Forecast

Opex for CP systems maintenance and inspection based on historical trends and operational experience is included in the opex forecast for pipeline routine maintenance and inspection in Section 6.3.1.

Capex forecast for rectifier replacement is shown in Table 6-14.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
50	50	50	100	50	100	50	100	100	100

Table 6-14 : Capex forecast for rectifier replacement ($000)

Capex forecast for the installation of additional CP rectifiers and anode bed units is shown in Table 6-15.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
60	90	60	60	60	60	60	60	60	60

Table 6-15 : Capex forecast for additional rectifiers and anode beds ($000)

6.4 Compressors

6.4.1 Maintenance and Inspection

Routine maintenance and inspection activities are described in detail in this section for the following asset components contained at compressor stations:

- Gas turbines
- Centrifugal gas compressors
- Reciprocating gas engines
- Reciprocating gas compressors
- Control systems
- Gas coolers
- Fire and gas protection
- Associated pipe work, valves and regulators.

A provision for the improvement of condition monitoring and predictive maintenance practices is included based on the results of recent investigations into component failures.

6.4.1.1 Gas Turbines

The gas turbines are subject to a “maintenance and overhaul” schedule based upon an Equivalent Operating Hours (EOH) that uses actual operating parameters, number of starts and hours in operation to determine an effective timeframe for specified overhauls. The EOH consumption is based upon the design life of the components from the Original Equipment Manufacturer (OEM), who in the case of the gas turbines is Siemens. Each start stop cycle consumes some of the creep life of the component; each hour at rated output consumes component life and situations where excess temperatures in the machine through over fuelling etc and/or surging also consume life. Typically a start stop sequence incurs a 10 hour penalty and an over firing uses an equivalent of two hours per fired hour.

Historically, one of the units at Rotowaro has typically been started every day. The two units operate for a combined total of 5,000 hours per year, with the accumulation of hours dependent upon which unit is selected for operation, and more importantly, the actual time in operation for each start stop cycle. From the noted EOH calculation, the 300 annual starts consume 3,000 hours life and 5,000 fired hours consume a further 5000 hours, totalling 8000 EOH per annum between the two machines.

Unit #5 currently has 19,500 fired hours and is scheduled for a core replacement in 2019, having undergone an early B Class review during the 2010 outage. Unit #6 has 16,500 fired hours and similarly underwent a 24,000 EOH review in 2009 following an inter-duct failure. Unit #6 is potentially scheduled for a core replacement in 2023 as unit #5 will be utilised as the preferred operating machine in order to manage the lifecycle of the machines and to operate as the fleet leader to prevent any age related common faults manifesting themselves closely together and affecting availability.

The overhauls vary in invasiveness and require disassembly of the unit, again based upon the capability of the components. The inspections are classed as A, B and C type and are shown in Table 6-16. Parts in the hottest areas of the machine will require replacement more frequently than components in the cooler areas. The overhauls utilise a standard suite of methodology, practices and parts, and can be applied to any set of circumstances that may transpire during any routine inspection.

Frequency (EOH)	Activity
8,000 hours	Basic Inspection and replacement of consumables (Type A)
24,000 hours	Type A + Minor overhaul to specified components (Type B)
48,000 hours	Type B + Core exchange (Type C)

Table 6-16 : Gas turbine maintenance and inspection activities

The OEM continually monitors the installed fleet service performance and materials technology, to develop retrofit and upgrade parts and materials to extend the life of the machine and components, and will also advise when there is sufficient concern to remove or replace components or parts that have not yet failed, outside of the normal replacement programme.

The OEM does not have a local presence for maintenance capability, and therefore this resource must be brought in from overseas. This requires careful planning for scheduled inspection and maintenance activities to ensure people, materials and machine downtime is available concurrently, and for unplanned maintenance is a source of delay to any programme starting. Vector staff do not have the skills or access to the technical documentation required to perform the overhauls, hence the OEM Technical Authority is utilised to oversee the work. Local skilled labour is used to provide the “hands-on” resource, supported by Vector field staff who have received specialist training overseas and form an integral part of the overhaul team, including fault finding.

Predictive maintenance is utilised to monitor the health of the gas turbine, which includes vibration monitoring, temperature monitoring, and oil analysis and bore scope inspections.

6.4.1.2 Centrifugal Compressors

Centrifugal compressors are also subject to an operating hours based inspection programme similar to gas turbine inspections, with standard repairs authorised by the OEM (Siemens) and non-standard repairs subject to proposal, analysis, repair and inspection prior to refitting and commissioning. In addition, an annual regulatory inspection is carried out by an independent authorised person to verify ongoing compliance with the pressure system regulations. The maintenance and inspection activity is shown in Table 6-17.

Frequency (EOH)	Activity
4,000 hours	Visual, seal gas system, valve operation (Type 1)
12,000 hours	Visual, alignment and run out, seal gas inspection (Type 2)
24,000 hours	Bearing replacement, gas seal bundle replacement,, visual and valve operation (Type 3)
Yearly	Regulatory inspection

Table 6-17 : Centrifugal compressor maintenance and inspection activities

6.4.1.3 Reciprocating Engines

Reciprocating machinery is inspected on operating hour intervals. This is based upon OEM (Waukesha) recommendations but has additional points of inspection based upon internal fleet experience. Corrective actions are generally completed during these inspections and the actual cost of the inspection is dependent upon the amount of equipment and components replaced. The maintenance and inspection is shown in Table 6-18.

Frequency (EOH)	Activity
2,000 hours	Gaps and clearances, timing
4,000 hours	2,000 hour plus replace valves,
8,000 hours	4000 hour plus replace valve stem seals

Table 6-18 : Reciprocating engine maintenance and inspection activities

Data gathered during these inspections, such as cylinder compression ratios, clearances and acoustic inspection results are recorded and trended to assist in the evaluation of asset condition in general.

Major overhauls are planned at 80,000 operating hours, but the actual overhaul point is dependent upon the results of previous inspection data and current condition. Performance monitoring of reciprocating engines is based on weekly performance records compiled by the site technicians for the compressor stations. These reports are used to gather an operating history of the machines and to check for specific deterioration.

Vector has in-house capability to perform all maintenance tasks on the machines, up to refurbishment of major components. The main rotating equipment is fully supported by the OEM who also provides technical oversight for major overhauls. Local industry support is utilised when Vector resources are unavailable, or for larger tasks for which Vector has no adequate equipment.

Turnaround time for most work is around 2 to 5 days, depending on the availability of spares, but due to the fact that Vector owns a large fleet of similar machines, a reasonable amount of spares are held.

6.4.1.4 Reciprocating Compressors

Reciprocating compressors are inspected in line with the reciprocating engine programme to ensure efficient use of resources and avoidance of staggered inspection down time. Performance analysis of the gas compressors is also undertaken on a quarterly basis to monitor the ongoing performance efficiency. The maintenance and inspection activity is shown in Table 6-19.

Frequency (EOH)	Activity
2,000 hours	Replace valves
4,000 hours	Replace packing and valves
8,000 hours	Replace packing, valves and seals

Table 6-19 : Reciprocating compressor maintenance and inspection activities

6.4.1.5 Gas Coolers

Coolers are inspected on a routine basis to ensure efficiency is not being impacted by infestation, nesting or any other foreign bodies that may become entangled in the system and hence affect performance. Coolers are designed with 110% duty capacity to allow up to 10% of system restriction. When the duty capacity falls significantly below 100%, major capital work is required to be performed to allow the cooler be brought back to specification. The maintenance and inspection activity is shown in Table 6-20.

Frequency	Activity
Monthly	Ground based visual check for obvious damage or leaks
6-Monthly	Access to structure for detailed check of tubing, fins and for evidence of any damage or leaks, paint damage or corrosion. Local repair of any concerns
Yearly	Independent review for Pressure Vessel compliance

Table 6-20 : Gas cooler maintenance and inspection activities

Expenditure Forecast

Opex forecast for routine maintenance and inspection of gas turbines, centrifugal compressors, reciprocating engines and reciprocating compressors based on historical trends and operational experience is shown in Table 6-21.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
3,122	3,164	3,164	3,164	3,164	3,164	3,164	3,164	3,164	3,164

Table 6-21 : Opex forecast for compressor unit maintenance and inspection ($000)

6.4.2 Replacement and Renewal

The definitions of asset categories and asset classes do not allow for the description of sub-components included in the AMP. For this reason some of the asset grades recorded in Schedule 12a reflect the overall condition of the asset category or asset class but cannot reflect the asset grade of the sub-components. Some sub-components require replacement and renewal investment, a description of which is included in the following sections for compressors.

6.4.2.1 Gas Turbines

Gas turbines do not have a finite asset life as the design basis is for parts to be removed and overhauled at set frequencies as described above. The planned change out of these parts is managed by the capex expenditure programme. The basic design life of gas turbine frame and enclosure is 30 years but it is possible to extend the life based on the as-found condition, safety compliance and economic justification.

Overhaul costs are assessed to determine if it may be more financially prudent to replace. When an overhaul exceeds 60% of the cost of a replacement, then replacement is considered. If the capacity of the equipment is found to be lower than the forecast demand, then consideration is given to replacement of the asset with one of greater capacity. If the asset is likely to become redundant due to reduction in demand, then provided that n-1 redundancy can be maintained at the compressor station, the overhaul could be postponed.

Major items and sets of parts that have a significant cost are not held or stocked by the OEM, though raw materials may be held, and as a result, procurement of spares can have an extended lead time. Vector does not hold major items or sets of parts on stock, though critical day to day spares are held.

Obsolescence of the rotating equipment is not an issue, as the OEM provides reverse compatibility data for upgrades. The technology is also suitably mature for alternate reverse engineered parts to be available, though this would then preclude the OEM supporting the machines going forwards.

The control systems on both gas turbines at Rotowaro were upgraded during FY13 to include an integrated fuel valve as well as a complete software upgrade.

The gas turbine units require significant mechanical devices in addition to the control system to be able to operate, and these are subject to deterioration and obsolescence of items such as hydraulic pumps, pneumatic valves, relays and actuators and whilst a reasonable level of stock is maintained to support local replacements and incidents, obsolete parts will generally become unsupported within three years of being declared obsolete and require a programmed change out. Major components such as gear boxes and clutches that are on long lead times and have a significant impact on the ability of the unit to operate are being identified and provisions for spares holding created.

Capex forecast for replacement and renewal of gas turbines is shown in Table 6-22.

Year	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Rotowaro #5	70	30	30	40	30	30	60	80	80	40
Rotowaro #6	50	30	30	40	60	30	60	30	30	40
Critical Spares	-	300	-	-	-	-	-	30	30	-
Total	**120**	**360**	**60**	**80**	**90**	**60**	**120**	**110**	**110**	**80**

Table 6-22 : Capex forecast for replacement and renewal of gas turbines ($000)

6.4.2.2 Centrifugal Compressors

There are no key issues associated with the centrifugal compressors and one full assembly on shaft is retained as a spare unit.

Capex forecast for replacement and renewal of centrifugal compressors is shown in Table 6-23.

Year	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Rotowaro #5	-	10	-	20	-	-	10	50	-	-
Rotowaro #6	-	10	-	20	10	50	10	10	-	-
Total	**-**	**20**	**-**	**40**	**10**	**50**	**20**	**60**	**-**	**-**

Table 6-23 : Capex forecast for replacement and renewal of centrifugal compressors ($000)

6.4.2.3 Reciprocating Engines

Obsolescence is not an issue, but ancillary equipment associated with the operation of the engine is subject to obsolescence. As the global fleet reduces, the cost of manufacture of parts increases due to the loss of economy of scale to the OEM who only make small production runs. In a manner similar to that of the turbo machinery, the reciprocating units were installed with an expected life of 30 years, and have been subject to review at the major inspections in order to allow extension of the life beyond that originally planned.

The OEMs are involved in the ongoing technical development of equipment resulting in new more efficient models being available, and upgrades to existing fleet machines. No significant upgrades to the units in the Vector fleet have been identified by the OEM however OEM service bulletins are provided as a guide to ensure continued effective and efficient operation of the machines is achieved.

Overhaul costs are assessed to determine if it may be more financially prudent to replace. Replacement is considered when an overhaul exceeds 60% of the cost of a replacement. If the capacity of the equipment is found to be lower than the forecast demand, then consideration is given to replacement of the asset with one of greater capacity. If the asset is likely to become redundant due to reduction in demand, then provided that n-1 redundancy can be maintained at the compressor station, the overhaul could be postponed.

Reciprocating engines have pneumatic control systems which are not sensitive enough to support the equipment operating regime, prevent all but rudimentary on line performance monitoring and will become a barrier to improved performance for this type of technology. The OEM recommendation for pneumatic control systems includes significant intrusive dismantling for component level replacement, however as this technology is approaching obsolescence there are few technicians capable of performing this work, and more importantly setting up the control system again to ensure that it operates as intended and does not build in a stress point or failure mode into the system. The mechanical and moving parts of the control system are also subject to wear, and this wear reduces the sensitivity and reactions of the system to such an extent that significant machine damage can be experienced without the control system picking up a problem and tripping the system. Finally, the pneumatic system cannot export data to a historian, which means that following a failure, the line of investigation cannot be established with any acceptable level of speed of response, and only the “as found” condition can be used to try and establish the causes.

The upgrading of the control systems of the reciprocating equipment will allow operating data to be exported to a historian, and eventually on-line performance monitoring. Mahoenui #1 will be the first machine to have the control system fitted and will be designed to facilitate roll out to the other units in the fleet. The roll out plan should deliver ongoing unit cost reductions through known expenditure and commitments plus lessons learned and familiarity with the projects. The priority listing is at date of report, however the actual roll out plan may change dependent upon asset operating conditions at the start of each planning year.

The technology being utilised for the control system upgrade is proven, and entering the mature stage and will remain supported for at least 30 years. The specific application of the technology will also lead to future proofing, for example the use of fibre optic for signal or data transmission means that as equipment currently using data switches to transfer between copper cable and fibre optic is withdrawn from the market and replaced by direct fibre optic terminations, Vector will directly connect this upgraded equipment to the fibre optic networks installed.

The significant change in risk for the change from pneumatic through to digital control systems is the reliance upon a stable power supply, for which Vector has implemented a strategy of upgrading the relevant UPS (Uninterruptable Power Supply) systems and putting into place mitigation to provide short notice provision of auxiliary generating capacity either through stand by generators on the specific compressor station or contracts to guarantee the supply of a temporary generator within a specific timeframe related to the UPS capacity.

Current vibration analysis is performed using external accelerometers applied by a third party on a routine basis (every 2 months), with the reporting of findings following on. This is not conducive to maximising the life of components as it prevents accurate prediction of when a component has entered a failure mode, and can lead to more serious consequential damage if the component fails before being replaced. The current philosophy is to replace components on an “hours run” basis, but this is not reflective of the actual remnant life when the operating conditions are considered, ie. some components may have seen very little stress in operation and could survive a further inspection cycle.

The upgrade to the control system and associated monitoring equipment will facilitate on line vibration monitoring.

The engine ancillary drives are a continued source of vibration and a programme of replacing the engine driven hydraulic systems, with electrical drives is being implemented. The capital cost will result in reduced engine loading leading to greater reliability and life of parts which will offset the ongoing cost of operation of these electrical drives.

Capex forecast for replacement and renewal of reciprocating engine control systems is shown in Table 6-24.

Year	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Mahoenui#1	1,300	0	0	0	0	0	0	0	0	0
Mahoenui #2	0	800	0	0	0	0	0	0	0	0
Kapuni #5	0	0	2,600	0	0	0	0	0	0	0
Kapuni #3	0	0	800	0	0	0	0	0	0	0
Kapuni #2	0	0	0	800	0	0	0	0	0	0
Rotowaro #3	0	0	0	1,500	1,100	0	0	0	0	0
Rotowaro #4	0	0	0	0	0	800	0	0	0	0
Pokuru #1	0	0	0	0	0	0	2,500	0	0	0
Pokuru #2	0	0	0	0	0	0	0	800	0	0
Kaitoke #1	0	0	0	0	0	0	0	0	2,500	0
Kaitoke #2	0	0	0	0	0	0	0	0	0	800
Total	**1,300**	**800**	**3,400**	**2,300**	**1,100**	**800**	**2,500**	**800**	**2,500**	**800**

Table 6-24 : Capex forecast for replacement and renewal of reciprocating engines ($000)

Capex forecast for reciprocating engine overhauls and other items is shown in Table 6-25.

Year	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Rotowaro #3 overhaul	500	0	0	0	0	0	0	0	0	0
Kapuni # 2 overhaul	0	0	0	0	0	0	0	500	0	0
Decommission Derby Road & Henderson	0	0	0	0	0	0	900	0	0	0
V16 engine critical spares	0	0	0	900	0	0	0	0	0	0
Total	**500**	**0**	**0**	**900**	**0**	**0**	**900**	**500**	**0**	**0**

Table 6-25 : Capex forecast for reciprocating engine overhauls and other items ($000)

6.4.2.4 Reciprocating Compressors

There are no significant issues with the operation of the reciprocating compressors; these units are inspected on a quarterly basis with the reciprocating analysis equipment sourced from USA. Vector staff service and overhaul the wear components of these machines to maintain an optimum operating condition.

6.4.2.5 Gas Coolers

New gas coolers have recently been installed at Kaitoke, Pokuru and Kapuni to address condition and performance issues. Localised repairs are available from the OEM where a replacement is either not mandated or required. As the coolers are external and subject to both erosion and corrosion, a routine inspection programme has been initiated and a regular allowance for repair costs written into the ongoing cost of operation.

The gas coolers at KGTP have experienced high gas temperature output for a number of years and the potential consequences of this have only recently been identified as a significant issue. A process and heat balance study has been initiated at Kapuni and the likely outcome is that further future investment in cooling will be required at the site in order to maintain gas temperatures below the upper allowable limit.

Capex forecast for replacement and renewal of gas coolers is shown in Table 6-26.

Year	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Cooler refurbishment	0	0	800	0	0	0	50	50	50	0
Kapuni Hot Gas Cooler	0	0	0	0	0	1,300	0	0	0	0
Total	**0**	**0**	**800**	**0**	**0**	**1,300**	**50**	**50**	**50**	**0**

Table 6-26 : Capex forecast for replacement and renewal of gas coolers ($000)

6.4.2.6 Fire and Gas Detection Systems

The fire and gas detection systems provide an important line of defence in protection of the assets, but are also linked to the logic and start permissive for each unit. The systems have been updated in an ad hoc manner and comply to the standards in force at each upgrade though insufficient attention was paid to ergonomic and maintainability factors. With the latest version of NZS60079 removing the grandfather clause, Vector will be required to self-qualify these installations to the original installation standards. The equipment is subject to a point to point function check on an annual basis. Any faults found during operation are resolved immediately as the equipment forms part of the machinery start permissive.

Kapuni has recently undergone a complete replacement programme for the fire and gas detection system which complies with latest standards and has been designed for minimum maintenance downtime, and also ensures that any system problems that could affect the start permissive of the station can be quickly traced and rectified. An ongoing review of the performance of this system is being carried out by Kapuni staff and the intention is to develop a standard design for the fire and gas systems and to roll it out to all compressor stations when the equipment becomes obsolete, or when self-qualification becomes unfeasible.

Fire and gas protection systems for other stations are described in Section 6.5.16 – Station Ancillaries.

Capex forecast for replacement and renewal of fire and gas detection systems is shown in Table 6-27.

Year	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Health checks and upgrades	130	130	130	250	150	230	0	0	0	0
I&E	100	100	100	100	100	100	100	100	100	100
Total	**230**	**230**	**230**	**350**	**250**	**330**	**100**	**100**	**100**	**100**

Table 6-27 : Capex forecast for renewal and replacement of fire and gas detection systems ($000)

6.4.2.7 Oil Storage Facilities

Potentially harmful substances eg. oils are stored at each of the sites, requiring careful segregation to reduce inherent risks. Many of these stores were not purpose built and have been modified over time to be utilised as regulations and awareness changed. Many of these store areas require a full review of fitness for purpose and an environmental aspect and impact review to ensure that they fulfil both the storage purpose and protection. A site will be selected as the pilot or reference site and this study will be performed in FY14. The results will be analysed and a gap analysis produced which will result in an action plan to be addressed.

Upon completion of the study, the methodology will be defined and applied to the other compressor sites with a final outcome that all sites will have a gap analysis and action plan to be addressed. The specific timing for the completion of the site action plan will be dependent upon the priority and risk rating of the results.

Capex forecast for replacement and renewal of oil storage facilities is shown in Table 6-28.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
100	80	80	80	80	80	80	80	80	80

Table 6-28 : Capex forecast for replacement and renewal of oil storage facilities ($000)

6.4.2.8 Control System Support

Vector has a support agreement with Rockwell Automation who supply programmable logic controllers (PLCs) for Rotowaro and Pokuru compressor stations. They are the preferred PLC supplier for gas transmission. This ensures that Vector receives the latest patches and updates on the installed systems. Vector's instrumentation and electrical technicians also receive Rockwell product training. Local external support is available for engineering and maintenance support on an ad hoc basis.

There are well developed electronic control system backup and disaster recovery procedures for Rotowaro compressor station controls systems. The PLC configurations are stored on common Vector drives and on site. PLC configurations revision format control allows easy identification of the latest edition and catalogues any changes to the programmes. Back-ups take place on a scheduled basis.

The changes in operating philosophy and upgrades allow for a more robust method of collecting and analysing the performance data. An effective historian system that is dedicated and developed for collecting and storing operating data provides the appropriate level of data and information investigation that supports the excellence in operation that is being targeted. Each station will be provided with a historian server with the information being made available at the Bell Block facility. The historian server will be installed at the same time as the health checks on the machines are being carried out, and base line performance data can be captured as an ongoing performance comparator.

6.4.3 Compressor Fuel

All Vector's gas turbine and reciprocating engines driving compressors are fuelled by gas taken direct from the gas transmission system. The opex forecast for compressor fuel based on historical trends and operational experience is show in Table 6-29.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990

Table 6-29 : Opex forecast for compressor fuel ($000)

6.5 Stations

6.5.1 General

Maintenance and Inspection

The philosophy and guidelines for maintenance on all station facilities is outlined in Vector document 3205250 - Maintenance Strategy. This document describes the general approach to maintenance, maintenance management model, planning, KPIs, processes, additional strategy elements, performance measurement and spare parts management. All maintenance on stations facilities including individual components is scheduled in a maintenance plan and monitored through the SAP-PM maintenance management system.

Where applicable, pressure vessels are subject to the requirements of Pressure Equipment, Cranes and Passenger Ropeways (PECPR) Regulations and are inspected in accordance with AS/NZS 3778: 2006 Pressure Equipment In-Service Inspection and maintained in accordance with Vector document 3206146 - Pressure Equipment Management Plan. This documents sets out the requirements for inspection intervals, competent person requirements, non-conformance reporting and standards to be applied.

All electrical equipment on stations located in Hazardous areas is checked every four years to meet the Electricity (Safety) Regulations 2010.

Station maintenance and inspection activities are described in the following sections for each class of asset.

Replacement and Renewal

Due to urban encroachment at the Bruce McLaren delivery point (DP), safety margins provided by distance from the station have been reduced sufficiently such that modifications are required for risk reduction. A number of alternative solutions will be considered to relocate, modify or remove the station completely. No provision has been made in the capex forecast due the likely solution being the installation of a gas distribution pipeline by the Vector gas distribution business (GDB) to allow the DP to be removed. Vector GDB has included $2.5m in their capex forecast for this work.

Based on historical activities a number of general station integrity and code compliance issues will require expenditure each year. Provision has been made for this in the capex forecast.

The design of gas transmission assets cannot conform to standard designs due the complex and bespoke nature of the assets. Where possible certain asset components eg. isolation valves will conform to pre-specified standards for specific applications to ensure wherever possible that design, procurement, installation and maintenance consistencies and efficiencies are made.

Station replacement and renewal activities are described in detail in the following sections for each asset class.

The replacement and renewal activities for many of station asset categories consist of work programmes made up of many individual small projects. The priority of these small projects can change significantly eg. where new defects are found at isolation valves. Hence, generic work programmes to replace identified types of asset categories based on performance, reliability and obsolescence are described rather than listing individual projects.

The definitions of asset categories and asset classes used in the AMP differ from those defined in the ID Determination and hence those reported in Schedule 12a – Report on Asset Condition. Most of the asset classes and categories used in the AMP map directly to the ID Determination definitions eg. heating systems, metering systems but some do not eg. pressure regulators, pressure safety valves, these being sub-components installed at various locations as described in the following sections. For this reason some of the asset grades recorded in Schedule 12a reflect the overall condition of the asset class or asset category but cannot reflect the asset grade of the sub-components. Some sub-components require replacement and renewal investment, a description of which is included in the following sections for station assets.

Expenditure Forecast

Opex forecast for station maintenance and inspection based on historical trends and operational experience (excluding compressors) is shown in Table 6-30.

	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Mechanical	1512	1524	1524	1524	1524	1524	1524	1524	1524	1524
I&E	470	492	492	492	492	492	492	492	492	492
Odorant	336	352	352	352	352	352	352	352	352	352
Metering	447	469	469	469	469	469	469	469	469	469
Telemetry	34	35	35	35	35	35	35	35	35	35
Total	**2,799**	**2,871**	**2,871**	**2,871**	**2,871**	**2,871**	**2,871**	**2,871**	**2,871**	**2,871**

Table 6-30 : Opex forecast for maintenance and inspection of stations ($000)

Capex forecast for stations is shown in Table 6-31.

	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Integrity and Compliance	450	750	500	500	500	500	500	500	500	500

Table 6-31 : Capex forecast for general station integrity and compliance works ($000)

Capex forecasts for renewal and replacement of each asset category is included in the following sections. A capex forecast summary for station replacement and renewal is included in Section 6.9.

6.5.2 Main Line Valves (MLVs)

Maintenance and Inspection

MLVs comprise of multiple components and maintenance requirements are summarised in Table 6-32.

Frequency	Activity
Six Monthly	• Mainline valve: operate valve • Bypass valves: operate valves and check for leaks • Pipe work: inspect for surface corrosion • Verify actuator operation, PCV & PSV operation, hand pump operation, check reference tank pressure, check for corrosion, verify LPT setting
Yearly	• Solar panels, batteries and regulators: verify operation, cleaning, replace batteries as necessary • Verify communication systems and remote valve position (gas control)
Three Yearly	• Take oil sample and analyse: overhaul if required.

Table 6-32 : MLV maintenance and inspection activities

Replacement and Renewal

The MLV remote actuation upgrade project was instigated by Vector in response to observations from the OSH Pipeline Inspectorate following the 2002 Himatangi pipeline rupture incident findings. The project was commenced in 2007 and forms part of a long-term strategic approach based on a recommended prioritised MLV upgrade list that was developed by Beca Consultants[3] in 2005, and other subsequent studies. There are two types of MLV actuators installed, Biffi and Shafer, each requiring a different remote actuation solution. Available existing station facilities such as power supply and communications are also factors in remote actuation design. Remote actuation packages are designed for particular site configurations. Upgrades are being carried out in stages over several years and are based on a risk assessment priority order. A number of completed remote actuation upgrades across the Auckland isthmus were originally installed with cellular phone communications. It was identified that the reliability of cellular phone communications, especially during periods of high demand, is not satisfactory for

[3] BECA Report Main Line Valve Actuation 2350157 Rev A. N1111:18604

this application. A high reliability radio network solution has been developed and was rolled out to most sites during FY13.

An oil sampling study was carried out during 2013 to assess the condition of the internal surfaces of the gas over oil actuators. Around 20% of the actuators sampled were found to have iron levels indicative of internal corrosion. These MLVs will be overhauled during FY14 and further sampling and overhauls/replacements will be carried out dependent upon the findings during these initial inspections.

Expenditure Forecast

Opex for MLV inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for replacement and renewal of MLVs is shown in Table 6-33.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
195	200	300	200	200	200	200	200	200	200

Table 6-33 : Capex forecast for replacement and renewal of MLVs ($000)

6.5.3 Heating Systems

Maintenance and Inspection

Loss of water in water bath heaters (WBHs) through a leak or evaporation may lead to tube failure and gas escape, with a possible fire. Regular checks on water levels are therefore an essential part of the maintenance and inspection regime.

Smaller gate stations and compressor stations have smaller heaters which typically use pneumatic controls. They still use the same technology as when first installed, and the components remain easily maintainable and readily available. Pneumatic devices performing protective and control functions require a reasonable degree of cleanliness and lubrication to function correctly. This requires periodic overhaul, cleaning and replacement of soft parts (as required).

Heater system outages are usually detected by a flame failure alarm or low temperature alarm from either SCADA or Autopoll or detected during scheduled maintenance and inspection.

WBHs are internally inspected every 10 years to assess their condition and to carry out any identified remedial work.

Heating systems comprise of a number of components and maintenance requirements and are summarised in Table 6-34.

Frequency	Activity
Six Monthly	**WBH:** • Verify water level, burner operation. Carry out water condition sampling, rectify as necessary. • Check terminations for tightness and check operation of elements **All heating systems:** • Inspect paint condition, instrumentation for corrosion.
Yearly	**WBH:** • PCV and PSV operation, instrumentation operation, shut-off valve operation, temperature control valve operation, high temperature trip, low water level trip.

Frequency	Activity
	Electric heating systems: • Verify operation and trip functions. • Check calibration of thermocouples and temp transmitters.
Two Yearly	**WBH:** • Replace UV lamps (where installed)
As required	**WBH:** • Cleaning and overhaul of pneumatic control devices
Ten Yearly	**WBH:** • Internal inspection and refurbishment. Fuel gas metering refurbishment.

Table 6-34 : Heating system maintenance and inspection activities

Replacement and Renewal

A number of issues have been identified associated with heating systems including:

- WBH internal inspection programme may reveal additional requirements for replacement and renewal.
- Automatic low water level cut-out switches are not fitted as standard on heating systems and consideration will be given to retro-fitting these protective devices.
- Electronic controls are mandatory (AS3814) for WBHs above 275 kW. These are relatively complex control and protection systems designed to detect main flame failure within 3 seconds, to prevent explosive mixtures being generated in the combustion chamber when a fault occurs. Some large WBHs do not incorporate appropriate control and protection systems and thus may require upgrading.
- On some WBHs the existing over pressure protection on fuel gas trains and burner control systems have been identified as requiring upgrades.
- Expenditure may be required to improve reliability at some locations eg. installation of flame stabiliser devices.

Expenditure Forecast

Opex for heating system maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for replacement and renewal of heating systems is shown in Table 6-35.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
400	600	600	500	300	300	300	300	300	300

Table 6-35 : Capex forecast for replacement and renewal of heating systems ($000)

6.5.4 Odorisation Plants

Odorant vessels are managed under Vector's Pressure Equipment Management Plan – 3206146 to meet Pressure Equipment, Cranes and Passenger Ropeways (PECPR) Regulations and inspected in accordance with AS/NZS 3778: 2006 Pressure Equipment In-Service Inspection. Odorant plants are also certified under the requirements of the Hazardous Substances and New Organisms Act 1996 (HSNO).

Bulk odorant supplies are imported and distributed to the odorant storage tanks.

Maintenance and Inspection

Odorisation plants comprise of a number of components and maintenance requirements are summarised in Table 6-36.

Frequency	Activity
Monthly	Instrumentation and pumps - verify operation Odorant quantity visual inspection, top up as necessary
Six Monthly	Pressure vessels visual inspection Pressure piping visual inspection and leak checks Mechanical checks
Yearly	Odorant vessel (fixed) external inspection
Two Yearly	Odorant vessel (transportable) external inspection
Five Yearly	PSV testing verification
Ten Yearly	Odorant vessel (transportable) internal inspection

Table 6-36 : Odorisation plant maintenance and inspection activities

Replacement and Renewal

The existing bulk storage vessel at Pirongia DP is now 44 years old and was originally used for the storage of LPG. This vessel cannot now be certified to meet current HSNO standards. The replacement of this tank is scheduled for FY14. The existing 140 litre bypass odorant vessel at Pirongia DP is also scheduled to be upgraded in FY14 as part of the upgrade of the bulk storage vessel.

No other existing bulk storage facilities require replacement during the period of this plan. The bypass odorant vessels were substantially replaced in 2005.

Odorisation plant pumped systems and associated controls will require progressive future replacement as new technology is introduced and existing equipment becomes either obsolete or unserviceable.

Expenditure Forecast

Opex for odorisation plant maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for renewal and replacement of odorisation plants is shown in the Table 6-37.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
200	-	-	300	-	300	-	300	-	-

Table 6-37 : Capex forecast for replacement and renewal of odorisation plants ($000)

6.5.5 Coalescers and Filter/Separators

Maintenance and Inspection

Coalescers and filter/separators are managed under Vector's Pressure Equipment Management Plan – 3206146 and inspected in accordance with AS/NZS 3778: 2006 Pressure Equipment In-Service Inspection.

Coalescers comprise of a number of components and maintenance requirements are summarised in Table 6-38.

Frequency	Activity
Six Monthly	Check operation and physical condition of level switches, dump valves and pressure controllers. Visual inspection of external surfaces for corrosion
Yearly	Check operation of High level trip and recalibrate as necessary
Four Yearly	Internal visual inspection of accessible vessels. 10% radiography of inaccessible vessels.
Five Yearly	Statutory testing by an accredited agency of pressure vessel protecting equipment.

Table 6-38 : Coalescer maintenance and inspection activities

Replacement and Renewal

No renewal or replacement plan is scheduled for the coalescer and filter/separator assets currently in service due to their satisfactory condition and integrity.

Expenditure Forecast

Opex for coalescer and filter/separator inspection is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

6.5.6 Metering Systems

Maintenance and Inspection

Vector's gas metering systems (GMSs) are operated, maintained and inspected in accordance with the Vector Metering Requirements for Receipt and Delivery Point standard.

Metering systems are calibrated at frequencies and to limits that are required by applicable codes, standards and manufacturers' recommendations.

Data from metering systems is regularly monitored and analysed to identify and prioritise performance issues or trends.

Metering Systems comprise of a number of components and maintenance requirements are summarised in Table 6-39.

Frequency	Activity
Monthly	Base volume indication (BVI), correction factor indication (CFI)and Primary Flow Signal Integrity (PFSI) checks
Three Monthly (Large Station)	All meter types: Series – Prove test. Ultrasonic meter: Electronic accuracy checks. Turbine & Rotary meters: Verify operation & lubrication Corrector: Verify operation Flow Computer: Verify operation Transmitter: Verify operation
Six Monthly (Small Station)	Turbine, Rotary & Diaphragm meters: Verify operation & lubrication Corrector: Verify operation

Frequency	Activity
Six Monthly (All stations)	Pipe work inspection
Yearly	Flow Computer & transmitter: Calibrate Cabling: Check
Two Yearly (More frequent for some sites)	Turbine meter: Exchange, refurbish & calibrate
Three Yearly	Corrector: Exchange, refurbish & calibrate
Five Yearly	Rotary & Diaphragm meter: Exchange, refurbish & calibrate

Table 6-39 : Metering systems maintenance and inspection activities

Replacement and Renewal

A number of issues have been identified associated with metering systems including:

- Corrector power supplies from battery only are prone to poor reliability and a programme of changing over to mains power supply or solar power using existing battery power for back-up is in progress.
- Corrector pressure sensing connection tubing requires upgrading.
- Advancements in corrector technology will be investigated to determine optimum replacement cycles.
- Meter accuracy can be compromised when operating outside specified minimum and maximum flow rates. Any meters identified as being outside or predicted to operate outside limits due to changing demand profiles will be considered for replacement.

Metering system components are usually replaced on a time basis to prevent obsolescence and end-of life failures according to Table 6-40.

Component	Design Life
Flow computer	10 years
Flow corrector	10 years
Rotary meter	20 years
Turbine meter	10 years
Ultrasonic meter	10 years
Pressure transmitter	10 years
Temperature transmitter	10 years

Table 6-40 : Metering systems components design life

A number of larger meters are now approaching or have exceeded 20 years and spare parts are becoming obsolete and no longer available from manufacturers.

A programme of meter replacement has been in progress since 2009. At present this is focussed on metering systems incorporating obsolete turbine meters.

As an alternative to turbine meters, ultrasonic meters are also now available. This has opened up opportunities to retrofit ultrasonic meters into existing turbine type applications. Given their wide turndown (100:1) ultrasonic meters are also an attractive option for both upsizing an existing site whilst retaining the existing flow tube sizing, as well as building a new site with smaller tube sizing but with the same or better flow capacity. Ultrasonic meters are also useful for bi-directional flow or highly variable flow sites where turbine meter flow range (turndown) is unsatisfactory.

A review and update of Vector's metering requirements was undertaken in late 2010. The completed document was re-issued in January 2011. A further review was completed in July 2011 and was subject to peer reviewed.

Expenditure forecast

Opex for metering system maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for metering system replacement and renewal is shown in Table 6-41.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
600	700	725	620	500	500	500	500	500	500

Table 6-41 : Capex forecast for replacement and renewal of metering systems ($000)

6.5.7 SCADA and Communications

Maintenance and Inspection

The master station and communications systems located at Bell Block are regularly tested, maintained and inspected by the Gas Control team with support from vendors. Field devices and associated control system are maintained, inspected and calibrated by the Transmission Services team as part of the arrangements described in Section 6.5.16 – Station Ancillaries.

Improvements in technology are making control systems more reliable and able to perform self-diagnostics. These features also permit a decrease in maintenance frequency. The aim is to achieve the scenario where the majority of maintenance is preventative and the minority due to break-downs.

Deloitte conducted an audit of the SCADA system in 2010 and all identified actions were completed by the end of 2011.

Replacement and Renewal

There are no major issues identified in respect of the existing SCADA and communication system, although there is a need to expand the communications links from the various station sites through to Bell Block to facilitate more active monitoring of equipment performance.

The SCADA master station and communication systems were upgraded in 2009. The expected useful life of these systems is nominally between 7-10 years. Provision for replacing the master station is included in the expenditure forecast in FY19 but consideration may be given to bringing this forward if significant benefits from rapidly changing SCADA technology become justified.

The Gas Control team monitors the communication system performance and recommends system upgrades. Feedback from field maintenance personnel is also logged by Gas Control to gather additional performance information. Individual components of equipment will be replaced when it is no longer considered fit for service.

Many smaller sites are monitored using the Autopoll system and associated meter corrector equipment installed on metering systems. This system was designed for dial-up meter readings downloads, but is being progressively upgraded to enable dial-out alarm functions. While the dial-out alarm functions are useful they do not provide the same level of constant monitoring and alarm capabilities that the SCADA system can deliver. Some sites have been identified as requiring upgrades from meter corrector systems to SCADA and RTU systems to provide enhanced monitoring and alarm capability. Provision is made for this in expenditure forecast for FY14 – FY16.

Opex for SCADA and Communications maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for SCADA and Communications replacement and renewal is shown Table 6-42.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
200	200	200	200	200	2,000	200	200	200	200

Table 6-42 : Capex forecast for replacement and renewal of SCADA and communications ($000)

6.5.8 Gas Chromatographs (GCs)

Maintenance and Inspection

Gas Chromatographs are operated, maintained and inspected under the Vector's Metering Requirements for Receipt and Delivery Point standard.

GCs comprise of a number of components and maintenance and inspection requirements are summarised in Table 6-43.

Frequency	Activity
Weekly	Auto calibration
Monthly	Manual calibration, verify sampling system and carrier gas system operation, change filtration elements
Yearly	Change filtration elements, visual inspection of shelter
As required	Exchange carrier gas or calibration gas bottles

Table 6-43 : GC maintenance and inspection activities

Replacement and Renewal

A programme of GC replacement is in place taking into account the recognised design life of 10 years.

The gas chromatograph at Rotowaro CS will be replaced in 2013.

Equipment faults at Frankley Road, Stratford and Southdown were recorded in 2007 and a subsequent Vector report into the faults recommended that the GCs at Stratford and Southdown should be replaced with NGG 8200 series equipment.

The report also stated that most of the failed GCs were not inside enclosures or buildings and were exposed to the weather facing east and south and subject to low temperatures in winter with minimal solar gains. The report also noted that while the Frankley Road GC was installed inside an enclosure there was no temperature control and was subject to extremes in temperatures. The GC at Kaitoke also falls into this category. These issues were addressed and completed over the last four years.

Calibration accuracy of a GC is largely dependent on the accuracy of the calibration gas used as a reference. One important consideration is storing the calibration gas above the gas dew-point. Only some of Vector's current installations incorporate heated calibration gas enclosure blankets, and consideration will be given to retrofitting these on all installations during FY14 and FY16.

Expenditure Forecast

Opex for gas chromatograph maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for gas chromatograph replacement and renewal is shown in the Table 6-44.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
90	-	90	-	90	-	90	90	90	90

Table 6-44 : Capex forecast for replacement and renewal of GCs ($000)

6.5.9 PIG Launchers and Receiver

Maintenance and Inspection

PIG launchers and receivers maintenance and inspection requirements are summarised in Table 6-45.

Frequency	Activity
Six Monthly	Visual inspection and leak check

Table 6-45 : PIG launcher and receiver maintenance and inspection activities

Replacement and Renewal

PIG launchers and receivers are not complex items of equipment and are not replaced or renewed on a condition or age basis.

In Line Inspection (ILI) tooling has changed over recent years to accommodate the latest technology developments resulting in ILI tools becoming longer. It was identified in a post ILI survey report in 2012 that modifications to PIG receiver and launchers will be required to properly accommodate the latest tooling. One solution may be to use portable PIG receivers and launchers but comparative economics, feasibility and practicality of this option will be evaluated in FY14. Modifications will be programmed to align with the ILI survey schedule included in Section 6.3.1 – Pipeline Maintenance and Inspection.

Expenditure Forecast

Opex for gas PIG launcher and receiver maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for PIG launcher and receiver replacement and renewal is shown in Table 6-46.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
500	-	-	500	500	500	500	-	-	-

Table 6-46 : Capex forecast for replacement and renewal of PIG launchers and receivers ($000)

6.5.10 Pressure Regulators

Maintenance and Inspection

Pressure regulators are either a single assembly or have a pilot valve to control operation. Pressure regulators are maintained in similar a similar way as summarised in Table 6-47.

Frequency	Activity
Six Monthly	Verify operation and record set values 'as found' and 'as left' Test operation of monitor and standby stream valves Inspect valve and mounting arrangements for evidence of corrosion Leak check
Yearly	Span check valve positioner on pressure control valve
Two Yearly	Overhaul pilot valve
As required	Overhaul regulator valve

Table 6-47 : Pressure regulator maintenance and inspection activities

Renewal and Replacement

The following criteria are used to assess whether a particular type of regulator needs to be replaced:

- Reliability
- Maintainability
- Performance
- Obsolescence.

Regulator reliability is determined by the frequency and severity of regulator failure. A reliable regulator will not require frequent adjustment, will be tolerant of varying environmental conditions and gas types/conditions and will not be prone to frequent or significant failures. In some cases, serious reliability problems resulting in loss of pressure control can be manifested suddenly as a result of changed pipeline conditions etc. The failures may include shaft breakage, pilot failure/blockage, diaphragm failures or tube swelling etc. Regulators which exhibit serious reliability problems will be replaced on an as-required basis.

Maintainability is the ease with which a regulator can be maintained. In general, complex pilot-operated regulators are more difficult and expensive to maintain than simple-direct-acting regulators. In-line maintainability (whether a regulator can be serviced without being removed from the pipe) is considered desirable although it is not a critical factor.

Regulators are considered to perform well if they are capable of delivering the required flow at a consistent delivery pressure, without undue droop at high flow and undue leakage at zero flow. Changing demands conditions may result in regulators that were previously regarded as performing adequately being deemed inadequate. Regulators which are not capable of delivering within required pressure/flow criteria will be replaced on an as-required basis.

A regulator is considered obsolete if it is no longer manufactured and if its parts can no longer be obtained. Generally the regulator body will remain serviceable and therefore the availability of spare parts determines whether the regulator can still be in service.

Pressure regulators that have become obsolete or face impending obsolescence will be replaced in a phased manner. The urgency of the programme will be driven by the forecasted availability of the serviceable parts.

The serviceable life of pressure regulators depends on regular maintenance and inspection. However experience has shown that when pressure regulators reach ages of 30 years and older the probability of malfunction increases.

Grove Flexflo regulators contain a rubber sleeve as the only moving part that controls the gas flow through the regulator core, this can become distorted over time, hence may not lock up completely. This problem regularly occurs at stations with an on/off gas supply e.g. industrial gas consumer delivery points. When these regulators fail to shut off the downstream section of the station continues to pressurise ultimately activating the pressure relief valves. A programme of replacing Grove Flexflo pressure regulators in these situations commenced in 2011 and will continue through the period of the AMP.

The configuration of some older pressure regulators and their operation in relation to other station equipment would not meet current design standards (these sites were compliant with the design requirements applicable at the time of construction and retrospective application of current code is not mandatory). An example of this is Kiwitahi delivery point which has a single fail open pressure regulator and overpressure protection provided by a full capacity pressure relief valve. Whilst the current design protects against over pressurisation of the downstream network a fault with the single regulator would lead to a significant controlled gas release within the station compound which would affect surrounding properties. Provision has been made to replace pressure regulators in these types of configurations.

Expenditure Forecast

Opex for pressure regulator inspection and maintenance based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for pressure regulator replacement and renewal is shown in Table 6-48.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
800	1,000	1,000	1,000	700	700	700	700	700	700

Table 6-48 : Capex forecast for replacement and renewal of pressure regulators ($000)

6.5.11 Pressure Safety Valves (PSVs)

Maintenance and Inspection Plan

PSVs are either a single assembly or have a pilot valve to control operation. Pressure relief valves regardless of type are maintained in similar fashion and this is summarised in Table 6-49.

Frequency	Activity
Six Monthly	Verify operation and record set values ‘as found’ and ‘as left’ Test operation of monitor and standby stream valves Inspect valve and mounting arrangements for evidence of corrosion. Leak check
Two Yearly	Overhaul Pilot Valve

Frequency	Activity
Five Yearly	Statutory testing by an accredited agency of pressure vessel protecting equipment
As required	Overhaul relief valve.

Table 6-49 : PSV maintenance and inspection activities

Replacement and Renewal

The following criteria are used to assess whether a particular type of pressure relief needs to be replaced:

- Reliability
- Performance
- Obsolescence.

The age of a pressure relief valve is not considered a criterion for replacement. Reliability is determined through regular testing incorporated into the maintenance schedule. An unreliable relief valve will not attain the correct set pressure, will not achieve full lift during pressure relief and will have a much higher re-seating pressure than the set pressure. Some relief valves are prone to 'chatter' caused by the valve opening and closing rapidly and repetitively, striking against the seat sharply many times a second. In some serious cases, relief valves will not re-seat or internal parts are damaged during relief operation. Relief valves that exhibit serious reliability issues will be replaced over a programmed period of time. The replacement period is set based on the number of relief valves to be replaced and the practical replacement frequency considering other station upgrade programmes in place.

A relief valve is considered obsolete if its soft parts can no longer be obtained. Relief valves that are obsolete or face pending obsolescence will be replaced in a phased manner.

Some relief valves in the statutory testing programme are not identifiable. Whilst they continue to test correctly on a five yearly basis there is no known documentation to support them and consequently uncertain spares support. A review will take place in FY14 to identify them as a usable asset or deem them obsolete.

Issues identified include the following:

- Reliance Management Control Systems (MCS) PSV - design has been found to be susceptible to water ingress through the vent pipe. This can cause corrosion of the vent pipe and the upper portion of the relief valve body once water is contained in the relief. The operation of the MCS can be affected through seizing of the soft seat carrier in the body and preventing the relief from lifting when the set pressure is reached. A phased replacement programme commenced in FY12 to replace all MCS PSVs. The programme is expected to be completed in FY14.
- The Sprague Reguliner PSV and its Grove 829 pilot are now obsolete and replacement programme commenced in FY13. The programme will continue during FY14 and FY15 with the remaining 29 Sprague PSVs and their associated pilot valves being replaced.
- Fisher 414 PSVs - valves are now obsolete and the three valves fitted to the transmission system will be replaced in FY14.
- Fisher 399 PSVs - valves are now obsolete and the four valves fitted to the transmission system will be replaced in FY14.

Expenditure Forecast

Opex for PSV inspection and maintenance based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for PSV replacement and renewal is shown in Table 6-50.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
250	250	250	250	155	150	150	150	150	150

Table 6-50 : Capex forecast for renewal and replacement of PSVs ($000)

6.5.12 Pilot Valves

Maintenance and Inspection

Pilot valves are usually considered as a sub assembly of the valve that they control, typically pressure control valves and pressure relief valves. Their maintenance and upkeep is therefore included within the schedules of the larger assemblies.

Replacement and Renewal

Pilot valves whilst forming part of a larger assembly are often developed and supported separately from the larger assembly; a single pilot valve type can be specified for use across a range of applications. Spares support therefore is usually independent of the larger assembly and consequently obsolescence is often independent of the main valve.

There are three models of Grove 829 pilot valves; 829, 829S and 829S1 with the earliest 829 valves fitted in 1969. Without notice spare parts supply ceased in 2012. Vector had 306 of these pilot valves in operation at that time. Some locally manufactured diaphragms were sought and have been operating successfully since early 2012 giving confidence that the valves can continue to be operated and maintained safely until they can be replaced. A five year programme commenced in 2013 to replace all of the now obsolete 829 valves with Mooney Type 20 pilot valves.

Expenditure Forecast

Opex for pilot valve maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Due to pilot valves being classed as sub-assemblies, capex for replacement and renewal of pilot valves is included in the capex expenditure forecasts for pressure regulators in Section 6.5.10 and pressure safety valves in Section 6.5.11.

6.5.13 Isolation Valves

Maintenance and Inspection

Isolation valves maintenance and inspection is summarised in the Table 6-51.

Frequency	Activity
Yearly	Cycle Valve, lubricate if required, check seat tightness and leak check.
Four Yearly	Overhaul gas actuator
Five Yearly	Flush valve and lubricate

Table 6-51 : Isolation valve maintenance and inspection activities

Detailed best maintenance practice currently requires clarification. Advice from OEMs and valve specialists is not consistent and consequently does not always align with documented instructions given to field technicians. This may result in changes to maintenance and inspection frequencies and activities.

Replacement and Renewal

In general valves are expected to last the lifetime of the asset to which they are connected. However, valves need to be replaced on a reactive basis where:

- The valve cannot be practically actuated.
- The valve is passing.
- The valve is leaking.
- In the case of plug valves, the amount of lubricant being installed is compromising the operation of the downstream asset.
- The cost of repair outweighs the cost of replacing the valve.

A central register for faulty valves was put in place two years ago to aid co-ordination and allocation of repair and investigative work. Currently a total of 116 valves have been registered as faulty and 66 have been repaired or replaced in that time. It is expected that further faulty valves will be identified due to the age and volume of isolation valves installed in the asset.

Replacement cost is largely based upon the complexity of the engineering works required. Some replacements are relatively straight forward and require either isolation to a section of pipe work in a station and/or temporary bypass where a valve can then be removed and replaced by the use of bolted flanges.

More complex replacements require sections of pipeline to have a stopple fitted to isolate the valve and/or the cutting of welded joints. Planning and engineering input into these projects far exceed those required for a straight forward replacement.

Some valves have gas actuators fitted to facilitate remote or local operation. The Bettis actuators fitted to many of these valves are becoming un-economic to maintain as they often require major refurbishment to allow continued use. Currently the lead time for soft parts is in excess of 26 weeks and it is expected that the supply of overhaul kits will cease over the next few years. It is intended to commence an actuator replacement programme starting in FY14 which will continue for a further five years.

Some stations are installed with older Versa type shuttle valves which direct gas to the actuators to shut or open their associated valve and many of these valves are required to operate emergency shutdown (ESD) systems at some stations. On occasion, under test conditions, these valves have failed to operate correctly. Provision has been made in the expenditure forecast to replace all Versa valves in FY14.

Expenditure Forecast

Opex for isolation valve maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for isolation valve replacement and renewal is shown in Table 6-52.

	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Non-complex valves	200	200	200	200	200	200	200	200	200	200
Complex valves	500	500	500	600	300	400	400	400	400	400
Actuators	100	100	100	100	100	-	-	-	-	-
Total	**800**	**800**	**800**	**900**	**600**	**600**	**600**	**600**	**600**	**600**

Table 6-52 : Capex forecast for isolation valve replacement ($000s)

6.5.14 Filters

Maintenance and Inspection Plan

Filters regardless of size largely require little maintenance and is summarised in Table 6-53.

Frequency	Activity
Six Monthly	Drain and check for fluid Leak check
Annual	Inspect and replace element if necessary

Table 6-53 : Filter maintenance and inspection activities

Replacement and Renewal

Filter unit life expectancy is the same as the station in which it is installed. Any future replacement programme would be driven by:

- Obsolescence of the filter element.
- Operational/maintenance costs.
- Changes in operational capacity.

Other identified issues include:

- Due to the low operational pressures at Marsden Point delivery point high gas velocities are present. Dust erosion issues have been noted at the station and a review will take place to assess the suitability of the installed filter system.
- The filter at Rotorua delivery point has to be completely removed from the station pipe work in order to replace the filter cartridge. The time required for this work is excessive and poses a health and safety risk to personnel carrying out the task. It is intended to replace this filter unit during FY14.
- Further work is required to fully assess the risk of obsolescent filter elements and to forecast as far as is possible future obsolescence.
- Some filter unit elements cannot be replaced without complete removal from the pipeline. These filter units are to be assessed for replacement.
- Some stations do not have a filter unit installed. These stations will be assessed with regard to compliance with NZS 5442 and upgraded as required.

Expenditure Forecast

Opex for filter maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for filter replacement and renewal is shown in Table 6-54.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
200	200	200	200	200	200	200	200	200	200

Table 6-54 : Capex forecast for replacement and renewal of filters ($000)

6.5.15 Electrical Equipment in Hazardous Areas

Maintenance and Inspection

Maintaining a “Verification Dossier” of all hazardous area electrical installations is a requirement as laid out in AS/NZS 60079.14 and AS/NZS 60079.17. It is the collection of various design, purchasing, compliance, maintenance, inspection and re-inspection documents needed to ensure that any electrical installation in a hazardous area is compliant with standards, is installed in a safe fashion and will pass an audit. The Vector Hazardous Area Dossier requirements are described in Vector procedure no. 6056.

Four-yearly interval re-inspection is required on all sites, and to the level of detail of each piece of hazardous area certified equipment on each site. Corrective work may arise from re-inspections, which is largely due to environmental impact and deterioration. However, from time to time items such as flame path damage on junction boxes can necessitate replacement on larger items.

On some older stations hazardous area certified electrical equipment was certified to old USA or Canadian standards. This equipment is not now recognised for use in New Zealand without additional supporting documentation and engineering approval.

Opex for electrical equipment in hazardous areas maintenance and inspection based on historical trends and operational experience is included in the Opex forecast for station routine maintenance and inspection in Section 6.5.1.

Replacement and Renewal

There is no specific replacement and renewal plan for this section as electrical equipment in hazardous areas is addressed as part of the major asset components described in this section.

6.5.16 Station Ancillaries

Maintenance and Inspection Plan

Station ancillary maintenance and inspection is summarised in Table 6-55.

Description	Frequency	**Activity**
Land, security fences (inc. gates), lighting, signage and buildings	Six Monthly	General station inspection Weed control
Power, Earthing and Bonding Systems General Cabling, Cable Trenches, Cable Support Systems, Junction Boxes	Two Yearly	Sites with RTUs installed. Inspection and maintenance
	Four Yearly	Sites with no RTUs installed Inspection and maintenance to Vector documents 6219 and 6220
General Instrumentation not associated with other asset categories	Yearly	Calibration and function checks, including checking the transfer of data back to the Gas Control Room at Bell Block via the SCADA system.

Description	Frequency	Activity
Piping – Below Ground	Yearly	The schedule of maintenance along with inspection results is contained in the buried station pipe work corrosion prevention plan
Piping and pipe supports – Above Ground	Yearly	Coating inspection is carried out by Vector field technicians
	Two Yearly	Inspection is carried out by a coating specialist
Gas Detection Equipment (not associated with compressor units)	Yearly	General inspection and function checks Calibration of sensors

Table 6-55 : Station ancillary maintenance and inspection activities

Replacement and Renewal

Land, Security Fencing (inc. Gates), Lighting, Signage, and Buildings

In general, security fencing (incl. gates), signage and buildings are not routinely replaced or renewed. Items are replaced or renewed when issues are identified during maintenance or inspection. Current issues include:

- Fence issues: Frankley Rd, Papakura DP, Matangi DP, Waitoa DP, Morrinsville DP, Mt Maunganui DP.
- Building issues: McKee Mixing Station, Henderson Compressor stn, Papakura DP, Papakura Pressure Reducing Stn, Pokuru OT, Pokuru oil shed.
- Levin DP additional fence to prevent 3-rd party interference.
- Pauatahanui DP entry/egress HSE issue.

Power, Earthing and Bonding Systems

In general, power, earthing and bonding system components are replaced or renewed when issues are identified during maintenance or inspection.

Many of the power supply units are in excess of 20 years old, and are now unsupported for parts. There are two models of 24 volt DC power supplies to be replaced, to avoid unplanned outages:

- Santon 50amp units – currently installed at Mahoenui Compressor Station, Henderson Compressor Station, Kawerau Compressor Station.
- Santon 15amp units – approximately 30 plus sites, which should be prioritised for replacement based on gas volume throughput and consequences from loss of supply.

It is intended to develop a standard design, and testing/acceptance criteria to determine the life of all 24 volt DC battery charger units, and assess all stations against these criteria to determine priority for replacement.

A report was produced for Vector in 2011 on the issues and interactions between copper based electrical MEN (Multiple Earths Neutral) systems, carbon steel piping buried in the ground, and cathodic protection techniques and system.

Many of the stations were built decades ago without what would appear to be a clear understanding of the interactions between these systems, due to electrochemical affects one system has upon another.

Key issues are:

- The earthing/bonding system for underground piping is often formed using copper or copper clad electrodes, and is connected via the station mains power supply to a much larger power network which also uses copper to form the earth. When copper and steel are electrically connected together, and both are exposed to soil, the steel will become sacrificial, resulting in corrosion to underground earthed piping. Stations with underground piping should be using zinc as the earthing system electrodes, and sacrificial zinc should be bonded to the underground piping in order to achieve protection. The 2011 report referred to above gives post-project performance test results for Kaitoke Compressor Station, which was upgraded to a zinc earthing system in 2011 with successful outcomes.

- Many of the small to medium sized stations are using a single galvanised steel earth electrode to form the main earthing point. Based on the stations being gas hazardous areas and the earthing and bonding systems being of significant importance in order to achieve electrical safety, all sites with single galvanised earth pegs will be reviewed to establish if this is satisfactory to achieve required standards (including factoring in earth resistivity), and will be upgraded if required.
- Most stations which have a 230V main power supply are not equipped with isolation transformers. Modern wiring standards require the installation of isolation transformers for risk mitigation. Consideration should be given to installing the appropriate isolation transformers as the opportunity arises.
- Many stations do not have any form of Earth Potential Rise (EPR) protection. EPRs exist or are created when a fault current is passed through earth, due to the soil not being a perfect conductor (but in fact a resistor). This forms a voltage gradient across the ground. This may sometimes be referred to as step potential or touch potential. When these faults occur, which can be due to lighting strike on pipelines, nearby electrified railway lines, nearby electrical network system ground faults, nearby power station faults, etc there is likelihood for earth potential rise in the nearby stations and pipelines. To mitigate this, a zinc ribbon conductor is normally trenched in to the soil up to 500mm deep, which causes the EPR within the station to rise to the same magnitude as the steel piping in that station, thus if someone is touching both the ground and the piping when the fault occurs, they are not exposed to any potential difference in voltage. Very few sites have zinc ribbon installed, and a review of these sites will be carried out in FY14 to determine requirements at each station. Factors such as proximity to power stations, proximity to electrical networks, etc will be considered; and
- Where cross country pipelines enter in to stations, generally the first flange set is used to electrically decouple the pipeline from the station piping. This is done using a Flange Insulation Kit (FIK). Across an FIK a surge diverter is required in order to channel any surge voltages/current from the pipeline down to the earth system within the station, and dissipate the fault, rather than have the fault jump across the FIK which would result in the FIK being damaged and becoming conductive. There is however an inconsistent application of surge diverters on the transmission system, and the more popular model used (Critec) does not give rise to adequate person protection nor does it have a power system fault duration rating. A review and further investigation will be conducted in order to determine a standard design for FIK protection.

The methodology by which station power, earthing and bonding major issues are prioritised is intended to be addressed during FY14.

General Cabling, Cable Trenches, Cable Support Systems & Junction Boxes

General cabling, cable support systems and junction boxes are replaced or renewed when issues are discovered during maintenance or inspection.

General Instrumentation not associated with other Asset Categories

In general, field instrumentation will last for many years. A replace-on-failure approach is taken with this kind of equipment, acknowledging that failure of electronic equipment is generally considered random, with the likelihood increasing as the devices age.

General instrumentation on the small to medium sized stations will be reviewed and included in routine calibration and function test maintenance checks. This will be addressed in FY14 due to the ageing nature of the instrumentation.

Piping – Below Ground

In general, below ground piping is not replaced or renewed. Protection of below-ground piping is reliant on sacrificial anodes, which are renewed as required.

Methodology for the checking of CP effectiveness on below-ground piping within stations is to be clarified during 2013/2014.

Several stations have underground steel piping which is bonded to the station above ground piping, which is then earthed and bonded. This piping does not have a CP system and will need new CP systems to be installed.

Sites identified which need CP system installations in order to protect below ground steel piping are:

- Hastings delivery point
- Westfield delivery point
- Kinleith delivery point
- Kapuni Compressor Station
- Kapuni GTP Inlet Meter Station
- Kapuni GTP Outlet Meter Station
- Pokuru Compressor Station
- Cambridge Delivery point
- Mahoenui Compressor Station
- Ammonia Urea delivery point.

Piping – Above Ground

In general, above ground piping is not replaced or renewed. Above ground piping is subject to thorough preparation and repainting as required, based on Vector standard 7034 - Surface treatment of pipe work and associated structures. Provision has been made in the capex forecast for an above ground station pipe work recoating programme to replace deteriorated chlororubber coatings.

Gas Detection Equipment (not associated with compressor units)

A review of all gas detection systems was conducted in 2009 which confirmed that in general Vector's gas detection installations comply with AS/NZS 60079. The report did, however, identify that there is a mixture of current and obsolete gas detection controllers in service. Older controllers are replaced as they fail although this method may not be totally effective. A replacement programme for obsolete controllers will be developed during FY14.

Expenditure Forecast

Opex for station ancillary maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for station ancillary replacement and renewal is shown in Table 6-56.

Category	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
I&E upgrades	100	100	100	100	100	100	100	100	100	100
Earthing upgrades	200	200	200	200	100	200	200	200	200	200
Above ground coating replacement	100	100	100	100	100	100	100	100	100	100
Below ground pipe work CP improvements	200	200	200	200	200	200	200	200	200	200
Total	**600**	**600**	**600**	**600**	**500**	**600**	**600**	**600**	**600**	**600**

Table 6-56 : Capex forecast for replacement and renewal of station ancillaries ($000)

6.6 Critical Spares and Equipment

In general the condition of the critical spares and equipment is satisfactory as found by regularly inspection and maintenance.

Critical spares and equipment is subject to compliance with technical standards and processes for their acquisition, management and maintenance.

Maintenance and Inspection

Critical spares and equipment is subject to regular maintenance and inspection.

Replacement and Renewal

In 2011 a project was undertaken to identify and store all emergency pipe assets in the Bell Block hangar store on properly designed storage racks and, where required recertified by Lloyds Register. As part of the project, a number of critical spares were reviewed and in some cases refurbished or replaced.

The compatibility of equipment with the range of specialized fittings currently available needs to be considered when planning the replacement of existing, or the acquisition of additional, items of critical equipment.

Expenditure Forecast

Opex for critical spares and equipment maintenance and inspection based on historical trends and operational experience is included in the opex forecast for pipeline routine maintenance and inspection in Section 6.3.1.

Capex forecast for critical spares and equipment replacement and renewal is shown in Table 6-57.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
-	50	-	50	-	50	-	50	50	50

Table 6-57 : Capex forecast for replacement and renewal of critical spares ($000)

6.7 Plant and Equipment

Vector owns plant and equipment that is used by personnel when carrying out planned maintenance, inspections and refurbishment of assets.

General plant and equipment includes items such as:

- Pressure gauges
- Thermometers
- Calibrators
- Specialised test equipment
- Pipe locators
- GPS units
- Personal gas detectors
- Lap-top computers
- Specialised software
- Hand tools
- Generators
- Pumps
- Lifting Equipment
- High and low pressure hoses
- Hot-Tap drills
- Trailers.

In addition to above Vector operates plant and equipment in the measurement laboratory at the Bell Block site for the calibration and certification of metering system components owned by Vector and others. Issues identified with this equipment include:

- The two air transfer provers used for meter certification are now over 20 years old with limited availability of parts.
- The liquid prover is over 25 years old and close to the end of its serviceable life. Many parts are no longer available for the prover.
- Some of the calibration test equipment is over 20 years old and close to end of serviceable life.

Maintenance and Inspection

General plant and equipment is subject to regular maintenance and inspection.

Replacement and Renewal

Plant and equipment is acquired or replaced as the need arises.

It is now necessary to carry out minor upgrades to the two air transfer provers in the measurement laboratory in FY14 with possible replacement in FY19. It is now also necessary to rebuild the wiring and add mass proving capability to the liquid prover in FY14 with possible replacement required in FY20. Provision has been made in the capex forecast for these items.

Expenditure Forecast

Opex for plant and equipment maintenance and inspection based on historical trends and operational experience is included in the opex forecast for station routine maintenance and inspection in Section 6.5.1.

Capex forecast for replacement and renewal of plant and equipment is shown in Table 6-58.

Category	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
General plant & equipment	300	300	300	300	300	300	300	300	300	300
Measurement laboratory	165	0	0	0	0	330	750	0	0	0
Total	**465**	**300**	**300**	**300**	**300**	**630**	**1050**	**300**	**300**	**300**

Table 6-58 : Capex forecast for replacement and renewal of plant and equipment ($000)

6.8 Engineering Studies

Based on historical data and activity levels it is expected that a number of engineering studies and front end engineering design (FEED) studies by external consultants will be required to support technical initiatives, identification of alternative options and decision making. Typical activities may include assistance with identifying failure modes, peer review of root cause analysis (RCA) investigations and assistance with particular technical aspects such as civil and geotechnical engineering disciplines.

Specific provision for engineering studies is required in the following areas:

- Land stability investigation and analysis studies to better understand and develop mitigation measures at identified areas posing threats to pipeline integrity. The Maui pipeline outage that occurred in October 2011 identified that a follow up to the 2009 GNS survey work is required. This includes a more detailed and structured approach with GNS to identify sites where threats exist and to carry out site investigation/analysis. This work commenced in FY13.
- Gas contamination episodes occur from time to time and improved analysis, monitoring and management is required to better understand causes and mitigations. This may include a review of the effectiveness of the current coalescer fleet.
- Development of maintenance strategy and efficiencies.
- Asset records/data and associated maintenance and reliability information needs improvement to assist asset management processes.
- Investigation of mitigation measures for electrical touch potential issues associated with buried metallic pipelines.
- Review of hazardous area classifications and identification of any required remedial works.
- Investigation and development of solutions for disposing of redundant odorisation plant components.
- Determine any required renewal and replacement of the aging IPS units.
- Investigation of requirements to upgrade the aging transfer provers in the metering laboratory.
- Investigation of options to add mass proving capability to the existing liquid prover in the metering laboratory.
- Updating of electrical installations hazard area verification dossier.
- Update of I&E periodic safety check documentation.

Opex forecast for engineering studies is shown in Table 6-59.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
1,231	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289

Table 6-59 : Opex forecast for engineering studies ($000)

6.9 Maintenance & Inspection and Renewal & Replacement Expenditure Forecasts

6.9.1 Summary of Section 6 Capex Forecast

AMP Section	Description	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
6.3.2	Pipeline signage upgrades	100	50	50	50	50	50	50	50	50	50
6.3.4	Pipeline - integrity	1,000	1,300	1,100	1,000	900	1,000	1,000	1,000	1,000	1,000
6.3.6	Special crossings	250	100	100	300	100	300	100	300	100	300
6.3.7	Rectifier replacement	50	50	50	100	50	100	50	100	100	100
6.3.7	New rectifier units	60	90	60	60	60	60	60	60	60	60
	Pipelines Sub-Total	**1,460**	**1,590**	**1,360**	**1,510**	**1,160**	**1,510**	**1,260**	**1,510**	**1,310**	**1,510**
6.4.2.1	Gas turbines	120	360	60	80	90	60	120	110	110	80
6.4.2.2	Centrifugal compressor	0	20	0	40	10	50	20	60	0	0
6.4.2.3	Reciprocating engine controls total	1,300	800	3,400	2,300	1,100	800	2,500	800	2,500	800
6.4.2.3	Reciprocating engine other	500	0	0	900	0	0	900	500	0	0
6.4.2.5	Gas coolers	0	0	800	0	0	1,300	50	50	50	0
6.4.2.6	Compressor fire and gas systems	230	230	230	350	250	330	100	100	100	100
6.4.2.7	Compressor oil storage	100	80	80	80	80	80	80	80	80	80
	Compressors Sub-Total	**2,250**	**1,490**	**4,570**	**3,750**	**1,530**	**2,620**	**3,770**	**1,700**	**2,840**	**1,060**
6.5.1	Stations	450	750	500	500	500	500	500	500	500	500
6.5.2	MLVs	195	200	300	200	200	200	200	200	200	200
6.5.3	Heating Systems	400	600	600	500	300	300	300	300	300	300
6.5.4	Odorisation Plants	200	0	0	300	0	300	0	300	0	300

AMP Section	Description	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
6.5.5	Coalescers & Filter/Separators	0	0	0	0	0	0	0	0	0	0
6.5.6	Metering Systems	600	700	725	620	500	500	500	500	500	500
6.5.7	SCADA and Communications	200	200	200	200	200	2,000	200	200	200	200
6.5.8	Gas Chromatographs	90	0	90	0	90	0	90	90	90	90
6.5.9	PIG Launchers and Receivers	500	0	0	500	500	500	500	0	0	0
6.5.10	Pressure Regulators	800	1,000	1,000	1,000	700	700	700	700	700	700
6.5.11	Pressure Safety Valves	250	250	250	250	155	150	150	150	150	150
6.5.12	Pilot Valves	0	0	0	0	0	0	0	0	0	0
6.5.13	Isolation Valves	800	800	800	900	600	600	600	600	600	600
6.5.14	Filters	200	200	200	200	200	200	200	200	200	200
6.5.15	Electrical Equip in Hazardous Areas	0	0	0	0	0	0	0	0	0	0
6.5.16	Station Ancillaries	600	600	600	600	500	600	600	600	600	600
6.6	Critical Spares & Equipment	0	50	0	50	0	50	0	50	50	50
6.7	Plant and Equipment	300	300	300	300	300	300	300	300	300	300
6.7	Measurement Laboratory	165	0	0	0	0	330	750	0	0	0
	Stations Sub-Total	**5,750**	**5,650**	**5,565**	**6,120**	**4,745**	**7,230**	**5,590**	**4,690**	**4,390**	**4,690**
	Total	**9,460**	**8,730**	**11,495**	**11,380**	**7,435**	**11,360**	**10,620**	**7,900**	**8,540**	**7,260**

- Figures are in 2014 real New Zealand dollars ($000)
- The year reference indicates the end of the Vector financial year
- The forecasts are inclusive of the cost of finance and in line with Vector's business practice

Table 6-60 : Capex forecast summary

6.9.2 Summary of Section 6 Opex Expenditure Forecast

AMP Section	Description	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
6.3.1	Pipeline maintenance and inspection	2,349	2,461	2,461	2,461	2,461	2,461	2,461	2,461	2,461	2,461
6.3.1	ILI survey and cleaning pig runs	783	645	59	59	59	1,231	1,817	1,231	59	352
6.3.2	Pipeline easement activity and surveillance (SD)	1,181	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242
6.3.2	Pipeline awareness & control of works adjacent to pipelines (AI)	134	141	141	141	141	141	141	141	141	141
6.3.3	Pipeline exceptional maintenance	705	738	738	738	738	738	738	738	738	738
6.3.5	Pipeline response to emergencies incidents	492	516	516	516	516	516	516	516	516	516
6.4.1	Compressor maintenance and inspection	3,122	3,164	3,164	3,164	3,164	3,164	3,164	3,164	3,164	3,164
6.4.3	Compressor fuel	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990
6.5.1	Station maintenance and inspection	2,799	2,871	2,871	2,871	2,871	2,871	2,871	2,871	2,871	2,871
6.8	Engineering Studies	1,231	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289
Total		**16,786**	**17,058**	**16,472**	**16,472**	**16,472**	**17,644**	**18,230**	**17,644**	**16,472**	**16,765**

- Figures are in 2014 real New Zealand dollars ($000)
- The year reference indicates the end of the Vector financial year

Table 6-61 : Opex forecast summary

Gas Transmission Asset Management Plan 2013 – 2023

Systems and Data
Section 7

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7. Systems and Data

7.1 Asset Information Background

This section describes the information systems and associated business processes that Vector maintains and operates to manage asset data.

Vector's day-to-day operation involves specialists and teams within Vector undertaking a wide variety of business functions such as financial forecasting, asset planning, project management, asset valuation, maintenance management, asset inspection and condition monitoring.

These business functions are supported by data, systems and business processes. Figure 7-1 illustrates the relationships between business teams, functions, information systems and data: many functions are dependent on the same systems and source data.

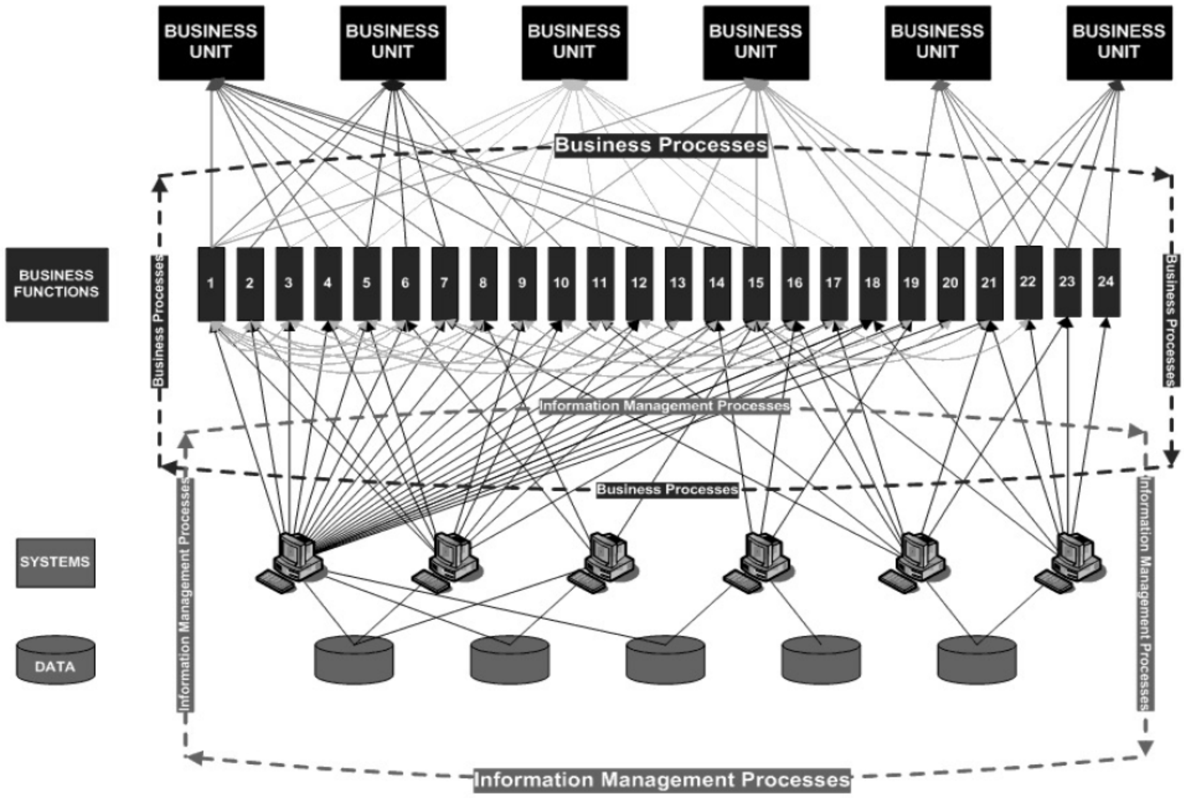

Figure 7-1 : Systems relationships

To establish effective management of data and Information Systems (IS), Vector has created a Corporate Data Catalogue (CDC), which holds a reference definition of data sets managed by Vector and held in its corporate systems, including those required to support asset management. For each data set, the master system and owner is identified. In addition, the CDC provides an assessment at the enterprise level of each data set in terms of quality, security, sensitivity and criticality and the basis for identifying fitness for purpose of data.

Recently, Vector supplemented the CDC by applying a Data Source Verification (DSV) methodology to those data sets that support external reporting purposes, such as compliance statements and information disclosures. DSV is a detailed field-by-field analysis to determine the quality and completeness of each data field in terms of its acceptance as a source for reporting requirements.

In many cases data flow diagrams are developed in conjunction with DSV analysis to provide a systems perspective on the verification of source to output. For audit purposes, Vector uses the UML 2.0 standard for data flow diagrams. The outputs of the DSV analyses provide a basis for prioritising actions where necessary to address specific issues of data quality or completeness.

An asset information process framework has been developed that defines, for each step in the end-to-end asset management process a set of controls for asset information from source to output including:

- Asset information policies.
- Asset information business process maps.
- Business rules / work instructions for asset information.
- Asset information standards.
- "Owners" and "responsible persons" for the execution of each asset information process.
- Operational level asset information systems.
- Asset management reporting methodology.

The framework is maintained and updated in line with the requirements of Vector's asset management practices, including emerging external reporting obligations.

7.2 Asset Information Systems

Data is held in a primary system which is built around a corporate Enterprise Resource Planning (ERP) system. Vector has adopted an Enterprise Asset Management (EAM) approach, in which assets are managed by its ERP system through their entire lifecycles.

The enterprise systems are supplemented by a number of standalone databases, typically PC-based tools some of which have programmatic data feeds to or from enterprise systems.

Each asset information system has a specific purpose, and is the master repository, providing the ultimate, sole source of truth for a specific data set, as summarised in Table 7-1.

Asset Information Systems	Financial information	Asset/network characteristics	Transactional history	Location	Connectivity	Customer service	System Type
Fixed Asset Register (FAR)	★	✓					ERP
Asset Valuation Register	★	✓					Standalone
SAP - Materials Management System (MMS)	★	✓	★				ERP
SAP - Plant Maintenance (SAP-PM)	★	★	★	✓		✓	ERP
Geographical Information System (GIS)		✓		★	★	✓	Geospatial
Engineering Documents System (EDS)		★		✓	✓		Other Enterprise

Asset Information Systems	Financial information	Asset/network characteristics	Transactional history	Location	Connectivity	Customer service	System Type
Pipeline Modelling System		★			✓	✓	Other Enterprise
Easement Management Database			★	★			Standalone
Contractors Database			★	★			Standalone
Non-Routine Activity Management System (NRAMS)		★		✓			Standalone
Pipeline Integrity Management System (PIMS)		★		✓			Standalone
SCADA		✓	✓		★	★	Real Time
Autopoll		✓	✓		★	★	Real Time
Incident Management System			★			✓	ERP
Risk Management System		★					Standalone

Master (source data) repository	★
Secondary reference	✓

Table 7-1 : Asset systems summary

7.2.1 Fixed Asset Register (FAR)

The FAR holds the master register of financial fixed assets, providing the basis for depreciation, taxation, valuation and financial reporting, and is linked with Systems Applications and Processes Plant Maintenance (SAP-PM). Both the FAR and SAP-PM are updated as assets are commissioned and decommissioned.

7.2.2 Asset Valuation Register

Vector's regulatory asset database is derived from the data maintained in the FAR, SAP-PM and Geographical Information System (GIS), in accordance with the guidelines set down by the Commerce Commission. The register is maintained in a standalone PC-based database.

7.2.3 SAP-Materials Management System (SAP-MMS)

The Materials Management System is the Systems Applications and Processes Materials Management System (SAP-MMS) module and is used to manage the procurement, capture of product information, i.e. serial numbers, storage and issuing of Vector assets. The ERP system (SAP) passes information from one part of the system to another to provide life cycle management of assets.

7.2.4 Overview of ERP and Related System Links

ERP automatically interfaces with other systems. This offers a number of advantages in terms of asset lifecycle information management, as described below:

- By linking SAP-PM and FAR, via an inherent ERP system interface, technical and financial registers are able to be maintained in synchronisation. In this way, regulatory, statutory and other audit compliance is supported.
- Settlement of capital costs from project Work In Progress (WIP) accounts through to financial asset records is able to be facilitated by the link from SAP-PM to FAR.
- A complete transactional history of maintenance information is available at the asset (or asset equipment) level. This supports investment decisions related to asset upgrading, asset replacement / refurbishment and the optimisation of operational / capital expenditure.

7.2.5 Geographical Information System (GIS)

The GIS system employed is the proprietary system Intergraph G/Technology. GIS is the master asset register for below ground pipeline assets and includes geospatial, technical, hierarchical, spatial, contextual, connectivity, cathodic protection and land management data. The functional locations of assets generated and recorded in SAP-PM are also recorded in GIS for cross referencing.

GIS provides a computerised mapping system for the asset, which shows the location of all assets against land-based data provided by Land Information New Zealand via Terralink. Its primary purposes are to accurately prepare and provide pipeline information and plans to any party proposing to carry out work in the vicinity of assets and to support Pipeline Integrity Management System (PIMS) and demand modelling systems.

A key piece of equipment used in the field to capture the location of assets is GPS (Global Positioning System) receivers. GPS uses satellites to establish an accurate position and coordinates on the earth's surface and allows data to be captured about the asset loaded into the GIS.

The GIS is linked with the Easement Management Database described in Section 7.2.10.

GIS software is updated on a regular basis and the next full update is required in FY14 at forecasted capex of $100k. It is anticipated that future GIS software upgrades will take place at three yearly intervals.

7.2.6 SAP-Plant Maintenance (PM) Module

In line with the Vector objective of optimising lifecycle asset management capability, the SAP-PM system and associated business processes have been designed to hold the planned maintenance schedule for each asset, according to the relevant engineering standard, and to capture transactional information against each asset record, including that gathered through inspection activities, maintenance activities and defects lists.

The format for transactional information entered into SAP-PM is defined by Vector's engineering standards, including maintenance standards. Works management is enabled by deriving inspection and maintenance schedules from the information held in SAP-PM, in line with Vector's operational and engineering standards and supported by Vector's asset engineers.

Interface software for performing database queries in SAP-PM is required for extracting asset details and performance data. Forecast capex of $50k is required in FY15 for this purpose.

Capturing field data regarding maintenance activities is currently carried out based on paper systems and data inputting by administrative staff. A new electronic based system comprising of tablet devices and associated software links between tablets and SAP-PM are to be introduced during FY14 and at a forecasted capex of $300k in each year.

Maintenance routines recorded in SAP-PM are to be reviewed and refined as part of the asset maintenance strategy described in Section of this AMP. Maintenance Task Analysis techniques and software will be require in FY15 to facilitate this at forecasted capex of $50k.

7.2.7 Supervisory Control and Data Acquisition (SCADA)

Vector's gas transmission system is monitored and controlled in real time using the SCADA system. SCADA is used to provide real time data for the OATIS system. SCADA is described in more detail in Sections 3 and 6 of the AMP.

To provide better access and analysis capability of asset performance for asset engineers it is proposed to install a user historian system to interface with SCADA over FY15 and FY16 at forecasted capex of $100k.

7.2.8 Autopoll

Autopoll is a proprietary software system used to poll information from data loggers at remote stations using modem technology over dedicated phone line connections. The prime purpose of Autopoll is to collect metering data for energy conversion and billing purposes and is installed at stations where SCADA RTUs are not installed. Autopoll is described in more detail in Sections 3 and 6 of the AMP.

7.2.9 Engineering Document System (EDS)

Asset standards and technical specifications have been developed for the design, construction, operation and maintenance, and disposal of assets. All documents are accessible via Vector's intranet in "Qmap" which links to the Vector system "Documentum".

Vector maintains engineering drawings and related technical information and data in a proprietary EDS called AM Meridian. Engineering drawings are created, maintained and managed in a proprietary Computer Aided Drawing (CAD) system called AutoCad and are viewable in AM Meridian.

Technical compliance with AS2885.3:2012 Pipelines - Gas and Liquid Petroleum Part 3: Operation and Maintenance is described and demonstrated in Vector's Pipeline Management System (PMS). The PMS is a dynamic, 'living' document, that is subject to change as regulations and business requirements change. The PMS includes a description of how technical records and data are maintained and stored to meet particular requirements of AS2885.

The existing AM Meridian and AutoCad software systems require upgrading at regular intervals at forecasted capex of $20k per annum from FY14 onwards.

7.2.10 Easement Management Database

The assets cross over approximately 7,000 parcels of land consisting of over 5,000 individual properties involving approximately 4,000 separate land owners/occupiers. A Microsoft Access database system is used for updating and keeping track of land ownership and recording/tracking communications with landowners and occupiers.

The database is used to list and record Vector's regular communications with landowners and occupiers which provide pipeline safety information and reminders about their responsibilities with respect to Vector assets on their property. This communication includes sending a calendar every December and a written communication in June.

The system is also used to assist with negotiation and liaison with landowners affected by the construction of new assets.

7.2.11 Contractors Database

A Microsoft Excel database is used to record details about contractors who have worked in the vicinity of the assets and to send them regular pipeline safety information.

7.2.12 Non Routine Activity Management System (NRAMS)

AS 2885.1:2012, Appendix F "Qualitative Risk Assessment", requires Vector to consider failure event consequences, severity and frequency and apply appropriately determined risk treatment actions, within the stated timescale, to manage the risk.

To comply with this, Vector has developed a risk assessment system exclusively for gas transmission assets to assist in prioritising actions, known as NRAMS. It is a tool used to submit information and record decisions involving activities that mitigate asset risk and proposed developmental activities. The system records and tracks information and provides visibility and risk assessments for employees and managers. A schematic of the NRAMS process is shown in Figure 7-2.

Figure 7-2 : Schematic of the NRAMS process

The existing NRAMS software requires upgrading to provide compatibility, stability and security with Vector IT platforms at forecasted capex of $130k in FY15. It is anticipated that future NRAMS software upgrades will take place at five yearly intervals. Prior to the upgrade in FY15 there will be a requirement to improve the security and stability of NRAMS in FY14 at a forecast capex expenditure of $80k.

7.2.13 Pipeline Integrity Management System (PIMS)

It is accepted best practice within the high pressure pipeline industry to have a GIS-enabled PIMS to manage the data that supports pipeline integrity. Vector employs the proprietary PIMS product Rosen Asset Integrity Management System (ROAIMS) In Line Inspection (ILI) Module.

In addition to supporting best practice pipeline asset management, the purpose of PIMS is to ensure that Vector achieves the following objectives:

- Retention of a CoF (Certificate of Fitness) to operate the Gas Transmission Pipeline System.
- Compliance with the Health and Safety in Employment (Pipelines) Regulations 1999 and AS 2885.

PIMS derives pipeline integrity data from a number of sources including GIS, ILI surveys, Cathodic Protection (CP) surveys, information on as-found asset condition from excavations and Safety Management Studies (SMS). The system stores and displays analysis data in an easily understandable and accessible format for asset engineers to assess and make pipeline integrity management decisions. PIMS data is stored on the Rosen server in Germany and is accessed utilising internet connectivity to dedicated PCs containing ROAIMS application software.

ROAIMS was installed and populated in 2010 and 2011 as Phases 1 and 2 to support existing requirements and to accommodate future software development upgrades. It was planned during installation to upgrade the software as Phase 3 of the programme. Additional features are corrosion analyst, feature assessment expressions, dent assessment, cathodic protection data capture, data view and land stability/DCVG correlation. Forecast capex for the upgrade is $140k over FY15 and FY16.

7.2.14 Pipeline Modelling System

Vector uses proprietary software system SynerGEE Gas for pipeline modelling. This is a software simulation package used to model and analyse pressure and flow of natural gas in transmission pipeline assets. Analysis is conducted using transient state analysis to model the temporal changes fluctuating demand causes to pressure and linepack. The system uses graphic imagery to display simulated pipeline conditions and behaviour.

Pipeline base models are validated against actual pipeline operating parameters. The asset is divided up into six sections for pipeline modelling:

- North: Rotowaro compressor station to Kauri offtake
- Central North: Rotowaro to Temple View and including the Te Kowhai offtake
- Bay of Plenty: Pokuru compressor station to Gisborne offtake
- Central South: Kapuni compressor station to Temple View offtake
- Frankley Road: KGTP inlet to Frankley Road interchange
- South: Kapuni compressor station to Waitangirua offtake.

The main uses of pipeline modelling include:

- Assessment of future asset performance.
- Assessment of asset reinforcement options.
- Assessment of ability to connect new demands.

- Capacity disclosure purposes.
- Compressor performance.

7.3 Asset Management Reporting

Whilst Vector's corporate Business Intelligence (BI) toolset includes a range of professional reporting applications for the reporting, visualisation and analysis of asset data, traditionally, Vector's approach to BI in the asset management context has been one of ad-hoc extraction of data directly out of a single operational system, such as the ERP or CMS, into a standalone PC-based database or spreadsheet.

In some cases, notably for the analysis and thematic mapping of geospatial information, specialised BI tools have been employed.

In order to maximise the value available from asset information systems Vector is developing an asset management reporting strategy using BI tools in a framework based on the asset management lifecycle, as illustrated in Section 2.11. Reporting requirements for decision making and other purposes are identified across the asset management lifecycle, drawing on data from several operational systems. In addition to the operational sources shown, a significant amount of relevant data is also sourced from outside Vector, including for example geospatial, meteorological and other contextual data, so that intelligence is gained from a blend of internal and external data sets.

Vector's objective is to make information accessible, by hosting / posting data (for example, via Vector's intranet), rather than by sharing or sending large amounts of data around Vector. This approach takes an iterative and collaborative engagement with users to identify requirements, which are often not fully understood at the outset, and builds the data into a seamless (rather than monolithic) repository of asset data. A key objective is to eliminate dependence on "human data warehouses".

In this way, by exploiting the functionality of all BI tools to export to spreadsheets, self-service of data is encouraged by asset management specialists and teams thereby enabling rapid data extraction, visualisation and analysis to support better, faster decision-making.

7.4 Improvement Initiatives

Vector, in common with other providers of integrated infrastructure solutions, has complex systems and processes for structuring and managing asset data. In order to address the challenges this presents, and in line with Vector's goals of operational excellence, cost efficiency and customer and regulatory outcomes (Section 2.3), Vector is adopting a more unified approach to managing asset information. This is illustrated Figure 7-3.

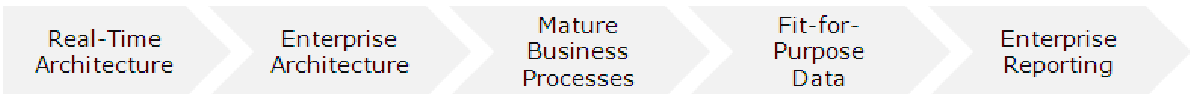

Figure 7-3 : Unified approach to managing asset information

This approach has led to the development of a programme of initiatives with the following objectives shown Table 7-2.

Focus	Objectives
Asset information	• Retiring or consolidating disparate datasets, particularly those in stand-alone systems • Ensuring, through the CDC (and where appropriate, through the application of DSV methodology) that all data is fit-for-purpose in terms of its ownership, definition, quality, completeness, accuracy, security and sourcing • Improving and simplifying how data is transformed into information • Continuing to cleanse data through a prioritised programme of improvement initiatives • Achieving full connectivity (allowing tracing from customer to supply)
Business processes	• Developing a framework of mature and consistent policies, business processes, work instructions and standards with the objective of simplifying the end-to-end management of asset information • Ensuring ownership and quality assurance along the information supply chain by closing the "information loop" • Addressing communication within and between business units to avoid duplication of effort
Information systems	• Extracting the maximum value from information systems • Consolidating information systems • Delivering integrated solutions, and developing simple user interfaces • Marking targeted improvements to address "band-aids" and "work-rounds" • Developing the approach to reporting

Table 7-2 : Programme of initiatives with objectives

In order to support these initiatives and deliver the programme, 10-year asset information systems strategic roadmap has been developed that addresses these areas of focus. This is illustrated in the Figure 7-4.

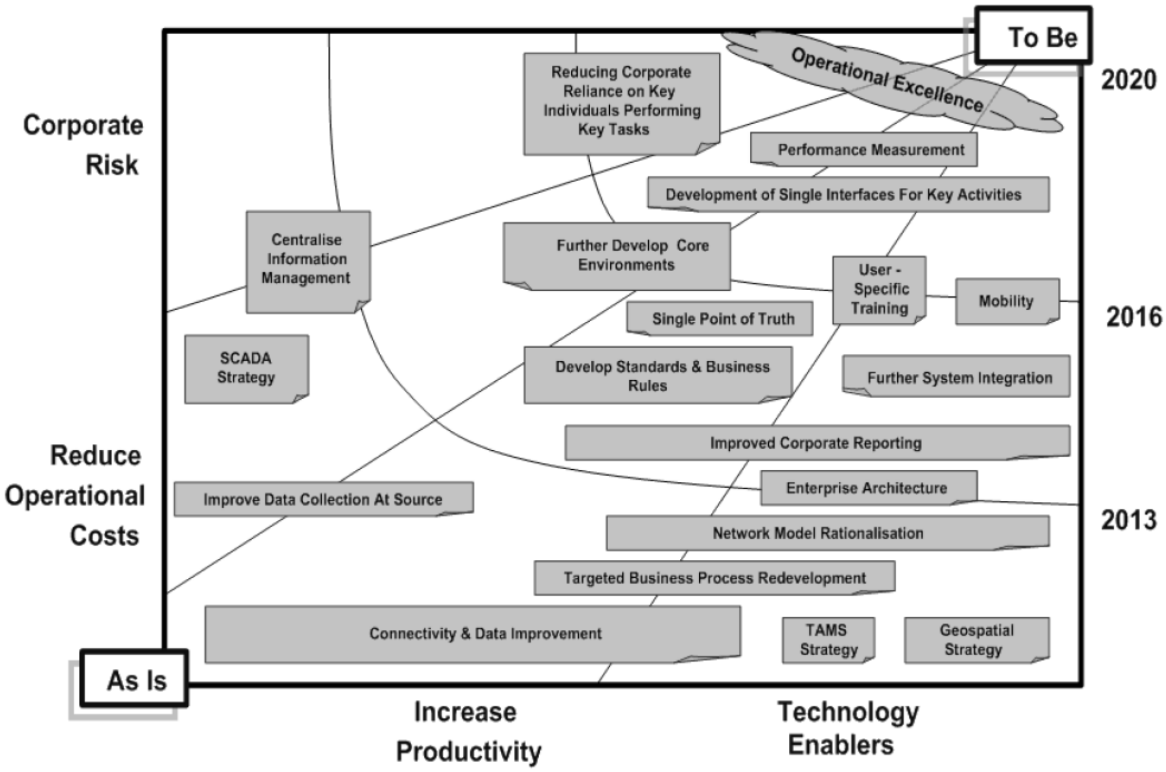

Figure 7-4 : Indicative strategic direction for Vector's asset information systems

Vector has a comprehensive internal audit programme aimed at identifying improvements in business systems and processes. Asset information and data is a particular area that is subject to audit as part of the programme. An audit in early 2013 identified a number of areas where improvements including FAR, GIS and SAP-PM. An action plan has been developed to support the delivery of the audit findings.

7.5 Asset Data Quality Improvements

Alongside investments in asset information systems, Vector continues to improve asset information. Where limitations have been identified at the data set level (described in the CDC, see Section 7.1), initiatives are put in place to address the root causes and remediate data.

Table 7-3 summarises the current practice for key data handling processes, the desirable practice and the target dates for achieving potential enhancements for the GTB.

Data Set	Current Practice	Desired Practice	Completion Date
Schedule 10a and 10b service level data	Derived from separate existing systems for analysis and reporting	Design and implement single new system to capture, check and report data	2013
Above ground station asset technical data fields	Recorded in SAP-PM but mandated standards and quality assurance in need of improvement	Define standards and QA process, check data fields, correct and populate where required	2014/15
Controlled documents and internal standards	Stored and managed in QMap	To be stored and managed in upgraded version of QMap	2014
Below ground pipeline asset technical data fields	Recorded in GIS but mandated standards and quality assurance in need of improvement	Define standards and QA process, check data fields, correct and populate where required	2013
On-line condition monitoring of compressors and other key asset parameters	Monitored by site survey	Monitoring link via SCADA or alternative derivative systems eg. PI historian	2014
Maintenance and inspection data collected in the field	Field technicians record information on paper forms which is then input to SAP-PM by technicians or administrative staff	Field technician to collect and record information electronically on portable device which would then automatically upload to SAP-PM thus avoiding manual transfer	2014/15

Table 7-3 : Target dates for achieving potential enhancements

7.6 Expenditure Forecast

The capex forecast for the asset management IT component of non-network assets based on historical trends and experience is shown in Table 7-4.

Description	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Geographical Information System (GIS)	100	0	0	100	0	0	100	0	0	100
SAP-PM Module Interface	0	50	0	0	0	0	0	0	0	0
SAP-PM Field Data Capture	300	0	0	0	0	300	0	0	0	0
Maintenance Task Analysis Software	0	50	0	0	0	0	0	0	0	0
PI Historian	0	50	50	0	0	0	0	0	0	0
Engineering Document System (EDS)	20	20	20	20	150	20	20	20	20	20
NRAMS	80	130	0	0	0	0	130	0	0	0
ROAIMS	0	70	70	0	0	0	0	0	0	0
Other	0	130	360	380	350	180	250	480	480	380
Total	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**

- Figures are in 2014 real New Zealand dollars ($000)
- The year reference indicates the end of the Vector financial year
- The forecasts are inclusive of the cost of finance and in line with Vector's business practice

Table 7-4 : Capex expenditure forecast

Gas Transmission
Asset Management Plan
2013 – 2023

Risk Management
Section 8

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8. Risk Management

8.1 Risk Management Policy

Risk management is integral to Vector's asset management process. Vector's risk management policy sets out Vector's intentions and directions with respect to risk management including its objectives and rationale. Vector's goal is to maintain robust and innovative risk management practices, consistent with the ISO 31000 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.

Vector's core operational capabilities, such as asset, operational and investment management, are supported by robust risk management decision-making, processes and culture. Risk and assurance management also underpin Vector's ability to meet its compliance obligations. Gas industry codes (principally AS 2885) require risk management to be a continuous process at all stages throughout the life-cycle of Vector's gas transmission network. The nature of the gas transmission business is such that there are many inherent risks and safety management is one of Vector's top priorities in the day to day operation of the business. The primary principle in managing risk is to reduce the risks to an acceptable level. Vector takes this responsibility seriously and has stringent risk management processes in place covering hazard identification, risk assessment and the monitoring and review of hazards.

The risk management capability is built on a risk management process which requires risks to be identified, analysed and treated where required. Each of these aspects is discussed in turn in Section 8.3.

Vector's Risk Management Policy requires all business units to have an effective risk management system and to provide assurance of the effectiveness of these systems to Vector's Board. The gas transmission business unit has a risk management system that is outlined in a controlled document entitled "Transmission Risk Management Guidelines". This guide outlines the minimum requirements and ensures consistency in risk management by the Vector gas transmission business.

The gas transmission system must also comply with the risk management requirements associated with pipeline certification and compliance with AS 2885, which requires a Safety Management Study to be completed.

8.2 Risk Accountability and Authority

8.2.1 Risk Structure

Figure 8-1~~Figure 8-1~~ shows Vector's risk management structure and reporting lines.

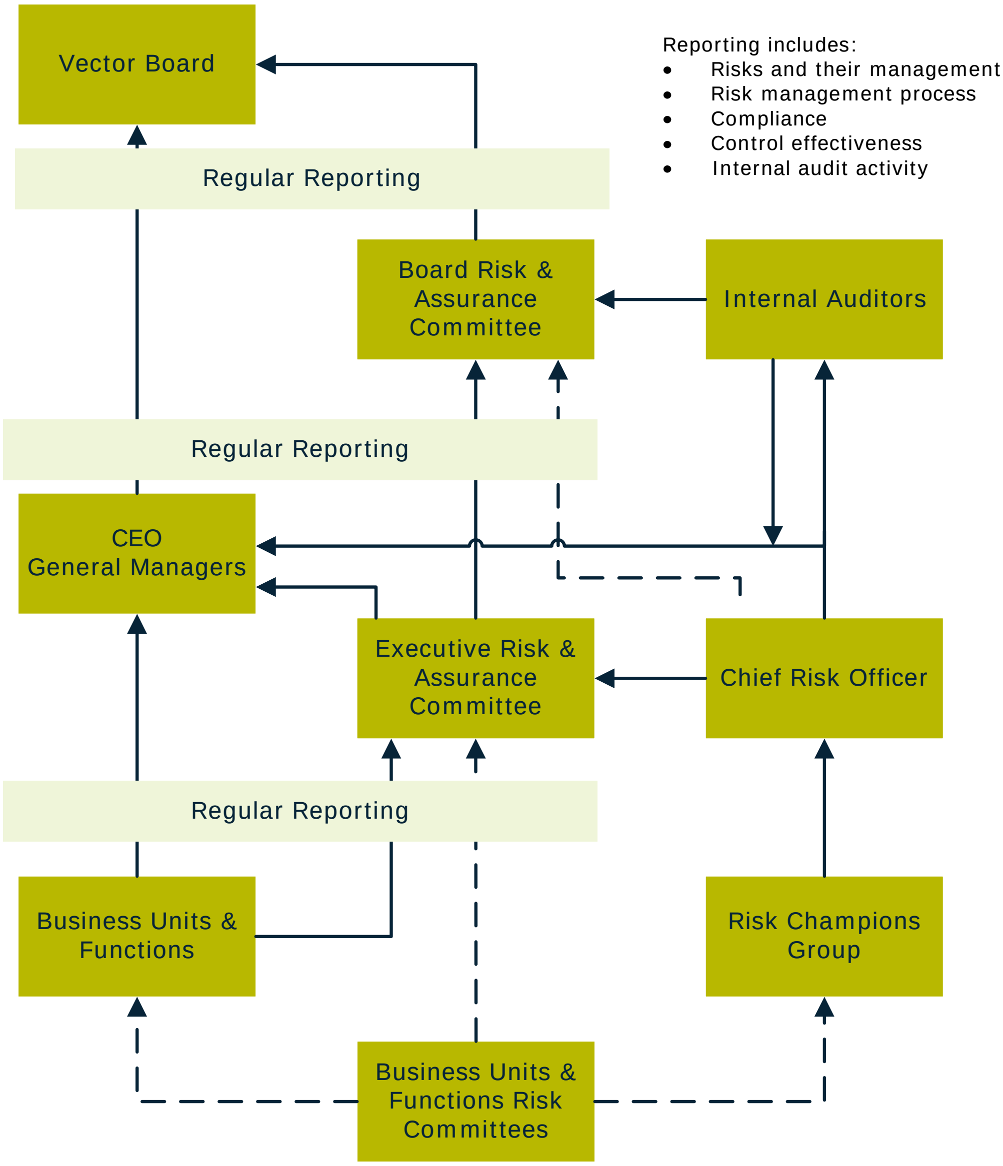

Figure 8-1 : Vector's risk management structure

8.2.2 Board Risk and Assurance Committee (BRAC)

The Board oversees the management of risk at Vector as part of its overall corporate governance responsibilities. To this end there is ongoing dialogue on risk related issues between the Board and executive management team as the Board executes its governance responsibilities, including the management of the business operations and assets.

To assist in the execution of these responsibilities the BRAC reviews risk and assurance across Vector. Key aspects of this role include endorsing the risk context under which Vector operates, and overseeing the internal audit and assurance programmes. The BRAC meets at three monthly intervals to review Vector's risk context, key risks and key controls, which include the internal audit and assurance programmes.

8.2.3 Executive Risk and Assurance Committee (ERAC)

Reflecting the importance of risk management to the overall management of Vector, an ERAC is also in place. The ERAC reports through to the full executive management team and to the BRAC. It monitors and oversees the implementation of appropriate and consistent risk management policy and practice across Vector by:

- Developing and maintaining, for the Board's review and approval, a risk management policy consistent with Vector's objectives.
- Overseeing and monitoring the implementation of risk management and assurance processes to ensure compliance with the risk management policy.

The ERAC meets at six weekly intervals. It reviews risk management policy and its implementation as well as key risks. These include those risks faced in the gas transmission business and the policies and practices required to manage them.

A key to the delivery of assurance at Vector is the internal audit programme managed at a corporate level although directly reporting through to the BRAC. The aim of the programme is to consider:

- The extent to which Vector's risk controls are in place and functioning effectively such that Vector's assets are safeguarded and effectively used, reliable business systems and processes are in place, and that Vector is compliant with applicable laws and regulations.
- Opportunities for improving Vector's established policies, structures, accountabilities, processes and reporting mechanisms in support of Vector's business goals.

8.2.4 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 includes, amongst other things, the monitoring and reporting of progress against the ERM plan and overall delivery of risk management and assurance, as well as communicating on risk management and assurance issues across Vector.

8.2.5 Risk Champions

The role of risk champions has been established to "operationalise" risk management within each functional or business unit. As a group, risk champions provide feedback on policy and the risk management framework, and provide a robust platform to integrate risk management across Vector, ensuring a consistent perspective. The roles and responsibilities of risk champions are to:

- Assist in the integration of effective risk management disciplines into day to day management of Vector within their functions or business units, including attending regular meetings to discuss risk and risk management, continuous monitoring and facilitating the development of an appropriate risk culture and processes.
- Within their function or business, raise the profile of risk identification and management encompassing the development and implementation of appropriate controls and additional treatments as required.
- Ensure that compliance risks are incorporated within the function or business bow ties.
- Maintain bow ties (described in 8.3.4 below) and ensure they are up to date.
- Assist business and function managers in reporting on risk management to the ERAC and BRAC.
- Stimulate open and effective discussion on business unit risks.
- Facilitate the effective management of common and shared risks.
- Consider and action outcomes and matters arising from BRAC and ERAC meetings.

- Provide assurance that risk management is being delivered within Vector's individual businesses and functions.
- Facilitate continuous improvement of risk management and assurance across Vector.

8.3 Risk Management Process

Vector has adopted the risk management process and definitions prescribed in the risk management standard ISO31000. The risk management process adopted by Vector is shown in Figure 8-2~~Figure 8-2~~.

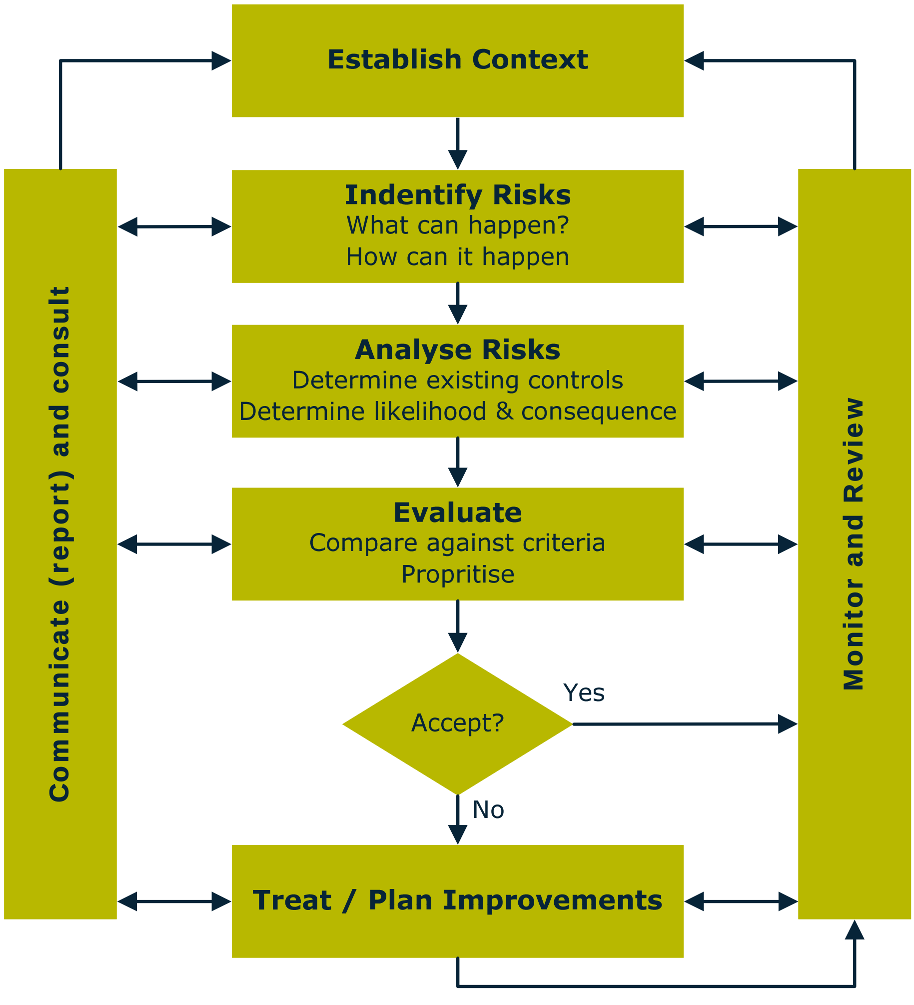

Figure 8-2 : Vector's risk management process (Based on ISO31000)

8.3.1 Risk Identification

Risks are identified in a variety of different ways. These may be as a result of formal risk identification studies, such as risk workshops, safety management studies or HAZOPs (Hazard and Operability Studies). They may be identified as outputs from audits, reviews and incident investigations, or may come from cross-business or pan-industry lessons learned.

New risks identified are passed on to the relevant risk champion for assessment. Urgent risks may be immediately acted upon, dependent upon the risk level. New risks are reviewed to confirm they are real and are considered against existing known risks to prevent duplication. Many identified risks are existing ones presented in a different way, or are, in fact, failure of a control rather than a risk in themselves. Nevertheless, all staff are encouraged to report new risks to maximise coverage. The philosophy that has been adopted is - if in doubt, report it.

8.3.2 Risk Analysis

The criticality of risk is assessed on the basis of likelihood and consequences of the event associated with the risk occurring. The combination of these two items is used to prioritise the level of controls to manage the risk. The risk assessment criteria and prioritisation matrix adopted by Vector is shown in Figure 8-3~~Figure 8-3~~ below. Risks which have catastrophic or major risk consequences include risks which could lead to loss of life, damage to the environment, loss of supply, financial loss or overall significant sustained loss of reputation of a magnitude sufficient to impact very negatively on Vector. These are normally low likelihood events.

Risk Assessment

	Minor	Moderate	Serious	Major	Catastrophic
Frequent	H	H	VH	E	E
Likely	M	H	VH	VH	E
Possible	L	M	H	VH	VH
Unlikely	L	M	M	H	VH
Rare	L	L	L	M	H

Risk Assessment Using Consequence And Likelihood

L = Low	Red = Board Attention
M = Moderate	Orange = Executive Attention
H = High	Green = Management Attention
VH = Very High	
E = Extreme	

Figure 8-3 : Vector's risk assessment criteria and prioritisation matrix

Analysis includes identifying and evaluating any controls currently in place. A risk control is any policy, practice or device which is in place to reduce the likelihood or consequences of a risk. Based on this analysis, risks are evaluated against Vector's risk management framework and a decision made as to whether the level of risk is acceptable. If it is not acceptable one or more risk treatments are developed and prioritised against other treatments.

8.3.3 Risk Treatment

Risk treatment is intended to achieve a lower level of risk by either reducing the likelihood of risk event occurring, or reducing its consequences should it occur (or both). Both the risk position including existing controls (current risk) and the expected severity post completion of the treatments (target risk) are recorded. This enables a balanced view to be taken of all risk mitigation actions such that suitable prioritisation can be applied. This also provides for a position to be taken on the suitability of the proposed risk treatment. Large, capital intensive projects that provide little or no risk reduction will not be suitable treatments and alternatives should be sought. In addition, particularly where the treatment involves intrusive or large scale project work, consideration is also given at this stage to new risks that may be introduced during the course of the treatment itself.

In terms of asset management, treatments often become security of supply or asset integrity capital projects, or become the basis for work practice decisions. Risk reduction, therefore, becomes one of the key drivers in the development of the capital cost programme for the asset. Following completion of the project or activity, the treatment becomes a new control, with a resultant reduction in severity for the particular risk.

Residual risk (that risk which remains even after treatment) is managed via routine work practices and activities, such as monitoring, maintenance, auditing, training and competence.

8.3.4 Risk Recording

All risks are recorded to ensure that they are visible and actively managed. A recent change in approach has been effected in the presentation of risks from a spreadsheet risk register into a bow tie format. The bow tie format is well established, particularly in the petrochemical industry, and has four principal benefits:

- It drives rigour in reporting risks – controls are clearly identified as such and loss of a control is less likely to be incorrectly identified as a risk.
- It clearly distinguishes between preventive and mitigating controls, allowing priority to be placed on preventive controls (in accordance with established control hierarchies).
- Where there is little influence over a risk, it reinforces the requirements for contingency controls, which have ancillary benefits in protecting against unforeseen risks.
- It provides a very clear and easily understood depiction of the risk landscape, supporting a culture where all staff are able to understand and support risk management.

All bow ties from different business units are collated by the Chief Risk Officer to allow a clear enterprise wide risk picture to be presented. This allows for the appropriate level of focus, support and resource from across Vector to be applied to those areas where risks are highest, as well as for shared knowledge and understanding of good practice across Vector.

8.3.5 Risk and Incident Review, Reporting and Investigation

Risks are reviewed on a regular basis as part of the risk management policy and processes. This ensures that risk controls and treatments are still valid and that the expected progress of assigned controls and treatments is on track. Subsequent reports are made to management, including the ERAC and the BRAC to ensure risks are escalated to the level appropriate for their severity.

Vector has a structured process for managing, reporting and investigating incidents across the business. The objectives of incident reporting are to:

- Inform supervision and management when problems are encountered to allow prompt attention to the incident.
- Document immediate corrective actions that are taken.
- Provide data to help determine where problems are occurring, where resources need to be applied, and how performance is changing.

The objectives of incident investigation are to:

- Analyse, determine and document the root causes of the more significant incidents.
- Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of incidents.
- Trend the root cause data from these incidents to identify system problems that, when corrected, can lead to improvements in overall performance.
- Ensure the basis for risk assessment is still valid and if existing controls and treatments require modification or addition.

The effectiveness of the controls and treatments and the delivery of these initiatives are subject to ongoing monitoring. The consequences and likelihood of failure or non-performance of assets, the current controls to manage these, and required actions to mitigate risks, are all documented, understood and evaluated by Vector as part of the asset management process.

Vector's internal audit programme is an important process to establish assurance around controls and the programme is overseen by the BRAC.

Risk management practices are reviewed periodically by an independent expert third party as part of this overall assurance approach. The results of the audit are reported through to the BRAC. Recent reviews, while identifying possible enhancements, have been favourable.

8.4 Gas Transmission Asset Risks

8.4.1 Risk Management Principles

Risk management principles are fundamental to the management of the gas transmission system. The Asset Investment (AI) group oversees the asset management strategy and performance, which includes the development of standards for the gas transmission pipelines and their component assets, together with the delivery of the capital works programme.

The Service Delivery (SD) group manages the operational delivery of the strategy. This includes delivery in the field of the requisite levels of maintenance 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 transmission system to predefined service and performance levels.

The AI and SD groups have an integrated view of risks being managed and their respective responsibilities in doing so and work together to meet the corporate objectives and approach outlined previously.

For gas transmission, there is also a requirement to assess and manage risk in accordance with AS 2885.1. For this purpose the gas transmission business also employs a Non Routine Activity Management System (NRAMS) process to determine how risks should be addressed – through capital development projects, maintenance/operational enhancement, contingency planning, hold and review, etc. These decisions consider the balance between the cost of mitigation measures, and the seriousness of the risk being considered and assist in prioritisation based on risk severity. Risk assessments and progress on mitigation measures are documented using NRAMS. For each planned action, the responsibility for implementation is allocated to a member of staff. Progress on these is usually monitored at six monthly intervals and more frequently in the case of critical tasks. The risk matrix prescribed in AS2885.1 differs slightly from the Vector corporate matrix. The gas transmission risk champion plays a key role in calibration of risks against both matrices and ensuring that both are complied with.

Risk assessment based on the safety management study (SMS) system approach as documented in AS 2885.1 is also employed. The SMS is supported by an integrated GIS and database application. It uses database capabilities to assist in the facilitation of the risk assessment workshop by following the AS 2885 guidelines through the three stages of the Risk Assessment – Sectional, Location and Non Location analysis. The application is also able to display the engineering related data where required and provide electronic filing, action tracking, query and reporting capabilities. The required actions resulting from the SMS assessments are recorded in NRAMS or have work orders raised against them.

8.4.2 Results of Risk Assessments

The risk assessment framework allows for the identification of areas of the system and credible risk events. The identified controls and treatments are used to advise the contents of development plans and the maintenance programme. In general terms, although a broad spectrum of treatments may apply, high risk activities are more likely to result in capex funded project activities to amend plant or process, while lower risk activities are more likely to be managed via incremental improvements or ongoing maintenance works funded from opex.

Adoption of the bow tie approach has seen a reduction in the number of key risks categories, with broader risk categories and a greater number of associated causal events, when compared with the previous risk register approach. The key identified risks for gas transmission are:

- Failure or damage to assets.
- Occupational safety or environmental incident.
- Loss of key staff.
- Total loss or reduction in upstream gas receipts.
- Legal, regulatory or standard non-compliance.
- Off-specification gas in the system.
- Breach or loss of 3rd party contract.
- Touch potential.

In the development of the bow ties, the extant risk registers were reviewed to ensure all risks were retained in one (or more) of these categories.

8.5 Catastrophic Consequence Risks

The most significant risk associated with gas transmission is that of asset failure or damage. Complete elimination of this risk is not possible while still retaining the operation of the pipeline, thus emphasis is placed on minimising the likelihood of occurrence through a range of controls, together with due emphasis placed on mitigating and contingency measures. Key factors in this risk and its control are discussed below.

8.5.1 Transmission Pipeline Failure

High-pressure transmission pipeline failure can lead to intense fire with enough radiant heat to cause combustion of surrounding buildings and severe injury or fatalities to people up to a few hundred metres away.

The risk associated with transmission pipelines failure is principally managed through compliance to industry codes. This includes protective measures such as depth of cover, pipeline wall thickness, protective concrete slabs and warning markers. The physical safety features are further supported by proactive programmes to educate parties likely to damage pipelines and the promotion of industry based one-call systems.

Mitigating the Risks for a Pipeline Rupture

Vector has a comprehensive inspection and monitoring programme to ensure the safety of its gas transmission pipeline system.

Vector monitors the system status in real time on a 24/7 basis, and regularly conducts leak inspections, surveys, and patrols of all gas transmission pipelines. Any issues identified as a threat to public safety are immediately addressed.

The Safety Management Studies assess potential threats from the following:

- The potential for third party damage.
- The potential for corrosion.
- The potential for ground movement.
- The physical design and characteristics of the pipe.

Vector also considers the proximity to high density population areas, potential reliability impacts and environmentally sensitive areas.

In total, some 71km (4%) of the overall length of Vector's gas transmission pipelines fall within urban boundaries, where the risk may be higher due to the proximity of the population – both people and property.

SMS were completed for the urban areas in 2010 and 2011 and are routinely kept up to date in accordance with AS 2885.

The Pipeline Integrity Management Plan (PIMP) described in Section 6 of the Asset Management Plan sets out in detail how pipeline risks are evaluated on an ongoing basis and how specific work plans, inspection, maintenance, monitoring and projects are developed to meet the requirements of AS 2885.3. Section 6 also details the different types of assets in service and describes how specific work plans, inspection, maintenance, monitoring and replacement is undertaken to ensure assets remain fit for purpose and risk levels are managed.

Potential for Third Party Damage

Third-party damage is a significant risk to Vector's gas transmission pipeline system.

Indications that a pipe may be at risk for third party damage include:

- Whether or not the line section has a history of third party interference (whether actual damage or near miss such as unauthorised works).
- The depth at which the pipe is buried.
- The pipe's diameter.
- The degree of marking available for the pipe's location.
- Local awareness in the immediate area of the pipeline location.

Potential for Corrosion

Factors include items such as:

- The coating design.
- Pipe supports interface.
- The resistivity of the soil.
- Other ground-based factors which, over time, could reduce the thickness of the pipe wall.

Potential for Ground Movement

Factors include:

- The proximity to seismically active areas.
- The potential for landslide.
- The potential for soil erosion around the pipeline.

Physical Design and Characteristics of the Pipe

Factors include items such as:

- The age of pipe.
- The type of welding performed on the pipe.
- The fittings used in the pipeline.
- The materials used to manufacture the pipe.

Compressor Station Fire

Fire break-out at compressor stations is a potential catastrophic risk issue, with the main control measures being:

- Purchase of code-compliant assets (with fire suppression in some compressor buildings or packages as appropriate).
- System detection / monitoring devices are installed.
- Technical compliance - the turbine / compressor skids are housed in the locally engineered buildings whose design, construction, internal fit-out, lighting and wiring complies with the relevant standards including AS 2885.
- The compressor unit buildings are constructed of non-combustible materials.
- The buildings are located with sufficient surrounding free space to isolate the building so as to minimize the hazard of fire spreading to or from the compressor building.
- Some compressor buildings are provided with a forced ventilation system to ensure dilution and venting of minor gas leakage, while others have provision for natural draft dilution.
- The control systems with ESD systems are hard wired and will isolate and vent automatically on detection of a gas leak or fire.

8.5.2 Critical Spares and Equipment

A stock of spares is maintained for critical components of the gas transmission system, so that fault repair is not hindered by the lack of availability of required parts. Whenever new equipment is introduced to the system, an evaluation is made of the necessary spares required to be retained to support repair of any equipment failures. Refer to Section 6 for further details.

8.6 Risk Mitigation

While considerable efforts are made to prevent risks being realised, should risk events occur, there is a need for systems and processes to mitigate their consequences. This section describes these systems and processes.

8.6.1 Business Continuity Management

To maintain stakeholder confidence and service levels, it is important to minimise the impact to people, operations, image and reputation that could result from a range of possible risk scenarios. Vector maintains a working Business Continuity Management (BCM) capability to enable management to professionally respond to and help the business recover from a range of serious situations.

The BCM capability is intended to be robust and must work when needed. All critical components are live tested on a regular basis to accommodate physical, business and personnel changes. Sufficient additional personnel are trained to manage serious situations and cope if key people are unavailable.

Vector also extends the requirement to maintain a robust and workable BCM capability to its key business partners / external service providers, on whom Vector relies to support operations.

BCM Responsibilities

Overall BCM functions are managed by the Chief Risk Officer. Overall BCM capability and programme activities are overseen by the:

- BCM Steering Committee
- Executive Risk and Assurance Committee
- Board Risk and Assurance Committee.

The head of each business and functional unit is responsible for maintaining the appropriate BCM capability and compliance requirements. All employees are responsible for contributing to the maintenance of the BCM capability and to assist with the emergency / crisis response and recovery effort in a real situation.

Business Continuity Framework

Vector’s BCM capability comprises four key components:

- Emergency Management – stabilise / manage / coordinate and action the immediate response to a physical event that threatens life and assets.
- Crisis Management – manage the broader response to the consequences of the situation, communicate with stakeholders and coordinate the recovery of critical business functions / operations.
- Business Recovery – recover critical business functions / operations within an acceptable timeframe.
- Technology Recovery - restore and support technology systems (IT, telephony, radio and SCADA) that support critical business functions

For each component to be effective it must address three key elements:

- People – a team structure and clear terms of reference, with multiple levels of trained and rehearsed people.

- Infrastructure – hard tested crisis command centres (including supporting resources and equipment), business recovery fallback sites (including staff homes), backup plant / equipment, vehicles, fixtures, communications and supplies.
- Plans – overview strategy summaries, detailed action plans / diagrams, supporting reference information, contact numbers, an assessment of business / technology criticality and other supporting analysis reports.

Within the 4 x 3 BCM Framework (as shown in Figure 8-4~~Figure 8-4~~), strong weighting is given to people and infrastructure to maintain a balanced capability.

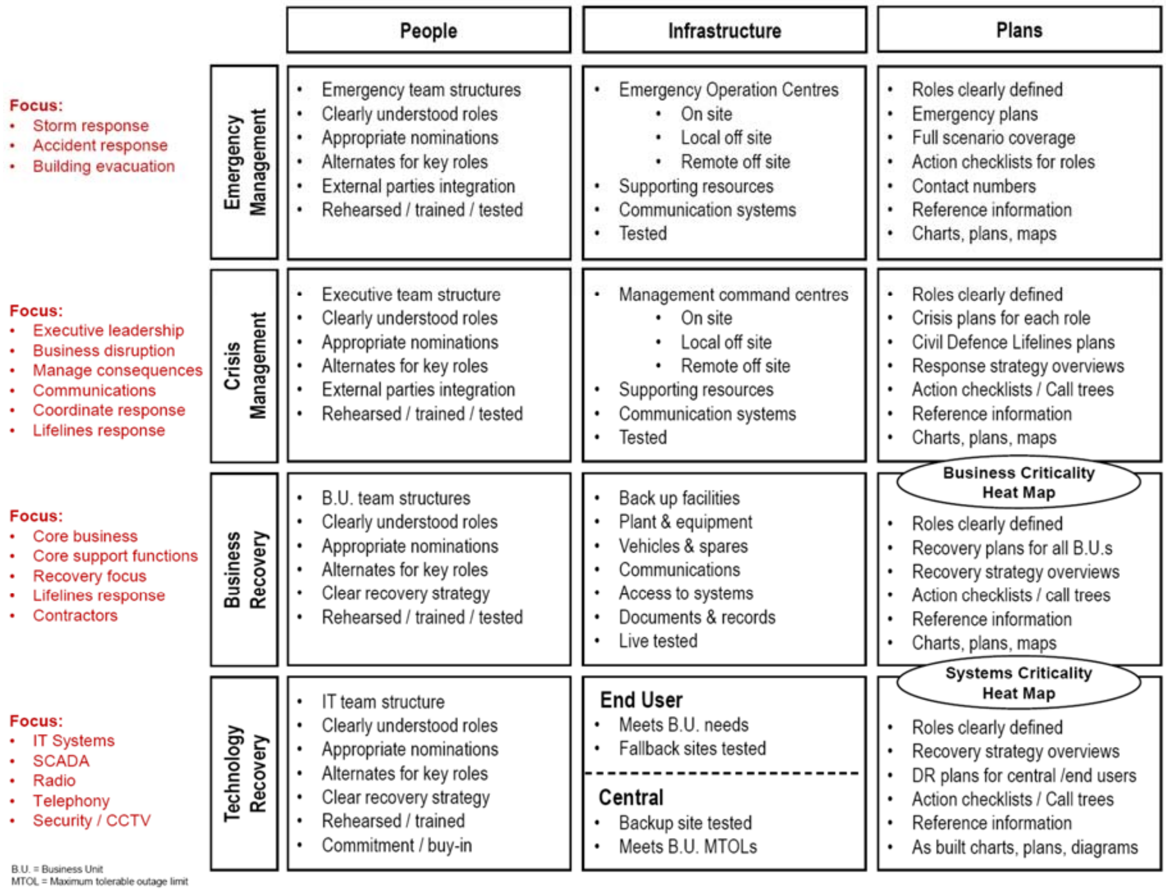

Figure 8-4 : Vector's business continuity framework

The gas transmission business has identified three critical processes that are required to ensure the business can continue to operate during events that would affect normal operations. Specific plans have been compiled in the format described above as follows:

a. Response to, and coordination of, emergencies, events, incidents or crises.

b. Schedule critical planned maintenance (including the resolution of routine faults).

c. Operate, maintain and monitor the system.

8.6.2 Civil Defence and Emergency Management

Vector is required under the Civil Defence and Emergency Management Act 2002 (CDEM) to be “able to function to the fullest possible extent, even if this may be at a reduced level, during and after an emergency” and also to have plans for functioning during and after an emergency.

A business continuity plan for Vector is in place. Vector is also a member of various Lifelines Groups throughout the North Island and through this membership keeps abreast of developments in the CDEM area to ensure it is fully prepared for an emergency.

Emergency response plans for major events are in place, as well as a National Civil Defence Emergency Management Plan that sits above these plans, for use in the event of a declared civil defence emergency.

8.6.3 BCM Emergency Response Plans

Vector has developed a number of plans to cover emergency situations in respect of the gas transmission system. These plans are reviewed and updated regularly to ensure their currency. Examples of the plans are:

- Crisis management plan
- Emergency response plan
- Critical contingency management plan
- Vector emergency communications plan
- Vector pandemic health plan.

Crisis Management Plan

The Crisis Management Plan identifies procedures for responding to a crisis affecting Vector, its customers and/or its employees, contractors and other stakeholders. The plans and procedures outlined in this document identify how Vector will manage the impacts of a crisis on its business. They are designed to establish clear lines of communication and reporting, as well as action guidelines for employees across Vector.

While the Crisis Management Plan procedures have been developed to cover a broad set of circumstances, Vector is mindful that every crisis throws up its own unique set of circumstances and that effective crisis management will still require good judgement from Vector employees.

This Crisis Management Plan is not intended to cover operational emergency response requirements, as these are covered by the relevant Emergency Response Plans. This plan is designed to support those 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.

Emergency Response Plan

The purpose of this plan is to ensure that Vector is prepared for, and responds quickly to any major incident that occurs or may occur on Vector's gas transmission system. The plan describes the actions required and the responsibilities of staff during a major emergency or incident.

A key component of the plan is the formation of the emergency response management team. This team includes senior staff whose role is to oversee the management of potential loss of and restoration of supply following a significant event. The team is experienced and undertakes exercises periodically, at least annually.

Critical Contingency Management Plan

Vector is defined as a Transmission System Owner (TSO) under the Gas Governance (Critical Contingency Management) Regulations 2008 (the Regulations) and must comply with the various obligations TSOs have under the Regulations. One of these obligations is to maintain and publish a Critical Contingency Management Plan (CCMP) that has been approved by the Gas Industry Company (GIC).

The purpose of the Regulations is to manage critical contingencies in the gas market and provide a clear commercial mechanism for settling gas trades that are imposed on parties during the contingency. Critical contingencies occur when there is a shortage of gas supply relative to demand. The pressure on the transmission pipeline system can fall to a point where intervention is required in order to prevent the collapse of gas networks. If a Critical Contingency is declared, the Regulations require transmission system owners (TSOs) to act in accordance with its approved CCMP and comply with the directions of the CCO (Critical Contingency Operator).

The CCMPs published by the TSOs define thresholds for each part of the gas transmission system designed to avoid disruption to connected downstream distribution systems. The approved version of the CCMP for Vector Gas Limited is published on the CCO internet site at:

https://www.oatis.co.nz/Ngc.Oatis.UI.Web.Internet/Common/CCOHome.aspx

The thresholds are defined in terms of a minimum pressure and projected number of hours remaining before the minimum pressure is reached at defined points on the gas transmission systems.

Critical contingency conditions may be caused by a variety of different events on the transmission systems. Events will generally fall into two main categories:

a. Shortage of gas supply relative to demand.

b. Physical failure, breakdown or damage to transmission system components.

Vector Emergency Communications Plan

The Vector Emergency Communications Plan has been written to ensure 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 emergency.
- Any actions they can or should take to mitigate the affect or consequences of the emergency.
- When the situation is expected to be (or is) resolved.

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.

Vector Pandemic Health Plan

The objective of this plan is to manage the impact of a pandemic on Vector employees and business activities, to ensure continuation of operations. This is intended to be achieved through containment of disease by reducing spread within Vector’s offices and facilities, and maintenance of essential services if containment is not possible.

8.7 Health and Safety Management

8.7.1 Health and Safety Policy

Vector's Health and Safety Policy states the commitments and requirements for health and safety. Vector conducts its business activities in such a way as to protect the health and safety of employees, contractors, members of the public and visitors in and within the vicinity of its work environment and assets. Vector is committed to continual and progressive improvement in its health and safety performance and ensures it has sufficient, competent resources and effective systems at all levels of Vector to fulfil this commitment.

Any work conducted on and around Vector's assets by external parties, including its service providers, is also required to be conducted in line with the Vector Health and Safety Policy and Vector's Health, Safety and Environment Management System (HSEMS).

Vector's Health and Safety policy objectives are to:

- Provide a safe and healthy work place for all staff, contractors, the public and visitors.
- Ensure health and safety considerations are part of all business decisions.
- Monitor and continuously improve health and safety performance.
- Communicate with staff, contractors, customers, and stakeholders on health and safety matters.
- Operate in a manner that minimises health and safety hazards.
- Encourage safe and healthy lifestyles, both at work and at home.
- Provide management commitment in supporting the safe and early return to work of injured or ill Vector people.

To achieve this Vector:

- As a minimum, meets all relevant legislation, standards and codes of practice for the management of health and safety.
- Identifies, assesses and controls workplace hazards.
- Accurately reports, records and learns from all incidents and near misses.
- Has established health and safety goals at all levels within Vector, and regularly monitors and reviews the effectiveness of the HSEMS.
- Consults, supports and encourages participation from its people on issues that have the potential to affect their health and safety.
- Promotes its leaders', employees' and contractors' understanding of the health and safety responsibilities relevant to their roles.
- Provides information and advice on the safe and responsible use of products and services.
- Suspends activities if safety would be compromised.
- Takes all practicable steps to ensure contractors work in line with this policy.

8.7.2 Health and Safety Practices

All Vector employees and contractors working for Vector are responsible for ensuring their own safety and the safety of others by adhering to safe work practices, making appropriate use of plant and equipment (including using protective clothing and equipment) and promptly reporting incidents, near misses and hazards to Vector.

The HSEMS defines the high level essentials necessary to maintain an incident free environment. This is documented in a set of 11 HSE 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 requirement documents allow each business unit to develop their own safe work method statements or procedures.

This approach is necessary for Vector and its contractors to have the flexibility to manage their business units in a manner that identifies and eliminates incidents.

Key elements of the health and safety practices, as they relate to the asset base and asset management, include the following:

- Wherever practicable Vector will eliminate, isolate or minimise hazards or control risks to As Low As Reasonably Practicable (ALARP), so as to ensure the safety and health of personnel, the public and the environment.
- The identification of safety and health hazards and the assessment of their associated risks to ensure they are managed to an acceptable level during their operation or associated activities.
- Vector practices preventative maintenance strategies to all critical plant and equipment to ensure continued safe, environmentally sound, economic and effective operation. In addition, Vector ensures the reliability of critical safety backup equipment, protective devices and key operating equipment is maintained.
- Safety considerations are incorporated into Vector’s design standards and asset selection criteria.
- Appropriate safety equipment is installed, inspected and maintained and staff are competent to identify items in need of repair or replacement.
- All contractors working for Vector are required, as a minimum, to comply with Vector’s safe work practices whilst carrying out any work on the network. Contractors are also required to report all employee and third party incidents related to work on the Vector network, together with their investigations and corrective and preventive actions.
- Vector monitors all health and safety incidents. These incidents are reviewed monthly to ensure lessons are captured and shared with contractors.
- Ongoing public safety awareness communications programmes are undertaken. These include landowner information processes and ‘dial before you dig’ single telephone contacts.

A full review has recently been undertaken of Vector’s health and safety framework and improvements made where opportunities were identified. Vector continually strives for excellence in safety performance and recognises the importance of a robust, well structured safety framework to assist in delivering an incident and injury free workplace.

8.7.3 Good Governance Practices Guideline for Managing Health and Safety Risks

Following the Pike River Tragedy, the Ministry of Business Innovation & Employment and the Institute of Directors have published a new good governance practices guideline for managing health and safety risks. The purpose of the guideline is to provide health and safety governance and to:

- Demonstrate how directors can influence health and safety performance.
- Provide a framework for how directors can lead, plan, review and improve health and safety.

- Assist directors to identify whether their health and safety management systems are at a standard and quality that is effective in minimising risk.
- Encourage directors to create strong, objective lines of reporting and communication to and from the board.

Vector is currently reviewing the guideline document and is well positioned to meet the requirements for managing Vector's health and safety risks.

8.8 Environmental Management

8.8.1 Environmental Policy

Vector's environmental policy confirms its commitment to managing the environmental impact of its businesses, and ensuring as a minimum, compliance with legislation, standards and any resource consents held by Vector. Vector conducts its operations in such a way as to respect and protect the natural environment and sensitive sites and is committed to continual and progressive improvement in its environmental performance. Sufficient competent resources and effective systems are provided at all levels of Vector to fulfil this commitment. Vector also requires all employees and service providers working for Vector to proactively manage their employees and work for Vector in line with this policy.

Vector's environmental policy is to:

- Ensure environmental considerations are part of all business decisions.
- Meet or exceed all relevant environmental legislation, regulations or codes.
- Participate and work with government and other organisations to create responsible laws, regulations, standards and codes of practice to protect the environment.
- Monitor and continuously improve environmental performance.
- Operate in a manner that minimises environmental and social impacts.
- Take appropriate action to remedy or mitigate a breach of the Resource Management Act.
- Communicate with employees, contractors, customers and other relevant stakeholders on environmental matters.

To achieve this Vector:

- Has plans in place to avoid adverse environmental effects in its operations wherever practicable.
- Focuses on responsible energy management and will practice energy efficiency throughout all of its premises, plant and equipment, where it is cost effective to do so.

The long-term operational objectives of Vector are to:

- Utilise fuel as efficiently as practicable.
- Mitigate, where economically feasible, fugitive emissions and in particular greenhouse gas emissions.
- Wherever practicable use ambient and renewable energy.
- Influence and work with and within supply chains to maximise energy efficiency.

8.8.2 Environmental Practices

Vector also puts significant emphasis on environmental management and continues improving its environmental management in partnership with its contractors. Vector's key practices in this regard include the following:

- Vector continually explores opportunities for minimising waste generation and, when identified, pursues economically viable opportunities consistent with business priorities and community expectations. All wastes generated from operations are effectively managed and disposed of in a cost effective manner in compliance with statutory requirements.
- When addressing environmental issues, consideration is given to both long-term impacts of waste disposal and to potential long-term issues.
- One of Vector's key performance indicators (KPIs) is to avoid any activity that would cause Vector to be in breach of the Resource Management Act.
- The HSEMS includes minimum acceptable standards on environmental management and a focus on eliminating damage.
- Environmental incidents are accurately reported, recorded and investigated with any learning and improvements shared across the business and its contractors.

Gas Transmission Asset Management Plan 2013 – 2023

Summary of Expenditure Forecast

Section 9

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9. Summary of Expenditure Forecast

9.1 Introduction

This section summarises how the capital, operating and maintenance forecast expenditures are compiled, including prioritisation of expenditure.

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 transmission 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 2014.[1] 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 Transmission Information Disclosure Determination 2012 requires Vector to disclose the financial information in real 2013 dollars and in regulatory years (ending 30th June[2]). 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 available estimates at the time of preparing this AMP, they will be subject to change in future as circumstances change and projects and work programmes 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 is required to include certain information on capex, opex and demand. Vector would need to ensure its capex and opex forecasts were aligned for the period of the CPP, and that they meet the requirements of the CPP Input Methodology.

9.2 Capital Expenditure

Vector's gas transmission capex forecast for the next ten financial years (ending 30 June) is presented Table 9-1.[3]

This is based on the forecasting methodology described above.

[1] FY2014 is the first year of the planning period of the disclosure AMP, commencing on 1 July 2013 and is the year when the AMP is publicly disclosed.

[2] The Vector financial year coincides with the regulatory disclosure year.

[3] The totals in Table 9-1 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.

Capital Expenditure	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Consumer connection	2,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
System growth	1,100	200	1,100	750	400	-	-	-	-	-
Asset replacement and renewal	8,735	8,270	10,515	10,620	6,915	10,570	9,070	7,440	7,740	6,800
Asset relocations	5,883	3,100	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Expenditure on network assets	**17,718**	**12,570**	**15,115**	**14,870**	**10,815**	**14,070**	**12,570**	**10,940**	**11,240**	**10,300**
Non network Assets	965	800	800	800	800	1130	1550	800	800	800
Expenditure on assets	**18,683**	**13,370**	**15,915**	**15,670**	**11,615**	**15,200**	**14,120**	**11,740**	**12,040**	**11,100**

- Figures are in 2014 real New Zealand dollars ($000)
- The year reference indicates the end of the Vector financial year
- The forecasts are inclusive of the cost of finance and in line with Vector's business practice

Table 9-1 : Capex forecast

9.2.1 Capital Expenditure Categories

The expenditure categories contained in the forecast are based on the Gas Transmission Information Disclosure Determination 2012 as follows:

9.2.1.1 Customer Connections

Customer connections expenditure is the gross capex for the purpose of establishing new connection points or altering existing connection points. This expenditure category includes gross capex relating to:

- Connection assets and/or parts of the asset for which expenditure is recoverable in total, or in part, by a contribution from the customer requesting the new or altered connection point.
- Receipt and offtake connection points.

Any capital contribution associated with the connection is captured separately and excluded from this expenditure category.

Details of the system growth works programme under this expenditure category and the supporting information behind the development of this programme are included in Section 5 of this AMP.

9.2.1.2 System Growth

System growth expenditure is defined as the gross capex required for the provision of increased asset capacity due to changes in offtake or receipt quantities or additional investment to maintain current security and/or quality of supply standards due to the increased demand.

Details of the system growth works programme under this expenditure category and the supporting information behind the development of this programme are included in Section 5 of this AMP.

Vector is prepared to invest in the asset to meet the growing demand of its customers provided that there is certainty it can recover a sustainable commercial return on its investment. Prior to any investments being made, Vector will explore practical alternatives e.g. interruptible demand options and operational adjustments to defer such investments. The costs and benefits of such alternatives are evaluated and tested against Vector's strategic objectives and customers' requirements.

The future demand forecast at each offtake station is presented in Section 5 and the ability of each station to meet this demand over the planning period assessed. Based on this assessment a number of offtake stations are shown to have capacity shortfalls against either the existing or forecasted demand. The details of these potential improvements and the associated expenditure provisions are discussed in more detail in Section 5.

9.2.1.3 Asset Replacement and Renewal

Asset replacement and renewal expenditure is defined as the gross capex required for the maintenance of asset integrity to preserve current safety, quality of supply and integrity standards and includes expenditure resulting from:

- The progressive physical deterioration of the condition of assets or their immediate surrounds.
- The obsolescence of assets.
- Preventative replacement programmes, consistent with asset life-cycle management policies.

- The need to ensure the ongoing physical security of assets.

Details of the asset replacement and renewal works programme under this expenditure category and the supporting information behind the development of this programme are included in Section 6 of this AMP.

The priority of projects and works programmes under this expenditure category work is set by management using non-routine activities management system (NRAMS) and pipeline integrity management plan (PIMP). It is essential that the work required under the PIMP takes priority over other expenditure as this ensures the long term reliability of the asset and places absolute emphasis on the safe reliability of supply.

9.2.1.4 Asset Relocations

Asset relocations expenditure is defined as the gross capex needed to relocate assets due to third party requests, such as for the purpose of allowing road widening or similar needs. Details of the relocation works programme under this expenditure category are included in Section 5 of this AMP.

This category of expenditure usually involves the relocation of small sections of pipeline due to road/rail realignments or the advent of new housing subdivisions or other private developments encroaching on pipeline routes. There are between five and ten requests for evaluation of pipeline relocations each year of which about two or three result in major works whilst others just require additional integrity assessment and protection from interference by methods such as laying protective concrete slabs.

Relocation costs are generally recoverable from the requesting parties such as New Zealand Transport Agency (NZTA) and subdivision companies. The amounts that can be recovered are generally guided by legislation. Only expenditures are captured in the relocation expenditure category. Recoveries are allocated to a different accounting category.

9.2.1.5 Quality of Supply

Quality of supply expenditure is defined as the gross capex invested to improve asset performance. This may include expenditure to:

- Reduce the average time that supply is affected by planned/unplanned interruptions.
- Reduce the average number of consumers affected by planned/unplanned interruptions.

There are no projects planned for this expenditure category within the planning period. If future expenditure is required under this category, explanations will be given in revisions to Section 5 of this AMP.

9.2.1.6 Legislative and Regulatory

Legislative and regulatory expenditure is defined as the gross capex to create new or modify existing assets to meet new regulatory or legal requirements. This category includes any step changes in gross capex as a result of new requirements. This does not include assets replaced due to condition assessment or ongoing work to improve or maintain the safety or environmental impact of the asset.

There are no projects planned for this expenditure category within the planning period. If future expenditure is required under this category, explanations will be given in revisions to Section 6 of this AMP.

9.2.1.7 Other Reliability, Safety and Environmental

Other reliability, safety and environmental expenditure is defined as the gross capex to improve asset reliability, safety or to mitigate the environmental impacts of the asset.

There are no projects planned for this expenditure category within the planning period. If future expenditure is required under this category, explanations will be given in revisions to Section 6 of this AMP.

9.2.1.8 Non-network Fixed Assets

Non-system fixed asset expenditure is defined as the gross capex that is related to the provision of gas pipeline services but that is not directly related to any system 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
- Any other items treated as non-system fixed assets under Generally Accepted Accounting Practice.

For the purpose of this Asset Management Plan, only expenditures on asset management systems, information and technologies and tools plant and machinery are included. These expenditures are discussed in more detail in Section 6.7 and 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 and the tools, plant and equipment discussed in Section 6.7 of this AMP.

9.3 Operational Expenditure

Vector's gas transmission (direct operational) expenditure forecast for the disclosure years ending 30 June from 2014 to 2023 are set out in Table 9-2.

The expenditure forecasts are presented in June 2014 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 forecast presented in this table has been classified based on the expenditure categories defined in the Gas Transmission Information Disclosure Determination 2012. The forecast under the Network Support and Land Planning and Associated Activity categories contain direct expenditure only (indirect/corporate components of this category are not included). The forecast for this category presented in the Information Disclosure schedule 11b however contains both direct and indirect expenditures and is therefore different from the figures in this section of the AMP.

Operational Expenditure	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Service interruptions, incidents and emergencies	904	921	875	875	875	967	1,013	967	875	898
Routine and corrective maintenance and inspection	8,574	8,732	8,297	8,297	8,297	9,166	9,600	9,166	8,297	8,514
Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-
Network Opex	**9,478**	**9,653**	**9,172**	**9,172**	**9,172**	**10,133**	**10,613**	**10,133**	**9,172**	**9,413**
System operations	666	679	645	645	645	712	746	712	645	662
Network support	1,812	1,881	1,852	1,852	1,852	1,911	1,940	1,911	1,852	1,867
Business support	155	158	150	150	150	166	173	166	150	154
Compressor fuel	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990
Land management and associated activity	685	697	663	663	663	732	767	732	663	680
Non network opex	**7,308**	**7,405**	**7,299**	**7,299**	**7,299**	**7,511**	**7,617**	**7,511**	**7,299**	**7,352**
Total	**16,786**	**17,058**	**16,472**	**16,472**	**16,472**	**17,644**	**18,230**	**17,644**	**16,472**	**16,765**

- Figures are in 2014 real New Zealand dollars ($000)
- The year reference indicates the end of the Vector financial year

Table 9-2 : Summary of direct forecast opex expenditure

9.3.1 Operating Expenditure Categories

Vector's direct operating expenditure is grouped under the following categories as defined in the Gas Transmission Information Disclosure Determination 2012.

9.3.1.1 Service Interruptions, Incidents and Emergencies

Service interruptions, incidents and emergencies expenditure includes expenditure on any unplanned instantaneous event or incident that impairs the normal operation of the asset. This relates to reactive work (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 to make safe, including a repair allowance, the cost of rechecks, restoring supply, provision for 24/7 response and any waiting/non-productive time for response teams. It includes back-up assistance required to restore supply, repair leaks or make safe. It also includes operational support used during the outage or emergency response. It also includes 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.

9.3.1.2 Routine and Corrective Maintenance and Inspection

Routine and corrective maintenance and inspection expenditure covers the activities specified in planned or programmed inspection; testing and maintenance work schedules and includes:

- Repair work that is undertaken at a time or date subsequent to any initial 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 assets.
- Outdoor and indoor maintenance of station buildings, 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.

9.3.1.3 Asset Replacement and Renewal

Asset replacement and renewal expenditure (subject to the rules under the GAAP) is defined as the opex to maintain asset integrity so as to maintain current security and/or quality of supply standards and includes expenditures as a result of:

- The progressive physical deterioration of the condition of assets or their immediate surrounds.
- Obsolescence of assets.

- Preventative replacement programmes, consistent with asset life-cycle management policies.
- The need to ensure the ongoing physical security of assets.

Vector classes the asset replacement and renewal category as capex only and hence there is no work planned for this expenditure category within the planning period.

9.3.1.4 System Operations

System operations expenditure includes office based system operations:

- Control centre costs
- Critical system operator activities (including Open Access Transmission Information System (OATIS))
- Outage planning and notification
- Planning and co-ordinating asset operations
- Production facility liaison.

9.3.1.5 Network Support

Network support expenditure includes costs for the management of the system including:

- Asset management planning including preparation of the AMP, load forecasting, asset modelling.
- Engineering studies and Front End Engineering Design (FEED) (excluding design costs capitalized for capital projects).
- Asset policy development (including the development of environmental, technical and engineering policies).
- Standards and manuals for asset management.
- Asset record keeping and asset management databases including Graphical Information Systems (GIS).
- Breakdown recording.
- Customer management databases.
- Operational training for asset management and field staff.
- Operational vehicles and transport.
- Information Technology (IT) & telecoms for asset management (including IT support for asset management systems).
- Engineering and technical consulting.
- Asset planning and system studies.
- Logistics (procurement) and stores.
- Asset site expenses and leases.
- Route/easement management (including locating pipelines for third parties, mark outs, stand-over, obstructions, plans and permits).
- Surveying of new sites to identify work requirements.
- Engineering/technical consulting services (excluding costs capitalized for capital projects).
- Contractor/contracts management (excluding costs capitalized for capital projects).

- Operations liaison and management.
- Asset related research and development.

9.3.1.6 Business Support

Business support expenditure includes costs associated with the following corporate activities:

- HR and training (other than operational training).
- Finance and regulation including compliance activities, valuations and auditing.
- Chief Executive Officer (CEO) and directors 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.
- Liaison with shippers and welded parties.

9.3.1.7 Compressor Fuel

Compressor fuel expenditure refers to the cost of natural gas consumed to operate the compressor fleet.

9.3.1.8 Land Management and Associated Activity

Easement activity expenditure includes costs for the management of pipeline easements including:

- Land database (property owners, occupiers and other stakeholders).
- Communications with landowners, occupiers and other stakeholders.
- Monitoring activities on or near the easement.
- Compensation and other associated legal costs.

9.4 Assumptions for Preparing Expenditure Forecasts

As discussed in Section 2 of this AMP, Vector has recently received advice from the Commission which clarified that Vector Gas Limited is the regulated gas transmission business and Vector Limited is a related party service provider to Vector Gas Limited. Vector will therefore need to apply the related party rules within the Commerce Commission's Input Methodologies and the Information Disclosure Determination to transactions between Vector Limited and Vector Gas Limited. The forecast costs in this AMP include an assumption regarding the charge to be applied to those transactions, this charge will be consistent with the related party rules set by the Commission.

While these expenditure forecasts have been prepared based on the best information at Vector's disposal, it should be noted the nation is still experiencing a period of significant economic volatility associated with the global financial crisis. This volatility has a major influence on Vector's gas transmission business. Factors that may materially influence investments levels going forward include:

- Economic cycles impact on business activities and gas demand. GDP figures published by Statistics NZ over the four years ending March 2012 show three recent years of very low growth (1.7%, 1.4% and 1.8% for the years ending March 2012, 2011 and 2010) following a year of negative growth (-3.5% for the year ending March 2009). Other economic indicators such as consumer and business confidence, unemployment rate and housing construction are also pointing towards a cautious recovery from recession. During the same period, gas transmitted through the Vector asset recorded growth rates of 2.1%, 0.4% and 4.9%, respectively. Overseas, various economies are facing uncertainties caused by state debt burden, the fading effect of economic stimulus packages and low consumer confidence leading to low rates of job creation and economy activities. The impact of this on New Zealand's export earnings and therefore the state of its economy is still uncertain.
- On the local front, the Government has brought forward a number of roading and infrastructure projects around the North Island, such as the Transmission Gully project in the Wellington region. The increased level in roading and infrastructure activities by local and central government agencies caused a corresponding increase in asset relocation requirements. These projects have been included in the latest expenditure forecast.
- The rebuilding of Christchurch and the Government's infrastructure programme (including the nationwide Ultra-Fast Broadband project) is likely to put significant pressure on construction resources both in terms of availability of the required skills and costs of construction.
- The Part 4 regulation can impact on both the opex and capex. The requirement to meet the regulated service quality standards can therefore impact on the required opex and capex 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.
- It is also not clear whether the regulatory regime and/or customer expectations will support investment in capacity, security and quality improvements or energy efficiency. The quality requirements for gas transmission 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, or could cause major variations between forecast and actual expenditure:

- Gas demand, which is a prime driver for asset investment, is closely linked to large industrial customer demand and consumption (which is sensitive to the economy), residential consumption behaviour (which is sensitive to the weather) and new industrial connection numbers which are related to economic conditions.
- The timing of large customer connections and relocation projects is very uncertain, and Vector often experiences large discrepancies between previously requested timelines, which drives the AMP cost estimates, and actual construction periods.
- Natural events such as earthquakes, landslips and volcanic eruptions may extensively affect to integrity of assets and necessitate significant unforeseen expenditure.
- This AMP reflects the capital and operating expenditure required to ensure that Vector's gas transmission system is operated in accordance with the principles and standards set out in the document. Vector notes that the revenue it is allowed under the DPP determination is based on levels of both capital and operating expenditure forecast by the Commission that are materially less than that reflected in this AMP. This is a result of the Commerce Commission's approach to determining the

expenditure allowance which arbitrarily limited forecasts provided by the business although these were based on in depth engineering assessments.

- The Commerce Commission methodology for setting a default price path (DPP) also does not cater for irregular, lumpy investments such as the relocation of a section of the 200line at Whitecliffs (as discussed in Section 6.3.4). In its DPP decision, the Commission applied a uniform reduction across Vector's proposed expenditure, without considering the practical implication on lumpy projects such as these. The DPP also does not accommodate significant new requirements that emerge and need to be addressed during the regulatory period. Lumpy capex can only effectively be catered for through a customised price path (CPP). Vector does not consider that the CPP process, as currently defined, is a satisfactory mechanism under which to seek revenue recovery in respect of lumpy capex. CPPs are time consuming, expensive and carry considerable regulatory risk for Vector. Consequently, Vector has not made any provision in forecast expenditure for the relocation of the pipeline at Whitecliffs and may have to consider the alternative approach of isolating and abandoning the affected section of pipeline due to its lower forecast expenditure.
- Vector is continually improving the manner in which asset information data is collected, stored and analysed. As better information becomes available, this sometimes identifies a need for accelerated (or decelerated) asset renewal.

9.5 Prioritisation of Expenditure

Expenditure is prioritised based on the assessment of risk presented and is based on the systems and processes described in Section 8 of this AMP.

Vector's core operational capabilities, such as asset, operational and investment management, are supported by robust risk management decision-making, processes and culture. Risk and assurance management also underpins Vector's ability to meet its compliance obligations. Gas industry codes require risk management to be a continuous process at all stages throughout the life-cycle of Vector's gas transmission asset. The nature of the gas transmission business is such that there are many inherent risks and safety management is one of Vector's top priorities in the day to day operation of the business. The primary principle in managing risk is to reduce the risks to an acceptable level. Vector takes this responsibility seriously and has stringent risk management processes in place covering hazard identification, risk assessment and the monitoring and review of hazards.

For gas transmission pipelines there is a requirement to assess and manage risk in accordance with AS 2885. Vector employs a Non Routine Activity Management System (NRAMS) process to register and assess risks and to provide information to advise:

- Capital development projects.
- Maintenance/operational enhancement.
- Contingency planning.
- Hold and/or review.

These decisions consider the balance between the cost of mitigation measures, and the seriousness of the risk being considered and assist in prioritisation based on risk severity. Risk assessments and progress on mitigation measures are documented using NRAMS. For each planned action, the responsibility for implementation is allocated to a member of staff. Progress on these is usually monitored at six monthly intervals and more frequently in the case of critical tasks. The risk matrix prescribed in AS2885.1 differs slightly from the Vector corporate matrix. The gas transmission risk champion plays a key role in calibration of risks against both matrices and ensuring that both are complied with.

The Health and Safety in Employment (Pipelines) Regulations 1999 require Vector to obtain and maintain a valid Certificate of Fitness (CoF) for the pipeline from specified inspection bodies. Vector uses the services of Lloyds Register to conduct the required 5-yearly CoF inspections and annual surveys. The most recent 5-yearly CoF was issued in November 2011 and the last annual survey conducted in August 2012.

Risk assessment is also based on the safety management study (SMS) system approach as documented in AS 2885. The SMS is supported by an integrated GIS and database application. It uses database capabilities to assist in the facilitation of the risk assessment workshop by following the AS 2885 guidelines through the three stages of the Risk Assessment – Sectional, Location and Non Location analysis. The application is also able to display the engineering related data where required and provide electronic filing, action tracking, query and reporting capabilities. The required actions resulting from the SMS assessments are recorded in NRAMS or have had work orders raised against them.

The risk assessment framework allows for the identification of areas of the system and credible risk events. The identified controls and treatments are used to advise the contents of development plans and the maintenance programme. In general terms, although a broad spectrum of treatments may apply, high risk activities are more likely to result in capex funded project activities to amend plant or process, while lower risk activities are more likely to be managed via incremental improvements or ongoing maintenance works funded from opex.

9.6 Price Inflation Adjustment

Vector is required under Clause 2.6 of the Gas Transmission Information Disclosure Determination 2012 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 Transmission Information Disclosure Determination 2012 requires the assumptions used in the price inflator to be recorded in the AMP. Table 9-3 shows the price inflation factors used to convert constant price forecasts to nominal forecasts.

FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
3.4%	2.7%	3.4%	3.1%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%

Table 9-3 : Price inflation factors

Gas Transmission Asset Management Plan 2013 – 2023

Appendices

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Gas Transmission Asset Management Plan 2013 – 2023

Appendix 1

Schedule 11a: Report on Forecast Capital Expenditure

Company Name	Vector
AMP Planning Period	1st July 2013 - 30th June 2023

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)

GTBs 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			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
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													
9	**11a(i): Expenditure on Assets Forecast**		**$000 (nominal dollars)**										
10		Consumer connection	147	1,944	998	1,033	1,065	1,091	1,118	1,146	1,175	1,204	1,235
11		System growth	1,734	1,069	200	1,136	798	436	-	-	-	-	-
12		Asset replacement and renewal	11,255	8,513	8,274	10,898	11,340	7,562	11,855	10,427	8,767	9,349	8,419
13		Asset relocations	180	5,687	3,078	2,568	2,646	2,713	2,780	2,850	2,921	2,994	3,069
14		Reliability, safety and environment:											
15		Quality of supply	-	-	-	-	-	-	-	-	-	-	-
16		Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
17		Other Reliability, Safety and Environment	-	-	-	-	-	-	-	-	-	-	-
18		**Total reliability, safety and environment**	-	-	-	-	-	-	-	-	-	-	-
19		**Expenditure on network assets**	13,316	17,214	12,550	15,634	15,849	11,802	15,754	14,423	12,863	13,547	12,722
20		Non-network assets	2,500	3,258	3,498	3,366	3,235	2,712	3,234	3,825	3,006	2,885	2,958
21		**Expenditure on assets**	15,816	20,472	16,048	19,000	19,084	14,514	18,988	18,248	15,870	16,433	15,680
22													
23	*plus*	Cost of financing	424	560	417	492	495	381	492	469	415	431	412
24	*less*	Value of capital contributions	385	5,668	2,670	2,125	2,190	2,245	2,301	2,358	2,417	2,478	2,540
25	*plus*	Value of vested assets	-	-	-	-	-	-	-	-	-	-	-
26		**Capital expenditure forecast**	15,856	15,365	13,794	17,368	17,389	12,650	17,179	16,359	13,867	14,386	13,552
27													
28		Value of Commissioned assets	15,856	15,368	13,801	17,361	17,387	12,655	17,179	16,359	13,867	14,386	13,552
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													
32			**$000 (in constant prices)**										
33		Consumer connection	147	1,881	940	940	940	940	940	940	940	940	940
34		System growth	1,734	1,035	188	1,035	705	376	-	-	-	-	-
35		Asset replacement and renewal	11,255	8,236	7,794	9,924	10,019	6,518	9,969	8,555	7,017	7,300	6,414
36		Asset relocations	180	5,502	2,899	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338
37		Reliability, safety and environment:											
38		Quality of supply	-	-	-	-	-	-	-	-	-	-	-
39		Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
40		Other Reliability, Safety and Environment	-	-	-	-	-	-	-	-	-	-	-
41		**Total reliability, safety and environment**	-	-	-	-	-	-	-	-	-	-	-
42		**Expenditure on network assets**	13,316	16,653	11,821	14,237	14,003	10,173	13,248	11,833	10,296	10,579	9,692
43		Non-network assets	2,500	3,152	3,295	3,065	2,858	2,337	2,720	3,138	2,406	2,253	2,253
44		**Expenditure on assets**	15,816	19,805	15,116	17,302	16,861	12,510	15,968	14,971	12,702	12,832	11,945
45	**Subcomponents of expenditure on assets (where known)**												
46		Research and development	-	-	-	-	-	-	-	-	-	-	-

Difference between nominal and constant price forecasts

$000	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
Consumer connection	-	63	58	92	124	151	178	206	234	264	294
System growth	-	35	12	102	93	60	-	-	-	-	-
Asset replacement and renewal	-	278	480	974	1,321	1,045	1,886	1,873	1,750	2,048	2,005
Asset relocations	-	185	179	230	308	374	442	512	583	656	731
Reliability, safety and environment:											
Quality of supply	-	-	-	-	-	-	-	-	-	-	-
Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
Other Reliability, Safety and Environment	-	-	-	-	-	-	-	-	-	-	-
Total reliability, safety and environment	-	-	-	-	-	-	-	-	-	-	-
Expenditure on network assets	-	561	729	1,398	1,846	1,630	2,506	2,591	2,567	2,968	3,030
Non-network assets	-	107	205	304	380	378	519	693	605	638	711
Expenditure on assets	-	668	934	1,702	2,226	2,008	3,025	3,284	3,172	3,606	3,741

11a(ii): Consumer Connection

*Consumer types defined by GTB** / $000 (in constant prices)	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
New Connections/Load Increase	147	1,881	940	940	940	940
[GTB consumer type]	–	–	–	–	–	–
[GTB consumer type]	–	–	–	–	–	–
[GTB consumer type]	–	–	–	–	–	–
Total						
** include additional rows if needed*						
Consumer connection expenditure	147	1,881	940	940	940	940
less Capital contributions funding consumer connection	81	-	-	-	-	-
Consumer connection less capital contributions	66	1,881	940	940	940	940

11a(iii): System Growth

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
Pipes	–	–	–	–	–	–
Compressor stations	–	–	–	–	–	–
Other stations	1,734	1,035	188	1,035	705	376
SCADA and communications	–	–	–	–	–	–
Special crossings	–	–	–	–	–	–
System growth expenditure	1,734	1,035	188	1,035	705	376
less Capital contributions funding system growth	-	-	-	-	-	-
System growth less capital contributions	1,734	1,035	188	1,035	705	376

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
97		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
98	**11a(iv): Asset Replacement and Renewal**						
		$000 (in constant prices)					
99	Pipes	1,653	1,037	1,273	1,085	990	896
100	Compressor stations	5,215	1,877	1,254	3,669	3,103	1,236
101	Other stations	2,198	3,395	3,443	3,160	3,773	2,976
102	SCADA and communications	86	189	189	189	189	189
103	Special crossings	225	236	94	94	283	94
104	*Components of stations (where known)*						
105	Main-line valves	243	184	189	283	189	189
106	Heating system	798	377	566	566	472	283
107	Odorisation plants	132	189	–	–	283	–
108	Coalescers	–	–	–	–	–	–
109	Metering system	559	566	660	684	585	472
110	Cathodic protection	54	104	132	104	151	104
111	Chromatographs	92	85	–	85	–	85
112	**Asset replacement and renewal expenditure**	11,255	8,239	7,800	9,919	10,018	6,524
113	*less* Capital contributions funding asset replacement and renewal	54	276	-	-	-	-
114	**Asset replacement and renewal less capital contributions**	11,201	7,963	7,800	9,919	10,018	6,524
115	**11a(v): Asset Relocations**						
116	**Project or programme***						
117	Waikanae Expressway	180	4,286	1,496	–	–	–
118	Transmission Gully	–	281	468	1,403	1,403	1,403
119	Other NZTA	–	935	935	935	935	935
120	[Description of material project or programme]						
121	[Description of material project or programme]						
122	** include additional rows if needed*						
123	All other asset relocations projects or programmes						
124	**Asset relocations expenditure**	180	5,502	2,899	2,338	2,338	2,338
125	*less* Capital contributions funding asset relocations	250	5,208	2,515	1,935	1,935	1,935
126	**Asset Relocations less capital contributions**	(70)	294	384	403	403	403
127	**11a(vi): Quality of Supply**						
128	**Project or programme***						
129	[Description of material project or programme]						
130	[Description of material project or programme]						
131	[Description of material project or programme]						
132	[Description of material project or programme]						
133	[Description of material project or programme]						
134	** include additional rows if needed*						
135	All other quality of supply projects or programmes	-	-	-	-	-	-
136	**Quality of supply expenditure**	-	-	-	-	-	-
137	*less* Capital contributions funding quality of supply						
138	**Quality of supply less capital contributions**	-	-	-	-	-	-
139	**11a(vii): Legislative and Regulatory**						
140	**Project or programme***						
141	[Description of material project or programme]						
142	[Description of material project or programme]						
143	[Description of material project or programme]						
144	[Description of material project or programme]						
145	[Description of material project or programme]						
146	** include additional rows if needed*						
147	All other legislative and regulatory projects or programmes	-	-	-	-	-	-
148	**Legislative and regulatory expenditure**	-	-	-	-	-	-
149	*less* Capital contributions funding legislative and regulatory						
150	**Legislative and regulatory less capital contributions**	-	-	-	-	-	-

Row			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
158								
159	**11a(viii): Other Reliability, Safety and Environment**							
160	**Project or programme***		**$000 (in constant prices)**					
161	[Description of material project or programme]							
162	[Description of material project or programme]							
163	[Description of material project or programme]							
164	[Description of material project or programme]							
165	[Description of material project or programme]							
166	** include additional rows if needed*							
167	All other reliability, safety and environment projects or programmes		-	-	-	-	-	-
168	**Other reliability, safety and environment total**		-	-	-	-	-	-
169	Capital contributions funding other reliability, safety and environment	*less*						
170	**Other reliability, safety and environment less capital contributions**		-	-	-	-	-	-
171								
172								
173	**11a(ix): Non-Network Assets**							
174	**Routine expenditure**							
175	**Project or programme***		**$000 (in constant prices)**					
176	[Description of material project or programme]							
177	[Description of material project or programme]							
178	[Description of material project or programme]							
179	[Description of material project or programme]							
180	[Description of material project or programme]							
181	** include additional rows if needed*							
182	All other routine expenditure projects or programmes		2,500	3,180	3,324	3,092	2,884	2,358
183	**Routine expenditure**		2,500	3,180	3,324	3,092	2,884	2,358
184	**Atypical expenditure**							
185	**Project or programme***							
186	[Description of material project or programme]							
187	[Description of material project or programme]							
188	[Description of material project or programme]							
189	[Description of material project or programme]							
190	[Description of material project or programme]							
191	** include additional rows if needed*							
192	All other atypical expenditure projects or programmes			-	-	-	-	-
193	**Atypical expenditure**		-	-	-	-	-	-
194								
195	**Non-network assets expenditure**		2,500	3,180	3,324	3,092	2,884	2,358

Schedule 11a Explanatory Notes

The box below provides commentary specific to the difference between nominal and constant price capital expenditure forecasts. It is provided in the same format as required for Box 1, Schedule 14a of the Gas Transmission 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) June 2013 PPI (Producer Price Index-outputs) forecast from 2013 to 2017. 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.

Additional explanatory notes pertaining to Schedule 11a are provided in the box below, in the format required for Schedule 15 of the Gas Transmission Information Disclosures:

Additional explanatory comment on disclosed information Although a substantial proportion of Vector's annual expenditure is to address safety, reliability, regulatory, legislative, quality and environmental aspects, these aspects are not costed separately in projects with multiple business drivers. For projects of this nature, this expenditure is therefore rolled-up into other capex categories such as Asset Replacement and Renewal.

Gas Transmission Asset Management Plan 2013 – 2023

Appendix 2

Schedule 11b: Report on Forecast Operational Expenditure

Company Name	**Vector**
AMP Planning Period	**01 July 2013 - 31 June 2023**

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.
GTBs 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												
8		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
9												
10	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
11	Service interruptions, incidents and emergencies	851	904	946	930	959	983	1,112	1,195	1,168	1,085	1,141
12	Routine and corrective maintenance and inspection	8,226	8,573	8,967	8,815	9,085	9,313	10,544	11,320	11,078	10,279	10,812
13	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
14	**Network opex**	9,077	9,477	9,913	9,745	10,044	10,296	11,656	12,515	12,246	11,364	11,953
15	System operations	1,083	1,117	1,160	1,164	1,200	1,230	1,338	1,411	1,406	1,357	1,412
16	Network support	11,879	12,037	12,565	12,967	13,365	13,699	14,109	14,496	14,824	15,121	15,518
17	Business support	8,640	9,325	9,580	9,901	10,205	10,460	10,740	11,018	11,284	11,546	11,840
18	Compressor fuel	4,103	3,990	4,098	4,239	4,369	4,478	4,590	4,705	4,823	4,943	5,067
19	Land management and associated activity	637	684	717	704	726	744	842	904	885	821	864
20	**Non-network opex**	26,342	27,153	28,120	28,975	29,865	30,611	31,619	32,534	33,222	33,788	34,701
21	**Operational expenditure**	35,419	36,630	38,033	38,720	39,909	40,907	43,275	45,049	45,468	45,152	46,654
22		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
23												
24		**$000 (in constant prices)**										
25	Service interruptions, incidents and emergencies	851	875	891	847	847	847	935	980	935	847	869
26	Routine and corrective maintenance and inspection	8,226	8,294	8,447	8,027	8,027	8,027	8,867	9,287	8,867	8,027	8,237
27	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
28	**Network opex**	9,077	9,169	9,338	8,874	8,874	8,874	9,802	10,267	9,802	8,874	9,106
29	System operations	1,083	1,081	1,093	1,060	1,060	1,060	1,125	1,158	1,125	1,060	1,076
30	Network support	11,879	11,645	11,836	11,808	11,808	11,808	11,865	11,893	11,865	11,808	11,822
31	Business support	8,640	9,021	9,024	9,016	9,016	9,016	9,032	9,039	9,032	9,016	9,020
32	Compressor fuel	4,103	3,860	3,860	3,860	3,860	3,860	3,860	3,860	3,860	3,860	3,860
33	Land management and associated activity	637	662	675	641	641	641	708	742	708	641	658
34	**Non-network opex**	26,342	26,269	26,488	26,385	26,385	26,385	26,590	26,692	26,590	26,385	26,436
35	**Operational expenditure**	35,419	35,438	35,826	35,259	35,259	35,259	36,392	36,959	36,392	35,259	35,542
36	**Subcomponents of operational expenditure (where known)**											
37	Research and Development	-	-	-	-	-	-	-	-	-	-	-
38	Insurance	1,966	2,226	2,530	2,784	2,831	2,831	2,831	2,831	2,831	2,831	2,831
39		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
40												
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions, incidents and emergencies	-	29	55	83	112	136	177	215	233	238	272
43	Routine and corrective maintenance and inspection	-	279	520	788	1,058	1,286	1,677	2,033	2,211	2,252	2,575
44	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
45	**Network opex**	-	308	575	871	1,170	1,422	1,854	2,248	2,444	2,490	2,847
46	System operations	-	36	67	104	140	170	213	253	281	297	336
47	Network support	-	392	729	1,159	1,557	1,891	2,244	2,603	2,959	3,313	3,696
48	Business support	-	304	556	885	1,189	1,444	1,708	1,979	2,252	2,530	2,820
49	Compressor fuel	-	130	238	379	509	618	730	845	963	1,083	1,207
50	Land management and associated activity	-	22	42	63	85	103	134	162	177	180	206
51	**Non-network opex**	-	884	1,632	2,590	3,480	4,226	5,029	5,842	6,632	7,403	8,265
52	**Operational expenditure**	-	1,192	2,207	3,461	4,650	5,648	6,883	8,090	9,076	9,893	11,112

Schedule 11b Explanatory Notes

The box below provides commentary specific to the difference between nominal and constant price operational expenditure forecasts. It is provided in the same format as required for Box 2, Schedule 14a of the Gas Transmission 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) June 2013 PPI (Producer Price Index-outputs) forecast from 2013 to 2017. 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.

Additional explanatory notes pertaining to Schedule 11b are provided in the box below, in the format required for Schedule 15 of the Gas Transmission Information Disclosures:

Additional explanatory comment on disclosed information
Insurance costs (row 38 of Schedule 11b) have been presented in nominal dollars. Although the Schedule requests these values in constant price terms, our insurance broker has advised that this is not possible, as no standard inflation index such as CPI is appropriate for use in the insurance industry. Insurance costs in constant price terms can therefore not be credibly forecast.

Gas Transmission
Asset Management Plan
2013 – 2023

Appendix 3

Schedule 12a: Report on Asset Condition

Company Name **Vector**
AMP Planning Period **01 July 2013 - 30 June 2023**

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

sch ref

sch ref	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
7				Asset condition at start of planning period (percentage of units by grade)						
8	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	Pipes	Protected steel pipes	km	0.00%	0.43%	30.18%	69.39%	0.00%	3	0.30%
10	Pipes	Special crossings	km	0.00%	2.10%	30.69%	67.20%	0.00%	3	-
11	Stations	Compressor stations	No.	0.00%	12.50%	87.50%	0.00%	0.00%	3	-
12	Stations	Offtake point	No.	0.00%	5.22%	94.78%	0.00%	0.00%	3	0.90%
13	Stations	Scraper stations	No.	0.00%	0.00%	100.00%	0.00%	0.00%	3	-
14	Stations	Intake points	No.	0.00%	0.00%	100.00%	0.00%	0.00%	3	-
15	Stations	Metering stations	No.	0.00%	0.00%	100.00%	0.00%	0.00%	3	-
16	Compressors	Compressors—turbine driven	No.	0.00%	100.00%	0.00%	0.00%	0.00%	4	-
17	Compressors	Compressors—electric motor driven	No.	0.00%	0.00%	0.00%	0.00%	0.00%	N/A	-
18	Compressors	Compressors—reciprocating engine driven	No.	21.05%	68.42%	10.53%	0.00%	0.00%	4	-
19	Main-line valves	Main line valves manually operated	No.	0.00%	9.86%	90.14%	0.00%	0.00%	4	-
20	Main-line valves	Main line valves remotely operated	No.	0.00%	0.00%	100.00%	0.00%	0.00%	4	-
21	Heating systems	Gas-fired heaters	No.	0.00%	30.10%	50.49%	19.42%	0.00%	4	7.00%
22	Heating systems	Electric heaters	No.	0.00%	0.00%	100.00%	0.00%	0.00%	4	-
23	Odorisation plants	Odorisation plants	No.	0.00%	4.35%	95.65%	0.00%	0.00%	4	-
24	Coalescers	Coalescers	No.	0.00%	0.00%	100.00%	0.00%	0.00%	4	-
25	Metering systems	Meters—ultrasonic	No.	0.00%	50.00%	50.00%	0.00%	0.00%	4	-
26	Metering systems	Meters—rotary	No.	54.39%	10.53%	35.09%	0.00%	0.00%	4	10.00%
27	Metering systems	Meters turbine	No.	70.27%	8.11%	21.62%	0.00%	0.00%	4	30.00%
28	Metering systems	Meters—mass flow	No.	0.00%	0.00%	0.00%	0.00%	0.00%	N/A	-
29	SCADA and communications	Remote terminal units (RTU)	No.	0.00%	4.55%	77.27%	18.18%	0.00%	4	7.50%
30	SCADA and communications	Communications terminals	No.	0.00%	0.00%	100.00%	0.00%	0.00%	4	-
31	Cathodic protection	Rectifier units	No.	6.25%	18.75%	56.25%	18.75%	0.00%	4	18.00%
32	Chromatographs	Chromatographs	No.	11.11%	66.67%	22.22%	0.00%	0.00%	4	20.00%

Schedule 12a Explanatory Notes

Explanatory notes pertaining to Schedule 12a are provided in the box below, in the format required for Schedule 15 of the Gas Transmission Information Disclosures:

Additional explanatory comment on disclosed information

In some cases the number of asset classes and asset categories included in Schedule 12a do not reflect the actual number of assets included in the AMP. This is due to how the definitions included in the ID Determination have to be interpreted:

a) The ID Determination does not define Scraper Station. Vector has interpreted a Scraper Station to mean a station used for the prime purpose of PIG launching/receiving. Therefore 11 Scraper Stations are included in Schedule 12a. PIG launchers/receivers installed at stations that have another prime purposes e.g. Compressor Stations, have not been counted;

b) The ID Determination definition for Main-line valve is: "*means any valves and ancillary devices in a dedicated station, installed for the purpose of stopping the flow of gas in a pipeline or lateral. This does not include instrumentation valves or valves installed in any other station type."* Therefore Vector has counted 78 Main-line valves in accordance with this definition. Main-line valves installed at stations that have another prime purpose e.g. Compressor stations, have not been counted; and

c) The ID Determination definition for Metering System is: "means devices that measure and record the quantity of gas that has flowed through a point in a period of time and may additionally measure and record the rate of flow". Therefore Vector has counted 137 metering systems in Schedule 12a. Some metering systems comprise of more than one meter and any meters in addition to the first meter at the metering system have not been counted.

Assets assessed as grade 1 condition will generally be replaced first and capex provision has been made in the AMP where replacement is considered appropriate. However some grade 1 condition assets e.g. metering systems have been assessed as grade 1 condition due to the expiry of their recognized design life. Not all grade 1 condition metering systems will be replaced in the next five years as metering system condition will be monitored and where metering systems continue to perform as grade 2 condition assets, replacement will be deferred. The three compressor units at Derby Road compressor station and one compressor unit at Kapuni Gas Treatment Plant are assessed as grade 1 condition and they are rarely used for operational purposes. Therefore it is not planned to replace any grade 1 condition compressor units in the next five years.

It is not planned to replace all grade 2 condition assets but to extend the serviceable life of these assets where it is considered safe, prudent and cost effective to do so.

Gas Transmission Asset Management Plan 2013 – 2023

Appendix 4

Schedule 12b: Report on Forecast Demand

Company Name	**Vector**
AMP Planning Period	**1 July 2013 – 30 June 2023**

SCHEDULE 12b: REPORT ON FORECAST DEMAND

This Schedule requires a forecast of new connections (by consumer type) and gas delivered for the current disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP and the assumptions used in developing the capital expenditure forecast in Schedule S11a [and 11b]

sch ref

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
7	**12b(i): Connections**						
8		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
9	for year ended	**30 Jun 13**	**30 Jun 14**	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**
10	**Consumer types defined by GTB**						
11	[GTB consumer type]		1				
12	[GTB consumer type]						
13	[GTB consumer type]						
14	[GTB consumer type]						
15	[GTB consumer type]						
16	** include additional rows if needed*						
17	**Connections total**	-	1	-	-	-	-
18							
19							
20							
21		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
22	for year ended	**30 Jun 13**	**30 Jun 14**	**30 Jun 15**	**30 Jun 16**	**30 Jun 17**	**30 Jun 18**
23	**12b(ii): Gas conveyed**						
24	Total gas entering the system at injection points	88,310	88,327	88,355	88,394	88,444	88,505
25	Total gas delivered to consumers	87,071	87,088	87,115	87,154	87,203	87,263
26	Total gas used in compressor stations	546	546	547	547	547	548
27	Total gas used in heating systems	117	117	117	117	117	117
28	Total unaccounted for gas	129	576	577	577	577	578
29	**Total gas conveyed**	87,734	87,751	87,779	87,818	87,867	87,928

Schedule 12b Explanatory Notes

Explanatory notes pertaining to Schedule 12b are provided in the box below, in the format required for Schedule 15 of the Gas Transmission Information Disclosures:

Additional explanatory comment on disclosed information

Line Pack

Schedule 12b asks for quantities of gas entering the system and exiting or being used within the system, as well as unaccounted for gas. However, it does not take account of changes to line pack gas, line pack gas is gas kept in the system to maintain the required system pressure level.
For this reason, in the disclosure for CY total gas entering the system does not equal total gas delivered to consumers plus total gas used in compressor stations plus total gas used in heating systems plus total unaccounted for gas. That is, some gas which has entered the system simply remains there and is not used or delivered as it has been purchased by Vector to increase Line Pack or, in the case where total gas conveyed plus unaccounted for gas is greater than the gas injected into the system, Vector has sold gas to decrease Line Pack.
Where line pack changes equal zero or can be assumed to be zero then this equation will balance.
Changes in Line Pack between two points in time are possible where there are differences in the measured pressure and/or temperature. Vector uses its best endeavours to maintain Line Pack within acceptable operational limits for defined sections of pipeline. Therefore, over time, by maintaining the line pack within these limits the changes to line pack can be assumed to be zero even though between two defined points in time material changes in line pack may be identified.
Vector has therefore forecast line pack changes to be zero over the five year planning period so the gas totals for those disclosure years balance.

Connections

Schedule 12b appears to include a drafting error where the metric “number of connections” has been omitted from the table of Connections in 12b (i). That term has been used in the equivalent schedules for both electricity and (by amendment via the Commission’s Issues Register) gas distribution.
Vector has therefore assumed that disclosure in 12 b (i) should be by “number of connections” which is defined in Schedule 16 as “number of new offtake points”. An offtake point has been interpreted to mean a delivery point.

Consistent with disclosure across electricity and gas distribution, and the Commission’s Issues Register, gross new connections are disclosed.

Gas Transmission
Asset Management Plan
2013 – 2023

Appendix 5

Schedule 13: Report on Asset Management Maturity

Company Name	Vector
AMP Planning Period	01 July 2013 - 30 June 2023
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the GTB'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
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	2			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.
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.
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?	2			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.
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).

Company Name	Vector
AMP Planning Period	01 July 2013 - 30 June 2023
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	The organisation does not have a documented asset management policy.	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.	The organisation has an asset management policy, which has been authorised by top management, but it has had limited circulation. It may be in use to influence development of strategy and planning but its effect is limited.	The asset management policy is authorised by top management, is widely and effectively communicated to all relevant employees and stakeholders, and used to make these persons aware of their asset related obligations.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to ensure that its asset management strategy is appropriately aligned with the organisation's other organisational policies and strategies or with stakeholder requirements. OR The organisation does not have an asset management strategy.	The need to align the asset management strategy with other organisational policies and strategies as well as stakeholder requirements is understood and work has started to identify the linkages or to incorporate them in the drafting of asset management strategy.	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.	All linkages are in place and evidence is available to demonstrate that, where appropriate, the organisation's asset management strategy is consistent with its other organisational policies and strategies. The organisation has also identified and considered the requirements of relevant stakeholders.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to ensure that its asset management strategy is produced with due regard to the lifecycle of the assets, asset types or asset systems that it manages. OR The organisation does not have an asset management strategy.	The need is understood, and the organisation is drafting its asset management strategy to address the lifecycle of its assets, asset types and asset systems.	The long-term asset management strategy takes account of the lifecycle of some, but not all, of its assets, asset types and asset systems.	The asset management strategy takes account of the lifecycle of all of its assets, asset types and asset systems.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation does not have an identifiable asset management plan(s) covering asset systems and critical assets.	The organisation has asset management plan(s) but they are not aligned with the asset management strategy and objectives and do not take into consideration the full asset life cycle (including asset creation, acquisition, enhancement, utilisation, maintenance decommissioning and disposal).	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.	Asset management plan(s) are established, documented, implemented and maintained for asset systems and critical assets to achieve the asset management strategy and asset management objectives across all life cycle phases.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Company Name: Vector
AMP Planning Period: 01 July 2013 - 30 June 2023
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
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.
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	2			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.
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.
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.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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?	The organisation does not have plan(s) or their distribution is limited to the authors.	The plan(s) are communicated to some of those responsible for delivery of the plan(s). OR Communicated to those responsible for delivery is either irregular or ad-hoc.	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.	The plan(s) are communicated to all relevant employees, stakeholders and contracted service providers to a level of detail appropriate to their participation or business interests in the delivery of the plan(s) and there is confirmation that they are being used effectively.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	The organisation has not documented responsibilities for delivery of asset plan actions.	Asset management plan(s) inconsistently document responsibilities for delivery of plan actions and activities and/or responsibilities and authorities for implementation inadequate and/or delegation level inadequate to ensure effective delivery and/or contain misalignments with organisational accountability.	Asset management plan(s) consistently document responsibilities for the delivery of actions but responsibility/authority levels are inappropriate/ inadequate, and/or there are misalignments within the organisation.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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)	The organisation has not considered the arrangements needed for the effective implementation of plan(s).	The organisation recognises the need to ensure appropriate arrangements are in place for implementation of asset management plan(s) and is in the process of determining an appropriate approach for achieving this.	The organisation has arrangements in place for the implementation of asset management plan(s) but the arrangements are not yet adequately efficient and/or effective. The organisation is working to resolve existing weaknesses.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to establish plan(s) and procedure(s) to identify and respond to incidents and emergency situations.	The organisation has some ad-hoc arrangements to deal with incidents and emergency situations, but these have been developed on a reactive basis in response to specific events that have occurred in the past.	Most credible incidents and emergency situations are identified. Either appropriate plan(s) and procedure(s) are incomplete for critical activities or they are inadequate. Training/ external alignment may be incomplete.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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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
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.
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.
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.
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.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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)?	Top management has not considered the need to appoint a person or persons to ensure that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s).	Top management understands the need to appoint a person or persons to ensure that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s).	Top management has appointed an appropriate people to ensure the assets deliver the requirements of the asset management strategy, objectives and plan(s) but their areas of responsibility are not fully defined and/or they have insufficient delegated authority to fully execute their responsibilities.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	The organisation's top management has not considered the resources required to deliver asset management.	The organisations top management understands the need for sufficient resources but there are no effective mechanisms in place to ensure this is the case.	A process exists for determining what resources are required for its asset management activities and in most cases these are available but in some instances resources remain insufficient.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	The organisation's top management has not considered the need to communicate the importance of meeting asset management requirements.	The organisations top management understands the need to communicate the importance of meeting its asset management requirements but does not do so.	Top management communicates the importance of meeting its asset management requirements but only to parts of the organisation.	Top management communicates the importance of meeting its asset management requirements to all relevant parts of the organisation.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to put controls in place.	The organisation controls its outsourced activities on an ad-hoc basis, with little regard for ensuring for the compliant delivery of the organisational strategic plan and/or its asset management policy and strategy.	Controls systematically considered but currently only provide for the compliant delivery of some, but not all, aspects of the organisational strategic plan and/or its asset management policy and strategy. Gaps exist.	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	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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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
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.
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.
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?	2			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.

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Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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)?	The organisation has not recognised the need for assessing human resources requirements to develop and implement its asset management system.	The organisation has recognised the need to assess its human resources requirements and to develop a plan(s). There is limited recognition of the need to align these with the development and implementation of its asset management system.	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.	The organisation can demonstrate that plan(s) are in place and effective in matching competencies and capabilities to the asset management system including the plan for both internal and contracted activities. Plans are reviewed integral to asset management system process(es).	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation does not have any means in place to identify competency requirements.	The organisation has recognised the need to identify competency requirements and then plan, provide and record the training necessary to achieve the competencies.	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.	Competency requirements are in place and aligned with asset management plan(s). Plans are in place and effective in providing the training necessary to achieve the competencies. A structured means of recording the competencies achieved is in place.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organization has not recognised the need to assess the competence of person(s) undertaking asset management related activities.	Competency of staff undertaking asset management related activities is not managed or assessed in a structured way, other than formal requirements for legal compliance and safety management.	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.	Competency requirements are identified and assessed for all persons carrying out asset management related activities - internal and contracted. Requirements are reviewed and staff reassessed at appropriate intervals aligned to asset management requirements.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
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?	2			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.
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.
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?	3			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.
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.

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Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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?	The organisation has not recognised the need to formally communicate any asset management information.	There is evidence that the pertinent asset management information to be shared along with those to share it with is being determined.	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.	Two way communication is in place between all relevant parties, ensuring that information is effectively communicated to match the requirements of asset management strategy, plan(s) and process(es). Pertinent asset information requirements are regularly reviewed.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not established documentation that describes the main elements of the asset management system.	The organisation is aware of the need to put documentation in place and is in the process of determining how to document the main elements of its asset management system.	The organisation in the process of documenting its asset management system and has documentation in place that describes some, but not all, of the main elements of its asset management system 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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered what asset management information is required.	The organisation is aware of the need to determine in a structured manner what its asset information system should contain in order to support its asset management system and is in the process of deciding how to do this.	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.	The organisation has determined what its asset information system should contain in order to support its asset management system. The requirements relate to the whole life cycle and cover information originating from both internal and external sources.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	There are no formal controls in place or controls are extremely limited in scope and/or effectiveness.	The organisation is aware of the need for effective controls and is in the process of developing an appropriate control process(es).	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.	The organisation has effective controls in place that ensure the data held is of the requisite quality and accuracy and is consistent. The controls are regularly reviewed and improved where necessary.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
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.
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.
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.
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
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.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	The organisation has not considered the need to determine the relevance of its management information system. At present there are major gaps between what the information system provides and the organisations needs.	The organisation understands the need to ensure its asset management information system is relevant to its needs and is determining an appropriate means by which it will achieve this. At present there are significant gaps between what the information system provides and the organisations needs.	The organisation has developed and is implementing a process to ensure its asset management information system is relevant to its needs. Gaps between what the information system provides and the organisations needs have been identified and action is being taken to close them.	The organisation's asset management information system aligns with its asset management requirements. Users can confirm that it is relevant to their needs.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to document process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle.	The organisation is aware of the need to document the management of asset related risk across the asset lifecycle. The organisation has plan(s) to formally document all relevant process(es) and procedure(s) or has already commenced this activity.	The organisation is in the process of documenting the identification and assessment of asset related risk across the asset lifecycle but it is incomplete or there are inconsistencies between approaches and a lack of integration.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to conduct risk assessments.	The organisation is aware of the need to consider the results of risk assessments and effects of risk control measures to provide input into reviews of resources, training and competency needs. Current input is typically ad-hoc and reactive.	The organisation is in the process ensuring that outputs of risk assessment are included in developing requirements for resources and training. The implementation is incomplete and there are gaps and inconsistencies.	Outputs from risk assessments are consistently and systematically used as inputs to develop resources, training and competency requirements. Examples and evidence is available.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to identify its legal, regulatory, statutory and other asset management requirements.	The organisation identifies some its legal, regulatory, statutory and other asset management requirements, but this is done in an ad-hoc manner in the absence of a procedure.	The organisation has procedure(s) to identify its legal, regulatory, statutory and other asset management requirements, but the information is not kept up to date, inadequate or inconsistently managed.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation does not have process(es) 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.	The organisation is aware of the need to have process(es) and procedure(s) 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 but currently do not have these in place (note: procedure(s) may exist but they are inconsistent/incomplete).	The organisation is in the process of putting in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning. Gaps and inconsistencies are being addressed.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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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
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?	2			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.
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	2			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).
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.
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.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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?	The organisation does not have process(es)/procedure(s) in place to control or manage the implementation of asset management plan(s) during this life cycle phase.	The organisation is aware of the need to have process(es) and procedure(s) in place to manage and control the implementation of asset management plan(s) during this life cycle phase but currently do not have these in place and/or there is no mechanism for confirming they are effective and where needed modifying them.	The organisation is in the process of putting 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 for confirming the process(es)/procedure(s) are effective and if necessary carrying out modifications.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	The organisation has not considered how to monitor the performance and condition of its assets.	The organisation recognises the need for monitoring asset performance but has not developed a coherent approach. Measures are incomplete, predominantly reactive and lagging. There is no linkage to asset management objectives.	The organisation is developing coherent asset performance monitoring linked to asset management objectives. Reactive and proactive measures are in place. Use is being made of leading indicators and analysis. Gaps and inconsistencies remain.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation has not considered the need to define the appropriate responsibilities and the authorities.	The organisation understands the requirements and is in the process of determining how to define them.	The organisation are in the process of defining the responsibilities and authorities with evidence. Alternatively there are some gaps or inconsistencies in the identified responsibilities/authorities.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	The organisation has not recognised the need to establish procedure(s) for the audit of its asset management system.	The organisation understands the need for audit procedure(s) and is determining the appropriate scope, frequency and methodology(s).	The organisation is establishing its audit procedure(s) but they do not yet cover all the appropriate asset-related activities.	The organisation can demonstrate that its audit procedure(s) cover all the appropriate asset-related activities and the associated reporting of audit results. Audits are to an appropriate level of detail and consistently managed.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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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
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?	3			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
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.
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.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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?	The organisation does not recognise the need to have systematic approaches to instigating corrective or preventive actions.	The organisation recognises the need to have systematic approaches to instigating corrective or preventive actions. There is ad-hoc implementation for corrective actions to address failures of assets but not the asset management system.	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.	Mechanisms are consistently in place and effective for the systematic instigation of preventive and corrective actions to address root causes of non compliance or incidents identified by investigations, compliance evaluation or audit.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation does not consider continual improvement of these factors to be a requirement, or has not considered the issue.	A Continual Improvement ethos is recognised as beneficial, however it has just been started, and or covers partially the asset drivers.	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.	There is evidence to show that continuous improvement process(es) which include consideration of cost risk, performance and condition for assets managed across the whole life cycle are being systematically applied.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
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?	The organisation makes no attempt to seek knowledge about new asset management related technology or practices.	The organisation is inward looking, however it recognises that asset management is not sector specific and other sectors have developed good practice and new ideas that could apply. Ad-hoc approach.	The organisation has initiated asset management communication within sector to share and, or identify 'new' to sector asset management practices and seeks to evaluate them.	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.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 17 Certification for Year-beginning Disclosures

Clause 2.9.1

We, Michael Stiassny and James 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 clause 2.6.1, and subclauses 2.6.3(4), and 2.6.5(2) of the Gas Transmission Information Disclosure Determination 2012 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.

Director

Director

11 September 2013

Date