Asset Management Plan

1 April 2020 to 31 March 2030

Marlborough Lines

Contents

List of Figures

List of Tables

1. SUMMARY

This Asset Management Plan (AMP) outlines Marlborough Lines Limited’s (MLL’s) asset management strategy to facilitate the safe and reliable distribution of electricity to consumers in the Marlborough region. MLL is committed to providing a network that meets the needs of its key stakeholders. MLL recognises the key role that a safe, reliable and resilient electricity network has in supporting the livelihoods of people and businesses throughout Marlborough.

Owning and managing an electricity network in Marlborough is not without its challenges, with a large area to service coupled with a low population base. This challenge is exacerbated in remote areas such as the Marlborough Sounds, where MLL has a vast network supplying very low-density connections, many of which are holiday homes that are unoccupied for significant periods of time. Many kilometres of overhead lines require significant vegetation and track management to keep vegetation clear of lines and to allow access to network assets.

The majority of the network in the Marlborough Sounds (and other remote Marlborough areas) was constructed in the 1960s and 1970s utilising grant funding from the Government of the day. Many of these assets are approaching the end of their economic life, and significant investment by MLL will be required to renew them.

As a community owned company, MLL seeks to ensure that its assets are well maintained, that investment decisions are prudent and that replacement decisions are optimally timed. The consumers connected to MLL’s networks ultimately fund network operations, and, are also the beneficiaries of the network. MLL will endeavor to act in the best interests of its beneficiaries.

In recent years, MLL‘s investments have focused on critical 33kV network assets – zone substations, power transformers, overhead structures and underground cables. This is reflective of the relatively low average age profile of these asset classes. For the ten-year planning period covered by this AMP (1 April 2021 to 31 March 2030), investment will focus on renewal of areas of the 11kV and Low Voltage (LV) network, driven by Asset Health Indicator (AHI) ratings and type-based replacement, to further build resilience of the network, and to maintain a high level of network reliability.

During the period covered in this AMP, MLL will give further consideration to the option of trialing alternative means of supplying connections at the extremities of the network if and where it can be demonstrated that this is a more cost effective and reliable means of supplying electricity at these unique locations. MLL is objectively aware of renewing uneconomic assets with long asset lives, whereby no economic return on that investment can be achieved and at the same time is conscious of the statutory requirements to meet continuance of supply obligations.

This AMP commences by describing the means by which MLL aligns its objectives and performance levels to the interests of its stakeholders. The network, including each of its planning areas, are described along with detail on the quantity and condition of the more significant asset classes. This plan then sets out the strategy and actions MLL will undertake in delivering the objectives and service levels it has set and the financial level of investment required.

1.1 Highlights of this AMP

Seven key areas are highlighted in this AMP:

- works to enhance MLL's duty of care in matters of public safety (including fire mitigation);
- a continued shift in capital expenditure towards the renewal of the network - older poles and conductor;
- a lift in the target for unplanned SAIDI from 80 to 85 minutes for the next three regulatory periods to reflect the safety policy of opening the nearest upstream recloser for any reported line down incident. Although many of these public reports are for LV lines or telecom lines, the policy reflects MLL's commitment to placing safety as its first priority;
- continuation of MLL's strong focus on vegetation management;
- the need to address the progressive aging of assets on the network, including the Marlborough Sounds, for safety, reliability and continuity of supply, with due consideration for economic impacts;
- continued works to improve the resilience of the network to extreme natural events, including earthquakes and high intensity wind events;
- an ongoing need to maximise energy efficiency throughout MLL's operations; and
- that the network is generally not expected to be challenged by load growth over this planning period due to its existing installed capacity levels including the potential for new loads from electric vehicles over the medium term.

1.2 Conductor renewal

Ongoing condition and risk assessments undertaken on MLL's HV conductor together with detected commencement of conductor failure faults, has led to the development of a 15-year renewal programme covering approximately 425km of MLL's older galvanised steel and light copper conductor. This strategy is supported by comparative age profile analysis and represents an annual replacement rate of approximately 1.4% of the total HV overhead conductor installed length.

The aged galvanised steel and light copper conductor is generally supported on original reinforced concrete or iron rail poles. This leads to full line rebuilds when conductor replacement occurs due to the changed conductor weight and the line design code requirements. This increases renewal costs but also addresses the replacement of older poles, in particular iron rails.

1.3 Duty of care

MLL has always recognised a duty of care in its network operations. Accordingly, this AMP includes works which further mitigate public safety risks including fire ignition risks. In many cases planned works, such as lines renewal, address multiple drivers including network continuance, reliability, and safety and fire liability risk through reducing MLL's exposure to defective equipment faults.

1.4 Consumer expectations

Through periodic consultation with key consumer groups, a recent consumer survey on distribution pricing and through its annual consumer satisfaction survey, MLL has set unchanged reliability targets for this planning period in recognition of the feedback received against the present level of service reliability, with the exception of the slight increase to unplanned SAIDI minutes.

Service targets for planned and unplanned SAIDI are therefore set at 65 minutes and 85 minutes for RY2021 to RY2023. The increase of five minutes to 85 minutes of unplanned SAIDI is due to the recent introduction by MLL of a safety based 'lines down' policy, refer to Section 5.1.1.3 for further detail). Further detail is provided within this AMP on this and other service level targets and objectives. The current level of reliability represents near frontier performance on a comparative basis given MLL's network characteristics, line lengths and environmental exposure. However, continuing to perform at this level requires MLL to continue with its strong focus on vegetation management and undertaking renewals to prevent an increase in the number of component faults that inevitably arise through network ageing, particularly in the remote parts of the network. This expenditure will be targeted through condition monitoring and focussed lines renewal.

1.5 Uneconomic reticulation issues

The network in the Marlborough Sounds area is extensive and problematic from an economic perspective for MLL. The network in this area was originally developed to meet the regulatory requirement with the assistance of the Rural Electrical Reticulation Council, but no assistance is currently available for its renewal, meaning that consumers connected to MLL effectively bear these costs, and cross subsidisation between economic and uneconomic consumers therefore occurs.

While MLL agrees in principle with current pricing reforms towards cost reflectivity, the scale of cross subsidisation occurring makes truly cost reflective pricing difficult to design and implement.

MLL is legislatively required to meet continuance of supply obligations, even for those consumers that are grossly uneconomic. As the assets supplying these remote connections are drawing closer towards end of life (age-based), these issues will only increase in scale.

Allowing its remote network to deteriorate as a means of deferring expenditure is not an option as MLL has the higher priority objective of operating a safe network and this may drive renewal regardless of any other service or cost objectives. MLL is currently assessing options for alternative supplies as a way of reducing the cost of renewal.

1.6 Resilience to extreme events

MLL has improved its network resilience to extreme events driven by both the 2017 re-evaluation of its network and business risks and the lessons learnt from the November 2016 Kaikoura earthquake. The recent commissioning of a new zone substation at Renwick to replace the original zone substation, which was located on the Wairau Fault, is an example of this.

Other works that MLL has completed recently include seismic strengthening (typically to Importance Level 4) of key structures such as zone substation and town distribution substation buildings. MLL also has two fixed generator sites in the Marlborough Sounds, and a suite of mobile generators ready for deployment to mitigate the impacts of equipment failures resulting from major events, such as earthquakes or significant storms.

Continuous review of network security and resilience to extreme natural events is undertaken by MLL, which feeds into MLL's asset management planning.

1.7 Load growth and distributed generation

Load growth within the network has been assessed within four planning areas determined on their load characteristics. Modest load increases within these areas are largely forecast to trend at constant rates driven by the steady GDP growth of the region, population trends and the observed shift toward more efficient lighting and appliances.

Whilst the installation of distributed generation within the network, wind and solar in particular, has increased significantly from levels in 2012, the levels are still small in total and a gathering rate of increase is not yet evident.

The current level of secure capacity enjoyed by the network will allow the business time to assess the effects of electric vehicle load as and when it arises. A close watch will be maintained on these new technologies to continuously assess their effects. Overall, load growth within the network is not expected to challenge the network capacity within this planning period, as further detailed in the network development section of this plan.

1.8 Energy efficiency

Energy efficiency for a lines business is mostly dictated by the degree of its network losses. MLL's network losses are shown, by comparative analysis, to be completely consistent with other New Zealand lines businesses after consideration of its network characteristics of total line length, installed transformer capacity per consumer and energy delivered. Other aspects of energy efficiency are managed through MLL's various policies that require consideration of energy efficiency in design, purchase of equipment and plant, and operation of the network together with its ancillary operations.

1.9 Cost efficiency

Cost efficiency is achieved through:

- Prudent and timely investment in both maintenance and capital expenditure.
- Ensuring that all such expenditure is incurred at minimum cost consistent with the overall requirements for the expenditure.
- Tenders are sought for all major capital purchases.
- All costs are benchmarked against alternatives.
- Internal costs are benchmarked against the same services provided externally.

Overall, comparative assessment of MLL's rate of return, direct operating expenditure and total cost, do not indicate concern particularly given MLL's circumstances of owning and operating a network with a large proportion being of low connection density in remote locations. Irrespective, MLL has a programme of continuous improvement and will continue to seek betterment in its operations.

1.10 Disclosure of this AMP

This AMP is required to be publicly disclosed and to provide particular information to comply with the requirements of Section 2.6 and Attachment A of the Commerce Commission's Electricity Distribution Information Disclosure Determination 2012. Regulatory disclosure schedules have been completed and are disclosed separately to this AMP. Appendix 11.3 includes a regulatory disclosure requirements map between the regulatory disclosure requirements and this AMP.

2. Introduction

2.1 Purpose of this AMP

The delivery of a safe, reliable electricity supply of adequate capacity to meet consumer requirements is essential for their lives, their homes and businesses. Concurrent in meeting its obligations in the delivery of electricity, MLL recognises its responsibilities not only to consumers but to its staff, contractors and the public to ensure that all practicable steps are taken to ensure all components of the network are safe and all parties are kept free from harm.

It is a requirement of the Energy Companies Act 1993 that MLL has regard to energy efficiency and this aspect is considered fundamental in all aspects of MLL's operations and is integral to the considerations within this AMP.

MLL recognises that it has an obligation to not only have regard to energy efficiency but the overall efficiency of its operations.

Accordingly, within MLL there is a commitment to continuous improvement.

MLL has achieved certification of internationally recognised standards which are an integral part of its operations including quality (ISO 9001), environment (ISO 14001), health and safety (ISO 18001) and public safety (NZS 7901).

Achievement of these standards is indicative of MLL's commitment towards achieving excellence but MLL recognises that the ultimate means of optimising performance within MLL is through a culture of seeking quality in all that is undertaken.

This AMP provides an overall strategy which will enable MLL to meet its identified objectives over the next ten years and beyond.

2.2 Basis of AMP

This AMP documents MLL's asset management strategy and objectives for its asset management processes. It sets out the assets, their condition, service levels, achieved performance, network development planning, lifecycle planning, fleet management and forecast expenditure. More specifically, this AMP provides detail on how MLL:

- maintains and operates all assets in a safe manner to safeguard the health and welfare of staff, consumers, contractors, landowners and the general public consistent with legislative requirements and best industry practice;
- optimises energy efficiency relative to costs and practical considerations;
- sets service levels for its network that will meet consumer, community, other stakeholder and regulatory requirements;
- understands the levels of network capacity, reliability and security of supply required now and, in the future, as well as the issues that drive these requirements;
- have robust and transparent processes in place for managing all phases of the network life cycle from initial concept to disposal;
- adequately considers the classes of risk relative to its network business and ensures there are processes in place to mitigate identified risks;
- makes adequate provision for funding and resourcing all phases of the life cycle of its network assets;
- makes decisions within structured frameworks at each level within the asset management process; and

- increases its knowledge of its assets in terms of location, age, condition and the likely future behaviour of the overall network as it ages.

This AMP is the key strategic document used by MLL as part of the asset management system. Disclosure of this AMP also assists MLL in complying with the requirements of Section 2.6 and Attachment A of the Commerce Commission's Electricity Distribution Information Disclosure (ID) Determination 2012. It is noted though that this full AMP (disclosure year 2021) is not a requirement of ID. However, MLL has elected to prepare and disclose this full AMP voluntarily to assist with its asset management and provide information for interested stakeholders.

This AMP is limited to MLL's network business only, not the wider MLL group which also includes the following entities:

- a 50% stake in Nelson Electricity, which has its own AMP and is independently disclosed; and
- full ownership of Yealands Wine Group Limited, which is independently managed.

The interrelationship of these entities along with the various holding companies and other investments by MLL, details of shareholders, together with MLL's financial accounts is provided on MLL's website and within its Annual Report.

2.3 Key stakeholders and objectives

MLL's key stakeholders are:

- Its owner, Marlborough Electric Power Trust;
- the public within its region;
- approximately 26,000 [1] individual connection points (ICPs, or consumers) to whom MLL delivers electricity (some of whom receive supply at 11kV);
- generators who are directly connected and embedded within the network and produce electricity for use by others;
- the (currently) 22[1] electricity retailers who operate over our network;
- the territorial authorities, the NZTA and other government agencies who MLL engage with; and
- the MLL staff and contractors who work in or on our network.

The interests of these and other stakeholders is assessed through stakeholder engagement that forms the driving objectives for the strategy, plans and actions set out in this AMP. These objectives are generally expressed through compliance achievement and measurable service level targets set within this plan.

This publicly disclosed AMP also serves as a means of communicating MLL's intentions to its stakeholders.

2.4 Link to other documents

Other documents related to this AMP include:

- MLL's Statement of Corporate Intent (SCI), published annually and available on MLL's website. This document sets MLL's key strategic objectives each year including network reliability targets, consumer engagement objectives, business development goals (accreditations etc.), consumer discounts, and rate of return to shareholders. Asset related objectives in the SCI are encapsulated within this AMP to ensure achievement.

[1] The ICP and retailer numbers are based on data from January 2020.

- MLL's annual report, which discloses the accounting position and reports on the business performance against budget and on SCI objectives achievement.
- The regulatory disclosures (schedules 1 to 10) required by the Commerce Commission.
- The MLL annual works plan aligned to the first year forecast of this AMP and subsequently updated for each successive year.
- The various internal standards, policies and procedures that ensure works are undertaken safely and to appropriate quality standards and in consideration of our stakeholders' wider interests.

2.5 Period covered

This AMP covers the period 1 April 2020 to 31 March 2030. It was adopted by the MLL Board of Directors on 24 March 2020. A statutory declaration has been made to the Commerce Commission on behalf of the MLL Directorate for this full AMP.

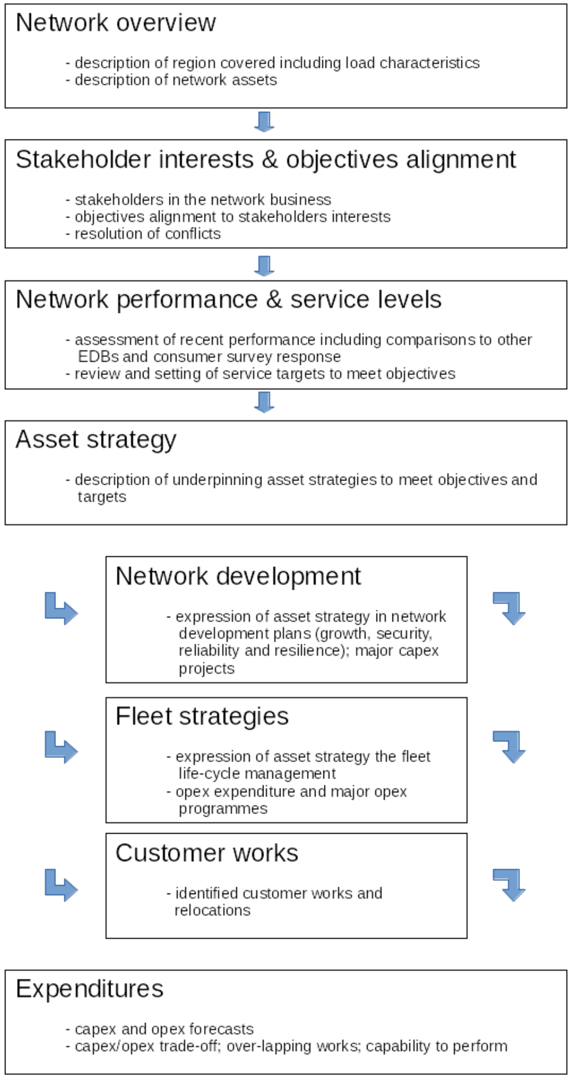


Figure 1: Overview of the structure of this AMP

2.6 Structure of this AMP

Asset management is a process of setting objectives driven by stakeholder requirements then entering a repeating cycle of measure, plan and act. This AMP is therefore structured around this process. Measurable and corrective or enduring service level targets over the planning period are set through measurement of the business performance, stakeholder input and comparative assessment against other electricity distribution businesses. Planning for the achievement of the service level targets is underpinned through MLL's asset strategy, with its expression in the network development plan and the life cycle fleet strategies.

Implementation of capital expenditure projects is undertaken through the annual works plan with the work guided by MLL's policies and standards.

The illustration of Figure 1 sets out the structure of this plan and summarises the included content of each section together with the structural relationship between the document sections.

3. Network overview

This section provides a summary of MLL's network and the region it operates in. Specific details about the composition of MLL's assets, and the work undertaken (and forecast to be undertaken) on the network itself, are presented in section 7 Network development and section 9 Fleet management.

3.1 Region and context

MLL's electricity network currently distributes electricity to approximately 26,000 consumer connections with an after-diversity maximum demand (as at RY2020) of 79MW. MLL's consumers are predominantly residential and small-to-medium commercial consumers with the largest consumer representing approximately 3% of the total 392GWh energy delivered during RY 2019.

MLL's network covers the Marlborough region in the north-eastern corner of the South Island as illustrated in Figure 2. The red lines show MLL's 11kV distribution network.

3.1.1 Supply area characteristics

MLL's network is located across a diverse area. This can be broken down into the main urban areas of Blenheim and Picton, Marlborough's East Coast, the Marlborough Sounds and the region's major inland valleys (Awatere, Waihopai, and Wairau).

Major consumers are typically located external to Blenheim, and include food processing, wineries, timber processing and manufacturing.

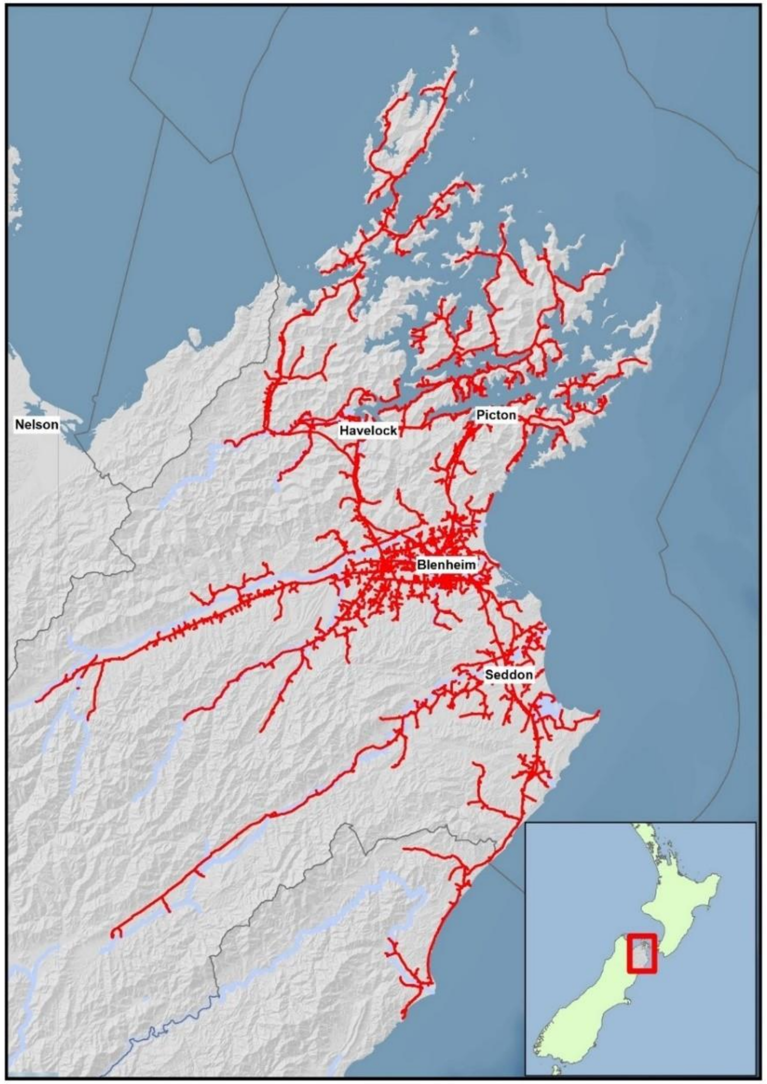


Figure 2: Extent of MLL network

Most of the load is related to the residential connections peaking in winter, as well as growth over recent years in wineries processing grapes at the time of vintage, typically April. Similarly, high demand in summer has resulted from an increase in irrigation load resulting in relatively high summer maximum demands – particularly during prolonged dry and hot periods.

3.1.1.1 Urban Areas

Blenheim and Picton contain a mix of residential, small commercial and industrial consumers. The maximum demands are predominately a result of winter heating in homes and typically occur between 7am to 11am and 4pm to 8pm during cold temperatures. In total, the towns of Blenheim and Picton represent approximately 60% of the total ICPs and 45% of the load. The reason for a lower percentage of the load compared to consumer numbers is that there is a concentration of industrial and larger commercial consumers located in the Riverlands industrial estate east of Blenheim and other large consumers are dispersed over the network.

Residential load growth is relatively static due to a number of factors including increased use of energy efficient lighting and other appliances and the use of heat pumps rather than conventional heaters etc. But this general reduction in individual consumption is to an extent offset by modest growth in consumer ICP's. Typically, growth in residential ICP's has been constrained by availability of residential sections.

3.1.1.2 Wairau Plains

Significant features of this area include Woodbourne airbase and airport, the Cloudy Bay industrial estate and a substantial horticultural/ agricultural area with extensive vineyards. The load tends to be driven by wine processing (late March to early May) and the need for irrigation (typically December to March). Vineyards cover a substantial area of the Wairau Plains as well as significant areas of the lower Awatere Valley.

3.1.1.3 Inland Valleys

While vineyards (and, to a much lesser degree, dairy farms) have expanded into the inland valleys, these areas are still of low connection density and relatively low connection loadings. The inland valleys tend to be sheltered from storms and this, combined with their topography, pastoral land use and MLL's lines being relatively clear of vegetation, makes supply in these valleys relatively reliable, especially given the long lengths of the radial feeders.

Dry conditions and forested areas sometimes give rise to extreme fire risks in summer. MLL recognises these risks in both its network design and operation as further detailed in other sections of this plan.

3.1.1.4 Marlborough Sounds

Supply in the Marlborough Sounds poses many unique operational challenges. Significant parts of the network in this area are constructed over rugged terrain with difficult access. Many areas can only be reached by foot, tracked vehicle, helicopter and/or boat as there can be no road access to many parts.

Often line spans are relatively longer in length where valleys need to be traversed and are frequently over significant vegetation. There are also significant spans across waterways (the largest being over 2km in length) utilised by shipping. These spans are subject to annual inspection.

The Marlborough Sounds has a relatively high rainfall and a temperate climate that encourages rapid vegetation growth, leading to the need for tree trimming and vegetation control on a short return basis.

Lines located near the coastal margins are subject to salt spray. These lines require higher levels of inspection and maintenance, with special provisions required to minimise corrosion damage to conductors and transformers, as well as managing salt build-up on insulators and the potential spalling on concrete poles. This is evident in the north western parts of the sounds where high winds are common.

The winds in the Marlborough Sounds can be extreme and accordingly the lines have to be designed, constructed and maintained to ensure their mechanical integrity.

MLL has approximately 750km of 11kV distribution lines (in the order of 20% of the network) in the Marlborough Sounds, supplying approximately 2,500 (<10%) consumers by way of approximately 15,000kVA of distribution transformer capacity. There are on average three consumers per km of HV line compared with close to nine consumers per km for the remainder of the network. Many of the installations in the Marlborough Sounds are holiday homes with intermittent occupation - approximately 50% of consumers in the Marlborough Sounds use less than 2,000kWh per annum. This compares to an average residential/domestic household consumption of approximately 7,500kWh per annum.

Because of the physics of electricity and supply within the Marlborough Sounds and the low consumer load factors, there is an inherent low utilisation of distribution capacity. The maximum demands on the various lines supplying the Marlborough Sounds typically occur over long weekends or public holiday periods, particularly the Christmas holidays. This holiday occupation also leads to a much lower diversity of demand at times of maximum load within the Marlborough Sounds.

Many parts of the Marlborough Sounds are very remote – some sites involve drive times from MLL's base of up to three hours to reach. Typically, the most cost effective first line of response is to utilise a helicopter.

These various factors significantly increase both the cost of construction and operation/maintenance of the network. They also reduce the overall operating efficiency of the network relative to installed capacity. The situation is exacerbated by the fact that revenue from these consumers does not meet the costs incurred and cross subsidies are required from the consumers in the economic areas.

Significant issues facing MLL regarding reticulation in this area are load growth and supply enhancement. Many of the existing lines are built on private or Government-owned land and constructed in the 1960s and 1970s, with access protected by wayleaves and the "existing works" provisions of the Electricity Act. MLL has limited easements over line routes. Therefore, upgrades which necessitate changes to the existing layout or create an injurious effect on the land require new easements to be created. This is a challenging, often costly and time-consuming process. Any future major developments in the Marlborough Sounds area will require very careful analysis and design of both asset and non-asset (e.g., demand control) alternatives to ensure the optimal solutions are found.

In addition, environmental regulations and changes in line construction code requirements are now more stringent than when the lines were constructed. This is likely to affect the establishment (or in some cases, re-establishment) of tracks and access to lines as they are re-constructed, thereby likely increasing the time to plan and undertake works, as well as increasing cost.

A further issue with respect to lines in the Marlborough Sounds is that of supply reliability. The various lines supplying sections of the Marlborough

Sounds are all radial/spur lines with no interconnection to other parts of the network. The longest radial feeder has a length of 326km.

MLL has installed automatic switching devices (sectionalisers, reclosers, etc) at various points along each of the radial spurs to minimise the areas affected by faults to the network. There is, however, a practical limit to the number of switching devices which can be installed. Over recent years the dedicated SCADA radio system linked to the devices has been expanded and will be further developed to enable increased remote control of switching devices within the network.

MLL has installed a ground fault neutraliser at its Havelock zone substation (2016) and more recently at the new Renwick and Linkwater zone substations. Much of the Marlborough Sounds network is supplied from the Havelock and Linkwater zone substations.

Many areas in the Marlborough Sounds are subject to prolonged and/or intense rain and/or extreme wind events. MLL has an on-going programme of vegetation control in an attempt to minimise interruptions caused by debris such as tree branches being blown across the lines. There are, however, practical limits to the amount of vegetation control which can be undertaken, particularly given the sensitive environment in which these lines are constructed and the distances that branches can be blown. In some areas the lines have been constructed in environmentally sensitive areas and in others the lines have been surrounded by forestry planted subsequent to the construction of the lines.

MLL has experienced disruption to the network by forestry, especially during harvesting operations or during severe storms when trees are not only blown over but in a number of cases have slid down hillsides. The current tree legislation restricts the ability of MLL to proactively remove potential hazards to the lines services it provides as it only allows trimming of trees in very close proximity to the lines.

In light of the challenges in supplying the Marlborough Sounds it is not realistic to expect that reliability to consumers in this area will be the same (or similar) to that of urban areas. Lines in the Marlborough Sounds are in a remote location, cannot be duplicated, and are subject to greater economic and environmental challenges.

Supply in the Marlborough Sounds includes the aerial crossings of four navigable waterways[2] with significant spans. Each of these spans has been in service for over 30 years. Because of the arduous environment in which they operate and the frequency of shipping, it was decided to replace the existing conductors and associated hardware of the Tory Channel (Arapawa Island) and French Pass crossings in 2013 to ensure their mechanical integrity.

The supply in the Marlborough Sounds has been constructed primarily using treated pine (TP) poles, principally because of their relatively light weight (ease of transport) and resilience to handling.

At the time of installation, these poles were anticipated to have a useful life of 35 years to 40 years. Over the years, the TP poles have been routinely tested and found to be in good condition. Accordingly, MLL now considers their useful lifespan to be in the order of 55 years to 60 years although the poles are now approaching this age with much of the reticulation undertaken in the 1970s. Difficult access and the remote

[2] Crossings of French Pass to D'Urville Island, Greville Harbour (D'Urville Island), and to Forsyth and Arapawa Islands from the South Island.

location mean that the cost of replacing poles in the Marlborough Sounds is markedly higher than in other areas.

The network in the Marlborough Sounds was constructed to meet the requirements of consumers and satisfy government regulation of the day but overall it is significantly uneconomic and subsidisation by MLL's other consumers is required in ensuring the serviceability of these lines

3.1.1.5 East Coast

The East Coast consists of a relatively narrow strip of land running sub-parallel to the coast down to Marlborough's southern boundary with some sparsely populated inland river valleys running typically west towards the centre of the South Island. Much of the network in this area was constructed in the late 1950s using reinforced concrete poles and copper conductors. The long radial nature of the area means there are no alternative supplies available during faults or planned outages (outside of mobile generation). However, the sheltered nature of the land and predominantly pastoral land use, together with relatively small areas of trees and vegetation, leads to relatively high reliability of supply in this area.

3.1.1.6 Demographics and GDP

At the time of the last published Census (2018), MLL's network area had a resident population of about 47,300 people, which was a 1.7% average annual increase from the 2013 Census. Of this population, about 23,000 live within the urban Blenheim area. Key demographic features of the resident population within MLL's network area are:

- That the population is older than the national average, with a median age seven years greater than the national median, and about 21% of the population is aged over 65 years (for NZ as a whole only 14% of the population is aged over 65 years)[3];
- That there is significantly lower unemployment than the national average, with the most common occupational class being labouring, typically within the viticulture industry, which is almost twice the national average by percentage;
- That the median income is slightly lower than the national median across all age groups; and
- Fewer people are involved in manufacturing with more people involved in agriculture, forestry and fishing.

The key demographic implications for MLL are therefore: low population growth, lower levels of discretionary spending in the community at large, and an increasing proportion of connected consumers shifting to retirement-level incomes.

At the time of writing, the Statistics NZ GDP figures[4] published for the Marlborough region were up to RY2018 and show a small variation around a linear 6.3% growth trend as illustrated in Figure 3. From this, MLL anticipates that relatively constant consumer connection growth at the historic average levels will continue over the planning period.

[3] From 2013 NZ Census data (noting that the 2018 census tables are not yet published at the time of writing).

[4] From stats.govt.nz table RNA001AA, March 2019.

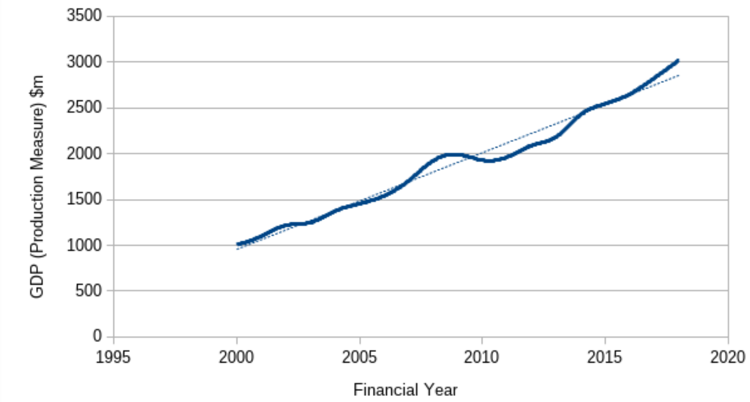


Figure 3: Marlborough GDP

3.1.1.7 Key Economic Activities

Marlborough's key economic activities include:

- viticulture and winemaking;
- aquaculture, including greenshell mussels and salmon farming;
- forestry;
- timber processing;
- food (particularly vegetable) processing;
- tourism;
- aviation (Woodbourne Air Force base and Marlborough Airport);
- pastoral farming;
- engineering manufacturing; and
- dairying.

The area's economy is therefore strongly influenced by:

- success of the viticulture industry and markets for wine;
- demand for aquaculture products, greenshell mussels and salmon;
- any sustained climate change which impacts on the viticulture or agriculture industries;
- Markets forestry production and timber processing;
- markets for dairy products;
- government policies on land use, particularly in relation to forestry and climate change;
- government policies on major defence installations;
- access to water for crop and stock irrigation and wineries;
- algae bloom, rough seas or sea temperature warming within shellfish farming areas; and
- the incidence and severity of frosts when grapes are flowering and the extent of rain when grapes are ready for harvest.

The impact of these issues on MLL's electricity distribution business is broadly set out in Table 1.

Table 1: Economic influences and impacts on the network

Issue	Impact
Shifts in market demand for wine	Currently there is strong demand for Marlborough wine with over 80% of New Zealand's wine produced in Marlborough. All major wineries are planting more grapes. This will result in more electricity used for irrigation and processing of grapes.
Shifts in market demand for aquaculture	Currently there is strong demand for aquaculture products (both greenshell mussels and salmon). The growth of these industries is constrained by the difficulties in obtaining further consents for increased areas for aquaculture. Aquaculture is a long-established industry in Marlborough with considerable diversity of location of farm sites and processors. Accordingly, this industry is likely to be sustainable long term with the greatest threat being the introduction of disease or adverse effects from climate change.
Shifts in market demand for timber	As with any international market, demand for timber can vary but prices have been relatively steady. Any short-term downturn within log/timber markets will result in a delay of harvesting until prices increase. Log/timber production has increased markedly in Marlborough in recent years and MLL understands that further growth in this area is being considered, although the timings for this remain uncertain.
Government policy on nitrogen-based farming	May lead to contraction of dairy shed demand. May lead to contraction of dairy processing demand.
Milk prices	A return to higher prices may lead to further conversion of pastoral land to dairying and subsequent increases in demand, although this now appears unlikely due to environmental concerns and alternative high value land uses. Maintaining levels or reduction of prices are unlikely to have much effect unless prices fell to a level where production was uneconomic.
Climate change increases frequency of droughts	May lead to increased irrigation demand.
Government policy on defence installations	Could lead to a significant contraction of demand at a single site, followed by a knock-on decline in disposable income in the community.
Lack of generation and/or electricity supply nationally	Very unlikely in the current environment.
Increase in distributed generation including photovoltaic installation on consumer premises	This trend can be expected to continue especially as the costs reduce. This has the potential to diminish electricity distributed over the network and ultimately may necessitate changes to MLL's pricing structure to ensure equity and fairness by greater recovery of costs on a fixed or capacity basis.
Major earthquake/tsunami	The likelihood of future catastrophic events is unknown but Marlborough is in an area deemed a 'high seismic zone' and is accordingly subject to earthquake risk. An earthquake has the potential to cause significant disruption to both Marlborough's economy, particularly in relation to production, and MLL itself. Within practical limits, MLL has sought to insulate its network and operations from the effects of major disaster and has emergency preparedness plans.

Low probability outcomes are considered and addressed within MLL's risk management framework. Other outcomes are managed on a case-by-case basis as the effects arise.

3.1.1.8 Other drivers of electricity use

Other drivers of electricity use include:

- low temperatures during winter where -5°C frosts can occur in significant areas of Marlborough;
- the use of heat pumps as air conditioners in the summer time;
- increased utilisation of electricity, as polluting sources of energy, such as coal and wood are phased out; and
- charging of electric vehicles (EVs) become more prevalent.

This AMP anticipates regional climate and appliance utilisation to exhibit similar trends to the past. MLL's planning response to higher electric vehicle up-take is discussed under asset strategy but is not expected to impact the network to any significant extent within this planning period, largely due to existing network capacity levels, expected gradual take-up, efficient load management and electric vehicle journey efficiency.

3.1.2 Large Consumers

Table 2 summarises MLL's five largest electricity consumers. Generally, the load on the network consists of a large number of smaller consumers and while the loss of any large load would affect operation of the network, the effect would be relatively minor compared to the overall impact of changes to the economy, or a decline in one of the significant regional industries. For example, an overall sustained downturn in the wine industry would have a much greater effect on the operation and development of MLL, than the loss or gain of two or three of the largest consumers.

Table 2: Our five largest consumers (based on peak demand from the previous 12 months)

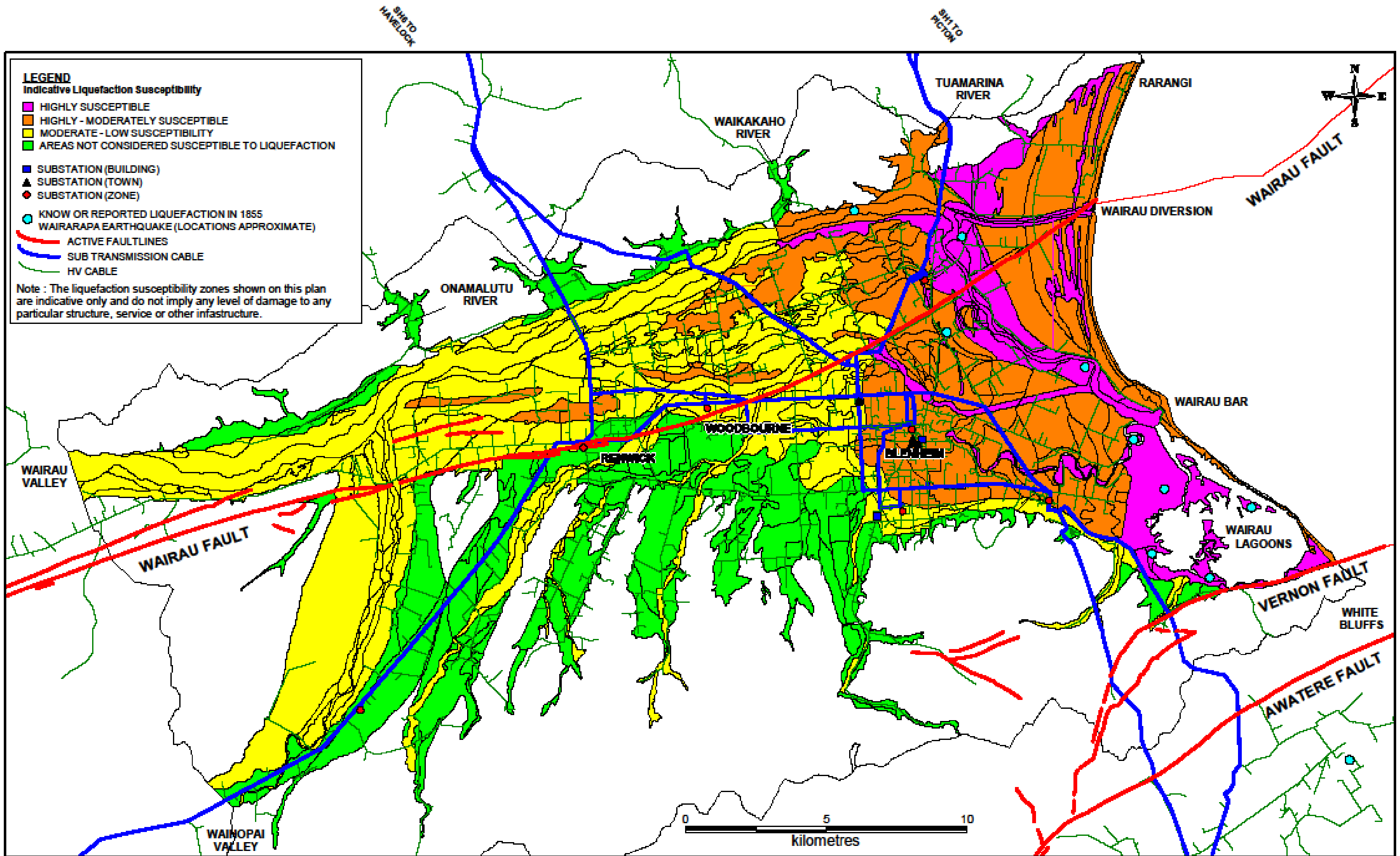
Ranking by size	Nature of business	Nature of demand
1	Food processing	Mild seasonal variation
2	Wine processing	Cyclical with harvest season
3	Timber processing	Relatively constant throughout year
4	Wine processing	Cyclical with harvest season
5	Timber processing	Relatively constant throughout year

3.1.3 Regional Risks

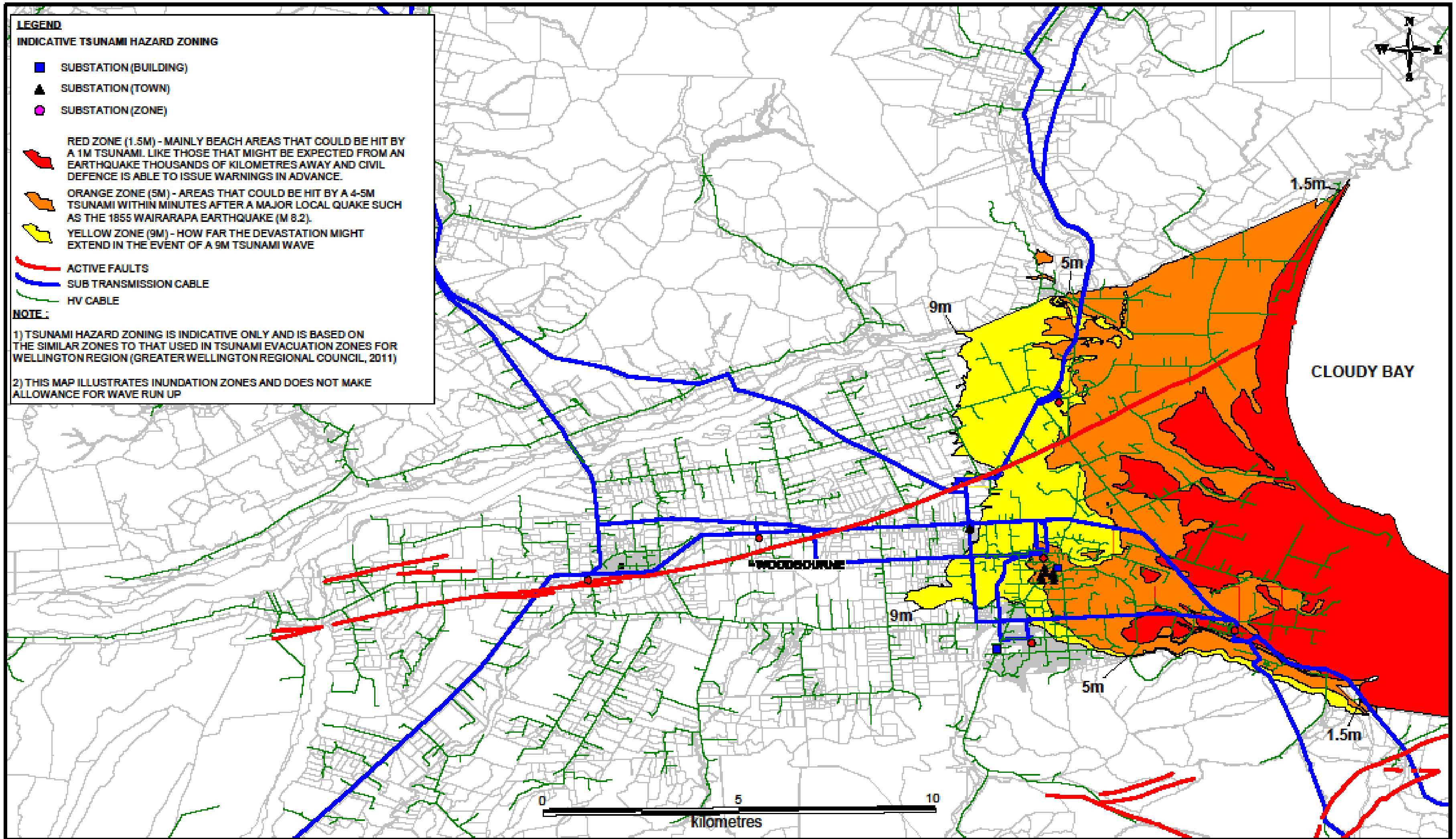
3.1.3.1 Earthquake (including liquefaction and tsunami)

Two major fault lines cross the Marlborough region; the Wairau fault line (an extension of the Alpine Fault) and the Awatere Fault. A third relatively significant fault line, the Vernon fault line, is located south east of Blenheim. The following maps (prepared by MWH in a 2011 report) show these fault lines and the higher populated areas subject to liquefaction and to tsunami risk arising from an earthquake event(s) (noting that the latter is more likely to be triggered from an offshore earthquake). Note that the blue lines on the maps mark MLL's 33kV sub-transmission lines.

Subsequent to the November 2016 Kaikoura earthquake, further work undertaken by GNS and other experts has identified that Marlborough is at risk from the Hikurangi subduction zone which runs under the sea out from the east coast of the North Island to Marlborough. This subduction zone has the potential to generate a major earthquake and/or tsunami.



Marlborough Lines	MWH	INDICATIVE LIQUEFACTION SUSCEPTIBILITY IN THE WAIRAU VALLEY	FIGURE 2	SCALE 1 : 125,000 @ A3 DRAWN BY : S FLEWITT DATE : 20/4/11



Marlborough Lines	MWH	INDICATIVE TSUNAMI HAZARD ZONING IN THE WAIRAU VALLEY	FIGURE 3	SCALE 1 : 125,000 @ A3 DRAWN BY : S FLEWITT DATE : 20/4/11

Earthquake risk in the Marlborough region is high and MLL's recent experience of the November 2016 Kaikoura earthquake has provided MLL with useful lessons and reinforced its thinking on ways to enhance its network resilience to the high likelihood of future earthquake events.

Key lessons taken from this earthquake were:

- the need for a resilient network and the importance of preparatory planning;
- in general, the new line construction stood up well;
- lines suffering most damage were older, often with weaker copper conductor and running transverse to the fault movement;
- An overhead network is an advantage when it comes to both inspection and rapid repair;
- the importance of adequate civil and mechanical design and appropriate location of zone substations;
- the continuance of communications and control systems is vital;
- having trained and well-resourced staff within MLL was the key determinant in the restoration of supply;
- the availability of MLL's mobile generation for use within the network was reinforced; and
- the ready availability of spares within MLL enabled rapid restoration of supply.

As a result of further information becoming available subsequent to the earthquake, MLL elected to establish a new replacement zone substation at Renwick further away from the known Wairau fault line trace; placed greater emphasis on network resilience with ability to off-load zone substations; and initiated review of two-pole distribution substations, particularly those in public places, all as further detailed in this plan.

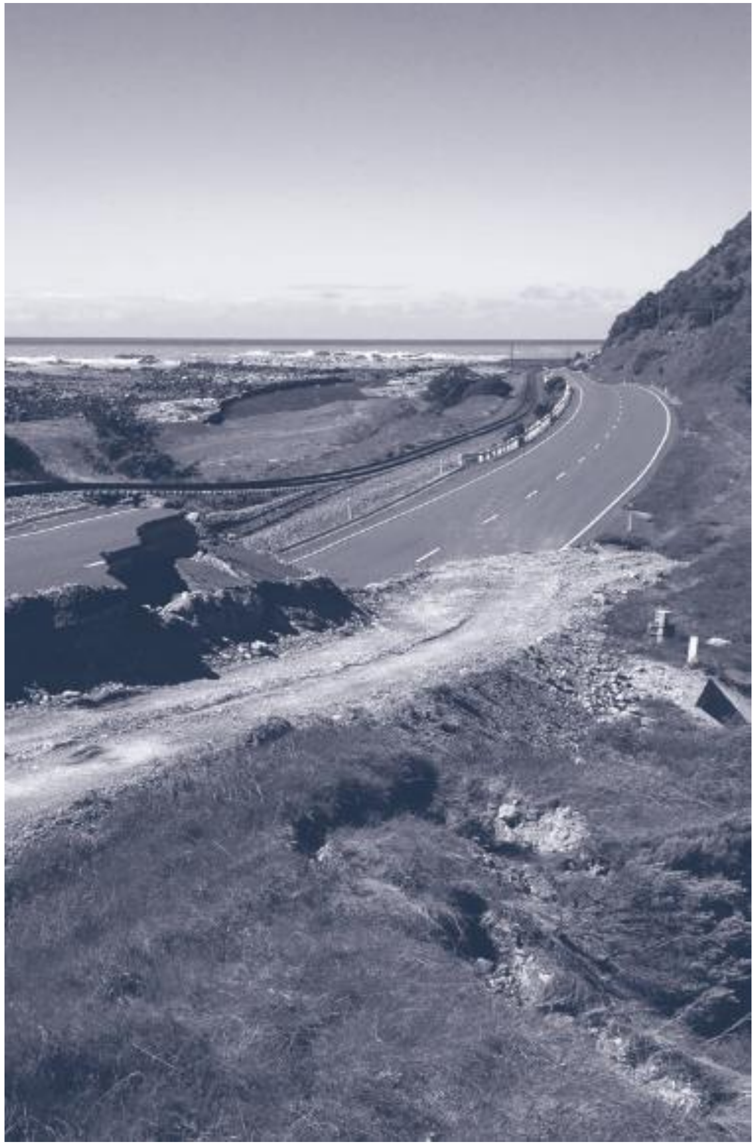


Figure 4: Faultline rupture in south-east Marlborough from 2016 Kaikoura earthquake

3.1.3.2 Summer fire danger

Marlborough enjoys high sunshine hours, but this also often leads to very dry summer conditions, both in the inland regions and the Marlborough Sounds. Consequently, a high fire risk frequently results. In response to this, MLL works with the rural fire authority to obtain information on a real time basis. This amongst other things includes the disablement of circuit breaker auto-reclose in areas designated as fire danger, not relivening lines in at risk areas within undertaking inspection along the entire length of the line[5], removal of equipment identified as a fire ignition source (such as drop-out fuses with cardboard cartridges) and MLL has commenced a program of installation of ground fault neutralisers onto zone substations serving feeders traversing high fire risk areas.

3.1.3.3 Significant adverse weather events

While infrequent, Marlborough is not immune to extreme weather events. By way of example, in June 2013, an intense weather system from the south east caused relatively significant damage to parts of Marlborough's East Coast – hundreds of trees were blown over. The network suffered numerous outages during this storm with significant damage caused by trees well outside the regulatory growth limit zone being blown over the lines and restoration works were substantial. Snowstorms, while rare, can potentially impact MLL's assets which are located at higher altitudes.

3.2 Network and demand

3.2.1 Consumers and load serviced

In RY2019, the network delivered 392GWh of electricity to approximately 25,750 connected consumers. The maximum coincident (instantaneous) system demand was 79MW with a load factor of 59%.

Overall MLL's load factor has only changed marginally over a period of some 40 years.

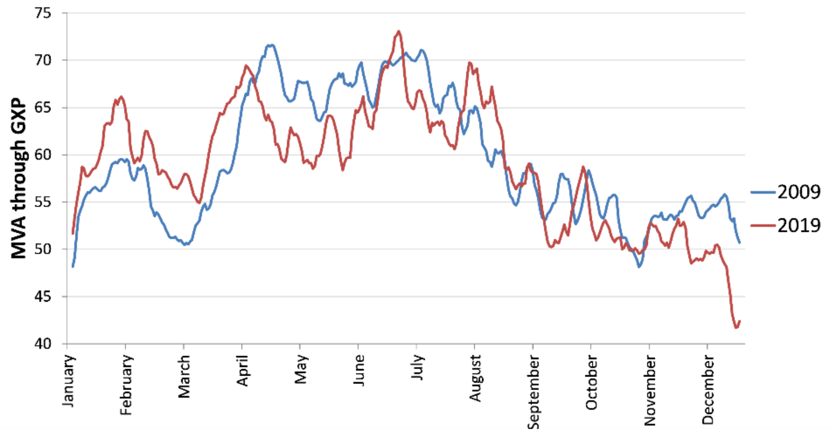


Figure 5: MLL's seasonal load profile

[5] Safety is always given priority over restoration of supply and reliability targets.

MLL's seasonal load profile is largely driven by winter load and the wine harvesting season in April. Maximum demand in summer months is typically subject to the vagaries of weather with prolonged hot spells resulting in a marked increase in irrigation consumption for both crops and viticulture. This is reflected in Figure 6, which also shows (generally) the increase in the wine harvesting peak load, winter peak, and summer irrigation peaks from 2009 to 2019.

MLL's daily load profile, especially in winter, consists of twin peaks; one in the morning and then again at night. Load management utilising ripple control is applied when appropriate. Generally, apart from parts of the Marlborough Sounds, the MLL network is not capacity constrained. The summer's day profile follows this pattern with much less exacerbated peaks in part due to the constancy of the irrigation load.

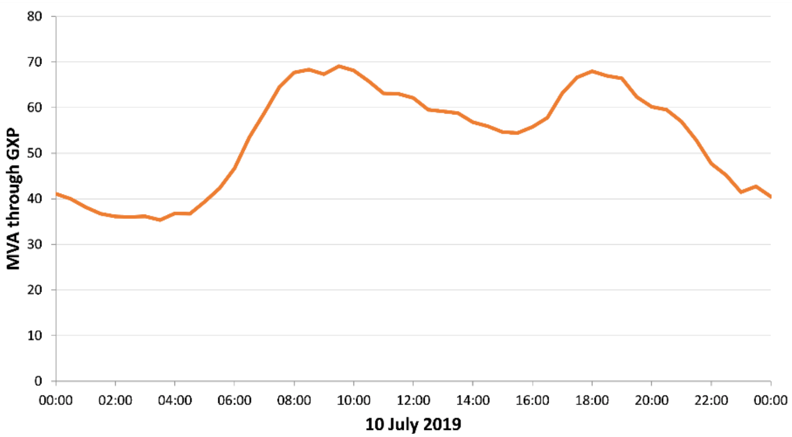


Figure 6: Daily GXP load profile

3.2.2 Network servicing consumers

MLL distributes electricity throughout Marlborough to in excess of 26,000 consumers (ICPs) on behalf of 22 energy retailers. Figure 7 indicates MLL's position in the electricity supply industry.

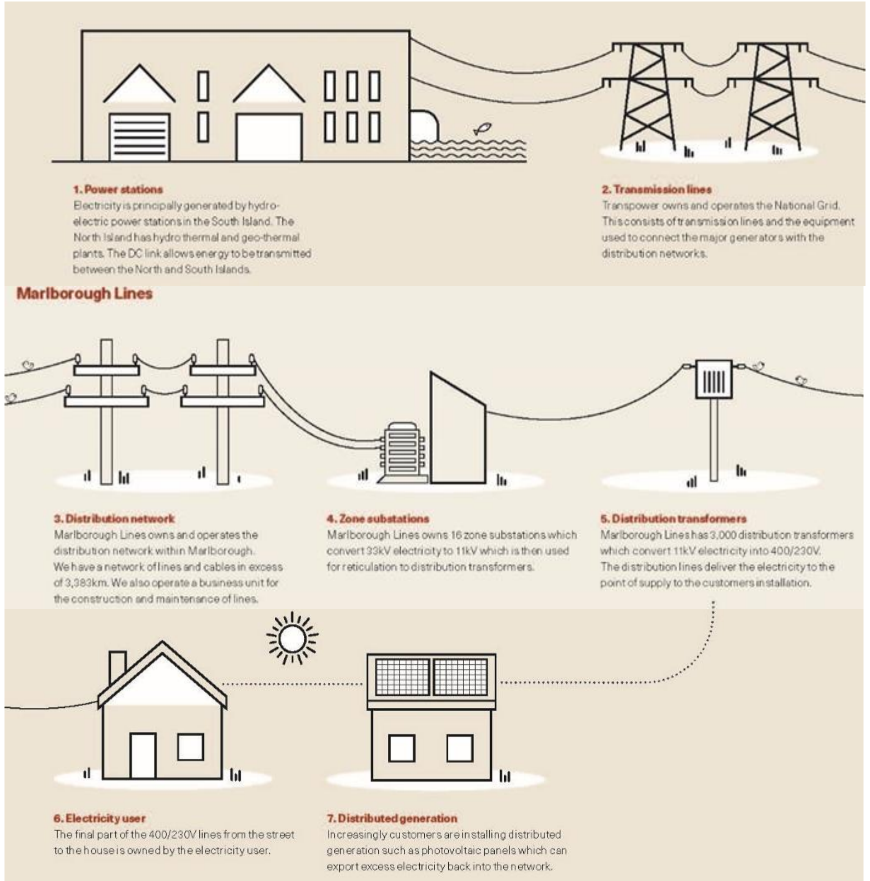


Figure 7: Illustration of the New Zealand electrical supply industry

3.2.2.1 Background to MLL network

MLL's network originally began as three historically distinct networks:

- The Marlborough Electric Power Board (M.E.P.B.), which was established in 1927 and began to supply the region from its own 1MW Waihopai River scheme.
- The Havelock Town Board electricity department, which commenced in 1917 with a 9kW Pelton Wheel, and was merged into M.E.P.B. in 1927.
- The Picton Borough Council electricity department, which commenced in 1917 with a 10kW Pelton Wheel, and was merged into M.E.P.B. in 1947.

Subsequent to 1947 these networks have operated as a single integrated system. The only surviving generation from the three above individual networks is the Waihopai hydro station now owned by TrustPower Limited.

In 1993 the MEPB was corporatised and became a company trading as Marlborough Electric Limited with the shares held by the Marlborough Electric Power Trust. The beneficiaries of the Trust are the ICP's connected to the Marlborough network.

In 1999 the Electricity Industry Reform Act (Bradford reforms) required the separation of generation and retailing from distribution. Marlborough Electric's generation and retailing businesses were sold and Marlborough Electric Limited became Marlborough Lines Limited with responsibility for electricity distribution in Marlborough.

3.3 Supply within Marlborough

Supply to the region is transmitted by three 110kV lines owned by Transpower New Zealand Limited to the Blenheim Grid Exit Point (GXP). As there is only a single GXP, MLL has an extensive and interconnected 33kV sub-transmission network to provide supply reliability and security for the bulk transfer of electricity to the 16 33/11kV zone substations across the network.

The zone substations transform the 33kV voltage level down to 11kV. Each of the 16 zone substations has between two and six 11kV feeders radiating outwards, with some meshing in urban areas. These feeders collectively supply approximately 4,000 distribution transformers that range from pole-mounted 5kVA units to ground-mounted 1,000kVA units. In turn, each distribution transformer has a number of 400V feeders radiating outwards, again with some meshing in urban areas.

The majority of consumers take supply at 230/400V, with nine of MLL's larger consumers taking supply at 11kV.

3.3.1.1 Transpower point of supply/transmission lines

MLL has a single Transpower GXP in Blenheim (on the corner of Murphys and Old Renwick Roads) where supply from the national grid enters MLL's network. Blenheim's GXP is currently supplied by three separate Transpower-owned 110kV circuits, one from Kikiwa and two from Stoke. The Kikiwa line is an "H" structure hardwood pole line, although a number of structures have been replaced with pre-stressed concrete (PSC) poles. This line has a summer rating of 56MVA and winter rating of 68MVA.

The two Stoke-Blenheim 110kV circuits are installed on the same towers. These circuits are rated at 76MVA for the original circuit and 105MVA for the second circuit added in 2005.

The 110/33kV transformer capacity at Blenheim GXP consists of two banks of three single phase 50MVA units and a third 60MVA three phase unit. The 60MVA unit was commissioned in January 2011. The three 110kV/33kV transformers supply three 33kV bus bars (buses). This gives an n-1 capacity of 100MVA.

From the Transpower 33kV circuit breakers, the 33kV sub-transmission network distributes supply to MLL's 16 separate 33/11kV zone substations.

The bulk supply characteristics are summarised in Table 3:

Table 3: Bulk supply characteristics

GXP	Demand	Voltage	GXP rating		Line rating	
			(n) rating	(n-1) rating	(n) rating	(n-1) rating
Blenheim	73.9MVA controllable to about 61MVA	110/ 33kV	160/ 172MVA	100/ 112MVA	189/ 202MVA	110/ 136MVA

Transpower's charging scheme means that MLL's peak charges are based on the network load coincidence to the 100 highest half hourly upper South Island peak demands.

3.3.1.2 Distributed generation on consumer premises

Increasingly, consumers are opting to offset their electricity consumption through the installation of Distributed Generation (DG) at their premises. MLL continues to receive applications for such generation systems, both small-scale (<=10kW) and large-scale (>10kW).

Consumer interest is expected to grow as the affordability of DG systems improves. This is becoming particularly apparent with solar PV installations, where falling costs of photovoltaic panels, greater availability of battery storage solutions and the rise of subscription-based ownership has resulted in another 680kW of small-scale solar PV generation onto MLL's network in 2019.

MLL received approximately 190 applications in 2019 for the connection/alteration of small-scale distributed generation (SSDG). This compares to approximately 70 applications received in 2014. As shown in Figure 8, small scale solar PV uptake has increased year-on-year since 2016.

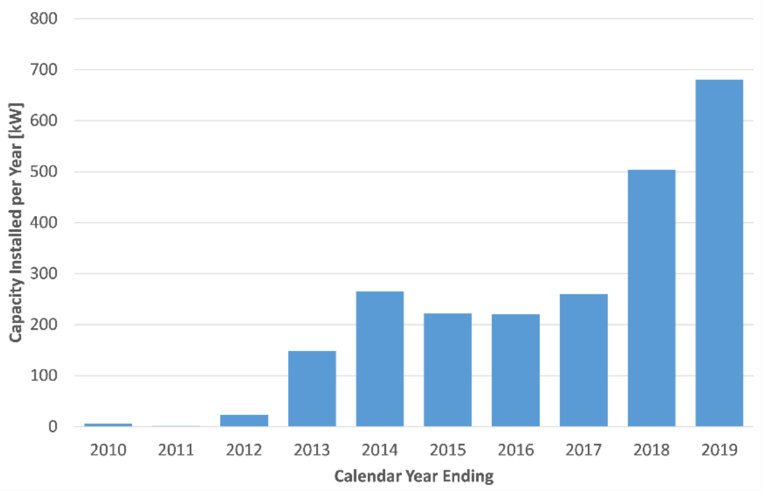


Figure 8: Solar SSDG (<10kW) installed capacity per year

As at 1 January 2020, MLL is aware of the following distributed energy resources connected to its network:

- 629 SSDG installations:
  - 560 with solar only;
  - 65 with solar and energy storage; and
  - Four with some combination of wind, solar and/or hydro.
- 37 large-scale DG installations:
  - 27 with solar only;
  - Three with solar and energy storage; and
  - Seven connected at 11kV or above (discussed further in the next section).

In addition to the DG listed above, several consumers with large or sensitive loads also have standby generation available for back-up purposes and/or demand management. These are typically diesel generators ranging from 10kW up to 1MW. Notable examples include the Wairau Hospital, communications sites and wineries seeking to manage their peak demands during the vintage period. These are presented separately to other DG since their primary purpose is load management and not the generation and/or export of energy.

3.3.1.3 Generation at high voltage

There are seven installations with generation embedded into MLL's network at 11kV or above.

TrustPower operates a 2.5MW 'run-of-river' hydro generator at Waihopai which is embedded into MLL's 33kV sub-transmission network.

Energy3 owns two wind farms in Marlborough. One is located at Weld Cone, near MLL's Ward substation, where there are three 250kW turbines. The other is located at Lulworth, just north of the Ure River, where there are four 250kW turbines installed which, due to their metering arrangement, are considered as four separate installations.

Because of the location of the Energy3 windfarms and their consumption of reactive power, MLL installed a Static Var Compensator (SVC) at the Ward 33/11kV substation.

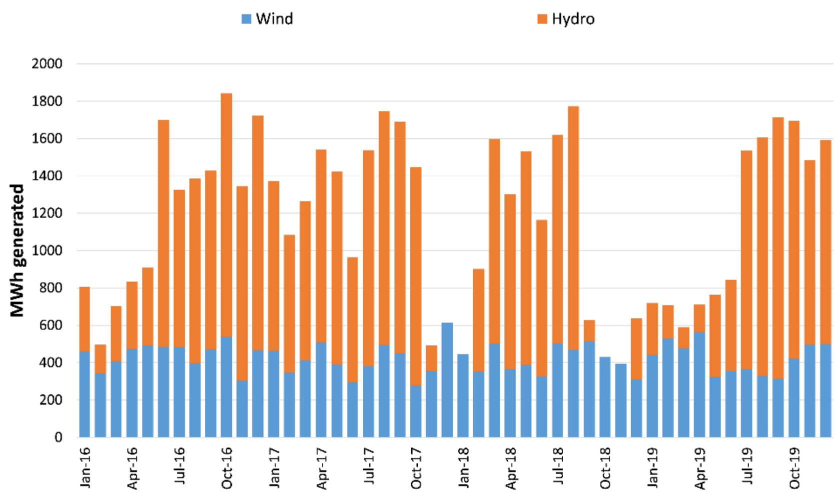


Figure 9: Electricity supplied from distributed generation in GWh

Dominion Salt Limited has installed a 660kW wind turbine, which is embedded into its own 11kV installation.

Collectively, these seven installations produced 14GWh of energy entering the network in 2019. This is mostly from the Waihopai hydro scheme which contributed 8.9GWh. As expected from hydro and wind generation, changes in river flow and the vagaries of the wind can result in significant variations in output.

Figure 9 shows the electricity supplied by HV connected distributed generation for the years from 2016 to 2019 and illustrates the monthly and yearly variability of this supply. Forecast supply from this source is expected to continue to show a high level of variability.

The potential wind resource in the Marlborough Sounds and on the East Coast is significant. However, the development of substantial wind farms requires construction of new lines to convey the output to load centres.

Further detail on embedded generation is described in Section 7.4.

3.3.1.4 Further Marlborough generation

TrustPower operates the Branch Power Scheme and was granted resource consent in 2008 to extend this scheme. However, this has not since materialised. Six new power stations were proposed with one connecting to the existing Branch scheme infrastructure, four connecting to a new substation on the 110kV Kikiwa to Blenheim line and one connecting to MLL's existing network in the Wairau Valley.

The implications on MLL's asset management/network of Distributed Generation (DG) is ensuring the network voltage regulation is properly managed due to the solar variation (clouding) effects; that the effects of the generation on the line protection arrangements are properly considered; that maintenance/fault work on the associated lines can be undertaken safely; and that MLL does not become unduly constrained in its ability to manage its network.

3.3.1.5 Sub-transmission system

Figure 10: Wind turbine

MLL's 33kV sub-transmission network uses radial duplicated feeders and provides n-1 security of supply to the 33kV bus at all zone substations, except Rai Valley, Linkwater, Leefield and Ward[6]. About 7% (by length) of the 33kV network is underground. MLL has 16 zone substations across its network, with four of these zone substations supplying Blenheim.

From a total of 300km of 33kV lines, 278km is overhead, most of which has been constructed since 1960. Lines constructed earlier than 1960 include a galvanised tower line constructed in 1926 between Waihopai Power Station and Leefield (noting that much of this from Blenheim to the Leefield zone substation has been renewed in the last five or so years) and

[6] Security is either n-1 or n-1 (switched).

part of the line between Riverlands and Seddon (where the majority of this has recently been renewed).

In the early 1970s, a 33kV and 11kV line utilising the same poles was constructed between Okiwi Bay and Elaine Bay in the Marlborough Sounds. The 33kV line was operated at 11kV to provide two circuits. This line contained a high proportion of larch poles treated with creosote. These poles have since been replaced.

Further poles between Elaine Bay and French Pass also need to be replaced.

Figure 11 shows the overall 33kV sub-transmission system (blue lines) together with zone substations and embedded generation (Waihopai Hydro). The graphs at each zone sub highlight MLL's secure availability relative to maximum and average substation loading.

A single line diagram is included in Appendix 11.4. All new 33kV line construction in rural areas is currently insulated at 66kV or 110kV.

3.3.1.6 Zone substations

Zone substations transform the voltage from 33kV to 11kV for reticulation to 11kV/400V transformers. All of the zone substations transformers are equipped with on-load tap changers and automatic voltage regulators to regulate the 11kV supply and maintain voltage within a controlled band. The major components of the substations are transformers and switchgear and the buildings within which they are housed.

Table 4 sets out the zone substation capacities, security level and 2019 (calendar year) loading.

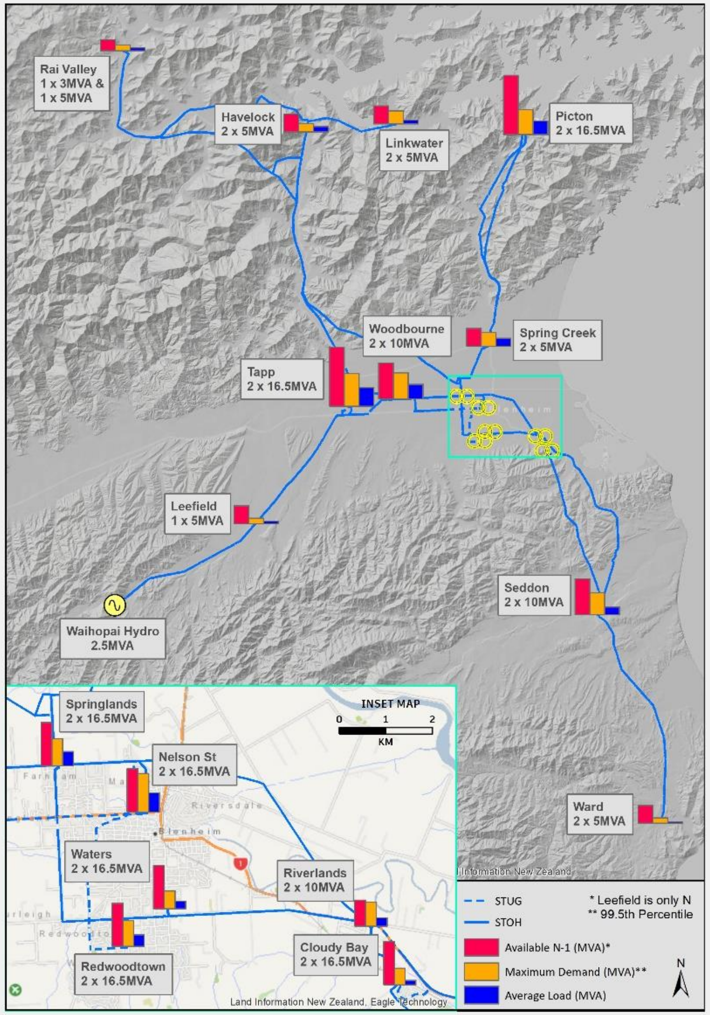


Figure 11: Overview of MLL's 33kV network, with zone substation capacity

Table 4: Zone substation capacities and security levels

Zone substation	T1 capacity (MVA)	T2 capacity (MVA)	Max demand (MVA)	Average load (MVA)	Security level
Cloudy Bay	16.5	16.5	4.1	1.3	n-1
Havelock	5.0	5.0	2.9	1.5	n-1
Leefield	5.0	N/A	1.8	0.7	n
Linkwater	5.0	5.0	4.2	1.1	n
Nelson Street	16.5	16.5	14.3	7.0	n-1
Picton	15.0	15.0	7.1	3.8	n-1
Rai Valley	3.0	5.0	2.0	0.8	n
Redwoodtown	15.0	15.0	12.7	5.4	n-1
Riverlands	10.0	10.0	9.1	2.8	n-1
Seddon	10.0	10.0	6.7	2.1	n-1
Spring Creek	5.0	5.0	4.5	2.2	n-1
Springlands	16.5	16.5	10.0	4.8	n-1
Tapp	16.5	16.5	10.9	5.2	n-1
Ward	5.0	5.0	1.4	0.4	n
Waters	16.5	16.5	7.5	3.4	n-1
Woodbourne	10.0	10.0	8.2	4.1	n-1

All of MLL's zone substations other than Leefield have (n-1) security for the 33/11kV transformers, e.g., for a zone substation to have a firm (n-1) 16.5MVA rating it must have two transformers of 16.5MVA. Note Linkwater, Rai Valley, Leefield and Ward substations only have a single 33kV line supplying them, and consequently have an overall security of supply of (n).

Consistent with its planning horizon, MLL has recognised the potential need for new zone substation sites and that opportunities to purchase substation sites are limited. At present, two new zone substation sites may potentially be developed within the current planning period at Fairhall, and Kaituna - subject to the expected load eventuating and other engineering and value reviews as further detailed in the network development section of this AMP. New consumer requirements can change in a short timeframe and MLL will accordingly move to respond, as and if such load eventuates.

MLL considers the usual loading of a substation and its n-1 capability and the ability of the network to maintain supply if a complete substation has to be removed from service. This could be from a cause on the MLL network or an external event such as a major earthquake. Ideally, zone substations should be able to be removed from service without a long-term disruption of consumer supply. For this reason, the capacity of the major zone substations typically provides for flexibility in network operation.

3.3.1.7 Distribution system

MLL operates an 11kV distribution network which is largely radial with some meshing in urban and higher density rural areas. Approximately 11% of the 11kV (by line length) is underground. The total length of cable and conductor operating at 11kV is approximately 2,300km.

Generally, underground cable is considerably more expensive to purchase and install than overhead line. The decision whether underground cable is more appropriate than overhead conductor involves several factors, for example surrounding land use, safety, public amenity, risk avoidance and economic considerations.

Some other key features of the 11kV system include:

- Lightning protection is generally installed on all underground to overhead transitions and in areas prone to lightning.
- All new/replacement 11kV lines in rural areas are insulated at 22kV to allow for possible future increases in supply voltage and to increase reliability.
- Distribution substations are installed to step down the voltage from 11kV to 400V/230V in locations appropriate to service consumers' needs.
- Protection devices are installed across the network. The selection of locations for protection devices involves consideration of a number of factors such as downstream consumers, location and cost.
- MLL's distribution network includes approximately 540 km of Single Wire Earth Return (SWER) lines. SWER lines are cheaper to construct when reticulating low density rural and remote areas having low demand requirements but requires special attention to the transformer earthing arrangements given the ground itself is utilised as the return conductor.

3.3.1.8 Distribution substations

MLL owns close to 4,000 distribution substations. Of these, approximately 480 are ground-mounted and the remainder are pole-mounted. All transformers greater than 300kVA are ground-mounted, in general, smaller transformers are pole-mounted. In future all transformers from 200kVA upwards will be ground-mounted.

Key features of MLL's distribution substations are the following:

- typically 200kVA or 300kVA in urban areas;
- fused on the HV side;
- LV cables with HRC fuses;
- LV typically runs along both sides of the street i.e., no multiple service lines crossing the street; and
- LV runs are typically limited to a maximum of 350m to reduce incidences of low voltage.

In rural areas, the distance between consumers and voltage typically limits the utilisation of low voltage lines. Also, 11kV lines are generally built with a pole spacing of 80m to 100m on the flat and a greater distance depending on the terrain. These distances inhibit the installation of low voltage (LV) in some situations and, combined with a low density of consumers, necessitate many rural consumers having their own transformers. This results in a lower coefficient of transformer utilisation than urban areas but is a function of the physics of electricity supply.

3.3.1.9 Low voltage network

MLL operates a 400V (LV) reticulation network totalling approximately 830km[7]. There is significant meshing in urban areas. About 45% (by length) of the LV is underground. As noted above, in many rural areas, pole spacing and consumer locations result in consumers having individual transformers with less use of an LV conductor.

[7] Includes street lighting circuits.

The LV network supplies the bulk of the ICPs, the majority of which are domestic consumers (i.e., residential properties) in urban areas. Typically, LV supply to ICPs in most cases is single phase but can be two or three phase depending on the supply for the area and the needs of the consumer.

3.3.1.10 Ripple control, SCADA and communications

MLL's ripple control system is utilised for the management of loads such as water heating, irrigation, industrial heating and the control of street lights.

Whilst MLL's network is generally not constrained, the ripple control system is used to minimise the cost of Transpower peaks. In future the ripple control system is expected to continue to make a valuable contribution within the network and may be utilised to provide an option for the charging of electric vehicles.

MLL operates 217Hz and 1050Hz ripple injection systems. These both inject at 33kV. The injection equipment is installed at the Springlands substation site. All ripple relays are owned by the energy retailers. The 1050Hz equipment was originally installed in 1967.

3.3.1.11 SCADA

SCADA covers all of the zone substations, voltage regulators and 33kV reclosers. This system allows staff to monitor and control the network remotely. Communication for SCADA consists of dedicated radio equipment, as well as use of internet and cell phones and including voice radio. The SCADA radio network is being progressively extended to ensure greater reliability in the event of major civil emergencies or widespread power outages and to extend the reach of remote control of network switches. Further detail on MLL's SCADA is included in Section 9.10.

3.3.1.12 Major asset groups

Table 5 presents a summary of MLL's major asset groups. Further breakdown of the assets (poles, conductor, etc.) including age profiles is provided within section 1.19 Fleet Management of this AMP.

Table 5: MLL major asset classes (RAB values from 2019 Information Disclosure)

Type	Unit	Number	Average age (years)	RAB $000
Sub-transmission lines	km	276	35	23,213
Sub-transmission cables	km	23	10	8,727
Zone substations	-	-		39,033
Buildings	each	16	21	
Switchgear	each	284	11	
Transformers	each	31	11	
Distribution and LV lines	km	2566	38	48,252
Distribution and LV cables	km	569	17	43,675
Distribution transformers	each	3919	22	22,470
Distribution switchgear	each	3179	14	15,912
Other network assets	-	-		7,670
Non network assets	-	-	-	15,337
Total				224,288

4. Stakeholder interests and objectives alignment

This section of the AMP sets out the various stakeholder interests and the alignment of those interests with MLL's asset management objectives as further articulated within this plan.

4.1 Stakeholder interests

MLL defines its stakeholders as any person or class of persons that:

- has a financial interest in MLL (equity or debt);
- pays money to MLL (either directly or through an intermediary) for delivering service levels;
- is physically connected to the network;
- uses the network for conveying electricity;
- has an interest in land on which MLL assets are located;
- has an interest in land that provides access to MLL assets;
- supplies MLL with goods or services;
- is affected by the existence, nature or condition of the network (especially if it is in an unsafe condition);
- has a statutory obligation to perform an activity in relation to the network's existence or operation such as: request disclosure data, regulate prices, investigate accidents, investigate consumer complaints, include in a District Plan, protect archaeological sites, Wahi Tapu sites, etc.;
- has an interest in the safety of the network; and/or
- is employed by MLL.

Figure 12 highlights MLL's key internal and external stakeholder groups as well as the nature of their relationships with MLL.

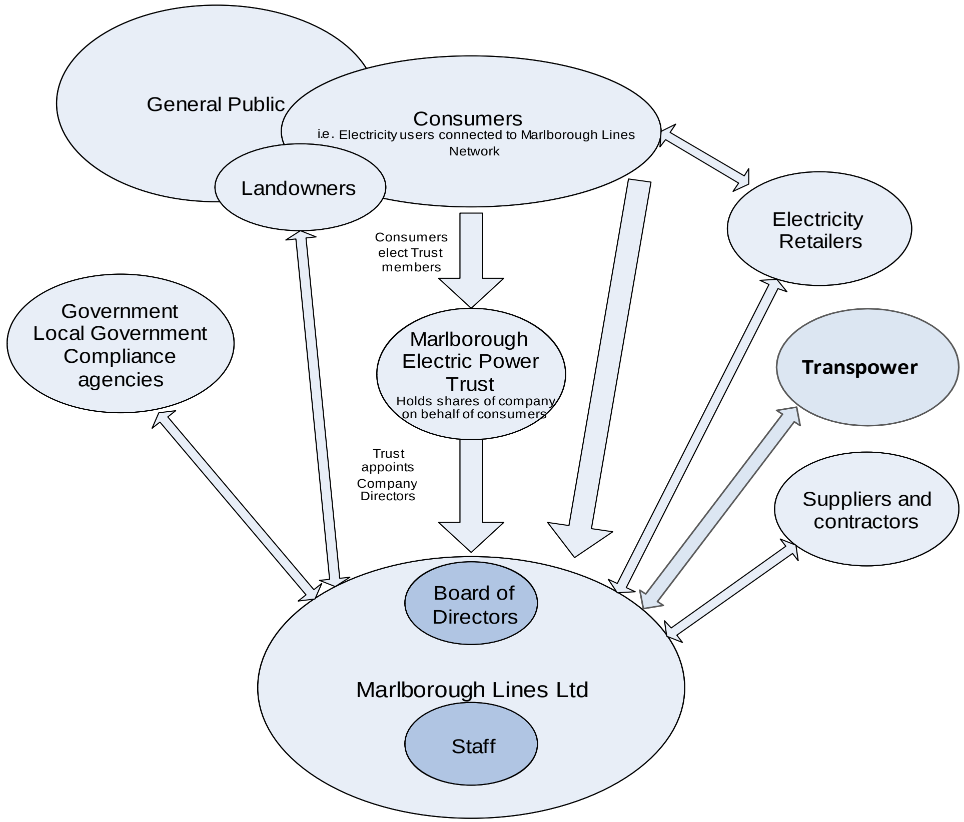


Figure 12: Our key internal and external stakeholders

Table 6 also gives a general indication of the most significant interests of various stakeholders. Most stakeholders generally have an interest in all aspects of the business.

Table 6: Summary of MLL's stakeholders with respect to the interests shown

Stakeholder	Interests					
	Viability	Price	Supply Quality	Safety	Compliance	Energy Efficiency
MEPT	✓	✓	✓	✓	✓	✓
Bankers	✓	✓		✓	✓	
Connected Consumers	✓	✓	✓	✓	✓	✓
Energy Retailers	✓	✓	✓	✓	✓	✓
Mass-market Rep Groups	✓	✓	✓	✓	✓	✓
Industry Rep Groups	✓	✓	✓	✓	✓	
Staff and Contractors	✓	✓	✓	✓	✓	✓
Goods and Services Suppliers	✓	✓	✓	✓	✓	✓
Public				✓	✓	
Landowners				✓	✓	
Councils (as regulators)				✓	✓	✓
NZTA (Marlborough Roads)				✓	✓	
MBIE	✓	✓	✓	✓	✓	✓
Energy Safety/WorkSafe				✓	✓	
EECA					✓	✓
Commerce Commission	✓	✓	✓	✓	✓	✓
Electricity Authority		✓	✓		✓	✓
Utilities Disputes		✓	✓		✓	

4.2 Stakeholder engagement

Table 7 sets out those stakeholders that MLL typically engages with, and the ways in which it engages in order to formulate business objectives that meet varied and numerous requirements.

Table 7: Summary of MLL's stakeholder's whom it engages

Stakeholder	How Expectations are Identified
Marlborough Electric Power Trust	• By its approval or amendment of the SCI. • Regular meetings between the MLL directors and the MEPT trustees.
Bankers	• Regular meetings between the bankers and MLL staff (Note: within MLL itself there is no debt). • Adherence to MLL Treasury procedure.
Connected Consumers	• Discussions with large industrial consumers. • Consumer satisfaction surveys. • Public disclosure documents including this AMP. • Connections newsletters. • Website.
Energy Retailers	• Annual consultation with retailers, regular contact and discussion.
Mass-market Representative Groups	• Informal contact with group representatives.
Industry Representative Groups	• Informal contact with group representatives. • WorkSafe website. • Safety bulletins from EEA. • Exchange and contribution towards industry best practice.
Staff and Contractors	• Staff briefings and meetings with contractors.
Suppliers of Goods and Services	• Regular supply meetings. • Letters.
Public (as distinct from consumers)	• Informal talk and contact. • Feedback from public meetings. • Information made available on MLL's website (including how to stay safe and how to report network damage).
Landowners	• Individual discussions as required.
Councils (as regulators)	• Formally, as necessary, to discuss issues such as assets on Council land.
Iwi	• Formally, informally and as required.

Table 7: Summary of MLL's stakeholder's whom it engages

Stakeholder	How Expectations are Identified
NZTA	• Formally, and as required.
MBIE	• Regular bulletins on various matters. • Release of discussion papers. • Analysis of submissions on discussion papers.
Energy Safety/WorkSafe	• Promulgated regulations and codes of practice. • WorkSafe website. • Audits of MLL's activities. • Audit reports from other Lines Companies.
Commerce Commission	• Regular bulletins on various matters. • Release of discussion papers and direct communications. • Analysis of submissions on discussion papers. • Conferences following submission process.
Electricity Authority	• Weekly update. • Release of discussion papers. • Briefing sessions. • Analysis of submissions on discussion papers. • Conferences following submission process. • Information on Electricity Authority's website.
Utilities Disputes	• Reviewing their decisions in regard to other Lines Companies. • Assistance with any complaint investigations.

This stakeholder engagement, both formal and informal, underpins MLL's response in setting its objectives as discussed next. MLL is a Trust-owned business and the consumers directly elect the Trustees. In turn the Trustees appoint the Directors, approve the annual Statement of Corporate Intent (SCI) and receive MLL's Annual Report and accounts.

4.3 Business and planning response

MLL's AMP is the key document that translates MLL's data, analysis, procedures, policies and strategic aims into planned actions and defines performance criteria and timeframes. It is also used as a means of communicating MLL's intentions to stakeholders.

MLL, as a supplier of electricity lines services, is included within Part 4 of the Commerce Act 1986. The Commerce Commission has regulatory oversight of the MLL network through the Company being subject to information disclosure regulation, including monitoring levels of return on investment. However, as a Trust-owned business, MLL is exempt from the default price/quality path requirements of the Commerce Commission.

MLL's Statement of Corporate Intent (SCI) provides information relevant to the AMP. Further detail on the SCI is presented in section ?. The SCI, along with other key Company documentation, is available on MLL's website.

4.3.1 Strategic Planning Documents

MLL's key strategic planning documents are constructed around its vision and mission statements.

4.3.1.1 Vision

"Our vision is to be a leader in all that we do to facilitate the safe, efficient and reliable distribution of electricity for the benefit of our customers, shareholder and community. For our investments, we will undertake investment which maximises benefit to our shareholder, the Marlborough Electric Power Trust, through the provision of capital growth and dividend streams which will enable distributions to current and future beneficiaries."

4.3.1.2 Mission

To exceed our consumer's expectations in all aspects of our operations and furnish our shareholder with a realistic rate of return.

MLL's primary objectives, in accordance with the Energy Companies Act 1992, are to:

- operate as a successful business in the distribution of electricity and other related activities; and
- have regard to the desirability of ensuring the efficient use of energy.

In achieving these objectives, MLL will:

- develop and maintain a network that responds to present and future demands of its consumers;
- ensure that all resources – financial, physical and human – are utilised efficiently and economically;
- meet commercial and productivity targets;
- fulfil market requirements in terms of quality and price on a competitive, commercial basis;
- ensure staff health and safety, and the safety of all systems, plant and equipment under MLL control and promote electrical safety within Marlborough;
- care for the environment and ensure that any impact of MLL activities is minimised or, where possible, eliminated;
- use all legislative powers fairly and in accord with the principles of natural justice; and
- be a good employer by observing and applying best practice in all areas relating to employment.

4.3.1.3 Statement of Corporate Intent

MLL's SCI is a requirement under section 39 of the Energy Companies Act 1992 and forms the principal accountability mechanism between MLL's Board and its shareholder. The SCI includes, *inter alia*, revenue and performance targets, which form the heart of the asset management activity. It is reviewed and republished on MLL's website annually.

Section 36 of the Energy Companies Act 1992 establishes that the principal objective of an energy company is to operate as a successful business and to have regard to the desirability of ensuring the efficient use of energy. The directors and the shareholder of MLL, as an energy company, believe that a "successful" electricity business is one which earns a commercially realistic rate of return, while providing a safe and reliable service that meets consumer expectations.

4.3.1.4 Interaction between Planning Documents

The interaction between MLL's major planning documents and processes is depicted in Figure 13. These plans are compiled annually (with the exception of the AMP) and are subject to regular review during the financial year.

The vision statement guides MLL's mission statement. These documents provide an overall direction to the MLL's key planning documents, the SCI and this AMP. Business plans and annual budgets are then developed from this AMP.

4.3.1.4.1 Guiding principles

The guiding principles within which stakeholder interests are accommodated are broadly set out in Table 8.

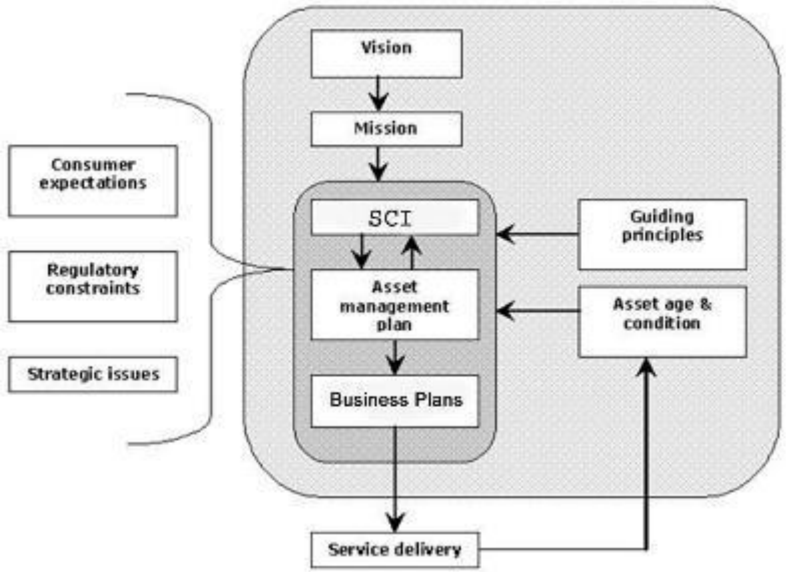


Figure 13: Overview of the key documents and the interaction between them

Table 8: Further detail on stakeholders' interests

Interest	Description	How Interests are Accommodated	Asset Management Actions
Viability	Viability is necessary to ensure that shareholders (and if required, other providers of finance, such as a bank), have sufficient reason to keep investing in, or provide funding for, MLL and for the shareholder to retain ownership.	MLL will accommodate stakeholders' need for long-term viability by delivering earnings that are sustainable and reflect a realistic commercial rate of return (broadly in keeping with the Commerce Commission's allowable rates of return for non-exempt EDBs)	Ensure expenditure is appropriate to maintain or enhance the viability of network, subject to consumer requirements.
Price	Pricing is a means of gathering the revenue required to operate the business and signal underlying costs. Setting prices correctly is important for both the consumers and MLL. The pricing methodology adopted by MLL sets an appropriate total target revenue and then sets tariff structures for different categories of consumers. As only a portion of network assets is dedicated to individual ICPs, this process involves elements of cost sharing between consumer groups, an approach commonly taken by most electricity network companies. The low fixed charge regulations require tariffs to be set at a level for some consumers that means that their service is subsidised by other consumers on the network.	Target revenue is set at a level which ensures MLL is sustainable in the long term and ensures there are sufficient funds to provide reliable assets. MLL takes a medium-term view of revenue requirements so as to avoid price shocks from year to year. The pricing methodology is expected to be cost reflective and pricing signals reflect the cost of services and supply where possible. The low fixed charge regulations and the cross subsidy of uneconomic areas cause significant distortions between consumer groups. MLL has an exemption from applying the low fixed charge regulations across some areas on its network (those classified as "Remote") which helps to reduce the level of cross-subsidisation required.	Although not subject to the Price Control mechanism in the default price quality path, MLL revenue is quite consistent from year to year. MLL aims to fund its expenditure through its annual revenues and therefore plans relatively smooth expenditure from one year to the next.
Supply Quality	Emphasis on continuity of supply of regulatory voltage, restoration of supply and preventing voltage flicker is essential to minimising interruptions to consumer's homes and businesses. Ensure that ICP supply is not subject to interference by other network users.	MLL will accommodate stakeholders needs for supply quality by focussing resources on continuity and the capacity of supply and restoration through ensuring assets are of a quality and standard to meet consumer requirements.	MLL has a strong community mandate to maintain/improve reliability and to reduce flicker. MLL adheres to regulatory requirements in the provision of electricity supply and has connection criteria which must be met by all ICPs. MLL also undertakes monitoring of the quality of supply to ICPs.

Interest	Description	How Interests are Accommodated	Asset Management Actions
		Require all ICPs to meet appropriate standards relative to power factor, harmonics and utilisation of supply.	
Health and Safety	Staff and contractors must be able to work on the network in total safety. The general public must be able to move safely around network assets.	MLL will minimise the risk to the safety of the public by ensuring that all assets are structurally sound, live conductors comply with regulatory clearances, all enclosures are kept locked, all exposed metal is securely earthed and assets are built and maintained in accordance with legislative requirements and best practice. MLL will prioritise the safety of staff and contractors by providing all necessary equipment, training, improving safe working practices, and ensuring that workers are stood down in unsafe conditions. MLL will work to and in accordance with applicable industry standards and codes of practice.	All work is subject to rigorous safety standards with safety given the highest priority for expenditure. The Public Safety Management System (PSMS) documents MLL's procedures for ensuring safety of the public. MLL has circulated its own safety booklet to all staff. All staff are encouraged to stop any work if it is considered unsafe.
Compliance	MLL must comply with many statutory requirements ranging from safety to disclosing information.	MLL will document all safety issues and make them available for inspection by authorised agencies. MLL will disclose performance information in a timely and compliant fashion.	Undertake sufficient monitoring and inspection for maintaining compliance, documented as appropriate.
Energy Efficiency	Consistent with the provisions of the Energy Companies Act 1992 and as a good corporate citizen, MLL endeavours to maximise energy efficiency within its own operations and promote energy efficiency to consumers connected to the network.	MLL will consider losses within its system and minimise where practical. MLL will assist consumers by providing advice and assistance on energy efficiency.	Comparative assessment of network losses and setting of appropriate loss targets. Energy efficiency is an integral component in the consideration of the purchase and design of network assets and operation of the network.

4.3.2 Translation into objective and performance targets

As the higher document, the SCI sets out MLL's primary objectives. The current SCI was published in June 2019 and covers the financial year (FY) ending June 2020. The next three FY performance targets are set out below.

Table 9: Performance targets for the next three years

Type	Objective
Financial	To achieve an overall post-tax rate of return on shareholders' funds of 5.0%, measured by taking net operating surplus after interest and tax, and adding back discounts paid to consumers.
Financial	Cash flow return from investments greater than 6.0% post-tax.
Financial	Pay a dividend to MEPT in line with MLL's dividend policy.
Financial	Pay discounts to consumers of at least $8.4m (excluding GST).
Network reliability	Planned SAIDI (average duration of consumer outages) not to exceed 65 minutes.
Network reliability	Unplanned SAIDI (average duration of consumer outages) not to exceed 80 minutes.
Health & safety	Achieve zero serious harm incidents.
Health & safety	Maintain certification in ISO 45001:2018 Occupational Health and Safety and NZS 7901:2014 Safety Management Systems for Public Safety.
Consumer	Maintain overall consumer satisfaction at above 85%.
Consumer	Provide at least two newsletters to consumers providing financial, energy efficiency and health and safety information.
Environment	Achieve certification in ISO 14001:2015 Environmental management System.

These SCI business targets are integral to this Plan which accordingly sets strategies to achieve them. The performance targets are further detailed and expanded in the performance evaluation and service levels section of this Plan. Note that the increase in this AMP for RY2021 of unplanned SAIDI to 85 minutes is a decision taken since publication of the SCI, and the SCI for the coming year will be updated to reflect that increase (arising from MLL's recent adoption of its 'lines down' safety policy).

4.3.3 Conflicting interests

Most activities result in a need to balance a number of different factors, e.g., quality, cost, time. Finding a balance acceptable to all stakeholders requires that various solutions are carefully considered, and priorities evaluated according to specific circumstances and environment. The general priorities, in order of highest to lowest, for managing conflicting stakeholder expectations and interests are given below:

1. **Safety**: MLL gives top priority to safety. Even if budgets are exceeded or non-compliance arises relative to interruption of supply, MLL will not compromise the safety of its staff, contractors and/or the public. Safety is fundamental to the way MLL undertakes any activity. By way of example, at times of extreme fire risk a complete patrol of a line is undertaken after loss of supply and restoration is delayed at the expense of increased SAIDI minutes.
2. **Compliance:** MLL gives priority to compliance, noting that compliance which is safety-related is given highest priority.
3. **Viability:** MLL gives high priority to viability.
4. **Return:** MLL recognises the need to operate as a successful business and earn a realistic commercial rate of return. This

ensures that funding will be available for future activities and ongoing supply continues to be available to consumers.

5. **Supply Quality:** This is important to consumers to allow them to utilise electricity in a reliable and safe manner. An unreliable supply may drive consumers to consider alternatives to grid supply.
6. **Environment:** As a socially-responsible organisation, MLL respects the environment and ensures that its operations are based on sustainable practices. MLL considers environmental issues in all aspects of its operations and whenever practicable seeks to eliminate or mitigate the impact of MLL operations on the environment.
7. **Energy Efficiency:** MLL considers maximising energy efficiency in all aspects of its operations.
8. **Other:** Other considerations are given lower priority than those listed above.

Aside from safety, the priority given to these issues may vary slightly from that outlined, according to the issue or issues, their respective magnitudes and the affected stakeholders. In practical terms, the general priorities set out above are not mutually exclusive and are factored into the decision process.

4.3.3.1 Consumer service lines

MLL's assets extend to the point of supply, which (in most cases) is the property boundary line crossed by a consumer's service line. This means that the majority of a consumer's service line is owned by the property owner, not MLL.

MLL has observed some privately-owned assets in very poor condition with associated safety and/or reliability of supply risks. Management of these assets is outside MLL's jurisdiction and has therefore been excluded from this AMP.

Where privately-owned assets in poor condition are identified by MLL, the property owner is duly notified of the risk and their obligations as the asset owner.

4.3.4 Accountabilities and responsibilities for asset management

MLL's accountabilities and accountability mechanisms related to asset management are described in section 11.6.

5. Network performance and service levels

This section of the AMP sets out and discusses the relative performance of the network and business against a number of measures including quality of supply, cost performance, network continuance (essentially, the adequacy of replacement levels), and losses and utilisation.

In concert with the assessment of relative performance against other businesses, this section also measures performance against MLL's internal targets for network and consumer satisfaction as notified through its annual SCI, specifically quality of supply, consumer engagement and satisfaction, and performance against other objective targets.

This analysis provides the framework for setting the consumer-oriented performance targets that, together with MLL's wider business goals, this plan then sets out to achieve.

Detail on the comparative assessments and reliability performance analysis is extended and discussed further in Appendix 11.7.

In overview, we show that MLL:

- has satisfactory network reliability given the length of its network and its low consumer density;
- is achieving its targets in consumer engagement and consumer satisfaction;
- has total costs in keeping with the network services it provides;
- has relatively high opex costs driven by high vegetation management cost, which peaked in RY2016 (on a $/km basis) and has lowered subsequently;
- is performing at expectation levels for network losses and transformer utilisation;
- has set capital replacement levels in keeping with good industry practice relative to MLL's asset quantities and age profiles;
- does not have an over-aged network;
- is operating as a profitable business; and
- has elected to lift its target SAIDI from 80 to 85 minutes for the next three regulatory periods to reflect the effects of its safety policy of opening the nearest upstream recloser for any reported line down incident. Although many of these public reports are for LV lines or telecom lines down, this revised policy reflects MLL's commitment to placing safety as its first priority.

The comparative performance discussed in the following sections sets MLL's performance against the 28 other Electricity Distribution Businesses (EDBs) within New Zealand using the RY2019 public information disclosure data as provided to the Commerce Commission.

The comparative SAIDI statistics for all networks to 31 March 2019 illustrate that the MLL network was the 11th most reliable in New Zealand (refer to Figure 14).

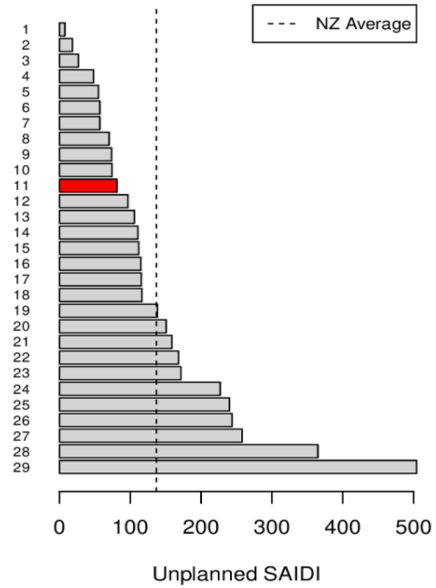


Figure 14: NZ lines companies 2018/2019 SAIDI comparison

5.1 Quality of supply

5.1.1 SAIFI/CAIDI comparative performance

The average duration of non-supply per consumer per annum (SAIDI) [8] is the key measure of the "average" consumer's experience of supply reliability. SAIDI is derived from the multiplication of the average number of interruptions per consumer (SAIFI) and the average duration of an interruption (CAIDI). Comparative performances of both measures are examined separately within this section although emphasis is placed on SAIFI as a more informative measure for asset management purposes.

5.1.1.1 Comparative SAIFI

For comparison purposes, SAIFI has been further divided between planned and unplanned (fault) SAIFI in the extended comparative analysis presented in Appendix 11.7.

This comparative analysis shows that MLL's planned SAIFI plots close to the mean expectation indicating its comparative performance in both number and impact of planned outages is, on a comparative basis, reasonable.

Unplanned (fault) SAIFI is also analysed through a regression analysis, as discussed in Appendix 11.7, on the basis of the scale of the Network exposure to faults. This shows MLL fault SAIFI plotting under the expectation line even for RY2014 and RY2017, which were particularly onerous years for storms and unavoidable events (i.e., the Seddon and Kaikoura earthquakes).

Taking RY2019 as a more representative year for unplanned SAIFI, MLL performs well being approximately 0.5 average interruptions per consumer below comparative expectation. This translates to a community value of approximately $0.9m per annum in avoided power losses.[9]

[8] SAIDI = System Averaged Interruption Duration Index expressed in minutes per consumer; SAIFI = System Averaged Interruption Frequency Index measured in interruptions per consumer; CAIDI = Customer Averaged Interruption Duration Index measured in minutes per interruption. SAIDI = SAIFI x CAIDI.

[9] This calculation assumes average CAIDI of 120 minutes per interruption; a loss per connection of 1.5 kW; 26,000 network consumers; and a value of lost load of $25/kWh as used in the Electricity Authority modelling after adjusting for shifts in CPI.

The trend in overall (planned + unplanned) SAIFI is also downward for MLL compared to a relatively flat trend for all distribution businesses combined, as illustrated in Figure 15 (MLL=red line; includes the effect of the 2017 Kaikoura earthquake). This, together with the comparatively low unplanned interruption frequency, shows the MLL network is responding to reliability improvement strategies.

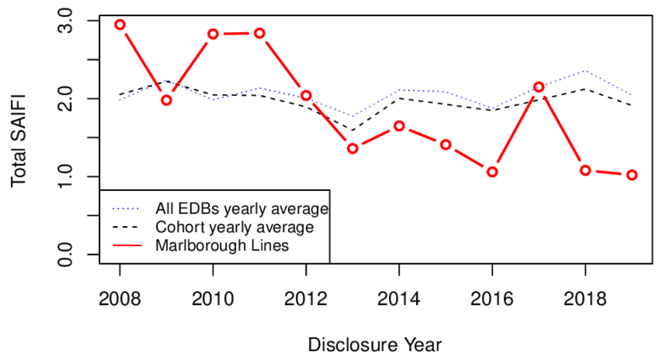


Figure 15: MLL's SAIFI trend

5.1.1.2 Comparative CAIDI

CAIDI measures the average duration of the interruptions and is generally highly variable between years, particularly when the total number of interruptions is not large, as is the case for smaller distribution businesses like MLL. CAIDI is also affected by the types of faults occurring as some faults are more difficult to locate and repair (i.e, underground cable faults) and the difficulty of getting to the fault location (i.e, remote faults in the Marlborough Sounds). Multiple faults occurring simultaneously (i.e, storms) also impact CAIDI as fault restoration has to then be prioritised over the available fault crews.

The comparative analysis described in Appendix 11.7 shows that MLL's CAIDI fits within the typical distribution of CAIDI times experienced by other distribution businesses. MLL's CAIDI might also be expected to be larger on average than other businesses that do not also have a significant proportion of remote lines within their networks.

MLL sets a fault CAIDI target of 120 minutes, which is generally achieved in years without major storms or system events (e.g., earthquakes). This target is therefore retained for this planning period given it remains a stretch target and is at a reasonable level for a network with MLL's characteristics.

5.1.1.3 SAIDI performance vs. internal targets

As MLL is a Trust-owned lines business, it does not fall under the Commerce Commission's quality path requirements for supply reliability. However, to meet its consumers' expectations for reliability and to manage the business based on measured performance, MLL sets internal business targets including for network SAIDI (which then define the internal SAIFI and CAIDI targets to meet this). Figure 16 shows the planned and fault SAIDI recorded against the internal business targets from RY2013, with targets extending out to RY2020.

As shown, targets in both planned and fault SAIDI have decreased over time to reflect both consumers expectations and the desire to lock in periodic performance improvements. Further reductions in reliability targets are dependent on identifying and implementing improvement projects that meet economic tests of prudence and efficiency or if MLL has clear signals from the community identifying a higher service level requirement.

Forecast SAIDI for RY2020 is projected (at time of writing) to be 57 minutes planned and 120 minutes unplanned. The lift in unplanned

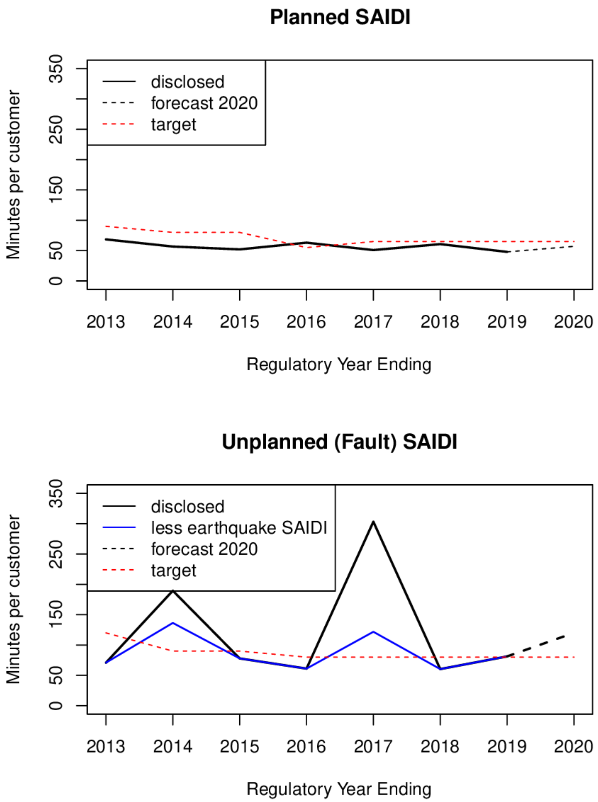


Figure 16: MLL's planned and unplanned SAIDI vs target values

RY2020 SAIDI arises from a number of events but was heavily affected by a single lightning storm in December that contributed 23 minutes alone with its impact accentuated by stand-down requirements under lightning conditions and the time to reach sites in the Marlborough Sounds area.

As shown, MLL is achieving the current targets in average across the years (omitting extreme events and noting RY2017 included a number of storm events as well as the 14 November 2016 Kaikoura earthquake) and as such these remain stretch targets. These targets also represent better than expectation performance on a comparative basis.

However, MLL's recent policy (introduced in 2019) of opening the nearest upstream switch to isolate supply upon any public report of a line down has had the effect of increasing unplanned SAIDI by approximately five SAIDI minutes in the current year. In many cases the public report is resolved to be a LV or telecommunications line down. However, as safety is MLL's first priority and the public safety implications of a line down are potentially high, MLL's view is that this loss of reliability has to be suffered.

To reflect the SAIDI increase, MLL has elected to increase its unplanned SAIDI target on a pro-rata basis – that is, by five SAIDI minutes to 85 minutes – for the RY2021 to RY2023 years. MLL is forecasting the SAIDI target to return to 80 minutes for the remainder of the projection (to RY2025) as the Network responds to the works program being undertaken and as processes are developed to reduce the impact of the feeder disconnection safety policy.

MLL's RY2019 performance, RY2020 projection and forward SAIDI targets to RY2025 are set out in Table 10:

Table 10: MLL's SAIDI targets

Measure	RY2019	RY2020 Projection	Target RY2021 to RY2023	Target RY2024 to RY2025
Planned SAIDI	47.9	57	<=65	<=65
Unplanned SAIDI	81.1	120	<=85	<=80
Total SAIDI	129.0	177	<=150	<=145

5.1.2 Outage durations compared to service level targets

MLL sets internal targets for supply restoration differentially based on four fault location areas within the network. This is due to a combination of both the importance of fast restoration when large numbers of consumers are involved (viz higher density urban areas) and the practicality of restoring service across the different parts of the network away from its base in Blenheim. MLL therefore internally defines four areas for its network with fault restoration target times as follows:

- Blenheim Urban 1.0 hours
- Urban Other 1.5 hours
- Rural 4.0 hours
- Rural/Remote 8.0 hours

The "box-and-whisker" chart of Figure 17 illustrates MLL's performance in fault restoration times against these internal targets for the RY2019 year. The fault restoration times for each fault plot on the x-axis. Rather than plot each fault restoration time, in this chart the boxes represent the bounds for 50% of the restoration times spanning from the 25th to the 75th percentile points and the whiskers are a measure of the spread beyond that. The box centre bar represents the median restoration time and the red bars identify the MLL restoration time targets. Faults plotting outside the whiskers (outliers) are shown as individual circles. The number of faults in each area is also noted on the chart.

Whilst the majority of faults are restored within the target times, these targets remain stretch targets. Also, whilst the worst performance against target is recorded against the Blenheim Urban area, this is also the most aggressive target and the total number of faults in this urban area is low compared to the other groups.

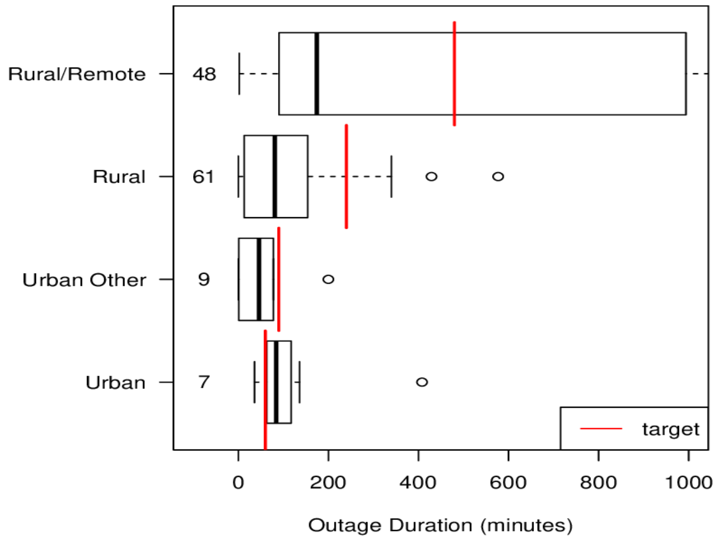


Figure 17: MLL's fault restoration times vs target values

As the restoration time targets remain stretch targets, these targets are retained for the current planning period.

5.1.3 Fault causes and response

Appendix 11.7 examines the total consumer minutes lost to 11kV faults by fault cause over the period RY2015 to RY2019 (five years) together with the average number of incidents per annum. This directs attention to the following:

- The major fault cause on the network is now failure of line components from a variety of causes followed by the effects of extreme wind and weather.

- Most vegetation-related faults occur from vegetation outside the legal growth limit cutting zones indicating that MLL's vegetation management on the network is working.
- Whilst conductor failure is rare and the reliability impact small, it is nevertheless an issue requiring active management due to the potential for public hazard and liability risk arising from such failures.

Further detail on the performance of the network in both planned and unplanned reliability is provided in Appendix 11.7, which shows:

- marked improvement in performance over the last 10 years (comparing RY2009 to RY2019);
- that this improvement has largely been in the Urban and Rural areas; and
- that SAIFI is now believed to be trending up (deteriorating) in the remote sections of MLL's network.

From this analysis, MLL makes the following conclusions:

- MLL needs to maintain similar levels of vegetation management expenditure if it is to retain its reliability performance at or under the current targets;
- there must be continued focus on potential asset deterioration, particularly in the remote parts of the network; and
- conductor replacement needs to be addressed to remove conductor from the network which is showing deterioration or is likely to be in a weakened state in order that MLL minimises the risk of potential conductor failures.

5.1.4 Voltage complaints

MLL records approximately six voltage complaints per annum, mostly in the rural network and usually associated to irrigation pumping loads. These are treated on a case-by-case basis, often being rectified through simply increasing the voltage tap of the associated distribution transformer. Few voltage complaints are recorded in the urban parts of the network.

Low voltage and other forms of voltage disturbance (e.g., flicker) are rare on the network and so no specific target or strategy is applied other than the usual consideration of voltage regulation that is routinely applied in network design and upgrade.

5.2 Consumer responsiveness

MLL commissions an independent annual consumer satisfaction survey through random sampling of its consumer base in a telephone survey of 200 domestic consumers and 30 business managers. The purpose of this survey is to gauge the general consumer's reaction to MLL's performance during the year, including network reliability, quality, consumer discounts, community sponsorship, information dissemination and company management.

MLL targets an 85% consumer approval rating for weighted overall performance[10].

The July 2019 survey reported an error of +/-3.5% at the 95% confidence level and showed that 85% of consumers were satisfied/very satisfied in

[10] The survey questions are all on a 5-category scale of satisfaction; a weighted average methodology is applied where a weighting of 0% is applied for very dissatisfied, 25% for somewhat dissatisfied, 50% for neutral, 75% for somewhat satisfied and 100% for very satisfied. Achieving a 85% weighted score requires a large proportion of respondents to score in the very satisfied category.

the weighted overall performance representing an decrease of 3% on the previous year, all as charted in Figure 18.

Approval ratings were down over most categories although only marginally so in the key areas of reliability, faults, faults duration and faults service. Larger drops affecting the overall rating were in satisfaction with Directors and Management. Overall performance satisfaction remains relatively stable, as shown in Figure 18.

In the key network measure of reliability, MLL's consumers scored 95% satisfaction. This provides a clear indicator that MLL's customers approve of MLL's current level of reliability, which is driven off the business's reliability targets.

MLL will continue to strive to achieve consumer satisfaction at >85% over future years. Although this figure is exposed to the inaccuracies of a relatively small sample size and the imprecision of human judgement, MLL believes that a strong focus on maintaining network reliability should continue to drive consumer satisfaction coupled with the standards of MLL's service.

5.3 Cost performance

This section looks at the comparative costs of MLL, to the extent that networks in different circumstances may be compared, and also examines the expenditure performance against forecast for the current (RY2020) year as promoted in the last interim AMP (published in March 2019).

5.3.1 Comparative cost performance

Network businesses may be broadly compared on cost as long as the limitations of such comparisons are recognised. In MLL's case, it has an extensive remote area to manage in the Marlborough Sounds, sometimes requiring helicopter access and/or long hours of travel for staff, thereby increasing its costs.

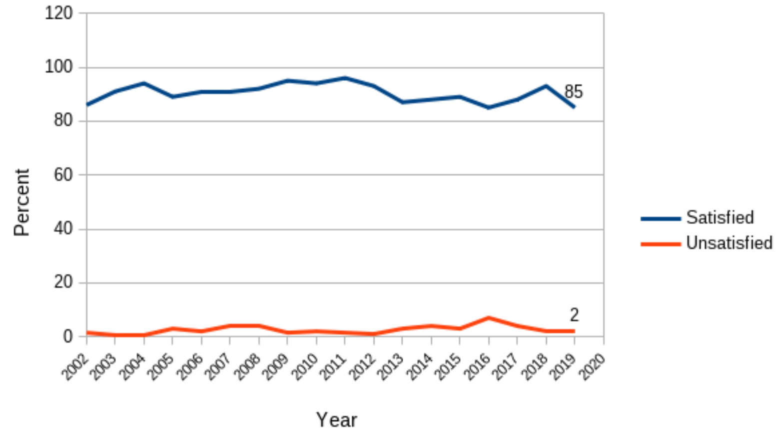


Figure 18: Consumer satisfaction survey results

5.3.1.1 Total cost

The comparison of the relative costs of EDBs needs careful consideration. By way of example, comparison needs to take into account network age, condition, environment, level of reliability and the reasonableness of capital and maintenance expenditure. Postponement of prudent capital and maintenance expenditure is not a measure of efficiency but is instead deferment of a likely greater cost to a future date.

Appendix 11.7 discusses and compares EDBs on the basis of net revenue (income less pass-through costs) against the network services provided (line kms, transformation capacity, number of ICPs managed, etc). Whilst being an approximate measure of relative productivity, this shows MLL plotting close to the mean line indicating that MLL's total revenue is broadly in keeping, on a comparative basis, with the network services it provides to its consumers.

5.3.1.2 Direct opex

Direct opex is that proportion of operational expenditure spent directly on network assets (as opposed to expenditure operating the network and associated business support costs). Comparative performance of direct opex is discussed Appendix 11.7. This shows MLL's direct opex is relatively high, although still within the confidence bounds of the regression model

Closer examination of the direct opex make-up reveals MLL's high vegetation management costs largely account for the opex variance in this comparison. High per-km vegetation management costs are an issue for MLL with some parts of the Marlborough Sounds network only accessible by boat, helicopter and/or on foot. However, the community value created by the improved reliability (approximately $0.9m) offsets these costs when considered more broadly.

5.3.1.3 Indirect opex

Indirect opex is that portion of operational expenditure accounted to the operation of the network (i.e, switching and system control, etc.) and to the support functions associated with running a network business. Comparison of MLL's indirect opex in relation to other distribution businesses shows MLL plot close to the regression expectation when using normalisers of both number of consumers serviced and regulatory asset base value. This indicates that expenditure in this category is at appropriate levels when assessed on a comparative basis.

5.3.2 Expenditure vs. budget

Projected expenditure (based on regulatory year to December 2019 extrapolating through to 31 March 2020) is set out in Table 11 and is compared to the expenditure projected in the AMP update prepared for the RY2020 year.

Table 11: Summary of RY2020 expenditure vs forecast (constant RY20 $)

Item	Projected for RY2020 ($000)	Budget for RY2020 ($000)	Variance as % of forecast
Capex: Consumer Connection	78	101	-23%
Capex: System Growth	711	101	604%
Capex: Reliability, Safety and Environment	2,258	1,674	35%
Capex: Asset Replacement and Renewal	6,727	8,111	-17%
Capex: Asset Relocations	182	254	-28%
Subtotal - Capex on network assets	**9,956**	**10,241**	-3%
Opex: Service interruptions and emergencies	1,202	1,015	18%
Opex: Vegetation management	2,239	2,029	10%
Opex: Routine and corrective maintenance and inspection	3,706	2,841	30%
Opex: Asset replacement and renewal	310	710	-56%
Subtotal - Opex on network assets	**7,457**	**6,595**	**13%**
Total direct expenditure on distribution network	**17,413**	**16,836**	**3%**

This shows an overall outcome of a 3.4% over expenditure comprising 2.8% under-expenditure on network capital and a 13.1% over-expenditure on direct opex. Reasons for the more significant expenditure variance against forecast in Table 11 include:

- Reclassification of primary driver categories for some works;
- Higher than expected customer related development projects relating in increased system growth related expenditure (noting that this could also be considered consumer connection related expenditure); and
- Increase in asset inspections and condition assessment related works resulting in an uplift of routine and corrective maintenance and inspection expenditure from that forecast.

5.4 Network continuance

To provide a safe and reliable electricity lines service, the network must be managed such that its condition is not allowed to run down. General assessments on whether the network is being properly managed in this regard may be seen in:

- the distribution of Asset Health Indicators (AHIs) applicable to each asset category;
- the expected lives and the consumption of those lives in the regulatory accounts;
- the age profiles in relation to the average industry age profiles; and
- the replacement capital forecast in relation to an age-based model forecast.

Asset Health Indicators are measures of asset health based on a set of criteria developed for a number of network asset categories. MLL has adopted the AHI criteria developed by the NZ Electricity Engineers Association (EEA). AHI charts are provided in the fleet management section of this AMP and in Schedule 12A in Appendix 11.2. These show no issues of concern, with the majority of the network showing health indicators commensurate with the asset ages and their expected lives.

Other measures of network continuance are discussed within this section and demonstrate that, in overview, MLL does not have an over-aged network, has an expectation for lives of its network assets in keeping with general industry practice and the level of replacement expenditure is broadly in keeping with the capital that would be spent by an average distribution business given the number, type and ages of MLL's assets.

5.4.1 Expected lives and comparative age profiles

The chart of Figure 19 describes the spread of cost-weighted depreciation-based lives (in years) amongst the different EDBs; that is the average accounting-based life expected for these asset classes.

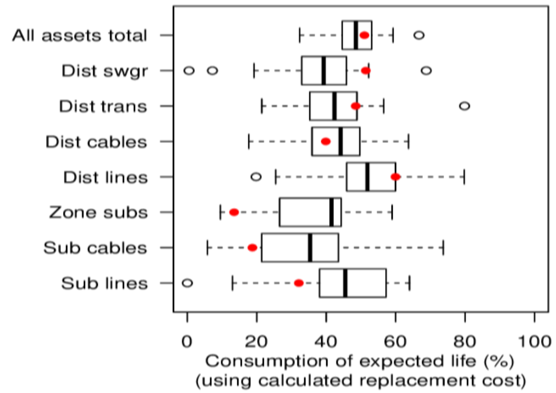


Figure 19: Consumption of asset lives

Figure 20 describes the spread of the percentage consumption of those lives.[11] MLL's expected life and percentage consumption of that life is represented by the red dot points in the charts. MLL shows mostly within the +/- 50 percentile boxes for expected lives indicating that MLL intends to achieve the asset lives commonly anticipated within the industry. In the comparison of consumption of life, MLL is at or below 50% consumed life (against its own life expectation) apart from distribution lines, which are becoming marginally over-aged in average.

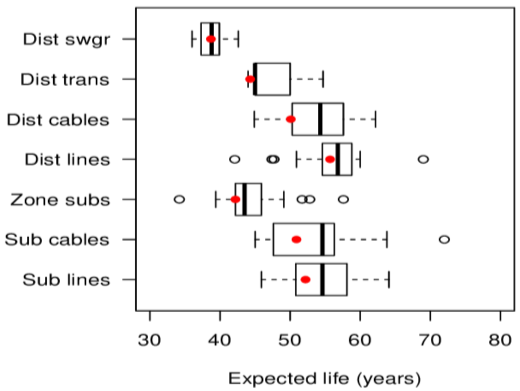


Figure 20: Comparison of expected asset lives

Further age information is depicted in the charts of Figure 21 (concrete poles) and Figure 22 (wood poles) which

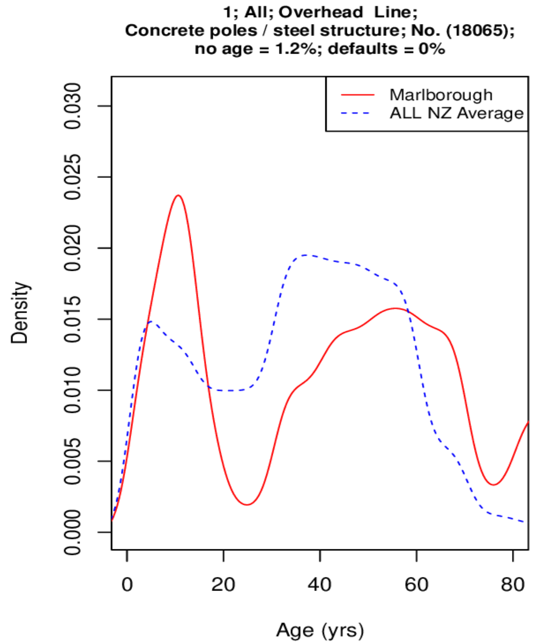


Figure 21: Comparison of MLL concrete and steel poles vs New Zealand EDBs average

show the disclosed age profiles for MLL's poles (red lines) in comparison to the New Zealand EDB's combined age profiles (blue dash lines).[12]

MLL's concrete poles show a proportion of the population in excess of the NZ average age profile and indeed MLL does have a significant number of reinforced concrete poles approaching 90 years of age (as described later

[11] We have used a calculation of life consumed based on the component depreciation and its depreciated life as there are issues with the regulatory disclosure values in their calculation. These are box-and-whisker charts; the boxes represent the 25th to 75th percentile bounds; the whiskers either the maximum or 1.5 x the inter-quartile length; and the chart circles the outlier points beyond that. Data is from RY2019 Information Disclosure Schedules.

[12] Age in years is on the x-axis and age distribution density on the y-axis. Density is used as the charts show the relative proportionality of asset quantities by age between MLL and all NZ EDBs summed together.

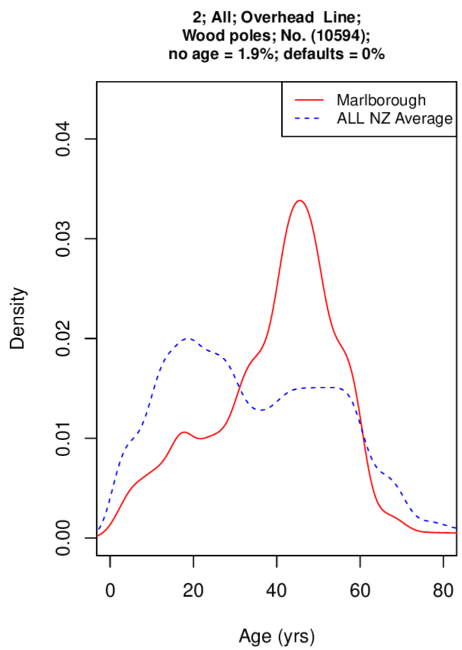


Figure 22: Comparison of MLL wood poles vs New Zealand EDBs average

in the fleet strategy section). However, these poles are typically in reasonable condition and the final life expectation of concrete poles (pre-stressed pole in particular) is not yet determined as even the NZ average age profile continues to advance in age almost year-for year. In MLL's case, replacement of many of these older concrete poles will be co-incident with conductor replacements due to the increased conductor weight and the reconstructed line design code requirements.

Whilst MLL does not have a large population of very old wood poles, its wood pole age profile is becoming weighted above 40 years. Wood poles in particular are considered to have increasing condition deterioration between 40 years and 60 years of age. MLL is therefore preparing for

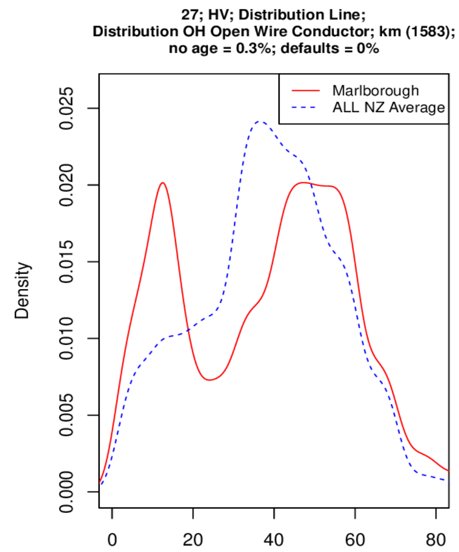


Figure 23: MLL vs all NZ EDBs HV conductor age profile

increasing wood pole replacements on its network and the strategic enhancement of its condition inspection processes, described later in this plan, is part of that forward thinking together with the budgetary preparation for these works provided within MLL's replacement capital forecasts.

Further analysis of the individual asset age profiles for MLL's assets in relation to the all-NZ average age profiles for the same asset classes reveals no evidence of a substantive "backlog" of over-age assets on the network, all as further detailed in Appendix 11.8[13]

Of note, however, is the HV conductor age profile which now exceeds the boundary of the NZ average age profile for HV distribution conductor and where further aging will lead to an age profile "overhang" under this comparative measure.

This is illustrated in Figure 23 with the red plotted line being the MLL HV conductor age profile and the blue dash line being the all New Zealand age profile for this asset class. MLL has recently commenced a programme of progressive conductor replacements of its older and at-risk conductor types such as galvanised steel and light copper based mainly on the risk assessments it has undertaken. However, this strategy is also supported in principle by this comparative age assessment as it shows MLL's conductor replacement programme commencement is neither too early nor too late in relation to the experiences of other businesses.

Whilst age is a useful proxy, network components needs prudent assessment relative to condition, location and importance, and not age alone.

5.4.2 Replacement levels

MLL's replacement capital forecasts are also supported by a "top-down" (repex) modelling based on the Hyland McQueen Ltd comparative benchmarking review of electricity distribution businesses for RY2019 using Disclosure data. The model applied considered the replacement probabilities with age of network assets under 51 categories and is determined using the combined age profiles of asset classes over all distribution businesses in New Zealand and how those age profiles shift in time. When applied to each business separately, the model indicates, in broad terms, the expected renewal and replacement capex forecast of the "average" New Zealand network business in the circumstances of the asset numbers and asset ages of the particular business.

When applied to MLL, the model agreement in total is reasonable, as shown in Figure 24, indicating MLL's forecasts for replacement expenditure (blue line) is not unreasonable in comparison to what other businesses might spend in its particular circumstances (black solid line). The gradually rising model line is indicative that MLL should anticipate

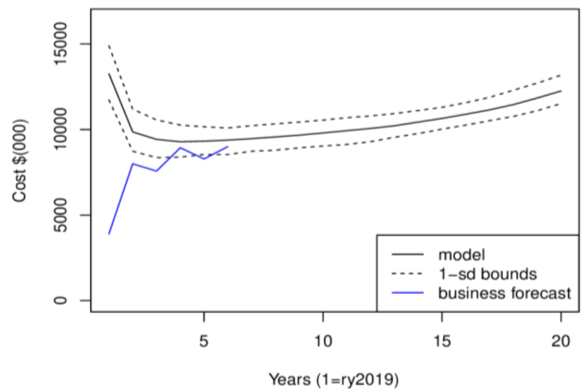


Figure 24: MLL replacement expenditure – model and forecast

[13] Note that whilst the LV conductor age profile plotted in the Appendix appears overhung, approximately 65% of this conductor has no allocated age (unknown installation dates), and the model algorithm spreads this group over the older age bins (on the rationale that if it was newer, the ages would be known). This inevitably leads to error where the proportion of the total asset with unknown ages is large. The same applies to assets noted as having default dates but to a lesser extent as the allocated ages are likely to be better approximated. Uncertainty in the ages of LV assets is an issue across the majority of New Zealand EDBs.

similar to higher levels of replacement expenditure into the future to arrest its network ageing.

5.5 Utilisation and losses

5.5.1 Network losses

MLL has the objective of pursuing the efficient use of energy and its delivery over its network. Comparative network losses for all EDBs from RY2013 to RY2019 are examined in Appendix 11.7, section 11.7.4. This shows MLL plots slightly below the network losses expectation given its circuit length and energy through-put. This analysis reveals no concern in terms of MLL's network conductor sizing and circuit loading arrangements as it affects line losses as, in general terms, the losses derived for the MLL network are consistent with those expected for a network of this kind, i.e, a predominantly radial network supplied from a single point of supply and with inherently fewer consumers per km than in a purely urban area.

MLL's RY2019 line losses are approximately 5%. This is relatively consistent from year to year. In this plan, the target of 5% is set for the current planning period.

5.5.2 Capacity of utilisation

Appendix 11.7, section 11.7.4.2 describes a comparative assessment of transformer utilisation (measured as the ratio of system maximum demand to the installed distribution transformer capacity) against a scale measure of energy density for each compared EDB. In this assessment, MLL plots close to the regression expectation indicating that, within the limitations of this performance measure, MLL's design practices for transformer sizing and loading appear reasonable.

MLL's Capacity of Utilisation (CoU) has declined over recent years and is expected to decline further in the coming years. This is due to the continued take up of energy efficient appliances, distributed generation and continued growth of electricity connections that do not typically contribute to maximum network demand within the Marlborough region. For example, baches in the Marlborough Sounds, wineries and irrigation all require transformer capacity, but these loads make little or no contribution to maximum demand set during winter months, thereby reducing capacity utilisation. However, as discussed above, the capacity of utilisation plots close to the expectation line in comparison to other distribution companies when scaled against network energy density, particularly after adjustment for non-standard loads. The current target of 21% for transformer utilisation is therefore retained in this plan.

Overall, the utilisation of transformer capacity cannot be regarded as a primary indicator of network performance given the location and number of transformers on a network are largely a function of ICP location, physics of supply and consumer utilisation of connected capacity and are therefore out of the control of the business.

5.5.3 Load factor

Load factor is a measure of the constancy of the load as it measures the average load in relation to the peak load principally set by consumer demand and not by MLL. Load factor can be influenced by the manner in which load control, primarily hot water cylinders, is used to limit peak demand. Currently, Transpower charges are based on the maximum demand on the Blenheim GXP at the time of maximum total demand of the upper South Island. This means that, at other times, there is no financial incentive to cut hot water supply to houses. The result of this is to not limit maximum demand through load shedding during high load periods within Marlborough that are not coincident with upper South Island maximum demand. This benefits consumers as service is improved.

In the current circumstances, load factor is largely irrelevant as a performance measure and is no longer targeted or tracked.

5.6 Objective commitments

Through its SCI, MLL also sets other objective targets for its network business including:

- consumer engagement;
- ISO re-accreditations/audits;
- compliance with regulatory requirements; and
- return to shareholders.

The performance against these objectives is included in the MLL annual reports published against an accounting year ending 30 June and is available on the MLL website.

5.7 Business continuance

MLL seeks to provide a commercial return to its shareholder, the Marlborough Electric Power Trust. Figure 25 identifies the comparative rate of return[14] to New Zealand EDBs where MLL's performance is highlighted both as disclosed (MLL) and after accounting adjustment (MLL adj) where the rebated consumer discount is added back for comparative purposes with investor-owned companies and Trust-owned companies that have operated with discretionary rather than a discount, which is integral to MLL's pricing.

As shown, in the more comparative (adjusted) assessment, MLL's return on investment is modest but in keeping with other businesses.

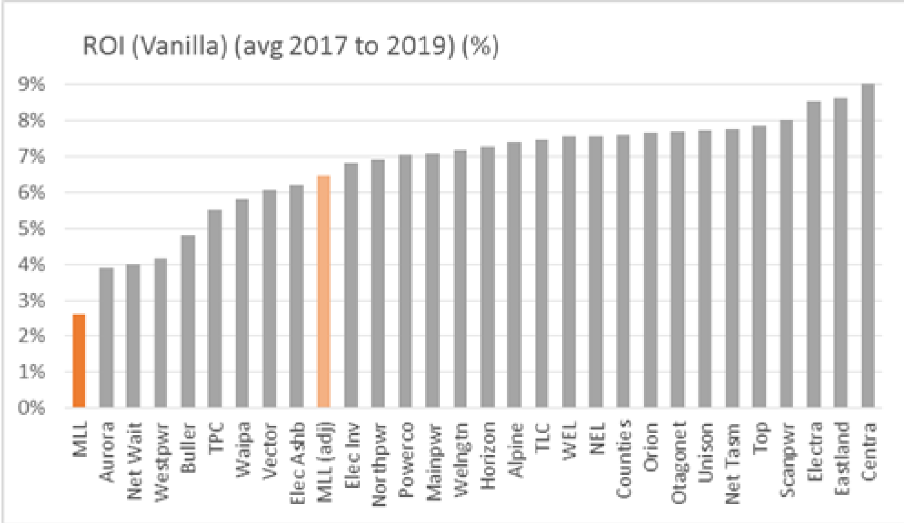


Figure 25: MLL's comparative rate of return

In addition to actual return, this measure also reflects the level of available investment. Hence, in any comparison it is important to consider previous levels of expenditure, the condition of the network, which will also determine future expenditure, and is likely to impact on network performance.

[14] The rate of return has been adjusted from the regulatory disclosure to correct differences in the manner in which discounts to consumers are treated such that the rate of return may be compared on an equivalent basis with other businesses.

5.8 Performance summary and response

The service level targets that MLL has described and set within this Plan have been derived from a combination of consumer engagement, comparative assessment and a commitment to continuous improvement recognising the practical limits of a mostly radial network covering a mix of urban, rural and remote areas.

Consumer engagement arises from planned periodic focus group engagement, particularly with key stakeholders, and through annual satisfaction surveys on the consumer base. Whilst the latter cannot, by its nature, provide specific direction, it does support the network reliability and faults response that is being achieved driven through the internal performance targets that have been set.

Comparative assessment shows the network is achieving above expectation reliability while managing costs within expectation levels and that the network is not over-aged and will not become so provided MLL manages its asset fleets through condition inspection and targeted replacement and through executing the renewal works set out in this plan.

System losses and the capacity of utilisation are of less interest to consumers than reliability although they ultimately impact on the cost of supply. To a large extent, these performance measures are a direct consequence of design standards and previous decisions on system configuration. Comparative assessment shows these measures to be consistent with expectations given the characteristics of MLL's network.

This performance analysis reveals the following key directives:

1. To achieve its reliability targets, MLL needs to keep up with its vegetation management programme as this has a significant impact on faults. Vegetation management costs are on a slightly decreasing path as second-cut costs begin to fall on tree owners. But this expectation needs to be tempered with the consideration that the second-cut provisions of the Tree Regulations, only apply to specific trees that have been cut and not properties visited. Because of the limitations of the Tree Regulations a network company is only mandated to cut or trim a tree when it is within the prescribed growth limit zone.

2. MLL is entering a period requiring increasing replacement of aging assets, in particular wood poles and conductor.

3. Whilst reliability has been improving overall, and in urban areas in particular, MLL can expect a decreasing reliability trend in the remote parts of the network driven by a potentially increasing fault count if assets are allowed to deteriorate. Aside from the economic issues of being forced to rebuild this uneconomic part of the network, proper targeting of renewal will require a greater focus on inspection and condition assessment as described later in this plan.

4. Given the expected deterioration of the remote areas of the network and the renewal investment that would trigger, MLL must consider alternative supply options against what would be otherwise an uneconomic reinvestment in network infrastructure.

5. No change in strategy is indicated as being necessary to achieve other performance targets such as line losses etc.

6. Asset management strategy

This section sets out the underpinning strategies that MLL will employ to realise the asset management objectives it has set and the performance targets it endeavours to meet.

6.1 Overarching asset strategy

6.1.1 Asset management policy

MLL will:

- always regard safety as the highest priority;
- define its supply quality targets principally by consulting its respective consumer classes, but also by considering other strategic, comparative, economic and regulatory drivers (as addressed in the preceding sections of this plan);
- achieve supply quality targets by maintaining existing assets and building new assets in accordance with MLL's design and construction standards, prevailing engineering standards and best applicable industry practice;
- build and maintain its network and assets to minimise lifecycle costs, recognising that its owners are representative of its consumers; and
- seek to continuously improve its asset management practices to a level that is appropriate and where priority will be given to strengthening the practices and skills which result in greatest benefit for stakeholders; and
- ensure that the capacity of the network is sufficient to meet the expectations of its consumers.

6.1.2 Service levels

MLL will:

- provide a safe environment for the public and staff through efficient and effective management of its network;
- continue meeting the service levels described in the performance analysis and service levels section of this plan;
- meet the minimum of statutory levels or agreed terms for supply voltage;
- follow its security of supply standards unless the required investment levels are inconsistent with good engineering practice and/or commercial criteria;
- endeavour to limit flicker to levels specified by AS/NZS 61000.3.7:2001, by educating and encouraging consumers to comply with this standard;
- endeavour to limit harmonics to levels specified in ECP 36:1993 and AS/NZS 61000.3.2:2013 by educating and encouraging consumers to comply with these standards;
- target an overall power factor of greater than or equal to 0.95 lagging at times of high load on the network and require that all ICPs meet this requirement;
- facilitate connection of embedded generation where it does not compromise safety, network operation, quality of supply to other consumers, or power factor. MLL may require an embedded generator to pay the economic costs of connection, including reactive power compensation, where these costs are consistent with Part 6 of the Electricity Industry Participation Code;
- interrupt supply to domestic consumers before interrupting supply to hospitals, industrial and commercial consumers for purposes of emergency demand management; and

- encourage and facilitate energy efficiency.

6.1.3 Asset configuration

MLL will:

- work with Transpower to minimise its fixed asset requirements commensurate with providing a reliable and secure supply to consumers;
- take a long-term view of asset requirements;
- build all future sub-transmission lines insulated to at least 66kV;
- ensure that, where possible, land purchases for new zone substations provide sufficient land to allow additional future transformer capacity to be installed;
- build all future rural distribution lines at 22kV;
- consider non-network solutions including demand-side management and distributed generation;
- use fixed generators on long radical feeders such as the those supplying the Marlborough Sounds to improve reliability of supply;
- seek opportunities to improve the network meshing for security and reliability where it is both feasible and economic to do so; and
- use mobile generators where feasible and economic to improve reliability and reduce the effects of faults and planned work on consumer's supply.

6.1.4 Resourcing

MLL will:

- identify the required skill sets on a timeframe equal to this AMP and ensure that recruitment and training plans are consistent with its needs and, where appropriate, use relevant contractors;
- endeavour to procure resources locally, where and when appropriate;
- retain its current field services staff for fault restoration, inspections, maintenance and renewal work; and
- use contractors/consultants where its staff do not have the required skill sets, where resources are inadequate for its works programmes or where it is more cost effective to do so, e.g., specialist work such as civil engineering design and radio equipment installation and maintenance.

6.1.5 Materials

MLL will:

- make safety the primary consideration in all purchases;
- only use, or allow onto its network, materials and equipment which meet recognised industry standards approved by its own internal standards and policies;
- endeavour to procure materials locally, where and when appropriate relative to cost and other considerations;
- consider the total lifecycle costs of network components when assessing offers;
- recycle materials where practical, taking into account the total lifecycle costs and overall risk;
- purchase timber products such as cross-arms and poles from sustainable and renewable resources; and
- consider all environmental impacts in the purchase and utilisation of all items in its operations.

6.1.6 Risk

MLL will:

- adopt a risk-averse position, especially with regard to worker and public safety;
- regularly review its risk position using the prevailing standard ISO 31000:2009; and

- err on the side of over-investment in network capacity, recognising that under-investment can lead to supply interruption and that the overall economic cost suffered by consumers can be markedly greater than the cost of prudent investment taken before it is required. Within the network industry, waiting until the demand exists is too late.

6.2 Systems and information management

6.2.1 Business management processes and standards

MLL recognises the importance of adopting best practice in its business management practices to undertake its work safely, efficiently and to achieve its objectives. It also recognises it is important to provide confidence and transparency to its stakeholders that its various management practices are consistent with required standards and best practice.

To this end, MLL has sought and achieved certification for the following management systems:

- Quality – ISO 9001:2015;
- Environmental – ISO 14001:2015;
- Occupational Health and Safety – ISO 45001:2018; and
- Public Safety – NZS 7901:2008 (legislative requirement), and NZS 7901:2014 (best practice).

Certificaiton with ISO 9001 Quality Management System indicates that MLL's procedures and work practices meet with recognised industry best practice. Compliance with the system's procedures is integral to MLL's operations and, as such, regular audits (both internal and external) are completed.

Through ISO 14001:2015 Environmental Management System, seeks to minimise impacts and manage adverse effects of MLL's activities upon the natural and built environment as well as the local community. MLL's operation have documented environmental policies and all staff are required to undertake work in accordance with these policies.

Where appropriate, consultation will be undertaken to assist in obtain an amicable outcome for MLL and affected parties.

In demonstrating its commitment to health and safety, MLL was one of the first New Zealand companies to achieve OHSAS 18001:2007 certification and also ISO 45001:2018.

NZS 7901:2014 - Safety Management Systems for Public Safety, is designed for organisations to develop a safety management system that operates to safeguard the public (including property) from safety-related risks arising from the presence or operations of MLL's assets. Accreditation to this standard also enables MLL to be exempt from some prescriptive requirements within the Electricity (Safety) Regulations in favour of its own risk-managed practices.

- ISO 45001:2018 - Occupational Health and Safety Management Systems. This System is designed to help organisation improve employee safety, reduce workplace risk and create better and safer working conditions.

During the planning period, MLL intends to remain certified with the above standards and to obtain certification to the following standard:

- ISO 55001 - Asset Management. This standard is a framework for an asset management system to help organisations proactively manage (including associated risks and costs) the lifecycle of assets from acquisition to decommissioning.

Expenditure associated with obtaining certification to ISO 55001, and ensuring that existing accreditations are maintained is included under the system operations and network support budget.

6.2.2 Information systems

Information systems are key to the performance of almost all modern organisations and therefore need to be planned and managed. MLL has a suite of information systems which have all been configured and developed for its needs. The systems are primarily used to house and manage asset data and are then used to drive many of the network activities. Table 12 highlights MLL’s key systems, their roles within the organisation, some of the more significant data that they hold and how these systems integrate together.

Table 12: Overview of Asset Management Information Systems

System Name	Description	Functionality/Usage	Integration
Infor's EAM	Asset and works management system.	Project and work order records including preventative maintenance programmes. MLL's primary database for electrical and non-electrical assets, and work orders management used for analysis and reporting.	Data sharing between ArcGIS and EAM to ensure consistency in asset information. Integration between Estimator and Daybook for project/work order records.
Milsoft	The Milsoft suite of products primarily allows management of electrical outages (duration, consumers affected etc.).	Electrical connectivity model – capacity and load calculations, electrical network analysis. Outage management – recording and reporting of service interruptions and duration. Ability to log consumer calls.	Integrated with ArcGIS (spatial model and selected assets).
ESRI's ArcGIS	Primary resource for managing spatial information of assets.	Spatial information, e.g., grouping and/or analysis of assets by area for example, spatial reporting (e.g., line lengths). MLL is currently employing an Esri mobility application to facilitate asset data capture in the field.	Data sharing between ArcGIS and EAM and ArcGIS and Milsoft to standardise asset information across systems.
DMS' IntraMaps	Map viewer of electrical assets and other map features.	Used by staff to confirm location of assets and use other map features (aerial imagery, property information etc).	The information available in Intramaps is based on that which is held in ArcGIS.
Technology One's Financials	Financial record keeping.	Records and reporting of expenditure on projects and works by cost type and category.	EAM to Financials integration – when a work order is created in EAM it integrates to Financials to create a corresponding record which financial information is then recorded against.
Estimator	Bespoke software developed for MLL to allow creation of cost estimates for jobs based on material picks lists, labour and plant inputs etc.	Preparation of cost estimates for projects and works for review by MLL network.	Integrated with EAM. Estimator receives project/work records for estimating from EAM.
Electronic Daybook	Bespoke software developed for MLL to allow the scheduling of human and plant resources to projects and works.	Human and plant resource scheduling.	Bi-directional integration with EAM to create unscheduled job records in Daybook and to update status of work orders in EAM based on scheduling in Daybook.
Gentrack's Velocity	Revenue and billing.	Stores consumer connection information and is used	No integration.

Table 12: Overview of Asset Management Information Systems

System Name	Description	Functionality/Usage	Integration
		for billing purposes.	
Microsoft Excel	Spreadsheet files containing asset information.	Spreadsheets containing asset data not deemed appropriate for inclusion in asset management systems; often project or task based.	No integration.
Mango Live	Repository for key health and safety and other documentation.	Repository for policies, procedures, standards, incidents, forms and staff training register/competencies (some of which relates to asset management at MLL).	No integration.
SCADA	Database for equipment which is SCADA enabled.	Allows remote operation of SCADA enabled network equipment.	Integrated with Milsoft – switches opened/closed in SCADA open equivalent equipment in Milsoft for outage recording purposes.

The primary asset management system at MLL is EAM, an asset and works management programme. EAM consists of a series of modules built around a central asset register of over 110,000 equipment records that make up MLL's network assets. The functionality covered by these modules includes:

- asset creation, modification and deletion;
- asset attribution and attribution history;
- management of MLL's capex projects (creation and management of project records and information);
- management of MLL's opex works (creation and management of opex tasks and information), including preventative maintenance tasks; whereby future works are pre-determined and managed by the system;
- integration with MLL's financial system; and
- GIS (map viewer) integration.

Most asset information (including many non-network asset classes) is contained in EAM with ArcGIS containing the spatial attributes of network assets. A third system, Milsoft, manages the connectivity of electrical assets, manages outage data and allows for engineering analysis of the network. The three databases are synchronised, i.e., they contain data in common and new data is entered into each system simultaneously through a database interface.

Information on connected ICPs is contained in Velocity's software 'Gentrack' and MLL's electircal connectivity software Milsoft.

Reliability and regulatory reporting uses the asset relationships in Milsoft to determine any ICPs affected by an outage. This module has been configured to suit the information disclosure requirements of MBIE and the Commerce Commission.

For each fault, the time, the consumers affected and the operation of assets is recorded and the network reliability figures (i.e., SAIDI, SAIFI, etc) are calculated based on the connectivity model and consumer connection data. This information is generally tracked within Milsoft.

The network is inspected every five years (annually for assets in public places) and the condition and other asset information updated accordingly in EAM.

Vegetation is inspected annually in forestry and in areas such as the Marlborough Sounds where growth is rampant and there is a need to minimise the risk of fire.

6.2.3 Asset data and data quality

Asset management at MLL is heavily dependent on accurate asset data. The storage and management of asset records, including various asset attributes, is fundamental in ensuring that appropriate asset management decisions are made. This pertains to the operations of the assets, maintenance regimes for various asset classes, and assessing renewal of assets based on factors such as age, condition and criticality.

6.2.4 Asset data

MLL holds records of over 110,000 electrical assets. Along with this, records of non-electrical equipment such as plant, vehicles, office furniture and equipment, and field tools and instruments, are recorded and managed. The assets are separated into distinct classes, such as poles, and then categories, such as concrete or wooden. The attributes held by assets varies by class.

The information that is recorded and managed by MLL is based upon the following requirements and purposes:

- Safety. Having knowledge of assets location and their condition is imperative in facilitating the safe operation of the network.
- Reliability. Knowing the types of assets (including the manufacturer, for example), their location, condition, their relationship (including connectivity) operating on the network allows the assets to be managed effectively to assist in minimising failures which can result in network outages.
- Regulatory. MLL is required to disclose certain information (age and condition for example) under specified asset categories.
- Expenditure. Managing asset records allows for analysis of cost trends and determining internal cost rates and therefore the effective better planning of maintenance and/or renewal activities.

Asset information is managed by Engineering, GIS and administrative staff in MLL's main office. Changes to assets (and some asset components in the field) are recorded by field staff, then passed back to MLL network staff to update the asset management system(s) as appropriate.

MLL reviews and updates the information held through adding attributes for various assets when and where it becomes apparent that there would be benefit in holding that information. An example of this is the recent (RY2018) review of pole inspection data. Apart from zone substations, MLL manages relatively high volumes of low value assets which are geographically dispersed making invasive inspection techniques uneconomic. This lessens the scope for data collection to mostly visual inspection records.

Whilst each asset type has unique attributes, MLL generally determines the data it collects from a framework of failure modes and consequence assessment. For example, spalling on a reinforced concrete pole generally has to be extensive for the pole strength to be affected, but even a small exposure of steel within a pre-stressed concrete pole is considered cause for repair or replacement. MLL's inspection templates reflect these different asset-specific risk assessments.

MLL also utilises information disseminated from organisations such as Electricity Engineers Association (EEA) and Electricity Networks Association (ENA) to identify particular asset types that may exhibit specific failure modes or symptoms, as experienced by other businesses, which may be monitored for.

6.2.4.1 Data locations

The types of data held in the various information systems is set out in Appendix 11.9.

6.2.4.2 Data limitations

While MLL endeavours to maintain its asset data as complete and correct as possible, there are general limitations (gaps) to this. These include:

- The occasional challenge in getting accurate and consistent asset information data following fault events. There is the potential for this information to be overlooked when the physical works themselves (including making sites safe and the restoration of supply from outages) is the primary focus. MLL has addressed this challenge by drafting a revised as-built standard which specifies what information needs to be captured by field staff when changes to assets (or sometimes asset components) are made. MLL is actively communicating the importance of recording changes to assets in the field through the roll out of the new as-built standard.
- Legacy data. MLL's network was first established approximately 90 years ago. It is unreasonable to expect that data has always been captured in the manner required by current standards. Records have been lost at times, or during the transfer from one asset system to another, data may have been compromised or lost, meaning that asset records today are not always entirely complete and accurate. Whilst the existence of visible assets is known, for a small proportion of assets, the installation date (for example) may be unknown. MLL believes it has a good understanding of the asset information that is not complete or accurate. MLL does not have a programme of retro-populating this data as, in most cases, there is no viable way to determine it or the costs of doing so are prohibitive.

More specifically, known data limitations include the following:

- Aerial conductor condition data. There is no practical means of assessing conductor condition other than by visual observation (which does not always provide sufficient information). As such, conductor condition is generally assumed based on type, age (where known), location and operational experience. This limitation may result in the risk-based rather than a condition-based renewal of conductor where renewal is based on type, age and location (and hence deterioration risk) along with the condition of the supporting poles. The installation age of MLL low voltage (mains) overhead conductor is not detailed in records, although this is a common issue across the whole sector for this particular asset class.
- Underground cable condition. Condition assessment of cable can only be undertaken through cable testing. However, some types of cable testing are known to prematurely age cables and results can be uncertain, so for the purposes of assessing condition alone, cable testing of distribution cables is generally not undertaken by MLL. As such, other than testing infrared emissions at cable terminations, cable renewal is largely based on age, failure consequence and operating history of the cable sections.
- Underground cable location. MLL has a policy to ensure that new cables installed are accurately plotted on plans using GPS. However, historically there are cables whose plotted location is less accurate.
- Pole condition. Pole condition is assessed during routine inspections/condition assessments. MLL has trialled various pole testing methodologies (including Porta Scan, Pole Scan and the Thor Hammer) with limited success (the results of MLL's testing were inconsistent and therefore inconclusive). As such, pole testing is generally undertaken by digging around the pole, sound testing with hammer impact and/or visual observation. This has limitations and results in subjective and usually conservative assessments. Conservatively assessing the condition of poles may result in their risk-based rather than their true condition-based replacement. However, a risk-based approach in assessment is deemed more appropriate than the alternative from a public safety perspective and is in keeping with MLL's approach to prioritise safety. MLL monitors industry practice and pole testing innovations and will review its practice should the situation change.

- Timeliness of inspections. Due to the extent of MLL's network, and in particular the remoteness and difficulty in accessing many parts of it, asset condition assessments can be expensive to undertake. While asset data is critical in achieving MLL's asset management objectives, there is a balance to be met in achieving appropriate quality data against the cost incurred in obtaining and managing such data. MLL periodically reviews its data management systems and processes to evaluate where improvements could be made in data quality and data management that are both useful and cost effective.

6.2.5 Communication and participation processes

MLL's asset management practices are communicated internally to staff and externally to other stakeholders through MLL's policy and standards and this AMP.

MLL has a suite of documentation relating to asset management practices which sit within MLL's asset management system. Some of the key documentation is summarised in Table 12. Figure 13 in Section 4.3.1.4 highlights the interaction of the asset management system with other key components of MLL's business such as the SCI and the annual works plan.

Table 13: Summary of communication asset management processes/documentation

Processes/systems/ plans within asset management system	Description and purpose	Stakeholders and communication of processes/systems/ plans	Management of processes/systems/plans
MLL Integrated Management System (IMS)	MLL has its own comprehensive IMS system. This includes a number of policies and procedures relating to asset management held and available through Mango.	Some policies and procedures contain content about the engagement and management of Consultants and Contractors working on the network. MLL's staff attend regular meetings whereby a Policy/Procedure from the IMS system is reviewed. The ISO system is part of new staff members induction. Monthly senior management meetings review issues arising from policies and/or procedures within the IMS system.	Each Policy/Procedure within the IMS system is internally reviewed on an annual basis. Similarly, an external audit is undertaken on the IMS system annually.
MLL Network Design Standard	MLL has its own network Design Standard which is driven by safety and recognised good industry practice, and is used by MLL staff primarily in designing infrastructure (assets) for and on the network.	Internal design team, in-house Contracting department, external Consultants engaged by MLL. Network design standard made available to staff through Mango Live.	The standard is reviewed and updated internally on an as-needed basis.
MLL Maintenance Standard	MLL has its own Maintenance Standards. These are used to specify processes and procedures relating to the maintenance of assets on MLL's network. This includes inspection requirements and frequency.	The document is communicated to relevant staff by the Network Engineering Manager.	In-house management of the maintenance standard by MLL's Network Engineering Manager.
MLL Construction Standard	MLL has its own Construction Standard which its own internal contracting company use for constructing (installing) and maintaining equipment on the network. This standard is disseminated to external contracting staff also, as appropriate.	Internal design team, in-house Contracting department, external Contractors engaged by MLL. MLL will instruct external contractors as part of the procurement process that works are to be undertaken in accordance with applicable elements of MLL's standard.	The standard is reviewed and updated internally on an as-needed basis.

Table 13: Summary of communication asset management processes/documentation

Processes/systems/ plans within asset management system	Description and purpose	Stakeholders and communication of processes/systems/ plans	Management of processes/systems/plans
Other relevant industry Standards	Designs should be undertaken in accordance with relevant industry best practice (i.e., following current applicable standards). Examples of this are the construction of new switch room buildings, or foundations supporting sub-transmission poles in soft ground. Consultant engineers engaged by MLL are required to undertake design in accordance with relevant industry standards, such as AS/NZS 1170.5: 2004 – Structural design actions, Part 5: Earthquake actions. Another example is AS/NZS 7000: 2010 – Overhead line design: Detailed procedures.	MLL staff work to applicable standards. The internal standards are formulated on the basis of applicable national/international standards.	MLL is a subscriber to Standards New Zealand. MLL receives electronic notification when relevant standards are updated.
Asset Management Plan (including AMMAT)	Summary of assets and their management for the next ten-year period.	Numerous stakeholders. AMP is publicly disclosed.	Regulated by the Commerce Commission. Internally reviewed and updated and signed off by the Board.

6.3 Compliance

One of the key drivers of MLL's asset management strategy is the need to comply with legislative requirements. The following list is a selection of some of the key statutory instrument (Acts and Regulations) relating to MLL's asset management activities:

- Health and Safety at Work Act 2015
- Electricity Act 1992 (including subsequent amendments)
- Commerce Act 1986
- Utilities Access Act 2010
- Energy Companies Act 1992
- Companies Act 1993
- Electricity (Safety) Regulations 2010 (and subsequent amendments)
- Electricity (Hazards from Trees) Regulations 2003
- Various Electrical Codes of Practice (tied to the Electricity (Safety) Regulations)
- Resource Management Act 1991

There is other legislation and/or regulations pertaining to MLL's activities (for example, the Employment Relations Act 2000). They are not included here for the sake of brevity.

MLL's procedures and policies are written to comply with legislative requirements and codes and are updated as and when revisions come into effect.

MLL's senior management regularly review MLL's legislative compliance and reports are provided to the CEO monthly and the Board on a quarterly basis. Legislative breaches are reported to the MLL Board as they occur.

6.4 Risk management

6.4.1 Risk management process

Risks can be variable in their nature and scale. The conveyance of electricity (MLL's core function) potentially involves significant health and safety hazards the risks of which must be mitigated. But MLL is also exposed to considerable business related and other forms of risk. To manage that risk and to keep exposure within acceptable levels, MLL has adopted a systemic approach to risk management through following the Australian/New Zealand standards ISO 31000:2009 *Risk Management* and NZS 7901:2014 *Electricity and gas industries – Safety management systems for public safety.*

MLL's risk management procedure is expressed in its internal standard PR79 (last revised in April 2018). At the same time, MLL also engaged insurance consultants Marsh Limited, to assist it in fully revising its major risks.

Figure 26 shows the risk management process suggested by ISO 31000 and adopted by MLL:

This process has five key steps:

- Establish the risk context;
- Risk identification;
- Risk analysis;
- Risk evaluation; and
- Risk treatment.

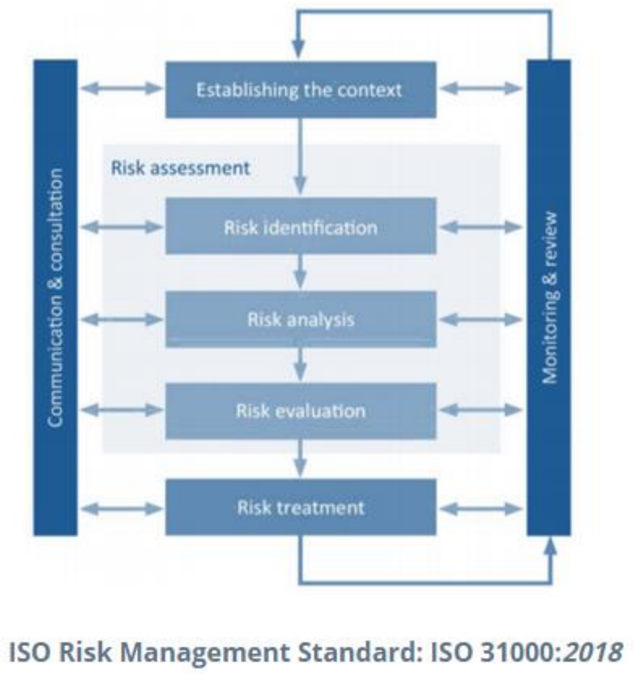


Figure 26: Risk management process overview

These are supported by a framework for:

- Risk monitoring and review; and
- Communication and consultation with stakeholders.

6.4.1.1 Risk context

The above process allows for better management of risk types affecting MLL. The definition of risk based on ISO 31000 is the effect of uncertainty on objectives. When considering risk and risk management at MLL, it is important to place these in relation to the organisation's objectives expressed through its Vision and Mission statements and its Statement of Corporate Intent, all as described in section 4 of this AMP.

The risk management process considers risks relative to the operations of MLL, which are broadly grouped into the following risk category types:

- Health and safety;
- Public safety;
- Quality;
- Environmental;
- Financial;
- Reputational;
- Business interruption; and
- Regulatory compliance.

6.4.1.2 Risk identification

At MLL, risks are identified by a variety of methods including (but not limited to):

- On site checklists, prior to starting work (tailgates);
- Re-assessments during the day as the work environment changes;
- Regular visual hazard inspections of work areas;
- Analysis of accidents/incidents or near misses;
- Internal and external feedback;
- Condition assessment of the network to identify public safety risks;
- External information from specialists;
- Risk workshops;
- External risk reviews; and/or
- Industry information.

Identified risks are reported into MANGO (either directly by employees or from paperwork provided to the Contracting Administration Manager).

6.4.1.3 Risk analysis

Once risks have been identified, they are analysed to:

- Identify the source and cause of the risk;
- Assess current controls and their effectiveness, and identify any gaps;
- Consider how likely the risk is of occurring and what the impacts are (likelihood and consequences); and
- Determine the risk rating (likelihood x consequence).

MLL uses the risk criteria and matrix described in Appendix 11.9 to analyse risks. This categorises likelihood into 5 categories (from rare to almost certain) and consequence also into 5 categories (from insignificant to catastrophic). This analysis is performed on the "raw" (uncontrolled) risk, and then again on the "controlled" (mitigated) risk.

MLL's risk profile is then mapped onto the matrix described in Appendix 11.9, which allows MLL to identify which risks its needs to focus the most attention on (e.g., risks that fall into the Red and Amber categories – its Priority 1 and 2 Risks).

6.4.1.4 Risk evaluation

Once a risk has been analysed, it is then evaluated based on the outcome of the analysis and against the risk assessment criteria to:

- Escalate to the necessary reporting levels;
- Prioritise risks;
- Consider options for managing risks;
- Decide what action is required; and
- Identify resources required to manage the risks.

6.4.1.5 Risk treatment

Risks are treated either through elimination, or the application of controls to reduce the likelihood and/or the consequences of the risk occurring. MLL seeks to put controls in place that will reduce risk to a tolerable level. Ongoing monitoring and review is undertaken to verify that.

For non-health and safety related risks, treatments may avoid, transfer, reduce, remove or modify (or in rare instances, accept) the likelihood and/or consequence of risk(s). Non-health and safety risks may be treated in a variety of ways. Some examples of controls include (but are not limited to):

- Changing policies, systems and processes;
- Changing plant and equipment;
- Redesign;
- New or different technology;
- Training and education;
- Inspections or increased inspection frequency;
- Testing; and
- Insurance.

In accord with the Health and Safety at Work Act 2015, when determining the appropriate control to effectively manage a health and safety related risk, a specified sequence of controls is followed to conform to the health and safety charter. Detail in relation to health and safety risk management is included in MLL's separate procedure document CSM6 – Risk/Health and Safety Management.

6.4.1.6 Risk registers

MLL maintains an electronic central risk register (in MANGO). The centralised register identifies risks in the broad category types as listed in

MLL's risk context above. Health, Safety, Public Safety, Quality and Environmental risks are held in the MANGO register. Financial, reputational, business interruption and regulatory compliance risks are recorded in a separate register held by the Chief Financial Officer with oversight from the CEO and the Directorate.

6.4.1.7 Risk monitoring and review

MLL has a proactive approach to public safety, safety to its staff, contractors and consumers.

Regular surveillance and monitoring relative to safety is undertaken in respect of network assets, e.g., ongoing measurement of line heights, inspections of substations, inspections of pillar boxes, and aerial and ground surveillance of lines and vegetation in proximity to the line.

Network Standards prescribe the standards to be followed in respect of network surveillance.

Serious incidents and near misses are investigated in accord with the recognised incident cause analysis method (ICAM) procedure to identify the cause and better enable their prevention in the future.

The importance of both lead and lag indicators relative to safety is recognised within MLL with an emphasis on proactivity.

The performance of the network and the effectiveness of work programmes relative to health and safety are regularly reviewed by MLL's senior management and where appropriate change is made.

These reviews focus on ensuring that the controls in place are effective and efficient. Notifications of risk reviews are triggered from MANGO, and records relative to reviews are maintained in MANGO. For business wide risks that fall into the Priority 1 and 2 categories, a report is generated from MANGO and circulated with IMS meeting papers for review and discussion.

6.4.1.8 Communication and consultation

Risk evaluation and communication is integrated within MLL's daily operations and processes including Board meetings, Health and Safety Committee meetings, team meetings, training, visitor and employee induction, inspections, etc. Where appropriate specific meetings are held with industry groups, e.g., wineries and, vineyards relative to the utilisation of grape harvesting equipment in the proximity of power lines. Other avenues for communication are set out in the risk management procedure PR79.

6.4.2 Key risks

MLL has on its risk register five Priority 1 risks and 16 Priority 2 risks that it is managing as further detailed in the following tables

6.4.2.1 Priority 1 risks

Table 14: Key risks – Priority 1

Risk source	Risk type	Risk drivers & controls
Products/ services	Damage caused to another party as a result of the goods/services supplied.	Inherently, the hazards within an electricity distribution system are ever-present for the general public. The hazards are electricity, and fire (resulting from electricity), and mechanically/structurally compromised network. Controls include: • Quality line construction, e.g., in exposed areas typically lines are constructed with individual "shackled off" spans rather than simply being installed on pins. • Renewal of identified at risk (weak) conductor. • Approximately 50% of 33kV lines do not have trees falling within distance. • Installation of a ground fault neutraliser (at Havelock zone substation) and resonant earthing systems (at Tapp and Linkwater zone substations respectively). • Reclose blocks during periods and in areas of high fire risk.
Staff and contractors	Potential harm activities (e.g., working at height, live electricity, working in confined spaces etc).	Risk of electrocution and falling from height have been the principal cause of harm within the electricity industry. Controls include: • All hazards are identified in MLL's Hazard Register together with risk management. • The Company Safety Manual and operating procedures including PPE, switching instructions. • Maintenance of an effective safety culture. • Helicopter lifting and securing guidelines.
Staff	Employees carrying out work offsite/ remotely that put them at significant risk.	Lone working on private property. Working alone in remote areas. Controls include: • Real time monitoring of employees' location (GPS location). • Radio and satellite radio communications. • Company operating procedures.
Public	To/ from trespassers (including children)	Unauthorised access into substations, cable boxes or other electrical equipment. Controls include: • Physical security (walls, fences, barbed wire, warning signs, locks, cameras) and access security (access cards). • Safety by design.
Public	Large crowds at public events	Public events, where MLL has supplied electrical assets or electrical advice relative to temporary power supplies. Controls include: • Appropriately trained staff and use of appropriate equipment.

The common characteristic of these Priority 1 risks is the breadth of the exposure situations and, therefore, the difficulty of managing the risk likelihoods.

6.4.2.2 Priority 2 risks

Table 15: Key risks – Priority 2

Risk source	Risk type	Risk drivers and controls
Technology	Emerging technologies and alternate power sources (e.g., advent and increased use of electric powered vehicles; photovoltaic and large battery storage facilities).	Combination of micro generation (PV, wind) and battery storage may in the future enable consumers to disconnect from MLL's distribution network. Controls include: • Ensure provision of highly reliable service which provides benefits of consumer load diversity and flexibility in relation to consumer demand. • Ability to modify pricing. Increased utilisation of electric vehicles is likely to enhance the need for efficiently operated electricity networks.
Products/ services	Key dependencies on the services of others to ensure on-time supply.	Transpower failure to supply. Transpower has three overhead circuits supplying MLL. Two 110kV circuits are on the same overhead support structure (tower) from Stoke. Each of the two circuits can supply meet 100% of MLL's network demand. The separate third circuit (110kV from Kikiwai via the Branch River power scheme), can supply 60% to 70% of MLL's network demand. Failure of Transpower's three 110kV/33kV transformers, switchgear, or the nine 33kV feeders supplying MLL could also occur. Failure to supply could also be a result of other issues within Transpower's national grid. Transpower's towers and conductors can be impacted by extreme wind, snow, earthquake, rock fall, landslide, fire and smoke, terrorism. Controls include: • Transpower has contingency plans for emergency events. • Transpower can helicopter in a spare pole. • Marlborough is supplied over two routes by three 110kV circuits.
Assets	Major accident/incident (e.g., fire, earthquake, tsunami, storm, volcanic eruption).	Earthquake - causing property damage and/or restriction of access to network assets. Controls include: • Construction (seismic) standards. • Network layout/configuration. • MLL uses earthquake fault line information in planning around critical assets. • MLL has an Emergency Preparedness Plan. • MLL owns a range of quality vehicles and special plant for utilisation in emergency situations. • MLL radios are installed within local helicopters.
Assets	Flooding – rivers, flash flood events, embankment failures, bridges etc.	Floods (e.g., embankment failures) - causing property damage and denial of access to ground-mounted equipment. Controls include: • Network layout/configuration. • Design standards and processes. • Avoid low lying equipment design.
Assets	Malicious damage.	Substations, key poles, earth wires could be a target. Controls include:

Table 15: Key risks – Priority 2

Risk source	Risk type	Risk drivers and controls
		• Secure access to sub-stations, perimeter fencing (electric), buildings alarmed, non-combustible building construction used. • Regular surveillance. • Public awareness.
Financial	Contingent liabilities.	Claims e.g., fire compensation/suppression, loss of continuity of supply. Controls include: • Network preventative maintenance established (tree cutting programmes, inspections and monitoring).
Financial	Uninsured loss exposures.	Uninsured property, lines and poles, transformers, switch gear, SCADA systems and uninsured business interruption (i.e, revenue). MLL's assets are spread over a wide area and it is unlikely that a single event would damage every asset. Hence the spatial diversity of network assets inherently provides a form of mitigation. Construction standards and the robustness of equipment used will help to minimise damage to critical and/or high value assets.
Terrorism, Riots, Insurrection	Uninsured loss exposures.	Measures are taken to restrict unauthorised access to network assets. MLL works with law enforcement agencies as appropriate should such unlikely events arise.

6.4.3 Risk mitigation initiatives

Aside from the ongoing surveillance and monitoring of MLL's network and operations, three mitigation projects pertaining to risk are set out in this plan:

- Continuation of the programmed renewal of copper and galvanised steel conductor, which is approaching "end of life". This renewal programme will mitigate public safety and fire ignition risk due to anticipated increase in conductor failures if no action is taken.
- Installation of resonant earthing systems into substations to manage fire risk and enhance public safety. A ground fault neutraliser has been installed at Havelock and other resonant earthing systems are currently being commissioned at Linkwater and Tapp zone substations. MLL is intending to better understand the performance of these systems before determining whether it is appropriate to extend these initiatives to other zone substations on the network.
- Staged replacement of MLL's 2-pole distribution substations following a review of seismic safety and in consideration of both the asset condition and risk priority.

6.4.4 Contingency planning

MLL's Emergency Preparedness Plan (EPP) documents procedures for use in the event of major damage to the network. It contains information on Transpower, the 33kV system, the zone substations, the 11kV lines, supplier's contact details, staff, consumers including those on medical support and other information which may be useful at times of emergency. Contingency planning is regularly reviewed with consideration given to various "what-if" scenarios. This helps to prepare MLL staff for various scenarios/events.

MLL operates a 24/7 fault service, with sufficient staff available to ensure appropriate responses to most foreseeable events on the network. The 2016 Kaikoura earthquake showed that the MLL's culture is such that staff make themselves available at times of emergency.

For a major event such as a severe earthquake, MLL expects to utilise resources external to Marlborough, if possible. The availability of resources within Marlborough is necessary, however, because road access to Marlborough may be cut off.

MLL is involved in Civil Defence and emergency management activities in conjunction with the Marlborough District Council and other community groups. Liaison is, in the first instance, through the emergency services groups of each organisation. Regular meetings between MLL and the other groups are held to review and assess current plans.

Civil Defence involvement is not restricted to natural disasters but includes any event – planned or unplanned – which disrupts the Marlborough area.

Following the Christchurch earthquakes, MLL reviewed its EPP and the location of the control room. An emergency control room is available within MLL's Springlands system control building, and another could be quickly setup at the Taylor Pass contracting depot. An emergency repeater has been purchased to allow communications to be quickly re-established in the event of loss of the existing repeater.

The radio system is interlinked with backup provisions to maximise its reliability. Over the life of this AMP, it is intended to further strengthen the radio infrastructure in recognition it is the backbone of MLL's network communications.

MLL is part of the group of South Island lines companies that have agreed to a Mutual Aid Cooperative in the event of major disruption to individual or multiple networks.

6.5 Lifecycle management

MLL considers its network assets within a lifecycle framework that covers the assets from design and purchase through operation and maintenance and finally to renewal and disposal. The goal of lifecycle management is to maximise the utility of the assets while minimising total cost over the life of the assets. Examples of this include the natural trade-off between cost and quality/capacity and purchase cost and the total operating costs over the assets lifetime.

Practical examples include;

- Distribution transformers in salt prone areas have galvanised tanks and longer insulators; and
- The provisioning of new distribution lines with 22kV insulation in rural areas (allows for future capacity upgrades).

In addition to work undertaken on MLL's network assets, it is also necessary to maintain access to assets and the environment around the assets, e.g., keeping trees clear of overhead lines and maintaining tracks to access assets such as switches. For MLL, a significant part of the maintenance budget is allocated to the maintenance of access tracks and vegetation control.

Network assets are exposed to wind, corrosion and other environmental effects and, therefore, deteriorate over time, albeit at different rates. Indeed, asset type and age can be a key predictor in assessing the general state of the network although it is often unreliable in predicting the particular state of any single asset. To manage total lifecycle cost, the cost of condition inspection is balanced against the cost of premature replacement and the costs and risk from asset failure with the latter often being significantly larger for electricity conveyance assets.

6.5.1 Key strategies

6.5.1.1 Condition-based maintenance

MLL undertakes a condition-based maintenance programme centred on regular inspection and testing of network equipment. The programme includes the following aims:

- To manage the risk from hazards to staff, consumers and the general public;
- To achieve a reliable, secure system in accordance with service levels and consumer expectations;
- To comply with MLL's environmental policy;
- To identify required corrective maintenance before failure;
- To minimise the total cost of ownership and maximise the efficiency of MLL's operations; and
- To satisfy legislative requirements.

MLL seeks to achieve these aims by undertaking maintenance efficiently and effectively. It is a process of continuous improvement and one that will become more effective over time. MLL endeavours to purchase quality new equipment with minimal maintenance costs to assist with both future reliability and to minimise the total cost of ownership.

By way of example, the 12 transformers at the major 33/11kV substations are fully sealed with nitrogen to prevent the ingress of air laden moisture which has the potential to impair the integrity of the insulating oil and the need to maintain the usual breathers is eliminated.

Typical maintenance tasks on critical equipment include the following classes of activities:

- Identification of any abnormalities;
- Maintenance in accord with manufacturer's requirements;
- Checking and/or replenishment of grease and insulation components such as oil, SF_6, vacuum;
- Checking and minor repairs or replacement of semi-consumable components e.g., brushes, contacts, gaskets, seals;
- Checking and minor repairs to breakable components e.g., sight glasses; and
- Calibration of components such as thermocouples, protection relays, etc.

The key criteria for these tasks are that they restore the original service capacity or utility. They do not increase that capacity or utility.

6.5.1.2 Asset replacement and renewal

MLL's policy is to obtain maximum value from each asset, without compromising safety and reliability. Allowing assets to run to failure is generally not a viable strategy given the safety considerations incumbent to electricity conveyance. As such network assets are renewed when condition assessment indicates that they no longer possess the ability to meet their design requirements. Small pole-mount distribution transformers are an example of the exception where run-to-failure would be considered acceptable because the failure and safety consequences are usually minor.

MLL may choose to replace assets ahead of "end of life" where there are advantages of doing so through economies of scale, for example, in undertaking whole line section renewal where most (but not all) poles and components in the line section are assessed in poor condition. Such a strategy is economically efficient due to the one-off project and site set-up costs especially in rural and remote locations.

Much of the existing network was developed in the 1960s and 1970s and accordingly would, without prudent maintenance, reach the end of its useful life over a short span of time. MLL's policy is to spread renewal expenditure to maximise efficiency and achieve consistency in operations. It is possible to defer this type of expenditure. However, that runs the risk of increasing failures (incumbent with safety and liability consequences), attendant increased costs and the possibility of inadequate resources being available to correct the problem in a timely manner.

MLL must continually and systematically renew its assets but replacement of assets is not always straightforward. Consultation with stakeholders is both important and may represent the longest activity in the time scale of executing the works. It can take considerable time to reach agreements with stakeholders such as land owners over access and asset configuration.

In general, asset replacement and renewal is prioritised towards areas where parallel renewal drivers exist, for example, low capacity or low strength lines, ties between substations without (n-1) reliability, safety concerns, and/or assets that are expensive or difficult to maintain (e.g., iron rail poles).

Consideration is given to making assets "smarter" on renewal. Developments in smart grid technologies are making new assets easier to monitor and operate remotely, which is an advantage when assets are difficult to access in a timely way.

6.5.1.4 Routine maintenance and inspection

Where possible, MLL prescribes time-based condition monitoring over time-based servicing. Benefits of condition monitoring are:

- Increased visibility of an asset's health;
- Ability to identify trends across asset groups;
- Maintenance actions become more timely (and therefore efficient) as they are driven by asset condition;
- Ability to identify, plan, prioritise and defer preventative maintenance works; and
- Ability to assist in planning future CAPEX work.

Monitoring schedules are prescribed tasks designed to detect potential failure conditions. The schedule is determined by balancing inspection frequencies against potential failure interval and the cost of the monitoring activity against the cost of asset failure.

Most of the preventative maintenance is planned within EAM's Work Order Planning module. Most asset classes have preventative maintenance plans.

A plan is made up of a list of assets that have a series of schedules. A schedule is a set of tasks undertaken at regular intervals. The inspection interval may be based on time between inspections or other units of measure like run hours or number of operations. For efficiency, tasks with similar intervals at the same site are packaged together.

The due date for each task is updated based on one of two methodologies:

- Variable: The task is due in one period from the previous occurrence's completion date. This method is generally used for schedules that have a high cost per task occurrence, e.g., out of service tests on a power transformer.
- Fixed: The task is due in one period from the previous occurrence's original due date. This method is preferred for schedules with high task occurrence rates, due to either large asset populations or relatively short task frequency. In this case, there is greater efficiency to be gained by grouping tasks in a similar geographical area rather than strict adherence to maintenance frequency.

During routine maintenance, field staff undertake a condition assessment on each asset that then leads to a condition score based off the definitions[15] in Table 16.

Table 16: EEA's AHI scores (with definitions)

AHI category	Meaning
H5	As new condition – no drivers for replacement
H4	Asset serviceable – no drivers for replacement; normal in-service deterioration
H3	End of life drivers for replacement present; increasing asset-related risk
H2	End of life drivers for replacement present; high asset-related risk
H1	Replacement recommended

[15] Condition scoring and definitions from Commerce Commission and EEA guide to Asset Health Indicators.

These scores are the Asset Health Indicators (AHI) levels promoted by the EEA, MLL has adopted these.

6.5.1.5 Corrective maintenance

Asset conditions scored Grade 1 (H1) are reported immediately through to the Control Room. A brief risk assessment is undertaken and appropriate reactive work put in train. This may include emergency shutdowns.

Defects on assets scored Grade 2 (H2) and corrective tasks identified by the field staff are assessed by the maintenance team. Corrective tasks are raised as a "work request" work order in EAM. These tasks are then prioritised based off a risk assessment as follows:

Consequence of functional and/or secondary failure in terms of:

- Risk to public safety;
- Risk to reliability (number consumers affected, restoration time, availability of alternate supply);
- Risk to environment; and/or
- Cost of asset replacement.

Probability of failure is assessed in terms of:

- Known asset health;
- Defect severity;
- Asset environment; and/or
- Predicted "time to fail" based on field experience.

The risk-based approach gives priority to serious defects, assets serving large numbers of consumers, specific high-value consumers, or places where public safety is a concern. This system ensures that at all times, corrective maintenance is being performed efficiently and the most critical tasks are focused on.

The corrective action to be undertaken is determined by:

- Risk to operator safety (during action);
- Risk to service levels (during action);
- Labour and material cost of action; and/or
- Remaining asset life (post-action).

MLL uses GIS to plan and schedule maintenance. Outstanding corrective maintenance tasks are plotted within a GIS viewer against the affected asset. This enables corrective maintenance to be grouped geographically and scheduled alongside known planned outages, thereby improving efficiency.

MLL is in the process of consolidating a mobile module into EAM with earth testing and pole inspections now being done electronically. This will allow field assessments to be recorded on electronic tablets rather than the current paper-based system. MLL is aiming to decrease the costs associated with data processing, and allow for faster communication of poor assessed asset health through to relevant staff through the shift to a mobility based system.

6.5.1.6 Maintenance levels

Maintenance tasks are categorised by a maintenance level. These levels act as a rough guide to the complexity of the maintenance task. Maintenance levels also provide an indication to the level of access required to complete the task required. Maintenance levels used at MLL are described in Table 17

Table 17: Maintenance level definitions

Maintenance level	Level code	Description	Definition
1	SHI	Security and Hazard inspection	Examples include: • Zone substation building inspection. • Distribution transformer visual inspection.
2	ISCA	In Service Condition Assessment	Assessment or testing of an asset based off a pre-determined criteria whilst the asset is in service. Examples include: • Earthing system resistance test. • SF_6 switch pressure gauge reading.
3	OSCA	Out-of-Service Condition Assessment	Assessment or testing of an asset based off a pre-determined criteria whilst the asset is out of service. Dependent on task, may require an access or test permits. Examples include: • HV cable Tan delta testing. • Circuit breaker functional test.
4	NIM	In Service/Out of Service Non-intrusive Maintenance	Maintenance activity where access to compartments containing HV conductors is not required, i.e., access/test permit not required Operational control or NESS may be required. Examples include: • Substation cleaning. • Ground-mounted switch operational test.
5	OSIM	Out of Service Intrusive Maintenance	Maintenance activity where access to compartments containing HV conductors is required. Access or test permits required. • Circuit breaker maintenance. • Tap changer overhaul.
6	SS	In Service/Out of Service Specialist Survey	Surveys undertaken by specialists generally external to MLL. Task is usually non-standard and will require a dedicated health and safety plan approved by the Operations Manager. May require Access or Test Permits. Examples Include: • Partial discharge survey. • Earthing system review.
7	PFM	Post Fault Maintenance	Assessments, testing or maintenance required on an asset after a fault has occurred.
8	OSM	Other Specific Maintenance	Other items that do not fit into the above categories, such as systemic reviews, for example: • Earthing system classification review.

6.6 Vegetation management

6.6.1 Overview

Vegetation management makes up a significant component of MLL's non-network expenditure. It is necessary to maximise public safety including minimising fire risk and maintaining reliability of supply by preventing interference to lines and the provision of access to network assets. MLL's network extends through heavily vegetated areas, including many parts of the Marlborough Sounds. Vegetation growth rates are typically high, which in dry summers, exacerbates the fire risk. Expenditure includes frequent assessment of the network to establish where vegetation is encroaching (or approaching encroachment of) MLL's overhead lines. It also includes liaising with land owners with subsequent first-cut costs borne by MLL associated with physical trimming or felling of vegetation and related network support activities (such as provision of mobile generation to allow continuing operation of the network if large shutdown areas are required to enable the vegetation work to be undertaken).

6.6.2 Legislation

Current legislation[16] specifies minimum distances that vegetation must be clear from overhead power lines "growth limit zone" with distances varying depending on voltage and conductor span length). The legislation also stipulates that electricity distribution networks shall advertise suitable safety information to vegetation owners in appropriate publications as well as contacting those owners whose vegetation is approaching, at or exceeding the specified minimum distances.

[16] Electricity (Hazards from Trees) Regulations 2003.

The current tree regulations are considered to be unduly prescriptive rather than principles-based and consequently they are ineffective in remote rural locations where tree growth is relatively high and fire risk can be elevated, and it is impracticable to measure the growth limit zone many metres above the ground where the vegetation is dense.

Vegetation owners have the option of taking ongoing responsibility for maintaining vegetation outside the minimum distance(s), or granting the line owner (i.e., MLL) approval to maintain the vegetation outside the minimum distance by appropriate trimming or removal. MLL must cover the costs of the first trim of an individual tree, along with appropriate record keeping, liaison and advertising. Costs associated with subsequent trims are borne by the vegetation owner. However, the same process of cut and trim notice has to be repeated for every individual tree on a property. A network owner has no mandate to remove a small tree from under a line but must wait until it encroaches within the growth limit zone before any action can be taken.

6.6.3 Risks with vegetation management

In practice, this legislation is not leading to optimal outcomes. The growth limit zones are not adequate for ensuring safety of the public in relation to trees particularly with trees of high growth in rural and remote environments. In many rural situations, the tree regulations do not enable a network operator to protect the lines from trees and/or to eliminate the risk of fire. In addition, the complex formulas require detailed and costly survey work to be undertaken if landowners require strict adherence to the legislation.

Of particular concern to MLL is areas of forestry plantations in the vicinity of MLL's network, of which there are many in Marlborough[17]. Forestry

[17] Forestry is a significant industry in Marlborough with over 70,000 hectares planted.

plantations involve high volumes of large trees which have the potential to damage MLL's network and/or result in fires. The minimum distances specified in the legislation are impractical to measure and manage on such a scale. They provide minimal protection to MLL's network.

Trees are one of the significant causes of outages on MLL's network. The current tree legislation only permits minimal clearances and removal of vegetation within the prescribed growth limit zone. In areas of high growth, this means that the limits are quickly exceeded after trimming, thereby requiring frequent return visits and high ongoing costs. These costs are further exacerbated in the remote area of MLL's network where access is difficult, and the work is undertaken at significant height resulting in relatively high costs of mobilising to work sites.

Upon advice from the Rural Fire Authority, MLL prevents the automatic reclosing of supply at times of specified high fire risk, which typically occurs during dry summers. This action has the potential to result in prolonged network outages. However, a fire is deemed to be a much greater threat to the public and so MLL willingly compromises network reliability in the interests of public safety.

Another concern MLL has is with vegetation owners who put themselves at risk by carrying out the vegetation trimming or felling work themselves. In some instances when MLL notifies vegetation owners of the requirements to maintain minimum distances to overhead lines, vegetation owners elect to undertake vegetation work themselves, against MLL's advice. This puts the vegetation owners at risk of electrocution, or, may elevate the risk of a fire being initiated.

6.6.4 Vegetation management strategy

MLL undertakes routine inspections of its network to identify areas where vegetation has the potential to (or already is) breaching the minimum specified legislative distances. The inspections are criteria-driven – factors such as asset criticality (i.e., 33kV vs 11kV vs low voltage) rural vs urban, topography and land use are considered to determine the frequency of inspections for various areas of the network. The inspections are undertaken by vehicle, boat, foot, use of unmanned aerial vehicle, or, in other remote/inaccessible areas, by helicopter. Because of the potential for extreme fire risk in the summer months, inspection of these high-risk fire areas is undertaken at least annually. Whilst more frequent inspections increase cost, this is balanced by the risk mitigation on this risk to MLL.

Records of vegetation that present a risk to MLL's network are established and managed within EAM in a similar way to an asset, i.e., a record is created with attribute data and specific location details assigned to it. Liaison with the vegetation owners then occurs as appropriate and where applicable work packs are designed and compiled to allow either MLL or external contractors to undertake the corresponding vegetation control work.

Despite the inadequacies of the tree legislation, MLL has directed its efforts to manage risk of vegetation interference by, where possible, obtaining greater clearances than those provided by the legislation with the cooperation of vegetation owners. Obtaining greater clearances than the minimum values specified in legislation reduces the potential for network damage, reduces the frequency of inspection required (and subsequent re-trimming of vegetation) and enhances the safety of landowners.

MLL expects its vegetation management to reduce over the planning period because many initial cuts (which MLL is required to fund) have been undertaken. Further detail on this is provided in Section 9.13.4.

6.7 Surveillance

Asset surveillance (inspections, monitoring, testing and condition assessments) is a major input to determining the health of the network assets and provides MLL with information that can be used to assess safety risks and reliability issues. A balance struck must be between repeated surveillance and condition or time-based servicing or replacement. Factors to be considered include:

- expected asset conditions and environment;
- setting the surveillance period in relation to the known defect rate; and
- balancing the cost of the surveillance activity against the cost of life extending maintenance or replacement or the consequences of asset failure.

Where asset defects are identified from surveillance, there are a number of approaches that can be considered depending upon the circumstances. These include:

- planned asset replacement;
- remove asset from service;
- increase frequency of monitoring;
- plan preventative maintenance work, including additional diagnostic testing;
- reprioritise existing works; and
- do nothing and continue to survey at normal frequency.

The approach adopted will principally be governed by risk of failure, public safety and then the criticality of the asset with respect to network reliability, cost of replacement and the cost of more frequent re-inspection in relation to earlier renewal.

6.7.1 Fault recording and analysis

MLL records faults within the outage management system (OMS), Milsoft. Details, like time of occurrence, the asset that failed, failure type/cause (where known) and external conditions are recorded against each failure event. Each failure recorded assists with establishing trends for the remaining in-service population and provides drivers for replacement or maintenance campaigns. In depth analysis of faults is prioritised by the impact on network reliability and the potential risks to safety that might be exposed by the fault.

6.7.2 Inspections

The majority of MLL's surveillance comes in the form of asset inspections performed by field staff. Due to the spatial diversity of MLL's network - the Marlborough Sounds in particular - the cost per asset of field inspections is high. Time is taken upfront determining what the right data is to collect and how to get the right quality of data out of inspections and to optimise the time (and cost) spent in the field collecting the data.

As part of a wider mobility project, MLL in 2018 introduced device based (electronic) pole inspections (condition assessments), which assist in improving data quality and turn-around time for inspections. The inspections undertaken are largely based on MLL maintenance standards, some of which have recently been revised. As this area develops, the intention will be to extend mobile inspections to other asset classes.

Data quality of the majority of MLL's asset surveillance is affected by the proficiency and consistency of the field staff undertaking the work. MLL recognises that the way to build and maintain proficiency is through education, training and support for MLL's asset inspectors and analysts.

MLL endeavours to keep clear, open lines of communication between its asset management and field staff to ensure the inspection process is undertaken within a continuous improvement cycle.

6.7.3 Digital mobility

The mobility pole inspections (condition assessments) platform is enabling field staff to capture data directly onto devices in the field, instead of the traditional "pen and paper" approach. Early results are encouraging, with significant work flow savings having removed significant paper work and double handling of data.

More recently, MLL has introduced a tablet-based system for undertaking earth testing of distribution transformers and other assets.

Other features that MLL is looking to introduce within the scope of the mobility initiative include field access to digital work and policy documentation, to network asset information and to MLL's geographic information systems.

The benefits MLL expect to see from this approach are:

- better access to information resulting in improved operator safety;
- improved communication channels between project management, engineering and field staff;
- removal of the requirement to double enter inspection data, resulting in faster inspection turnaround time and improved data quality;
- less time spent on preparation of printed documentation for site visits;
- improved confidence in system data;
- better planning decisions based on better data quality;
- reduced revisits to sites to collect missed information;
- ability to assess progress in the field through real time field tracking; and
- increased opportunity to group tasks in the same area.

MLL will give consideration to how this may be utilised elsewhere across field work, e.g., capturing of as-built data in the field.

6.7.4 Online monitoring

MLL's SCADA system provides measurement and logging of the network utilisation and system events, which can be used to identify unusual operating conditions and indicate accelerated service-based aging.

The data provided from online monitoring can reduce the requirements of on-site work and inspections and allows MLL's Operations team to respond faster to abnormal conditions on the network. MLL's online monitoring systems currently operate almost exclusively on the sub-transmission and 11kV distribution systems.

Increasing amounts of SSDG is being embedded into MLL's LV networks. In order to monitor the effect of this technology on MLL's quality service levels, MLL is likely to want to improve its electrical surveillance of the low voltage reticulation. It may be possible to utilise this monitoring infrastructure as part of a future network congestion management scheme. Examples of online monitoring that MLL undertakes on its 11kV and 33kV network are included in Table 18

Table 18: Types of online monitoring

Telemetry type	Measured at	Used for identifying	Relevant Assets
Current	Zone substations Recloser sites Switch rooms	Asset failure (electrical protection) Thermal aging Network utilisation and growth	All electrical assets Transformers Cables Overhead conductors
Voltage	Zone substations Recloser sites Switch rooms	Asset failure (Electrical Protection) Abnormal operating conditions	All electrical assets
Temperature	Power transformers Generators Plant rooms	Thermal ageing Abnormal operating conditions	Transformers Generators Power factor correction equipment
Oil/fuel pressure and levels	Power transformers Generators	Abnormal operating conditions Leaks	Power transformers Generators
Operation counting - cyclometers	On load tap changers Generators Circuit breakers	Service wear	Power transformers Regulator transformers Circuit breakers Generators

When procuring new assets for installation on the network, MLL has a preference for products that have the ability to be remotely monitored.

6.7.5 Engagement of external parties and external reviews

MLL engages external resources for specialist activities. These tasks generally require skillsets and experience that are not available within MLL. Examples include:

- civil and mechanical engineering design;
- technical surveys for zone substation earthing systems;
- thermographic surveys; and
- partial discharge surveys of switchgear and cables.

MLL also engages consultants and auditors to independently review and provide quality assurance of its systems.

6.8 Network development strategy

MLL undertakes development expenditure in a timely manner to ensure that appropriate levels of network service and reliability are provided in accordance with consumer expectation and in line with organisational strategies.

MLL has adopted planning processes and technical and engineering standards to ensure that assets placed to meet service levels meet the following requirements:

- load demands of its consumers;
- the safety of its public, consumers, staff and contractors;
- maximise efficiency of operations;
- prevent unnecessary investment;
- be undertaken in an appropriate timeframe;
- minimise risk of long-term stranding;
- comply with regulatory requirements;
- maximise operational flexibility;
- maximise fit with organisational capabilities such as engineering and operational expertise and vendor support;
- comply with environmental requirements; and
- appropriate to environment.

For example, a fundamental criteria considered for 11kV/415V transformers is the maximum demand and delivery of required voltage. Transformers of 200kVA, or greater, are monitored together with other transformers as appropriate and any transformer where the indicated load exceeds the transformer rating is considered for upgrade. Other options such as rebalancing, and or moving load to other transformers are also considered. Other factors taken into account are the load duration, i.e., how often the transformer is close to, or above, its ratings, and the time of day and year of the highest loadings.

Increases in load are then reflected in planning upstream through the various classes of MLL assets back to the Transpower GXP. The load on all 11kV feeders, zone substations and the 33kV feeders is continuously monitored and the data is used for system modelling and project planning purposes.

6.8.1 Trigger points for planning purposes

MLL has a broad range of criteria that represent trigger points for action across its varying classes of fixed assets. These are summarised in Table 19.

Table 19: Summary of planning trigger points

Asset class	Capacity criteria	Reliability criteria	Security of supply criteria	Voltage criteria
400V reticulation network	Conductor or fuse rating.	Blenheim CBD – 50% of load restored within 0.5 hours of fault, 100% within 1 hour. Elsewhere – restored within repair time.	(n) security of supply for standard residential or commercial connection.	Voltage falls below minimum regulatory voltage or 0.94pu at consumer's point of supply based on 1st percentile and 99th percentile.
11kV/400V distribution substation	Transformer rating (kVA).	Blenheim CBD – 50% of load restored within 0.5 hours of fault, 100% within 1 hour. Elsewhere – restored within repair time.	n security for most subs, with rapid transformer replacement, or use of mobile generator.	
11kV distribution network	Current exceeds 90% of thermal rating for more than 15 hours per year.	Meshed feeder - 50% of load restored within 0.5 hours of fault, 100% within 1 hour. Radial feeder – target restore time dependent on location.	(n-1) security for most of the urban 11kV network. (n) security for rural 11kV network.	Voltage falls below 0.95pu for more than 100 hours per annum.
11kV distribution hardware	As appropriate to equipment. Not to exceed maximum rating.			
33/11kV zone substation	Firm capacity available 98% of the time, i.e., can exceed firm capacity for 2% of time.	50% of load restored within 2 hours of fault.	(n-1) > 5MVA (n) < 5MVA	Able to cope with 0.85pu to 1.05pu on 33kV network and provide 11.2kV on bus.
33kV sub-transmission network	Current exceeds 66% of thermal rating for more than 1,500 hours per year.		(n-1) > 5MVA (n) < 5MVA	>0.85pu at all zone substations connections with 1.0pu at GXP.

6.8.2 Standardising assets and designs

MLL's network standards document the design and construction of network assets. The Network Standards are used for assets where ownership and/or maintenance responsibility ultimately rests with MLL.

The standards contain information and drawings to be used in designing network assets and detail the procedures for design approval and construction. These standards and policies include consideration for public safety at the design stage and assist MLL in meeting its obligations under the Electricity (Safety) Regulations 2010. They also assist in standardising assets to help achieve reliability of supply targets.

MLL, along with other New Zealand EDBs, has access to, and the use of, the PowerCo Contract Works and Network Operations guide. Where appropriate, PowerCo's documents are used to develop and update MLL's standards. This also increases the standardisation across the industry.

MLL is also part of a group of South Island EDBs buying group for cable, line hardware and store items. This has led to cross-company standardisation and reduction in the number of store items, unit costs and inventory held.

MLL is a member of the Collective Network Operations Group, which includes all South Island EDBs. The groups purpose is to work towards common access processes, documentation, competency training and assessment, consistent operational requirements and emergency plans.

Table 20 summarises some of the key strategies for standardising assets and designs at MLL

Table 20: Summary of standard strategies for assets/design

Asset category	Standardised features	Standardising methods
Sub-transmission, distribution, and, LV lines	Standard suite of conductors/cables to be selected from – generally available conductor/cables.	MLL Design Standard. Other types not included in standard needs specific network review and management approval.
Sub-transmission, distribution, and, LV cables		
Distribution substations/ transformers	Size of transformers (pole-mounted) generally dictate supporting pole. Off the shelf" models for network consistency.	MLL Design Standard.
Distribution switchgear	Selection generally from preferred suppliers of off the shelf goods – bespoke options avoided unless exceptional circumstances warrant.	MLL Design Standard. MLL preferred suppliers list.
Poles	New concrete poles are pre-stressed type. Load changes to iron rail, hard wood, larch or lattice tower poles result in replacement. Select from approved manufacturers and limited pole types only.	MLL Design Standard. Relevant utility pole standards to apply to new poles.
Other network assets	Generally procure from preferred (i.e., pre-approved) suppliers.	MLL preferred suppliers list and Design Standard.

6.8.3 Strategies for asset efficiency

MLL monitors and considers losses when looking at the system configuration and network development. In practice, the physical considerations (e.g., conductor size and pole spacing) and the requirement to deliver regulatory voltage tend to take priority at the asset design and construction phases of the lifecycle and this determines the losses.

Demand management also plays a part in energy efficiency. Where trends indicate future increases in demand for example, this is factored into the capacity of new or replacement transformers.

MLL specifies the level of power factor required to be met by users of the network to maximise the efficiency of utilisation. Similarly, maximum harmonic levels are specified for consumer installations.

MLL considers energy efficiency when purchasing and replacing transformers and the cost of the fixed and variable losses over the life of the transformer are considered.

Lines pricing is designed to incentivise consumers to install transformers of an appropriate rating. However, in many cases, consumers and their consultants prefer to over specify transformer capacity in anticipation of future requirements (thus increasing standing losses).

Energy efficiency initiatives also pertain to electricity users. MLL has interposed Use of System Agreements (UoSA) with electricity retailers. MLL, therefore, does not have direct contact with consumers, limiting its ability to influence consumer behaviour. As the local EDB, though, MLL provides advice to consumers through publications, e.g., newsletters.

6.8.4 Setting asset capacity

The theoretical starting point for quantifying new capacity is to build, “just enough, just in time”, and then add incrementally over time. However, MLL recognises the following practical issues:

- The standard size of many components, which makes investment “lumpy”.
- The ability of MLL to obtain a commercial return on investment.
- The one-off costs of construction, consenting, traffic management, access to land and reinstatement of sealed surfaces, which may make it preferable to install additional capacity rather than returning in the short to medium-term. This is especially the case since network assets typically have long lives, far in excess of the regulatory period and the 10-year horizon of this Plan.
- The addition of extra capacity can, in some cases, require complete reconstruction, for example, where larger conductor requires stronger poles or closer pole spacings, leading to considerable increases in total cost of ownership if an incremental approach is used at the outset.
- The need to avoid over-load risk. Over-load can lead to asset failure, reductions in service and reductions in asset lives.
- In terms of some items, e.g., power transformers and underground cables, the marginal cost of providing additional capacity for the future is typically small relative to overall project costs.

MLL’s guiding principle is therefore to minimise the level of investment ahead of demand while minimising the costs associated with doing the work as well as the total cost of the asset over its lifetime. This recognises that the costs of investment in advance of requirements is far more preferable than investment after failure has occurred or consumer supply is lost.

Generically in determining capacity requirements, MLL monitors and reviews loading data across the network (and specific areas depending on what is being considered) and assesses trends in data, liaises with other relevant stakeholders in the district (for example, the Marlborough District Council around its development plans), whilst reviewing existing infrastructure and any current capacity restraints. Considering these (and other) factors in combination is generally the best approach for determining capacity.

More specifically at the asset level, more detailed criteria are considered in determining asset capacity. Some of these are summarised in Table 21.

Table 21: Summary of criteria used to determine capacity of network assets

Asset category	Criteria to determine capacity*
Sub-transmission lines	Loading, growth forecasting, health and safety considerations. Surrounding land use (man-made or natural environment), climatic conditions, topography.
Distribution and lv lines	
Sub-transmission cables	
Distribution and lv cables	
Distribution substations and transformers	Expected demand within next 10 years, taking into account diversity.
Distribution switchgear	Expected future fault and load levels – generally only available in step sizes
Poles	Conductor mechanical loading (i.e., size of conductor and span lengths drive pole size), environment, loading from other sources (i.e., steady state and/or dynamic loads).
Zone substations - transformers/ switchgear/ buildings	Current loading, expected future growth and demand forecasting.

* Note – not an exhaustive list.

6.8.5 Prioritisation of development projects

In prioritising development work, MLL assesses the estimated cost and benefits. The drivers of the work are considered along with, the benefits to stakeholders. Table 22 summarises the ratings of typical benefits.

Table 22: Considerations in prioritising development projects

Description	Comments	Rating (10 = highest)
Safety	MLL will not compromise the safety of staff, contractors and the public. Safety is fundamental to the way MLL undertakes its activities and as such has highest priority.	10
Capacity	Overloading can lead to overheating, reduction in asset life, fire, explosion or cascade tripping.	9
Reliability	Consumers want a reliable supply.	8
Voltage	Consumers want items of their electrical plant and equipment to perform. This requires stable voltage levels free of harmonic interference.	7
Environ-mental	Managing impact on the environment is a key part of MLL's values, especially in highly sensitive areas.	5
Energy Efficiency	Low consumer-density EDBs like MLL have relatively high numbers of transformers, all of which incur losses regardless of consumption. Energy efficiency is taken into account during design and purchase of network assets. MLL also seeks to maximise the efficiency of its network through operations, notwithstanding the limitations from MLL's network physical constraints.	5
Renewal/ end of life	Lower priority if it is safe, has adequate capacity and voltage and low costs.	6

In assessing the potential benefits of the work, consideration is also given to the number of affected consumers, the total kW/kWh and the impact (if any) on revenue/ costs, e.g., reductions in maintenance/ increased line charges.

Potential projects come from a wide range of work including technical studies of the network, e.g., load flow analysis, consumer requests, consideration of load growth, information on proposed load changes, examination of existing constraints and limitations within the network and asset monitoring e.g., large concentrations of maintenance work may result in line renewal and reliability studies.

Projects are developed and budget pricing is undertaken on an annual basis. The benefits are assessed in terms of the criteria above and projects ranked accordingly. This is undertaken by the Network engineering staff. From this information a draft plan and budget is developed. This is then discussed with, and approved, by the CEO before being submitted to the Board for approval or alteration. Once approved, it is included within MLL's annual budget. The programme of projects is then managed on an ongoing basis (both underway and planned projects) to track expenditure and to ensure that any planned projects are still relevant. The programme is then updated accordingly. Monthly reviews are undertaken by engineering and finance staff to manage the status of Capex projects and capitalise or expense costs when and where appropriate.

6.9 Non-network solutions

The electricity distribution model has, until recently, remained relatively unchanged for many decades. However, the industry is now seeing the increasing availability of alternative technologies to the traditional network assets of poles and wires mainly through small scale distributed generation and battery storage. The use of non-network solutions, where appropriate, can offset investment in standard network assets. However, it needs to be recognised that an effective electricity network provides significant diversity benefits of electricity utilisation between ICP's and typically has the ability to provide flexibility in meeting consumer demand.

Historically, MLL has implemented non-network solutions including ripple control of water heating, night-store heaters, peak demand tariffs and reactive power tariffs. These legacy solutions have become less applicable as the line and energy segments of the electricity supply chain have been vertically disaggregated and line charges have diminished relative to the costs of energy. By way of example, the cost difference between delivered day/night energy has been markedly reduced in recent years.

Irrespective, the ripple control system remains a valuable tool for load management and is used to good effect when there are restrictions in Transpower's capacity to supply.

Significant uptake of electric vehicles, if and when this materialises in future, may result in the need for the introduction of alternative line delivery pricing structures, for example, if network capacity constraints are experienced. MLL is actively considering what the potential impacts of high penetration rates of EVs might be

With respect to new non-network solutions (technologies), MLL is part of a national industry group considering the potential impact of disruptive technologies and the manner in which network assets will be operated and managed in the future. Technologies which are becoming increasingly available and affordable are likely to impact the network. These include distributed generation (photo-voltaic, in particular), to a lesser extent wind and electric vehicles in conjunction with capability improvement and cost reduction in storage batteries.

6.9.1 Distributed generation, photovoltaic/solar and wind

The reduction in the cost of photovoltaic systems and greater consumer interest is resulting in increases in the number of photovoltaic installations into MLL's network. Figure 27 plots the distributed generation capacity in solar and wind energy installed into MLL's network in kW from year 2010 to year 2019. This shows steady growth, particularly in solar, from 2013 but a trend cannot be discerned at this stage. Total distributed generation-installed capacity of solar is approximately 3.2MW and wind is 2.4MW. Given the current relatively low utilisation (generation) rate from photovoltaics[18], the current capacity build is not expected to markedly alter network requirements over the next five years and perhaps not even over the 10-year planning period.

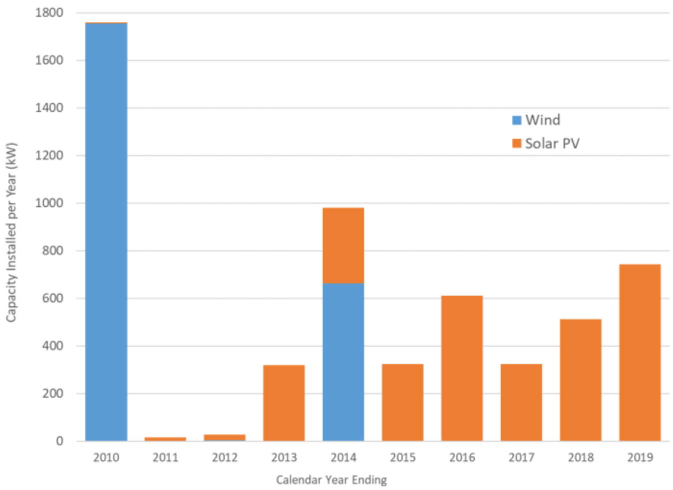


Figure 27: Solar and wind distributed generation into MLL's network since 2010

[18] Approximately 17% for the region (https://globalsolaratlas.info).

It is also noted that, as more cost reflective network pricing is introduced, the attractiveness of photovoltaic installation will likely diminish with the actual saving being specifically related to a reduction in energy consumption (variable) prices.

To date, there have been two ICP wind installations which are located in the relatively windy East Coast area. Both of these installations have the capacity to utilise the entire electricity generated. In both instances, these commercial installations have not altered expectations of capacity from the MLL network.

Two other wind generator installations have been installed as investments, with the objective of supplying electricity to ICPs connected to the MLL network. Accordingly, were it not for the interconnectivity provided by the MLL network, these wind generators could not operate. The East Coast wind generation output is subject to significant variation and cannot be predicted with much degree of certainty.

Predicting the future installation of wind generation and large-scale photovoltaic installation is uncertain. This will be influenced by a number of factors, including the recent (1 October 2019) removal of avoided cost of transmission benefits, falling installation cost, improving solar panel efficiencies, reducing storage battery costs, the degree of marketing undertaken by suppliers, the potential for local or national government subsidies/funding schemes, and changes to standard connection and operating standards of EDBs and possibly the Electricity Industry Participation Code.

Solar and wind DG by nature generate intermittently. Wind DG also has an inherent requirement for bi-directional power flows. They can lead to an increase in the voltage swings in the network requiring capacity reinforcement, particularly in the LV network. Additionally, it is considered likely that there would be little or no reduction in the network peak demand - or at least the potential to strike that peak and to which the network must be designed. Perversely for MLL, the areas where MLL might see benefit from consumers disconnecting into home or micro grids is remote and uneconomic (for MLL to supply) areas, but consumers here have less incentive to invest in this technology as, generally, the premises they own are not continuously occupied and so the total kWhs consumed is low lessening the return on investment in off-grid generation.

Widespread installation of solar SSDG particularly in the Marlborough Sounds has the potential to cause voltage problems on the network. MLL gives this due consideration when assessing network (and feeder) capacity and when reviewing applications for the installation of DG.

6.9.2 Electric vehicles

The transportation sector utilises a significant amount of energy. Uptake of EVs will impact on both the need for generation and the electrical networks which distribute it.

The impact of EVs on the network remains to be determined but due to the present capacity margins in the network, peak demand could increase significantly without triggering growth expenditure. The ripple system could be utilised in accord with user requirements to assist in maximising the efficiency of charging relative to time of use. Additionally, anecdotal evidence suggests the effects on EV charging will be moderated by the short journey distances experienced to date (perhaps due to range anxiety) combined with the relative high efficiencies of these vehicles (in km/kWh).

It is not expected that EV numbers in Marlborough will increase at such a rate that MLL will not be able to respond to meet the supply demand. Additionally, while battery powered EVs have been given recent prominence in New Zealand, other competing technologies exist; for example, the US Department of Energy reports significant progress in cost reductions for hydrogen fuel cell infrastructure.[19] MLL will continue to monitor EV technology and uptake in the region but has no plans for network augmentation at this time in relation to it. MLL will consider alternative line delivery price structures, if deemed appropriate, to manage potential significant increased demand from electric vehicles.

6.9.3 Battery technology

This is an important factor in both EVs and in the uptake of PV. Low cost batteries could enable some installations to become independent of the electrical network, if the flexibility of demand capacity provided by the network is not a consideration, and, provide others with a means to store the generation and use it at times which produce maximum benefit. But, as with the utilisation of photovoltaics, the cost of the batteries needs to be balanced against the introduction of cost reflective network prices, the requirement for which has been signalled by the Electricity Authority.

The Marlborough network is not capacity-constrained, and it provides the opportunity for ICPs to share the benefits of diversity of load.

[19] Refer https://www.energy.gov/sites/prod/files/2017/10/f37/fcto-progress-fact-sheet-august-2017.pdf

A study of battery costs for EV and stationary storage commissioned by the EU in 2018 forecast falling battery costs as illustrated in Figure 28.[20] This shows past falling costs and projected costs out to 2030 down to €100/kWh representing an approximate halving of current costs.

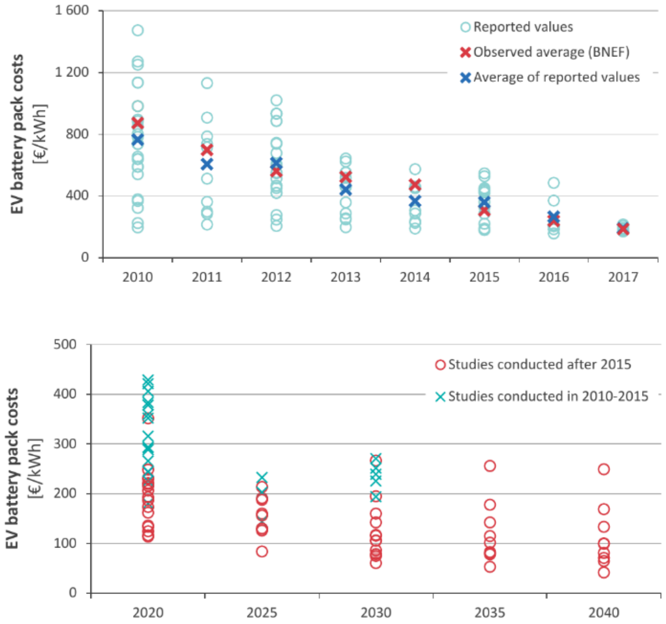


Figure 28: Forecast lithium ion battery costs

These cost reductions are expected to drive increased take-up of both battery storage for PV installations, thereby increasing their utility, and the take-up of EVs assuming these costs pass below price threshold points for consumers. The main issue from a strategy perspective is that the future take-up rates for these technologies is uncertain. MLL is mindful of this and will monitor this technology closely.

6.9.4 Remote Area Power Supplies

Remote Area Power Supplies (RAPS) are essentially an alternative electricity supply from a standalone generation system, to that of a network connection. A RAPS system typically utilises a combination of solar generation, battery storage and diesel backup to provide supply.

As has been outlined in this AMP, MLL has a significant number of uneconomic connections, particularly at the extremities of the network. There are a very small number of instances where RAPS may provide immediate benefit, by minimising economic losses, typically at sites characterised by:

- Extreme remoteness resulting in increased line and vegetation maintenance costs.
- Extremely low consumer count per km of line requiring renewal.
- Poor asset health driving a case for short term renewal.

While MLL does not currently have plans for any significant investment in RAPS within the next five years, MLL is proactively reviewing this situation and potential sites for trials of RAPS where minimising economic losses may be possible.

Depending on the outcome of the trials, MLL may look to implement RAPS systems at other suitable sites. The potential to install RAPS as an alternative electricity supply will need to consider as a minimum:

[20] “Li-ion batteries for mobility and stationary storage applications "JRC science for Policy Report; ISBN 978-92-79-97254-6”.

- significant renewal of the assets where RAPS may be most suitable as a replacement alternative is not likely to be required within the next five years;
- battery technology and asset life cycles.;
- uncertainty around the safety risks and maintenance costs associated with a RAPS scheme;
- costs and risks associated to the transport of back-up diesel fuel (particularly over water ways in the Marlborough Sounds), and the storage, maintenance and security of managing diesel fuel in remote areas;
- uncertainty in the regulatory environment particularly in regard to battery and generation ownership; and
- MLL's obligations for the continuance of supply under the Electricity Industry Act 2010.

MLL believes that a coordinated approach with Government and its regulators would be beneficial to EDBs and consumers alike. MLL has a significant proportion of ICPs in areas which are uneconomic and have always been uneconomic. Continuance of supply to these ICP's will add costs for consumers in economic areas.

6.9.5 Network adaption

Ultimately, the role of network services may diversify to range from a traditional full lines service to provisioning firm capacity, fault current and frequency regulation support for micro networks. The greatest risk for MLL may not be mastering the technology involved but rather the ability to properly reflect its long-run and marginal costs for the services it provides.

It is generally believed that the factors driving the uptake of new technologies will not result in a need for major change in asset management practices within the period of this AMP or that future plans can be adapted as the technology becomes established and its effects more certain. MLL will continue to monitor these technologies and consider how the network can best be managed to give maximum benefit to all stakeholders. MLL does not anticipate any difficulty meeting the requirements of EVs when and if their additional demand commences.

6.10 Key assumptions

In preparing this AMP, and undertaking its asset management activities, one of the key assumptions made by MLL is that the business will carry on in perpetuity, i.e., the assumption is that MLL will own, operate and maintain an electricity distribution network into the future.

Other key assumptions (quantified where possible) are set out in Table 23.

Table 23: Significant assumptions underpinning MLL's asset management (and AMP)

Assumption	Sources of uncertainty	Possible impact of uncertainty
That no major disasters or widespread systemic problems will occur.	While contingency planning and emergency response plans are in place, it is difficult to predict the timing, extent and location of events with any great degree of certainty.	Extensive damage to significant proportion of MLL's network requiring significant expenditure (both opex and capex) in a relatively short timeframe. MLL has no debt, a strong balance sheet and is expected to have the capacity to deal with all but the most serious of disasters.
That there are no significant changes to local authority (i.e., Marlborough District Council (MDC)) long-term plan.	MDC may alter existing plans. This may allow opportunity for cost sharing with MLL – for example, if road widening, or renewal of underground services occurs, then there may be opportunity for MLL to renew electrical infrastructure (or underground overhead sections) at the same time.	Inclusion of as yet unplanned activities by MLL.
Inflation assumptions.	Inflation is manged by the monetary policy of the Reserve Bank of New Zealand (RBNZ). While RBNZ aims to keep inflation near the 2% target midpoint, this could vary.	Inaccuracies in forecast expenditure amounts (either over or under depending on actual vs assumed price inflator allowed for). Further detail is presented in the expenditure forecasts section.
There are no significant changes to forecast load demand.	Step change in district population growth, or load demand from industry growth.	Additional or reduction in forecast growth expenditure.
Consumers remain satisfied with current reliability and resulting costs.	Consumers may change preferences – i.e., accept less reliability for lower lines charges. Uncertainty here is knowing consumers future preferences.	Less revenue which in turn would result in less expenditure. Ultimately, this would result in a less reliable network.
No significant changes to regulatory regime and requirements.	Change in Government, changes to regulatory nature/requirements of EDBs.	Revision of plan may be required to adhere to any changes in regulatory requirements.

Table 23: Significant assumptions underpinning MLL's asset management (and AMP)

Assumption	Sources of uncertainty	Possible impact of uncertainty
The rate of uptake of new technologies (e.g., EVs, PV).	The rate of uptake of new technologies is largely unknown at this stage.	The widespread charging of EVs on the network has the potential to provide a source of revenue which currently does not exist, particularly given the MLL network is typically not capacity constrained. The widespread installation of PV can have two principal effects. A reduction in delivered energy to ICPs where all of the output is consumed within the premises and if large numbers of consumers sought to inject into the network the level of PV or their internal control, would need to be limited to prevent voltage problems. In event of injection from ICP PV the network will be required to deliver to other ICPs. The introduction of cost reflective line charges will likely damper enthusiasm for PV given line charges should relate to installed network capacity not delivered energy. If the cost of battery storage were to significantly be reduced, the benefits of photovoltaics would be further enhanced but again it is advocated if network charges related to the provision of capacity and ICP's required for security of the network capacity the utilisation of photovoltaics and batteries would be constrained.
That no major new loads or new sources of generation connect to the network.	Inability to accurately predict future growth which is controlled by others, change in economic opportunities for various industries.	May require upgrade and/or modification(s) to network depending on nature and scale of new load(s) or generation. Addition to growth expenditure above forecast.

6.11 Asset management improvement

As outlined in Section 6.2.1, MLL, during the planning period, is intending to become certified to the ISO 55001 Asset Management Standard. This will provide MLL and its stakeholders with a further level of confidence that the asset management practices being undertaken are done so in accordance with international best practice.

Completion of the AMMAT has identified areas of improvement in MLL's asset management. A selection of improvements (those deemed as having the greatest importance/benefit) based upon the AMMAT assessment are summarised in Table 24.

Table 24: Asset Management Improvements for MLL

Improvement Area	Details	Improvement Action
Asset management policy	Asset management policy not specifically drafted other than what is included in AMP.	Consider drafting policy for the organisation outside of AMP. MLL's asset management documentation (SCI and AMP) should be based on the policy.
Asset management framework	Compare existing asset management practices to assess whether they fit with industry standard asset management framework.	Modify and align existing asset management to fit with ISO 55001 framework.
Certification	Work towards becoming ISO accredited in asset management systems.	Become certified to ISO 55001.
Personnel/resourcing	Effective asset management requires adequate resourcing (staffing) to develop, implement and manage asset management policy, processes and procedures.	Review staffing structure and determine whether changes in roles may benefit existing asset management at MLL. Asset management could be improved with staff solely dedicated to asset management. This is challenging given the relatively small size of the organisation and breadth of work.
Asset data	Certain assets and/or their attributes data is less accurate than desired by MLL. Greater focus should be placed on asset data to ensure data integrity.	Review asset data and if requirements are meeting MLL needs and where improvements can be made.
Asset data	As-built process currently under review. Review success and continually improve as-built standard as required.	Implement new as-built process and review effectiveness.
Information systems	A number of information systems are in use.	Review information systems to ensure appropriateness and that correct asset data is held.
Information systems	Mobility.	Further develop and expand mobility solutions to capture more asset information in the field.

7. Network development

7.1 Overview

MLL's network has been developed over time in response to the demand of its consumers and this development will continue into the future. This section provides details on the anticipated forecast growth in demand and changes that are expected to the network to accommodate that.

7.2 Growth/demand projections

7.2.1 Demand trends

Figure 30 shows both the historical and forecast demand for the whole network. The growth rate is projected to be approximately 0.5% per annum. However, a higher and lower forecast growth rate (0.75% and 0.25% respectively) are also included to illustrate potential longer-term effects of variable forecast growth. The forecast growth rate will be regularly reviewed and updated. Table 25 presents a summary of the

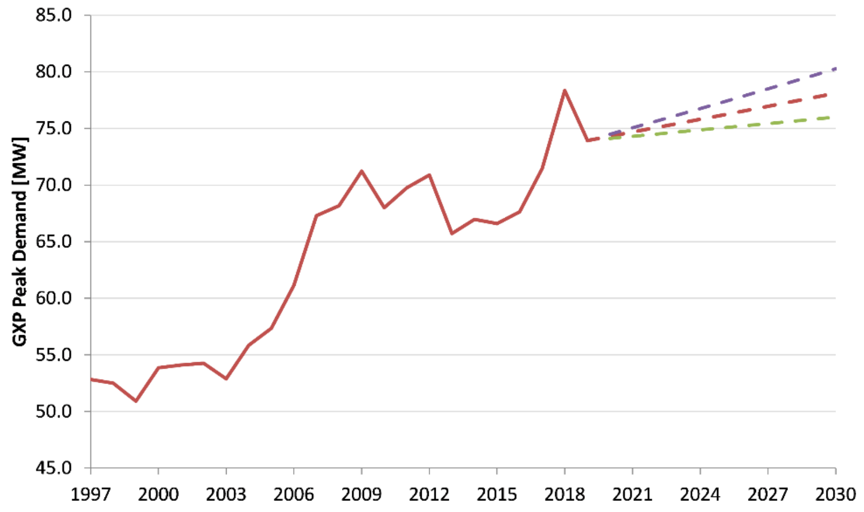


Figure 30: Network peak demand trend and forecast

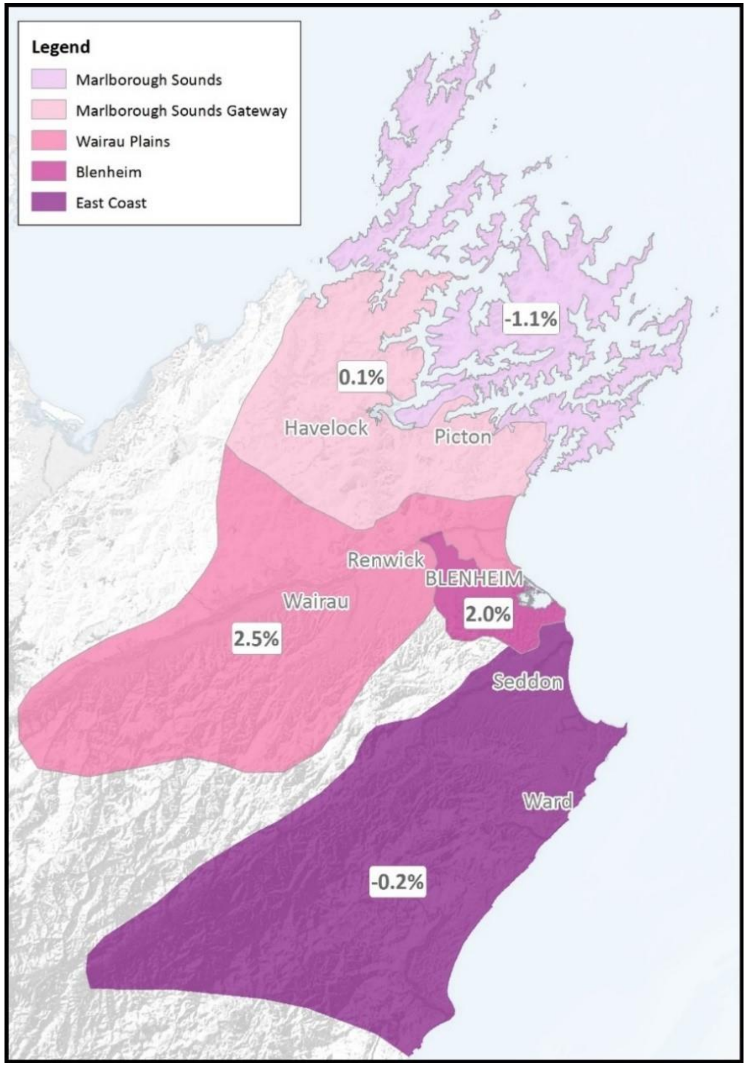


Figure 29: Forecast demand growth by planning area

maximum forecast Blenheim GXP demand, noting that column headers are calendar years.

Table 25: Blenheim maximum demand forecast

Substation	Security rating	Secure capacity (MVA)	2019 (actual)	2020	2025	2030
Blenheim GXP	N-3	100	73.9	74.3	76.2	78.1

The steady growth exhibited is mainly a result of:

- steady residential subdivision activity, especially in a number of areas such as Springlands, Omaka and Taylor Pass (i.e., largely driven by steady population growth); and
- changes in the demand of some larger industrial consumers, especially within the viticulture industry, and largely driven by economic growth which is also relatively constant as noted in section 3.1.1.6.

Growth in each area of the network varies according to load type and economic activity. Figure 29 indicates annual forecast growth rates by planning area as forecast by MLL.

7.3 Area plans

The network is split into five planning areas to better segment demand forecast and associated planning. The areas are based on both geographical and load type features. These area plans are summarised in the following sections.

7.3.1 Blenheim planning area

Stable residential and commercial growth in the Blenheim area is forecast to result in the n-1 rating being exceeded at one zone substation (Nelson St) within the planning period. This, together with other drivers such as improving network resilience to major contingent events, will be the main drivers of investment in this area.

Security in the area is generally satisfactory with all substations supplied by at least two separate 33kV circuits.

Security and growth project spend over the 10-year planning period is set out in the Expenditures section of this plan

7.3.1.1 Area overview

The Blenheim area terminates roughly at the town boundaries but also includes the industrial zones at Riverlands. Six of the 16 zone substations are within this area: Springlands, Nelson St, Waters, Redwoodtown, Riverlands and Cloudy Bay. All these substations are supplied by the only Blenheim GXP located near Springlands.

Blenheim contains a mix of residential, commercial and small industrial consumers. The maximum demands are predominately a result of winter heating and tend to occur at 7am to 11am and 4pm to 8pm during cold and/or wet times. In total, the Blenheim area represents approximately 60% of the total ICPs and 45% of the load.

When viewed as an individual consumer level, individual residential load growth is static or falling slightly due to a range of factors, including increased use of energy-efficient lighting, use of heat pumps rather than conventional heaters, etc. From a network perspective, this is counteracted by an increasing number of consumers due to steady population growth.

The industrial type load tends to be driven by wine processing (late March to early May) and can be when Marlborough reaches its peak demand. Load growth generally follows the viticulture industry growth.

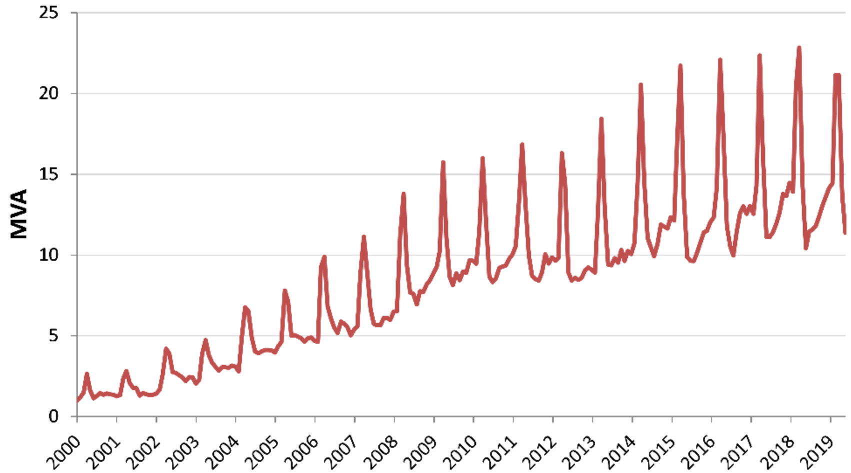


Figure 31: Winery maximum demand by year (MVA)

7.3.1.2 Demand forecasts

Demand forecasts for the Blenheim zone substations are shown in Table 26 (note that column headers are calendar years).

The Blenheim area has a relatively high rate of growth with much of that coming from the industrial area (Riverlands and Cloudy Bay). Considerable investment has recently taken place in this area with two of the six zone substations less than nine years old.

Table 26: Blenheim area zone substation maximum demand forecasts

Substation	Security rating	Secure capacity (MVA)	2019 (actual)	2020	2025	2030
Cloudy Bay	N-1	16.5	4.1	4.2	8.0	9.1
Nelson St	N-1	16.5	14.3	14.6	16.1	17.8
Redwoodtown	N-1	15.0	12.7	12.9	13.9	14.9
Riverlands	N-1	10.0	9.1	9.3	7.2	8.2
Springlands	N-1	16.5	10.0	10.2	10.9	11.8
Waters	N-1	16.5	7.5	7.6	8.2	8.8

Cloudy Bay is forecast to grow considerably but a large part of that is planned load transfer from the nearby Riverlands zone substation. This growth is largely based on a continued and stable viticulture industry.

Nelson Street is predicted to almost reach its secure N-1 capacity by 2025, if increases in demand in Blenheim's commercial CBD occur. This can be addressed by the transfer of load to other zone substations.

Aside from the normal capacity utilisation of a particular substation, it is also necessary to consider flexibility of operation within the network should circumstances preclude the utilisation of a zone substation requiring its load to be transferred to those adjacent.

7.3.1.3 Area constraints

Growth constraints affecting the Blenheim area are the zone substation capacities. As noted above, secure capacity is forecast to be exceeded at Nelson Street zone substation in 2025.

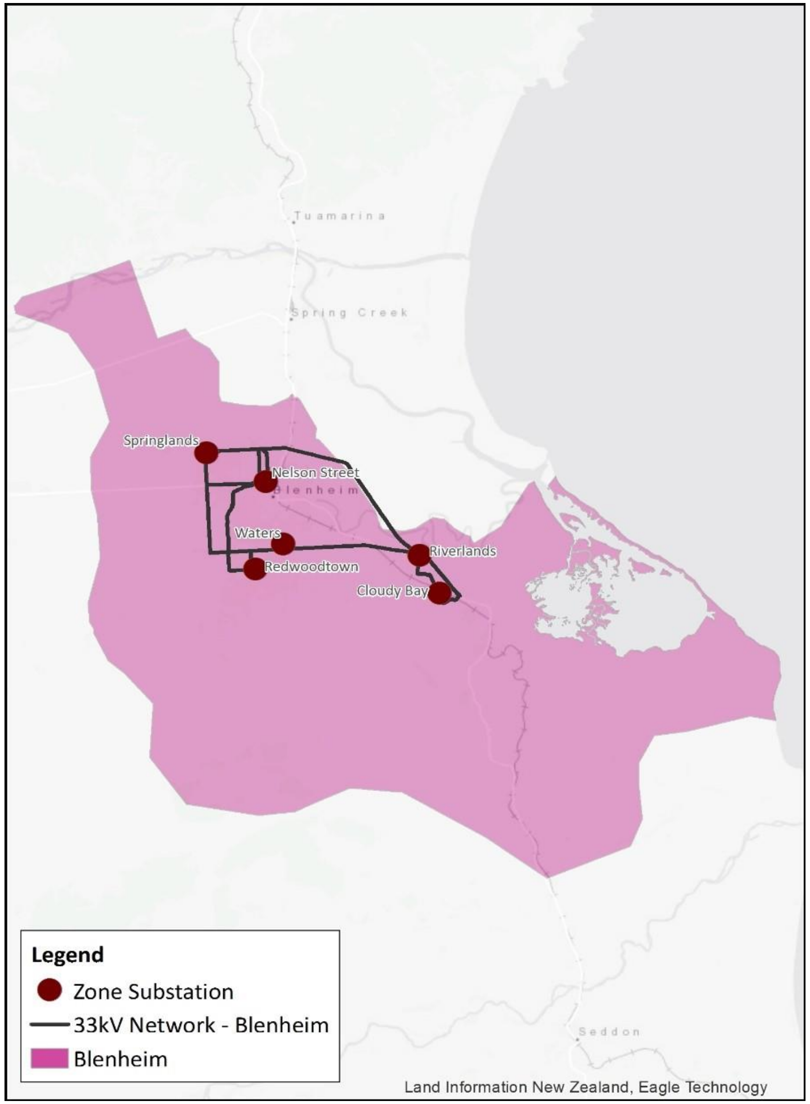


Figure 32: Blenheim urban area

7.3.1.4 Growth and security projects

Growth or security (reliability) related projects for the area are set out in Section 7.5 and include Murphy's Road 33kV cable installation and "T" removal; Redwoodtown "T" removal, Redwoodtown to Waters substation conductor upgrade and a further 11kV feeder tie between Cloudy Bay and Riverlands zone substations.

7.3.2 Wairau Plains planning area

Tapp zone substation was recently constructed and commissioned to replace the Renwick zone substation due to a combination of growth, aged equipment and proximity to the Wairau Fault.

Steady growth in this area is not forecast to trigger any security constraints, however, many long radial feeders are located in this area which pose their own security implications.

7.3.2.1 Area overview

The Wairau Plains area surrounds the Blenheim planning area and covers the more rural parts of Marlborough. Four of the 16 zone substations are located in the Wairau Plains planning area and include Woodbourne, Tapp (replacing Renwick), Spring Creek and Leefield.

Significant features of this area include Woodbourne airbase, Renwick Township and airport and a substantial horticultural/agricultural area with extensive vineyards. The load tends to be driven by wine processing (late March to early May) and the need for irrigation in the vineyards (December to March).

7.3.2.2 Demand forecasts

Demand forecasts for the Wairau Plains zone substations are shown in Table 27 (note that column headers are calendar years).

Table 27: Wairau Plains area zone substation maximum demand forecasts

Substation	Security rating	Secure capacity (MVA)	2019 (actual)	2020	2025	2030
Leefield	N	5.0	1.8	1.8	2.1	2.3
Spring Creek	N-1	5.0	4.5	4.6	5.1	5.6
Tapp	N-1	16.5	10.9	11.1	12.2	13.5
Woodbourne	N-1	10.0	8.2	8.3	8.7	9.1

The growth in this area is forecast to be steady at 2.5% based largely on previous data and anticipated growth in the area (primarily residential and vineyard related (irrigation and/or processing) developments).

Renwick zone substation was replaced by Tapp zone substation at a new green field (commissioned RY2020) and has a secure rating of 16.5MVA, alleviating the forecast capacity issues in that area and improving network resilience to earthquake events.

7.3.2.3 Area constraints

Major constraints affecting the Wairau Plains area are:

- Kaituna Valley load capacity constraint (should there be a significant demand increase).
- Leefield zone substation at only N security (but loaded below the 5MVA security trigger level).

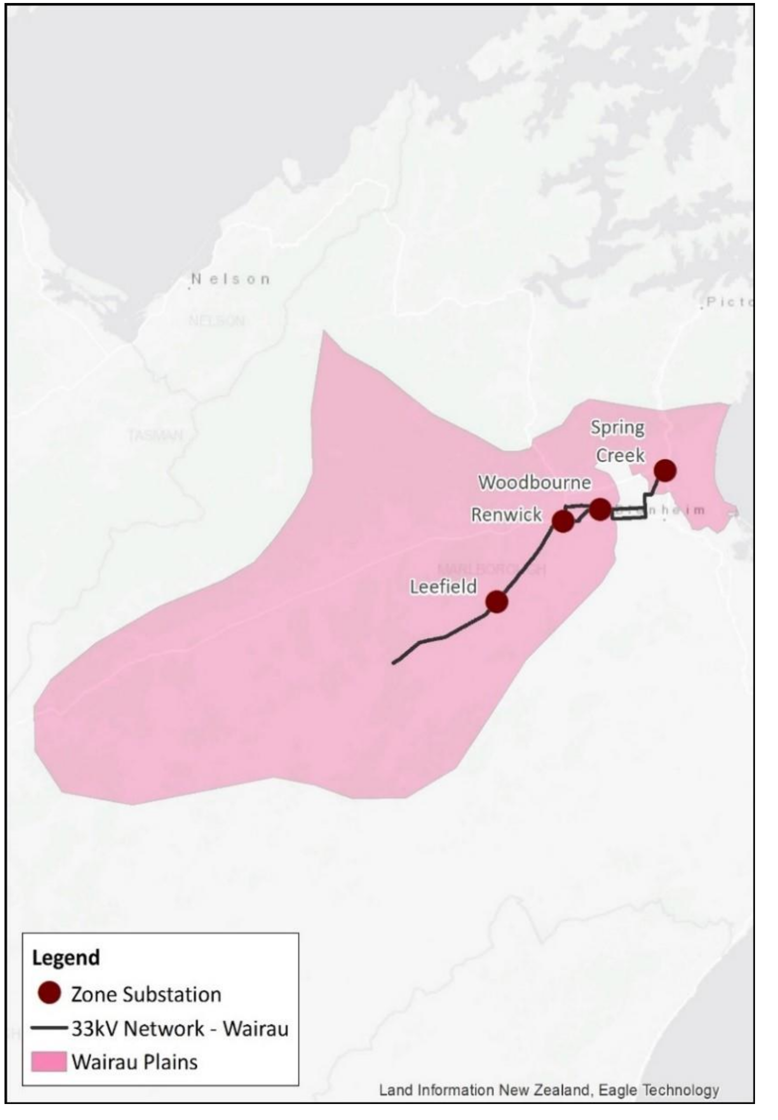


Figure 33: Wairau Plains area

- Spring creek zone substation supplied by dual circuit strung on the same towers such that one event could impact both circuits and supply to the substation.

7.3.2.4 Growth and security projects

Projects planned for the Wairau Plains area are Kaituna substation, subject to confirmation of a major consumer increasing their demand through expansion (combined with inability to supply this load from adjacent substations). This, and other less substantial projects in the area are set out in Section 7.5.

7.3.3 Marlborough Sounds “gateway” planning area

Forecast load growth is low in the Sounds Gateway area at only 0.1% with the residential sector converting to more efficient appliances and lighting. Irrigation load in the Rai Valley area is steady and there is limited industrial growth.

As a result, few projects other than renewals are planned for this area.

7.3.3.1 Area overview

The Marlborough Sounds gateway area includes the townships of Rai Valley, Havelock and Picton. Four substations supply this and the Marlborough Sounds area and include: Rai Valley, Havelock, Linkwater and Picton. All of these substations are supplied by the Blenheim GXP, with Picton being supplied by dedicated 33kV dual circuits.

Parts of the planning area are largely pastoral (beef/sheep) with a low ICP density. The inland valleys tend to be sheltered from storms. Pastoral land use combined with some irrigation means that the load tends to peak in the winter months.

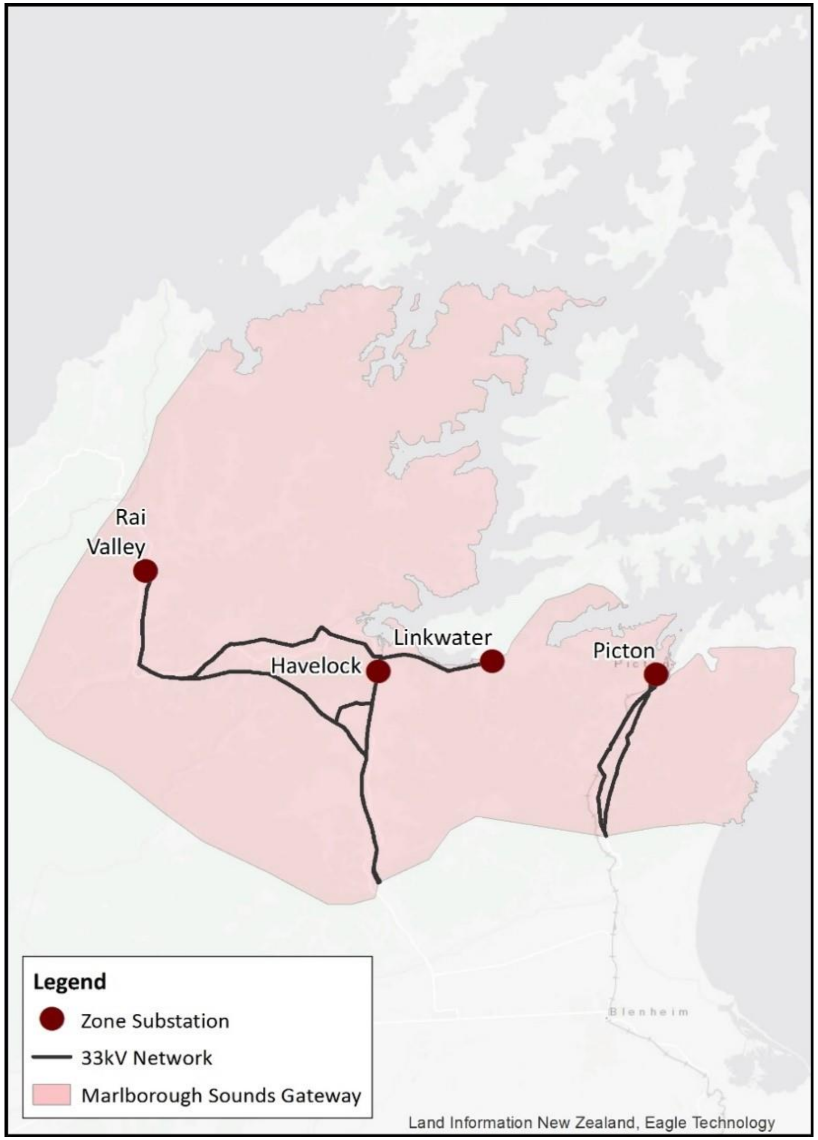


Figure 34: Marlborough Sounds “gateway” areas

The planning area also includes the townships of Waikawa and Havelock.

7.3.3.2 Demand forecasts

Demand forecasts for the Sounds Gateway zone substations are set out in Table 28 (note that column headers are calendar years):

Table 28: Sounds gateway area zone substation maximum demand forecasts

Substation	Security rating	Secure capacity (MVA)	2019 (actual)	2020	2025	2030
Havelock	N-1	5.0	2.9	2.9	3.0	3.0
Linkwater	N	5.0	4.2	4.2	4.2	4.2
Picton	N-1	15.0	7.1	7.1	7.1	7.1
Rai Valley	N	3.0	2.1	2.1	2.1	2.1

The forecast load in this area is very low with a flat load at Linkwater and Picton zone substations based on previous years' data. However, there is potential for:

- further commercial and/or light industrial development at the Havelock marina area. Should this development materialise, then the figures forecast for Havelock will likely be exceeded; and/or
- Significant demand on the Picton zone substation from new connections that are currently in feasibility stage.

7.3.3.3 Area constraints

Constraints affecting this area are:

- Rai Valley and Linkwater zone substations at N security.
- All four zone substations are supplied by a dual 33kV circuit strung on the same towers (over some sections of the line) where one event could affect both circuits and supply to these substations (Picton is separate to Rai Valley, Linkwater and Havelock but suffers the same problem over some sections of those respective lines).

7.3.3.4 Growth and security projects

Growth or security (reliability) related projects for the area are set out in Section 7.5.

7.3.4 Marlborough Sounds planning area

MLL does not have any substations in this planning area, however it has approximately 750km of 11kV distribution lines (in the order of 20% of the network) in the Marlborough Sounds. These 11kV lines supply approximately 2,500 consumers by way of 15,000kVA of distribution transformer capacity. There are on average around three consumers/km of HV line compared with over 9 consumers/km for the entire network. Many of the installations are holiday homes with intermittent occupation - approximately 50% of consumers in the Marlborough Sounds use less than 2,000kWh per annum (note, this compares to an average residential/domestic household consumption of approximately 7,500kWh per annum).

The maximum demands on the various lines supplying the Marlborough Sounds generally occur over long weekends or public holiday periods – Easter, Christmas, Queens Birthday or Labour Weekend. This holiday occupation also leads to much lower diversity of demand than would usually be expected from most areas.

As has been outlined in this AMP, connections in these areas are generally uneconomic, i.e., the revenue recovered from these consumers does not meet the costs to supply them. Costs are generally higher because of the remoteness of these areas, accessibility (boat or helicopter is required to access many connections), the rugged terrain and dense, fast growing vegetation, for example.

7.3.4.1 Area overview

Reticulation in the Marlborough Sounds poses many construction and operational challenges. Most of the lines are constructed over rugged terrain, with access to many areas for construction and maintenance limited to foot, tracked vehicles or helicopter. Often spans are relatively large in length where valleys need to be traversed. Some areas do not have road access and can only be accessed by boat and/or on foot. The Marlborough Sounds has a relatively high rainfall and a climate that encourages rapid vegetation growth, leading to the need for tree trimming and vegetation control on a short return basis.

A significant issue facing MLL regarding reticulation in this area is associated with load growth or supply enhancement.[21] .

Many of the existing lines are built on private or Government-owned land and constructed in the 1960s and 1970s, with access protected by the “existing works” provisions of the Electricity Act. MLL has limited easements over line routes. Therefore, upgrades which necessitate changes to the existing layout or create an injurious effect on the land require new easements to be created. Any future major developments in the Marlborough Sounds area would require very careful analysis and

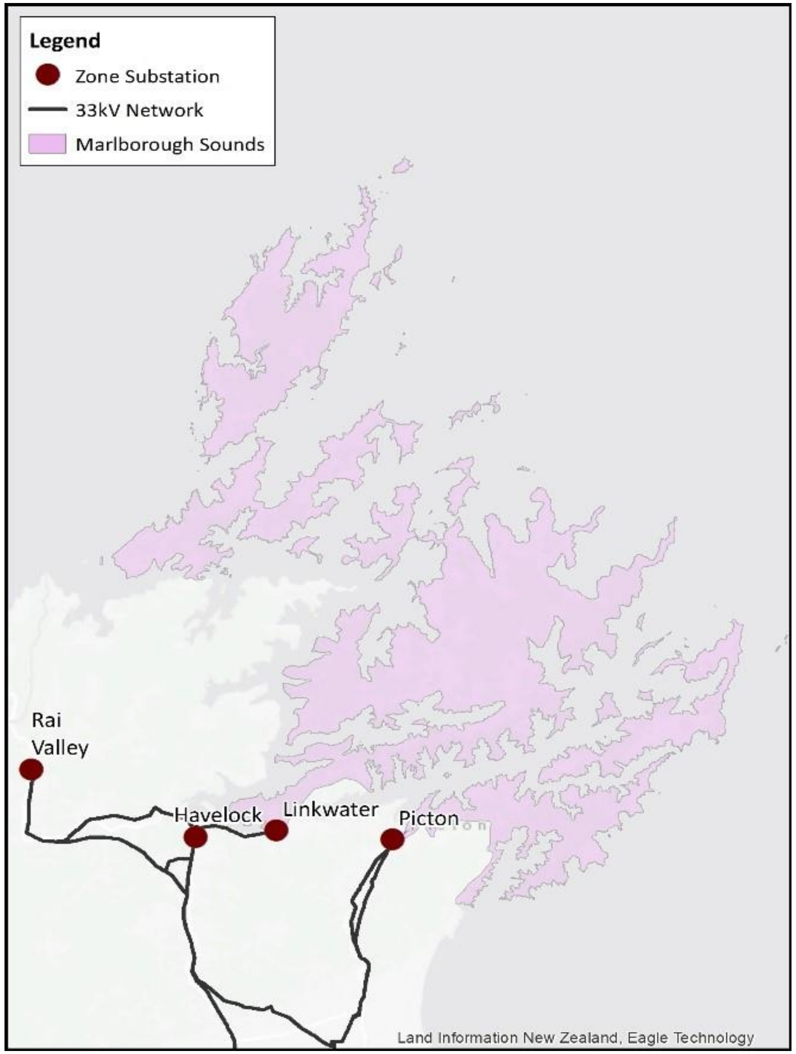


Figure 35: Marlborough Sounds planning area

[21] Whilst load is decreasing in average across the area, there remain instances of load increase or supply enhancement at some points.

design of both asset and non-asset (e.g., demand control) alternatives to ensure the optimal solutions are found.

In many instances, the access utilised to construct the lines has long since gone. The lines which were constructed over rugged bush-clad terrain by helicopter pose particular problems, especially in relation to line access and vegetation maintenance.

A further issue with respect to lines in the Marlborough Sounds is that of supply reliability. Lines supplying the Marlborough Sounds are radial/spur lines, with no interconnection to other parts of the network.

7.3.4.2 Demand forecasts

Demand forecasts for the Marlborough Sounds main 11kV feeders are shown in Table 29 (note that column headers are calendar years).

Table 29: Demand forecasts for main 11kV feeders in Marlborough Sounds

Feeder (zone sub)	Zone substation security rating	Zone substation secure capacity (MVA)	2019 (actual)	2020	2025	2030
French Pass (Rai Valley)	N	3.0	1.0	1.0	1.0	0.9
Sounds (Linkwater)	N	5.0	2.6	2.5	2.4	2.3
Waikawa (Picton)	N	15.0	3.6	3.5	3.3	3.2

The load in this area is forecast to be static or slightly declining based on load trends from the last five years.

7.3.4.3 Area constraints

Constraints affecting the Marlborough Sounds area are:

- Radial feeders, although MLL does have emergency generation installed at Kenepuru Heads and Elaine Bay.
- All three substations which supply the 11kV feeders (Table 29) are themselves supplied by a dual circuit strung on the same poles (over certain sections) where one event could affect both circuits and supply to these substations.
- There are limited opportunities to transfer 11kV load between substations because of the distance involved and the radial nature of the feeders.
- Backup substation supply is best provided by mobile generators owned by MLL.

7.3.4.4 Growth and security projects

Growth or security (reliability) related projects for the Marlborough Sounds planning area are set out in Section 7.5.

7.3.5 East Coast planning area

Forecast load growth in the East Coast area is low. The terrain and environment lends itself to mainly pastoral farming. The viticulture industry has been expanding in the Seddon area but water is limited further south constraining expansion into these areas. However, MLL understands that a significant irrigation project in the Ure River area has been considered. If this materialises, it would result in intensified land use including viticulture and dairying. Any pumping station proposed at Ure River may ultimately necessitate an upgrade of the capacity of the existing line.

7.3.5.1 Area overview

The East Coast area includes the townships of Seddon and Ward. Each town is the location of a substation.

The East Coast consists of a narrow strip of coastal land running down to Marlborough's southern boundary, with some sparsely populated river valleys running into the centre of the South Island. Much of the network in the coastal area was constructed in the late 1950s using concrete poles and copper conductor. The long radial nature of the area means there are no alternative supplies available during faults or planned outages. The low population density makes it difficult to justify the high levels of expenditure required to provide alternative supplies through feeder interconnections.

The sheltered nature of the land and pastoral land use, with relatively small areas of trees and vegetation, leads to high reliability of supply in these valleys, unless impacted by snow or significant events.

7.3.5.2 Demand forecasts

Demand forecasts for the East Coast zone substations are set out in Table 30 (note that column headers are calendar years).

Table 30: East Coast area zone substation maximum demand forecasts

Substation	Security rating	Secure capacity (MVA)	2019 (actual)	2020	2025	2030
Seddon	N-1	10.0	6.7	6.7	6.6	6.6
Ward	N	5.0	1.4	1.4	1.4	1.4

The forecast load for both Seddon and Ward is relatively flat based on loading data from recent years. However, MLL is aware of current

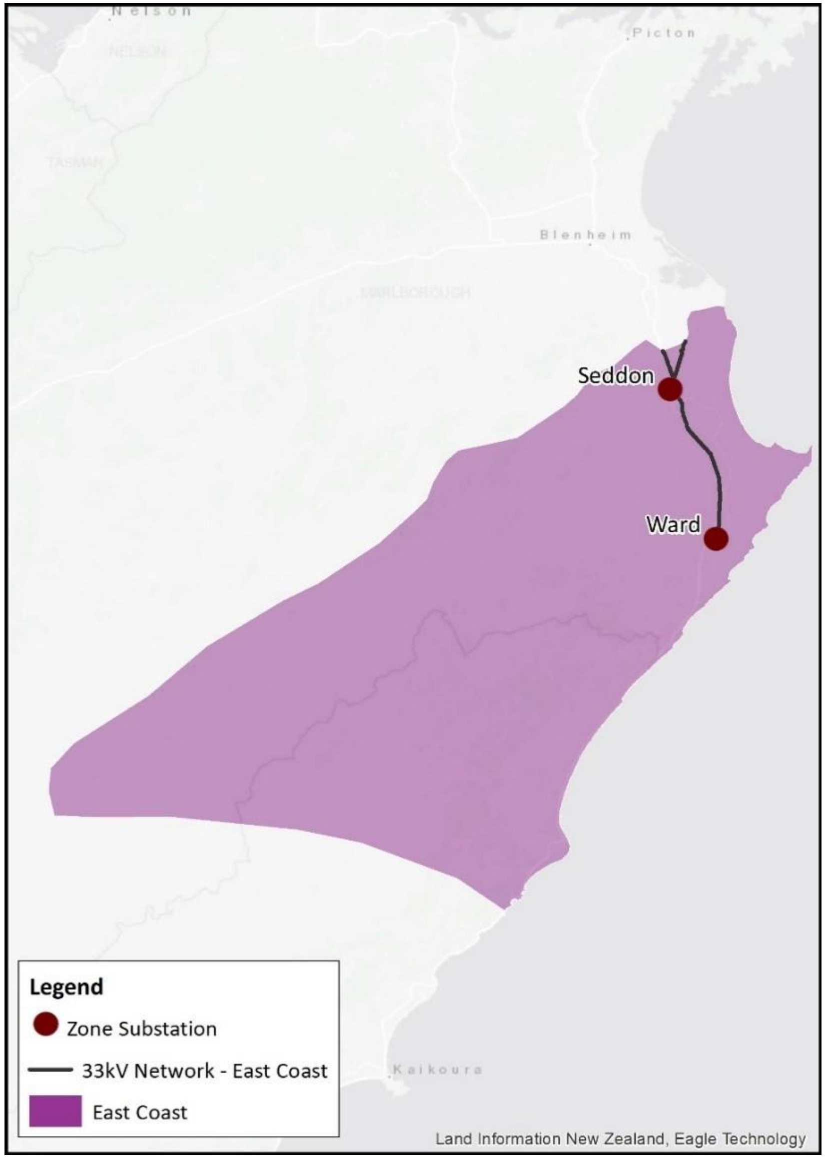


Figure 36: East Coast area

investigations into an irrigation scheme at Ure River. If this proceeds then maximum demand at Ward is likely to increase and MLL may then need to facilitate this growth by upgrading its existing 11kV East Coast feeder from Ward.

7.3.5.3 Area constraints

Constraints affecting this area are:

- Radial feeders; and
- Wind generation consumes line capacity.

7.3.5.4 Growth and security projects

No growth or security projects are noted for this area within the planning period.

7.4 Grid Exit Point and embedded generation

7.4.1 Grid Exit Point

MLL receives electricity at 33kV from the transmission grid, owned by Transpower at the single GXP at Springlands. Forecast load growth over this planning period does not see the load exceed the 100 MVA firm capacity of this GXP. No growth or security projects are therefore planned.

7.4.2 Embedded generation

Aside from the need to meet increased consumer demand, it also may be necessary for MLL to extend or increase the capacity of its network to provide for new sources of generation from larger single sites.

If and when additional generation sites are proposed, MLL will work in good faith with prospective parties, and in accordance with relevant industry requirements (for example Part 6 of the Electricity Industry Participation Code).

7.4.2.1 Policy

MLL is committed to facilitating the connection of new generation to its network subject to generators meeting appropriate technical and commercial criteria. MLL's policies are on its website under "Get Connected". Guidance for embedded/distributed generation is set out in separate categories – generation of 10kVA or less, and generation of greater than 10kVA.

7.4.2.2 Distributed generation

Embedded or distributed generation with solar and/or wind as the primary energy source is not considered to be sufficiently diverse or reliable enough to reduce or defer capital expenditure for meeting peak demand. Solar has limited production during the winter months where MLL's peak loads and highest energy flows occur, while the production from wind is highly variable.

Low solar (i.e., thick cloud cover) and windless days occur despite Marlborough being one the sunniest regions of NZ and, accordingly, it is necessary to have sufficient capacity within the network to cope with days where solar and wind generation is limited.

TrustPower operates a 2.4MW "run-of-river" generator at Waihopai which is embedded into MLL's 33kV network. Output of this generator is dependent on rainfall in the catchment area.

Energy 3 has two wind farms, at Weld Cone, near the Ward zone substation, there are three 250kW turbines, while at Lulworth, just north of the Ure River, four 260kW turbines are installed. Both schemes are embedded into MLL's 11kV network.

Dominion Salt Limited has installed a 660kW wind turbine which is embedded into their 11kV installation.

The potential wind resource in the Marlborough Sounds and on the East Coast is significant. However, the development of substantial wind farms require construction of new lines to convey the output to load centres and careful consideration of the need for reactive power compensation.

TrustPower operates the Branch Power Scheme and has been granted resource consent to extend this scheme. Six new power stations are proposed with one connecting to the existing Branch scheme infrastructure, four connecting to a new substation on the 110kV Kikiwa to Blenheim line and one connecting to MLL's existing network in the Wairau Valley. MLL understands that TrustPower does not currently intend to proceed with construction of this scheme.

The Wairau Hospital and a number of wineries and local businesses have small diesel generators which are used for load management and emergency power supply. Some of these units are capable of embedded operation.

The current low cost of PV cells has seen an increase in interest in small scale solar distributed generation. Details on the installations on the network are set out in Section 3.3.1.2.

7.5 Major network development projects

The following subsections provide a summary of the major projects identified under network development. In most cases, the alternative option is to "do nothing" and not realise the reliability benefits or facilitate potential future growth. Where other alternative options to "doing nothing" are available and have been considered, these are noted.

7.5.1 Growth and security

7.5.1.1 Year one (RY2021)

There are no major projects proposed for the first year of the planning period where the primary driver is system growth. A new zone substation (Tapp) was commissioned in Renwick in early RY2020 to replace the existing aged substation which was (unknowingly at the time of construction) located on the known trace of the Wairau Fault. There were multiple drivers for this project, including security (network resilience) and replacement/renewal of aged assets.

7.5.1.2 Years two to five (RY2022 to RY2025)

7.5.1.2.1 Kaituna zone substation

The new Tapp zone substation in Renwick supplies the township of Renwick, the greater Wairau Valley area and the Kaituna Valley area north of the Wairau River.

There already relatively large load in the Kaituna area may increase in future, subject to further development/expansion of industry. As it stands currently, the electricity supply in the Kaituna area is limited due to the voltage restrictions that arise from supplying large loads through radial sections of the 11kV network from Tapp substation. As well as this, security of supply to the could be reduced due to the impractical nature of supplying load of this magnitude from other alternate supplies.

To remedy this, MLL has made allowance in its planning to construct a small zone substation near the existing 33kV sub-transmission network in the Kaituna area, which could supply large load directly (and would allow for further growth in the area). This will increase the quality of supply by removing voltage constraints, increase reliability and provide improved security of supply to the area.

To facilitate the construction and commissioning of the proposed zone substation, an extension of the 33kV and 11kV network will be required and the land to construct the substation secured, along with installation of an outdoor transformer and switchgear undertaken. A preliminary design has been developed by MLL which could utilise the transformers from the decommissioned Renwick zone. The transformers could be installed outside, alongside a small building (to house switchgear and control equipment).

The materialisation and timing of this project is largely dependent on localised demand growth. An approximate timeframe of 18 months to consent, design, procure and construct the project has been allowed for. The cost of the works is expected to be in the vicinity of $1m, this amount has been excluded from forecast schedules due to uncertainty of the project materialising. If it does, then other projects may be briefly deferred if appropriate.

7.5.1.2.2 Fairhall capacity increase

MLL has easement over a land parcel in Fairhall, where a zone substation could be constructed to provide capacity for further development (and resulting load growth) in that area. This is one option of providing capacity to the area to facilitate potential future growth. Other options include an additional 11kV feeder originating from Woodbourne zone substation, or developing an alternative site east of Fairhall in an area that has recently been rezoned for development by the local council.

MLL will keep abreast of this situation and will contact large consumers in the Fairhall area to better understand the likelihood (and timing) of potential further growth, before considering options further. A nominal amount has been included in the capex forecast for RY2025 at this stage to allow for this potential development.

7.5.1.2.3 Other growth projects

To facilitate the installation of a potential significant new irrigation pumping station at Ure River the capacity of the line from Ward to Ure River would need to increase. Actual timing is dependent upon Resource Management Act consents and project implementation, if indeed this project proceeds. There is little in the way of detail at present, and MLL considers it unlikely that this project would proceed in the next five years, hence no allowance has been included for network works associated with this in the forecast expenditure.

The transformers at Nelson Street Substation are forecast to approach their N-1 capacity in 2025. Provision has been made on these transformers to fit additional radiators which will increase the rating from. This work has been scheduled for RY2024, which will provide sufficient time to plan and carry out the work. The cost of this project is estimated at $100k.

7.5.1.3 Years six to 10 (RY2026 to RY2030)

System growth is difficult to anticipate for Years six to 10 due to a number of uncertainties (local economic conditions, market demand, for example) and a lack of information. The following provides a summary of what MLL considers could be possible growth-related projects over this time.

- MLL owns a small land parcel on Hammerichs Road, Rapaura over which the 33kV line traverses. Should growth in that area occur as previously proposed by a major winery, then consideration would be given to establishing a zone substation at that site to help meet the growth in consumer demand. At this stage no expenditure is included in the forecast for this project.
- Dependent on future growth, a zone substation may be required to supplement growth in the southern parts of Blenheim. The relatively recently developed Taylor Pass subdivision area, for example, is currently supplied by the Redwoodtown zone substation. Should future growth continue further towards Taylor Pass, then additional zone substation capacity may be required. MLL does not anticipate this need to become apparent, if indeed it becomes apparent, until later in the planning period. No expenditure is included in the forecast for this project.
- Approximately 10 years ago, MLL acquired a residential property in Budge Street, which was a strategic investment to provide additional supply capacity for eastern Blenheim. Load growth has not met earlier forecasts in this area (largely a result of engineering investigations revealing unsuitability for dense development following the Christchurch Earthquake Sequence), and as such, a zone substation has not been developed at the site. At this stage, there are no firm intentions from MLL to develop a zone substation at that site. The possibility of an additional 11kV cable to provide additional capacity into the area will be considered in future years.

7.5.2 Reliability and safety

7.5.2.1 Year one (RY2021)

The reliability- and/or safety-related projects (i.e., those projects that meet the primary driver definitions of quality of supply and/or other reliability, safety, environment) forecast for RY2021 are set out in the following sub-sections.

7.5.2.1.1 Spring Creek 11kV Switchgear replacement

The Spring Creek Substation 11kV switchgear currently consists of a combination of Reyrolle and AEI/GEC switchgear that have migrated from other sites. The switchgear is being replaced due to ongoing maintenance requirements, reliability concerns and difficulty in obtaining spare parts. Protection and communications systems will be upgraded at the same time as the switchgear. Work commenced in late 2019 and is scheduled for completion by mid-2020 (i.e., disclosure year 2021). Most of this expenditure has already occurred, and so only a small amount is included in the forecasts (the balance expected to occur in RY2021).

7.5.2.1.2 Other less material projects

A number of less material projects will also be included under the Year one reliability and safety projects. These include:

- A number of distribution pillars have been identified that present hazards due to their design where there are issues around the clearances between live components and earthed metal. These pillars are typically in the CBD area and as such require careful planning to minimise disruption to businesses supplied through them.
- 'T-Joint' removals programme. A number of earlier subdivisions constructed prior to 1980 were supplied by underground low voltage cable T-jointed with ICP service cables such that there was no ability to isolate or sectionalise cables to individual households from the main feed. In the event of faults, instead of only the property where a potential fault occurs being affected, all properties supplied and connected to the main feed would typically lose supply back to the

nearest isolation point. There are several streets around Blenheim where this design was utilised. This is a continuation of an ongoing programme to replace these joints and mitigate the widespread impacts from such faults.

- Remote device installations. Where appropriate, MLL intends to install remote controlled switches on the network to improve operation of the network remotely, thereby potentially reducing outage times. MLL is planning to install five remote controlled switches in Year one of the planning period.

7.5.2.2 Years two to five (RY2022 to RY2025)

7.5.2.2.1 SCADA system upgrade

MLL plans to upgrade its SCADA master station software within the next five years to provide more functionality and add additional support for managing the greater quantity of data being generated. Any such system needs to support more flexible implementation processes and live replications of operations for redundancy. The current system is constrained, and a new system is required to allow future SCADA-enabled equipment to be managed, as well as providing increased functionality.

The project is expected to take between two and three years to complete, with Year one consisting of scoping requirements and going to the market and year 2 consisting of implementing the system. Expenditure is forecast to be spread over two years and at this time is anticipated to be approximately $1.5m.

7.5.2.2.2 Redwoodtown 33kV “T” removal

This project improves the resilience and security of the 33kV system and allows for future load increase.

Removing the existing “T” connection to Redwoodtown zone substation would create discreet circuits between Springlands and Redwoodtown zone substations and Redwoodtown and Waters zone substation. This would provide better protection and operational flexibility, along with increased reliability and security at both Redwoodtown and Waters zone substations.

The project would involve the installation of approximately 2km of 33kV cable from the Batty’s Road/ New Renwick Road intersection to Redwoodtown zone substation via Richardson Ave and council reserve. The 33kV switchboard would be extended to provide a new circuit breaker.

An 11kV cable would be included in the trench to allow for redistribution of consumers across heavily loaded feeders.

The project is conditional on securing suitable routes for the proposed cable installation. At this time, approximately $1.7m has been allowed for in the forecast.

7.5.2.2.3 Redwoodtown to Waters zone substation conductor upgrade

This project would provide a discrete circuit between Redwoodtown zone substation and Waters Substation with a 33.5MVA rating, sufficient to supply the Riverlands area and east coast with N-1 capacity.

The project involves the installation of new conductor (Neon AAAC), insulators and cross arms along Howick and Alabama Roads on the 33kV circuit between the two substations on the existing poles. $600k has been allowed for in the expenditure forecast for this.

Included in the estimate, is new line differential protection will also be installed at each end of the circuit, using fibre optic cable for signalling over a route to be determined as part of the project.

Recent condition assessments of poles did not reveal any drivers for replacement, and so allowance for pole replacements is not included in the project at this time. However, MLL endeavours to inspect its 33kV poles annually, and if sufficient evidence exists which demands renewal of poles, this may be included in the project scope. No allowance in expenditure has been made for this at this time.

7.5.2.2.4 Zone substation protection upgrade

This involves the installation of new line differential relays on both ends of the Waters - Riverlands circuits as well as on the circuits between Transpower, Riverlands, Springlands and Nelson Street zone substations.

The project will provide increased reliability and security at all central zone substations. A one-line fault will not impact supply to zone substations that will have been brought into a closed mesh arrangement.

There will be increased safety by isolating faults more rapidly and better operational flexibility in the 33kV network.

7.5.2.2.5 Murphy's Road 33kV cable Installation

The installation of two new underground 33kV circuits over approximately 1.1km from Springlands zone substation to the roundabout at the southern end of Murphy's Road is proposed under this project.

The spare circuit breaker at Springlands will be used and overhead lines down Murphy's Road would be rearranged to remove the bottom (to be) redundant 33kV circuit.

The 11kV conductor condition and rating will be reviewed and may be upgraded, if necessary, along with the poles supporting this conductor.

The project eliminates the current "T" connection at the end of Murphy's Road and provide discreet circuits to Nelson Street zone substation and Jacksons switchroom. Other benefits include greater operational flexibility of the Network, improved circuit protection through the use of line differential relays, reduction of potential fault impact through removal of one of the two overhead circuits down Murphy's Road.

$1.6m has been allowed for in the expenditure forecast for this project. No allowance has been made in that estimate for the replacement of conductor or any poles, which will be subject to further condition assessment closer to the proposed project commencement.

7.5.2.2.6 Resonant earthing systems

MLL is currently commissioning a resonant earthing system at Linkwater zone substation (refer to section 6.4). Following commissioning, MLL will invest time better understanding the operational effectiveness and performance of the resonant earthing system. If benefits expected can be clearly demonstrated, MLL will consider installing resonant earthing systems at other candidate zone substations such as Seddon and Ward. No allowance has yet been made in the expenditure forecasts for further resonant earthing systems at this time, but MLL expects to be in a position of greater certainty with respect to this by the time the next AMP (RY2022) is prepared.

7.5.2.2.7 Other non-material projects

The following non-material projects are proposed to be undertaken within the two to five-year period (RY2022 to RY2025) of this AMP.

- Continuation of the 'T-Joint' removal programme detailed in Year one. Each year of the programme intends to remove T-Joints from a single street.
- Tie line (11kV) between Cloudy Bay and Riverlands industrial estates. This project involves an underground cable between the Cloudy Bay zone substation and Riverlands industrial estate. This would provide increased reliability to the Riverlands industrial estate area. In the event that the Riverlands zone substation was not in service, then the Riverlands industrial estate could be fed from Cloudy Bay zone substation once the tie cable is commissioned. Planning work has been underway for some time but due to the difficulty in obtaining easements this project has not progressed as originally intended. Target completion is RY2022.
- Francis Street tie line. This project involves installing an underground cable to tie the 11kV network. This provides greater operational flexibility, greater capacity, greater reliability, and removes aged overhead infrastructure which is in the vicinity of childcare centres and a secondary school.
- Continuation of the remote device installations. This work was summarised under the Year one programme. For years two to five MLL is intending to install seven devices per year which will allow remote operation using SCADA.
- Wairau River crossing cable. Subject to investigations, the option of installing a cable on the SH 1 Wairau Bridge to provide a secondary alternative supply to the old overhead crossing. This will provide greater security of supply to Picton, which is reliant on the existing overhead crossing for supply.
- Backup ripple control plant. MLL currently has two ripple plants at System Control in Springlands, a 217Hz and 1050Hz plant. The 1050Hz plant is being phased out. Due to its criticality, MLL is considering the need for a backup 217Hz plant so that there is redundancy in the event of a fault or major event.
- Commencement of a zone substation protection upgrade/replacement programme. The protection relays at a number of zone substations are nearing end of life. The current technology allows for greater functionality and will be adopted to renew the older suite of relays. This is separate to the 33kV projects described that involve new protection systems. This programme is predominantly for transformer, incomer and feeder protection relays that are nearing end of life
- Replacement of pole-mounted substations programme. A number of pole-mounted substations, particularly in Blenheim, are nearing end of life. They were constructed to designs which were based on loadings relevant at the time, but which were less stringent than those currently in place. As a number of these pole-mounted substations are near areas of public interest, MLL is intending to replace these with ground-mounted substations. MLL is intending to replace approximately five pole-mounted substations each year.

7.5.2.3 Years six to 10 (RY2026 to RY2030)

7.5.2.3.1 Other non-material system reliability or safety projects

For years six to 10 of the planning period, the following reliability or safety related projects are proposed. Note that due to these projects being forecast at least five years from now there is greater uncertainty of time of occurrence.

- Continuation of the “T”-joint, pole-mounted substation replacement and remote device installation programmes.
- Park Terrace 11kV tie line. MLL is considering replacing the aged overhead lines down Park Terrace with an underground cable. This would replace existing end of life assets and increase reliability in the area by providing an alternative 11kV feed into the area.
- Waikawa Road alternative 11kV supply. Approximately 2,000 consumers along Waikawa road and beyond are largely supplied by a single 11kV feed. In the event of an outage on the 11kV feeder, there is no alternative to supply these consumers (other than bringing in mobile generation although the loading is significantly more than the capacity of any one of MLL’s mobile generators). MLL is intending to investigate options to provide an alternative supply to increase network resilience and reliability in this area. Options may include an underground supply along Waikawa Road, or a second 11kV overhead circuit on other poles than those that the existing circuit is located on.
- DeCastro subdivision tie line. This area is also supplied by a single 11kV feed. MLL will evaluate options to provide an alternative supply to this area to increase resilience and reliability. In the interim, the line, which services close to 200 ICPs has been converted to swan construction (centre phase conductor raised above the 2 outside conductors) due to the recurrence of faults through bird strike.

7.5.3 Non-system growth projects

In RY2021, MLL intends to construct a new truck shed at its Taylor Pass contracting depot. The new truck shed is forecast to cost $0.6m and will be undertaken coincident with pavement and stormwater renewal/upgrade works (refer to section 9.12.2.1.1).

No other non-system growth projects are allowed for in the planning period covered by this AMP.

8. Customer works

8.1 New connections

This chapter outlines MLL's approach to connecting new consumers and how expenditure is forecast relating to the connection of new consumers. The process used to connect new consumers is tailored to ensure the fast, efficient and cost-effective connection of new electricity consumers to the MLL network.

8.1.1 Overview of consumer connections

Every year, MLL connects approximately 200 new residential, commercial and industrial electricity consumers to the distribution network. Depending on the size or number of the new connections, the ability to supply the new connections may demand investment to extend the distribution network to the desired point of supply, or to upgrade assets to meet the required capacity.

On occasions the new consumer connection may require the upgrade of near end of life MLL assets to accommodate new equipment and/or an upgrade in capacity. When this occurs, MLL gives consideration to the assets being replaced, and may cover the costs (at least in part) of the new equipment.

8.1.2 Connection process

Residential consumers requiring a new connection in developed areas, such as new builds or subdivision development, will often contact an electrician who will make an application to MLL on their behalf. The electrician will submit the proposed connection specifications and design and notify MLL of any special requirements, such as the need for an easement. This will then be reviewed and approved provided the distribution assets have sufficient capacity. Upon approval, the installation will be planned and performed by MLL's contracting division or one of MLL's approved contractors.

Larger commercial consumers, subdivision developers, and others will often contact MLL directly to discuss connection requirements or work with engineering consultancies to develop suitably sized distribution systems for their proposed works. Installations of this size will often involve relatively significant infrastructure development, network extension or asset renewal. MLL works with these larger entities to facilitate the connection of large loads in a standardised and efficient manner.

Where asset replacement is required, MLL will review this on a case by case basis to determine the level of contribution, if any, that MLL will provide. It is beneficial for MLL to work with developers during the connection process as it provides an opportunity to upgrade assets that may be approaching end of life or its capacity rating.

MLL's consumer connection process and capital contributions policy is set out in further detail on the MLL website.

8.1.3 Expenditure forecast

The ability to forecast works relating to new consumer connections is relatively limited. Currently, forecasting strategy is reliant on trending expenditure information from recent years, residential development forecasting from major developers and MDC planning, having an understanding of the current economy driving local commercial development, and other environmental factors.

Over the planning period, capital expenditure forecasting will be based on the following assumptions:

- Residential development in the Blenheim and Renwick areas will continue at an approximate rate as seen over recent years. Approximately 1% per annum ICP growth.
- Commercial development, especially in the viticulture industry, to continue at or around current rates.
- A general steadying in load through the installation of energy efficient lighting and heating in residential applications slows the need to increase capacity of distribution assets. It is noted though that if the widespread uptake of electric vehicles occurs, this may increase demand in some localised areas. At this time, MLL considers the likelihood of this to have any material impact to be low within the planning period.

8.2 Asset relocations

This section reviews MLL's approach to the relocation of distribution assets when required by external stakeholders, such as landowners or Marlborough Roads/NZTA. It includes an overview of typical drivers of asset relocation, managing the relocation works and how they are funded.

8.2.1 Overview of asset relocations

Electricity distribution assets often require relocation due to the development of the surrounding environment or infrastructure where they are installed. This is typically due to the activities of other utility owners operating in Marlborough, e.g., the replacement of water pipes, telecommunications circuits, roading activities, or through the development of land for farming activities such as the installation of new vineyards.

Working with the stakeholder undertaking the project that has requested asset relocations provides an opportunity to upgrade segments of the network, or replace aged assets, at reduced cost. MLL considers undertaking asset relocations during major works because of this.

In most circumstances MLL receives contributions from the external stakeholder requesting the relocation of assets, reducing the amount of MLL investment in these projects. In most asset relocations resulting from road works, MLL bears costs, often in the form of materials in accordance with required legislation. For other projects, MLL considers these on a "case by case" basis. MLL's capital contributions policy is set out in further detail on the MLL website.

Expenditure is capitalised where assets are in poor condition or approaching end of life and are able to be renewed or upgraded during the performance of the asset relocation process. Otherwise, relocations of the same individual asset, or replacement of like-for-like is considered operational expenditure. Where major works are required for asset relocation, such as major roading and other infrastructure projects, MLL will build this into the capital expenditure plan to resource the project. Asset relocation projects proposed for the planning period are set out in the following sub-section.

8.2.2 Asset relocation projects

Asset relocation projects are typically driven by external stakeholders, such as utility owners, requirements. As MLL is not always aware of their capital expenditure plans, particularly further into the planning period, it is difficult for MLL to forecast its capital expenditure where asset relocation is the primary driver. MLL regularly meets with representatives from MDC and Marlborough Roads to discuss the more certain upcoming capital expenditure plans, and where possible, seeks to optimise opportunities as and when they arise.

MLL is aware of the following asset relocation projects at the date of this AMP:

- Ōpaoa Bridge replacement and State Highway 1 northern “entrance” to Blenheim undergrounding (RY2021). MLL is (in conjunction with Marlborough District Council) undergrounding the section of line immediately north of the Ōpaoa Bridge running alongside SH1 as far North as Aberhart’s Road. This section of line (both HV and LV) is at the northern “entrance” to Blenheim and is adjacent to large trees which require regular trimming. The overhead poles and conductor have been in service for almost 60 years. Underground cable and new switchgear to the north of the bridge was installed and commissioned in 2019 (calendar year). The project will be completed in RY2021 when access to the bridge is available to install new cables through to the network on either side, after which the redundant overhead assets will be decommissioned and removed.
- Rapaura Road/State Highway 6 intersection roundabout. MLL is aware of concept plans to construct a roundabout at this intersection. This would require MLL shifting its 33kV overhead lines, and other equipment. $100k has been allowed for in the expenditure forecast for this work. The timing of the project is not yet known, but allowance has been made for this project in RY2022.
- MLL is aware of concept plans to construct a new roundabout at the intersection of Batty’s Road and New Renwick Road to facilitate better flow of traffic. This would likely necessitate the shifting, and potentially undergrounding, of some of MLL’s existing overhead lines. $150k has been allowed for at this stage in the expenditure forecast. The timing of this project is also not yet known, but it has been included in the RY2023 forecast.
- Horton Park, Redwood Street undergrounding. HV and LV lines constructed in the late 1950s run adjacent to the western side of Horton Park along Redwood Street. Regular trimming of the adjacent large mature trees is required to prevent interference with the lines. The timing of this project is subject to MDC requirements.

As MLL is made aware of external stakeholders’ plans which may impact on assets MLL will consider options to relocate, and possibly renew, its equipment to meet external stakeholders’ requirements.

9. Fleet management

9.1 Fleet management overview

This fleet management section provides a summary of key MLL asset classes, their populations, condition and specifics of their preventive maintenance regimes and renewal. Good fleet management enables prudent and efficient outcomes in the management of the network assets and allows the drawing out of specific capex and opex programmes for more focused resourcing and cost control.

The fleet strategies developed are implemented in the field through MLL's policies and procedures which are documented and disseminated in its IMS system.

Many of MLL's asset management objectives are common across the different fleets. These include public safety as the top priority, maximising asset utility while minimising total cost (life cycle strategy) and meeting the network service level targets that have been set.

9.2 Overhead structures (poles)

9.2.1 Asset management objectives

Apart from the fleet-wide asset management objectives (safety, lifecycle, reliability etc.), pole renewals may be undertaken coincident with conductor or pole component renewal/replacement works where it is deemed economically beneficial to do so.

9.2.2 Fleet overview

9.2.2.1 Sub-Transmission

Based on condition assessments22, MLL's sub-transmission network is in good condition. Due to the criticality of the sub-transmission network for bulk power transfer around the network, more regular monitoring is undertaken and therefore defects are more promptly identified (and corrected). Approximately 75% of the sub-transmission network is built upon concrete poles, most with hardwood crossarms. New builds are predominantly built on steel poles with steel cross arms as standard.

A number of steel lattice towers in service date back to the late 1920s when the network was first being established. These original steel lattice towers are mostly located alongside Waihopai Valley Road. Many of these have been recently replaced, the balance may be targeted for replacement over the planning period, subject to their next condition assessment.

9.2.2.2 Distribution

The distribution network is generally in good condition. Nearly half of the distribution lines are supported by concrete poles (a mixture of reinforced and pre-stressed), and most of the balance on TP (TP) poles. New builds are typically constructed using either pre-stressed concrete, TP (TP) or steel poles. TPs and steel are typically considered where the installation of concrete poles is precluded by technical factors.

A large amount of the Marlborough Sounds reticulation was constructed on TP poles between 1968 and 1975. Age based AHI indicate that this

[22] MLL targets annual visual inspections of 33kV poles, with full condition assessments being undertaken at less than five-year intervals.

population will likely move into a period requiring increased replacements during the planning period.

There are also approximately 1,600 iron rail poles on the network. The condition assessment of these poles is difficult. MLL has a 'no-climb' policy in place on iron rail poles because of the difficulty of assessing their structural integrity. MLL has not experienced unassisted failure of steel rails but given their age and former use their mechanical strength is uncertain. During the planning period, MLL has a programme of renewal of iron rail poles.

The population of reinforced concrete poles within the network is relatively unaffected by age. Evidence of spalling is beginning to appear in some areas of the network. For the most part, trends do not seem to have a significant age component.

Most of the network uses flat construction hardwood cross-arms, although some limited areas have been altered to delta construction (where faults have occurred from bird strikes) to improve network reliability.

9.2.3 Populations and ages

The AHIs presented for overhead structures are based on pole type and age. MLL has implemented a more robust condition-based AHI system for overhead structures that encapsulates the returned condition assessment data. The "do nothing" forecasts presented in the following charts have been provided by extrapolating MLL's existing populations and do not consider any new build or replacement activities.

The age and condition profiles of MLL's poles (separated into sub-transmission and distribution) are presented in the following sub-sections.

9.2.3.1 Sub-transmission

Figure 37 presents a summary of MLL's sub-transmission poles by age and type. The majority of these poles are steel and pre-stressed concrete, with the older poles typically being reinforced concrete type. As shown, there are still a number of older 33kV poles remaining on the network earmarked for renewal during the planning period.

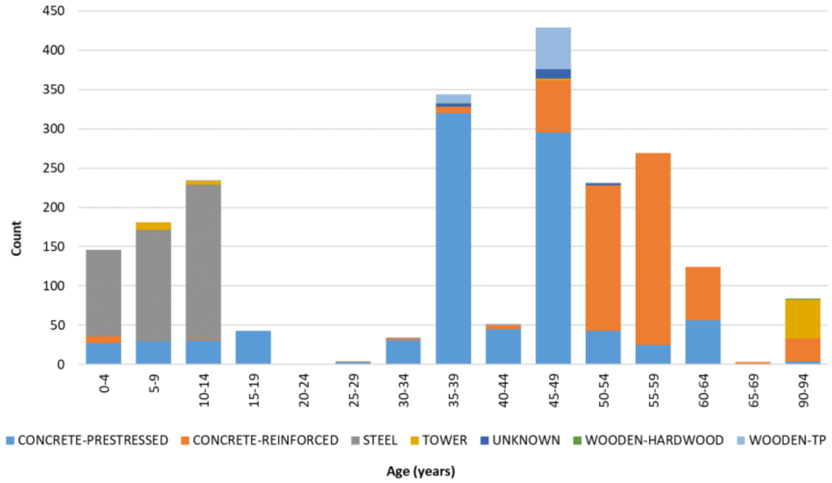


Figure 37: Sub-transmission overhead structures by age and type

Figure 38 presents a summary of the AHI condition values derived for the sub-transmission pole fleet, based on the pole type and age profile. Definitions for each AHI category are provided at 6.5.1.3. The figure illustrates the increase in pole quantities that would be classified in the H1 category, should no renewal projects be undertaken during the planning period. Likewise, there is a significant increase in pole quantities in the H3 category if the "do nothing" option were taken.

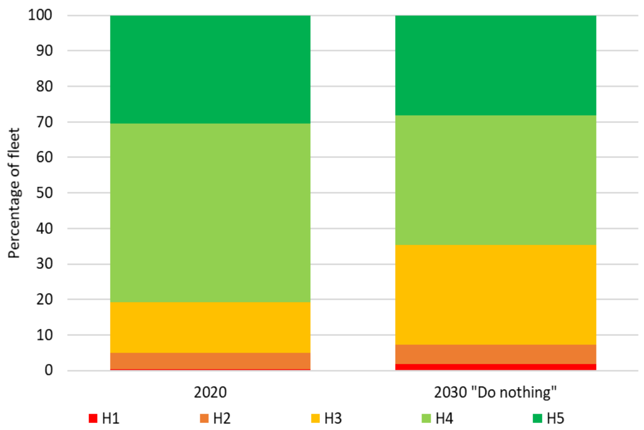


Figure 38: Sub-transmission poles age-based AHI scores

9.2.3.2 Distribution

Figure 39 presents a summary of MLL's distribution (including LV) pole fleet by age and type. It illustrates the more even spread across the pole types for the distribution pole fleet, compared with that of sub-transmission poles (along with the relatively large quantities of distribution and LV poles).

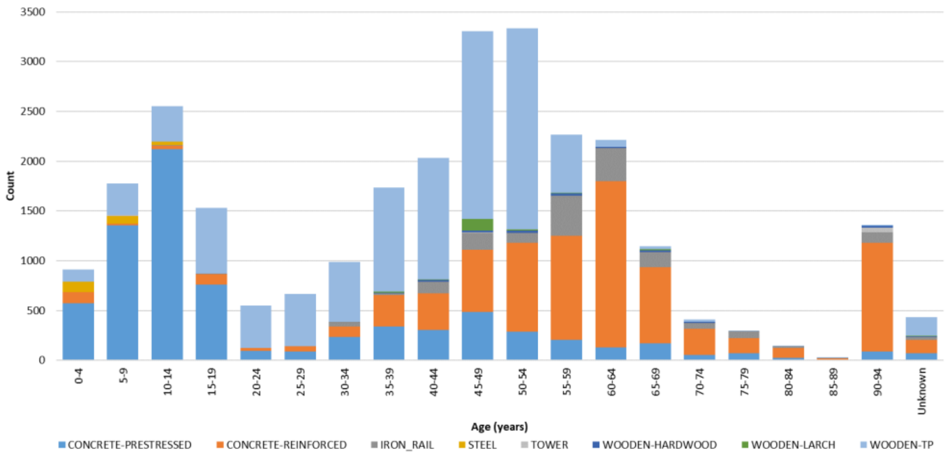


Figure 39: Distribution overhead structures by age and type

The AHI condition values derived for the distribution pole fleet, based on the pole type and age profile are presented in Figure 40. This clearly illustrates the significant inclusion of a number of poles that would be classified in the H1 category, should no renewal projects be undertaken during the planning period. The other AHI scores (H2 to H5) remain relatively unchanged.

As stated in preceding sections, a large amount of the Marlborough Sounds reticulation was constructed on TP poles between 1968 and 1975. Age based AHI indicate that this current population of approximately 7,000 poles will likely have reached an H1 condition within 18 years.

Based on age alone, the required replacement of around 80% of these structures is likely to be just outside on the horizon of the 10-year planning period of this AMP. As this is a significant portion of the population, MLL views it as prudent to make inroads into assessing and prioritising replacement programmes within this planning period.

Recent initiatives to improve the quality of MLL's pole AHIs will provide information on how best to prioritise the replacement requirements. Indeed, MLL's pole inspection programme will be moving into parts of the Marlborough Sounds from RY2021. The condition assessment data will allow MLL to better determine an appropriate renewal programme.

9.2.4 Condition, performance and risks

Condition assessments of poles has identified end of life indicators for some of the older hardwood cross arms – primarily through evidence of 'flogging' or splitting. Where possible, cross arms exhibiting these conditions are grouped for replacement, with the insulators renewed at the same time.

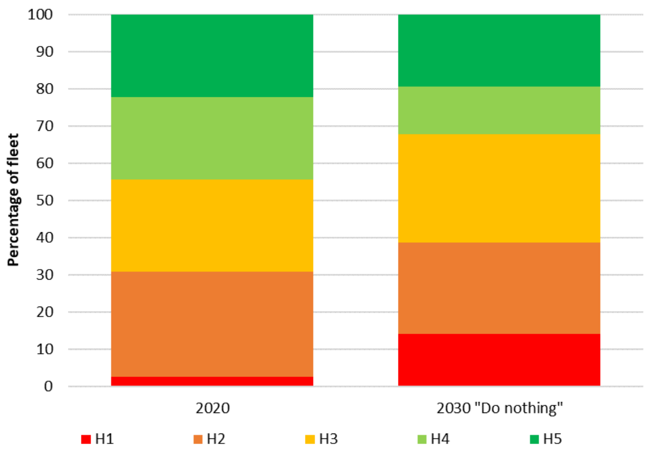


Figure 40: Distribution overhead structures by AHI score

The heightened risks of SWER lines, particularly for faults leading to low conductor or conductor on the ground, is considered in the prioritisation of renewal works despite the generally low consumer density associated to these lines and the lessened reliability impacts.

9.2.5 Design and construct

The 11kV line projects within the MLL network have the following main drivers:

- New connections - growth
- The block replacement of poles that are reaching end of life - i.e., complete line rebuild.
- Conductor upgrade for capacity increase – growth.
- Conductor upgrade for capacity increase - supply security.
- Reliability hot-spotting.

The general scope of a new line is:

- Poles:
  - Primarily pre-stressed concrete poles.
  - TPs where access and transport prevents the use of pre-stressed concrete.
  - Steel for sub-transmission structures or when required for structural loading, and/or more difficult to access areas (similar to TPs).
- Pole top hardware:
  - Sub-transmission
    - Constructed at 66kV for both reliability and allowance. for future capacity upgrade.
    - Use of steel cross arms.
  - Distribution:
    - Constructed to 22kV outside of the townships of Blenheim, Picton, Havelock and Seddon.
    - Hardwood cross arms or steel if on a steel structure.

9.2.6 Operate and maintain

Poles are inspected and condition assessed on a five yearly (maximum) basis. Other than the possible recoating of steel structures (which has not been necessary to date), poles are durable and do not require electrical or mechanical preventative maintenance work for the duration of their lives.

Cross arms are considered a component of the structure. A hardwood cross arm is likely to have a shorter life than the pre-stressed concrete pole to which it is attached. Cross arm replacements are preferred to be undertaken as block replacement projects due to the economies of scale - particularly when working in rural or remote areas. Replacement of associated pole structures at the same time is subject to condition assessment of each structure.

Table 31 summarises the maintenance schedule for overhead structures.

Table 31: Maintenance schedule for overhead structure

Item	Action	Period	Maintenance level
33kV Poles	Visual inspection Condition assessment	1 Year 5 Years	SHI ISCA
11kV Poles	Condition assessment	5 Years	ISCA

9.2.7 Renew or dispose

9.2.7.1 Line rebuilds

There are often economies of scale in replacing entire sections of line at the same time particularly in remote areas where crew transport and set-up costs are significant. MLL considers "block" replacing an entire section of line when end of life indicators begin appearing across multiple assets along the section. Generally, the structures within the sections will be of similar age and construction. The scope of "block" replacement projects usually includes new conductor. Drivers for overhead structure replacement are assessed alongside conductor replacement.

Renewal of individual structures is subject to condition assessment, and, are typically expensed, rather than capitalised.

9.2.7.2 Off the grid supply as an alternative solution to renewal

MLL has kept abreast of alternative methodologies of electricity supply to remote and uneconomic connections on its network. Remote Area Power Supplies (RAPS) provide one potential alternative to a conventional grid supply and are included in further detail under section 6.9.4. Where renewal of assets is required in these areas, MLL will consider alternative supplies.

9.2.8 Overhead structures renewal forecast

The renewal component of this AMP's capital expenditure forecast is based on a combination of those poles identified in poor condition for renewal, an expectation of how pole condition will deteriorate over the planning period years, and policy-based replacement due to known type defects or safety concerns.

Iron rail poles will be progressively replaced due to concerns around the inability to determine their strength. However, many of these poles support either copper or galvanised steel (GZ) conductor and will be replace co-incident with the replacement of that conductor as further detailed in the conductor fleet strategy This situation also applies to a number of older reinforced concrete poles.

MLL has a small population of larch poles, mainly on D'Urville Island where condition assessment has identified them in poor condition. MLL is intending to address these poles during the planning period, at this stage, RY2023 to RY2025 is being targeted.

MLLs' expectation for the manner in which the remaining pole population will deteriorate is based on survival analysis from past replacements applied to the current pole population by type.[23] An example of the calculation is illustrated in Figure 41 for TP poles where the red line fits a probability distribution to the observed survival. The fitted distribution is then used as a prediction tool when applied to the pole age profile by type.

Based on this analysis, MLL expects the TP pole replacements to rise to approximately 100 per annum. which represents approximately 1% of the roughly 10,000 TP poles installed.

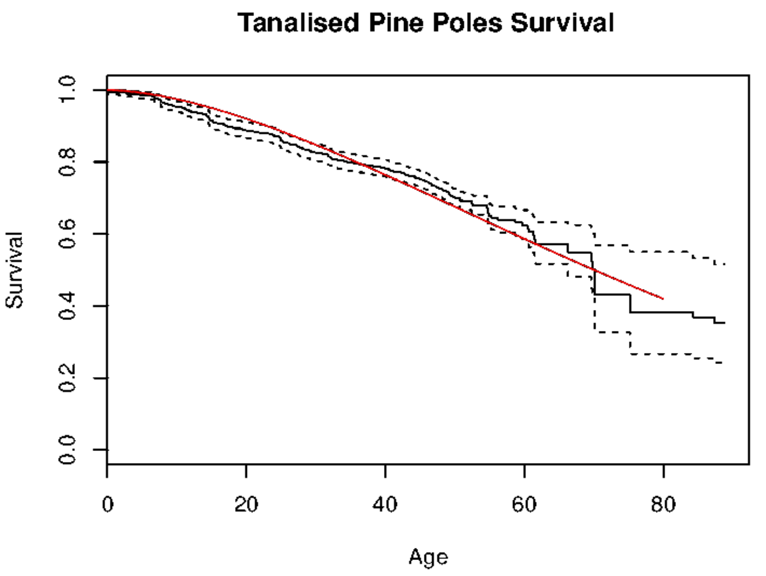


Figure 41: TP pole survival profile

[23] Survival analysis is a statistical method for determining the likelihood an asset will fail (in this sense deteriorate to a state requiring renewal), given characteristics such as type, location, age, etc. but where age and type are the main drivers.

The lives of concrete poles are more difficult to forecast forward as they are more affected by environment than age. The expected life of pre-stressed concrete poles is not yet known as any acceleration in the deterioration of the older poles has yet to be detected. Renewal is forecast at the historic rate being carried forward.

Forecast renewal costs for the concrete pole fleets are provided in the expenditure sections 9.12 and 10.2 of this AMP.

9.3 Overhead conductor

9.3.1 Asset management objectives

Apart from the fleet-wide asset management objectives of safety, lifecycle, reliability, etc., conductor renewal is often undertaken coincident with other works (such as pole replacements) where it is deemed economically beneficial to do so.

9.3.2 Fleet overview

Overhead conductors have been summarised by voltage in the following subsections. The disclosure schedule on asset condition data presents a summary of the conductors by AHI grade. The AHI grading that MLL has applied is based on asset age, given the difficulty in assessing the condition of conductor.

9.3.2.1 Sub-Transmission

MLL's sub-transmission overhead conductor was built using aluminium conductor steel reinforced (ACSR) conductor, with all aluminium alloy conductor (AAAC) the preference over the last approximately 12 years. ACSR may still be used when additional strength is required (e.g., for long spans).

New sub-transmission is constructed at 66kV but will continue to be operated at 33kV. A section of line that runs from Leefield zone substation to the Waihopai power scheme which is over 90 years old. However, this is principally a dedicated line for the Waihopai power scheme and is subject to ongoing assessment.

9.3.2.2 Distribution

The backbone of the distribution system is constructed at three phase 11kV with some spur lines and lines at the extremities of the network being two phase 11kV, together with 33 separate areas of single wire earth return (SWER) overhead lines. All of the distribution system currently operates at 11kV. New rural construction is generally insulated at 22kV, mainly for reliability but also for providing future options for network growth.

Most of the central area of the 11kV network is capable of being ring-fed with supply available from at least two zone substations. This arrangement provides flexibility in the operation of the system and enables supply to be maintained to most consumers in urban areas during planned or unplanned outages. However, a significant portion of MLL's network is supplied by way of long radial spur lines, which have no alternative supply options (other than mobile generation that may be brought in in some cases, or fixed generation at selected locations (such as Kenepuru Heads in the Marlborough Sounds).

Most conductors are aluminium, although some copper, copper weld and galvanised steel conductor remains in use on older lines and spur lines. These are generally in parts of the network where demand is relatively low and static. Programmatic renewal is generally driven by risk assessment including (safety and fire ignition considerations).

9.3.2.3 11kV SWER

SWER lines have been used extensively throughout the more remote sections of MLL's network. In total there is approximately 540km of 11kV SWER lines on MLL's network, a significant percentage of total line length. These lines were constructed at significantly lower cost than the more traditional two- and three-wire systems, due to the ability to span longer distances without the possibility of mid-span wire clashing. This type of construction is ideally suited to areas of low population density, such as parts of the Marlborough Sounds and the upper Awatere Valley and especially where the terrain is undulating where pole numbers can be minimised.

The trade-off for the reduced construction costs is that the earthing systems at each transformer must be constructed as an operating rather than just a safety earth and require more rigid monitoring than with standard construction.

9.3.3 Populations and ages

For this AMP, the AHI's presented for overhead conductor are summarised by voltage and have been built on the conductor type and age criteria. The "do nothing" forecasts have been provided by extrapolating MLL's existing overhead conductor population data and do not consider any new build or replacement activities.

In sub-transmission, the older conductor is the earlier ACSR which remains in reasonable condition despite its age. In distribution, the older conductor is the weaker copper and galvanised steel types, which is now subject to programmed replacement.

9.3.3.1 Sub-transmission

MLL's sub-transmission conductor age by length is plotted in Figure 42. The increase in AAAC conductor is demonstrated. Figure 43 presents a summary of the sub-transmission conductor AHI values. The sub-transmission conductor population is generally in good condition.

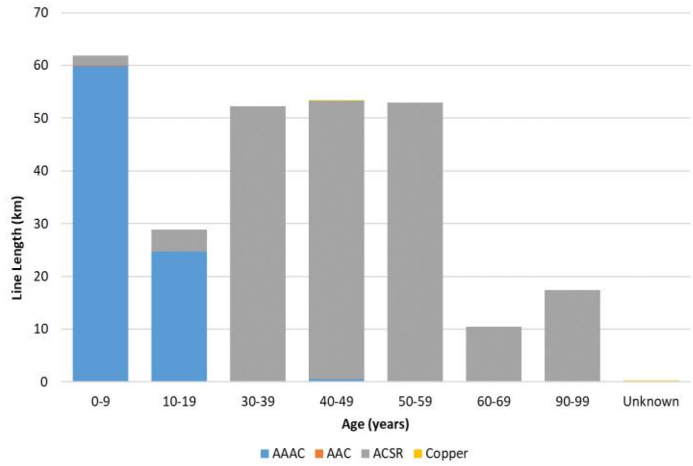


Figure 42: Sub-transmission conductor age profile by conductor type

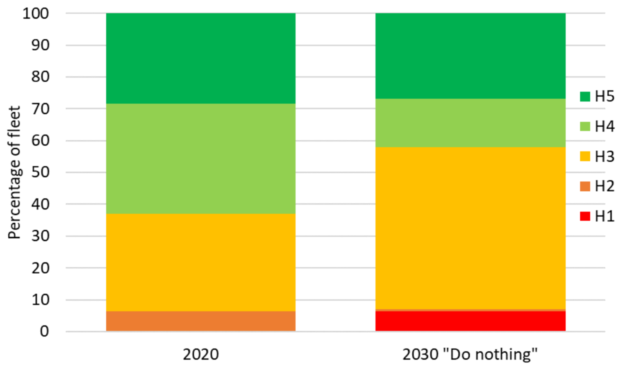


Figure 43: Sub-transmission conductor age-based AHI

9.3.3.2 Distribution

MLL's distribution conductor age profile is presented in Figure 44. This shows the bulk of the distribution conductor fleet is made up of ACSR, with significant quantities of copper and galvanised steel conductor making up the bulk of the aged fleet. Much of the newer conductor fleet is comprised of AAAC.

Figure 45 presents a summary of the distribution conductor fleets AHI values today and projected out 10 years if no renewals are undertaken across the planning period. It shows that 13% of conductor that would be scored H1 and H2.

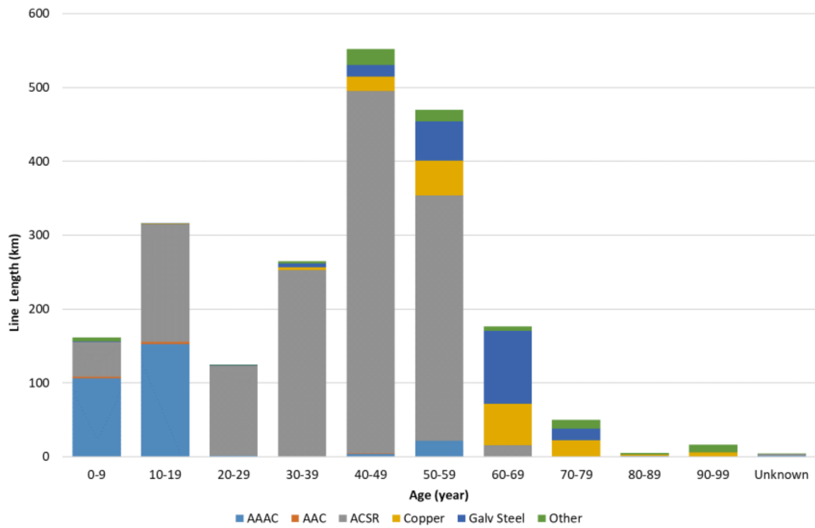


Figure 44: Distribution conductor age profile by conductor type

9.3.4 Condition, performance and risks

The condition of the network's aluminium and ACSR conductor is considered good. The older part of MLL's distribution conductor is predominantly copper and galvanised steel. In both cases, the types of conductors are lower capacity, which can provide further justification for replacement. Conductor failures are predominantly caused by contact from foreign objects like trees or birds or from corrosion or fatigue.

MLL's vegetation programme, noted elsewhere, has decreased (but not eliminated) the occurrences of these faults. However, the effects of corrosions and/or fatiguing can only be remedied by renewal. While inland Marlborough is generally benign for steel corrosion, corrosion still progresses, albeit at a slower rate than where the conductor is exposed to coastal wind. Conductor vibration and wind also contribute to metal fatigue. The effects of this are cumulative over time.

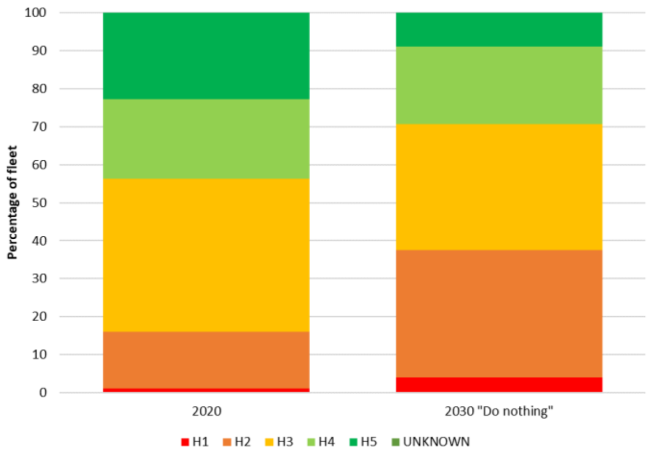


Figure 45: Distribution conductor age-based AHI

MLL has noticed ageing of some of the oldest copper and galvanised steel conductors. It is anticipated that a large part of MLL's pole and overhead line replacement budget will be focused on the renewal of lines that fit into this category. There is approximately 430km of this older style line within the network.

MLL takes a precautionary approach to line renewal in consideration of:

- the public safety issues of line faults where conductors have the potential to fail;
- the difficulty of testing conductor strength;
- it is more cost effective to take a proactive approach rather than react to failure;
- coincident renewal of overhead support structures (poles) and pole top equipment; and
- fire ignition risk from fallen conductor.

SWER lines present an increased operational risk as spans are typically longer than two or three phase lines and line faults on SWER lines have been traditionally harder to detect because of the limits of protection equipment in an earth return system. As mitigation, and with advances in technology, MLL is:

- installing smarter, remote controllable reclosers at the beginning of SWER networks; and
- retrofitting SWER lines with a new insulator bracket.

9.3.5 Design and construct

As a general guide, MLL's standard line conductor specifications are:

- Primarily AAAC conductor – some AAC used on LV; and
- ACSR where required (typically based on mechanical loading).

- Special consideration will be given to unique circumstances, if and when appropriate, such as the crossing of Tory Channel which has a span of 2,029 metres.

Periodic review identifies those areas where changes in demand may require upgrades to the capacity of the network, generally by way of increases in the conductor size.

9.3.6 Operate and maintain

Conductors are generally long-life assets, with little maintenance required. Corrosion from sea spray or fatigue from wind driven vibration can age the conductor.

Visual inspections are undertaken on the conductor heights at the same time as pole structure inspections. Intrusive testing on conductors is only used on a case by case basis generally to support replacement decisions.

Where foreign object damage is a common failure mode, the conductor configuration may be redesigned or modified to mitigate the consequence of further contacts. Examples of this include utilisation of delta configurations, the application of bark guards, and insulated conductor systems.

Table 32 provides a summary of the maintenance regime for conductor.

Table 32: Maintenance schedule for overhead conductor

Item	Action	Period	Maintenance level
33kV Lines	Visual inspection	1 Year	SHI
11kV (and LV) Lines	Visual inspection	5 Years	SHI

9.3.7 Renew or dispose

MLL uses a condition and risk-based strategy to determine the priority for conductor replacements.

Drivers for conductor renewal are analysed alongside structure (pole and crossarm) renewal as these will often be actioned at the same time. However, conductor renewal usually requires renewal of the supporting structures (poles) and their components, as:

- older conductor is generally strung on older poles;
- the replacement conductor is invariably heavier necessitating a line redesign to current code requirements; and
- remnant pole strengths of older poles are often unknown so cannot be reutilised under the new line construction codes regardless of their condition.

9.3.7.1 Load control as an alternative to capacity upgrade

Generally, MLL has few areas that are constrained due to line capacity. Should there be demand growth above line capacity, there are a number of tools that MLL could apply other than capacity upgrade, including:

- utilising the ripple control system to remove participating hot water load during peak periods;
- establishing a generation participant programme to utilise backup generators embedded within consumer installations based on ripple control signalling; and
- pricing signalling that encourages consumers to reduce load during peak times.

MLL will give due consideration to these tools as required.

9.3.7.2 Battery storage and demand side management as an alternative to capacity upgrade

MLL does not plan any investment in battery storage within the planning period of this AMP. This is predominantly due to not having a requirement for such storage. Aside from not having a need for batteries, other factors to be considered are:

- the current market pricing and payment structures, systems and tools are not currently available to allow for MLL or its consumers to realise the value in demand side management;
- the uncertainty around the safety risks and maintenance costs associated with battery systems;
- current battery costs; and
- uncertainty in the regulatory environment as to ownership of these assets.

MLL will keep abreast of this rapidly developing area and review its position on battery storage, demand side management and associated infrastructure during this planning period. Off the grid power supplies as an alternative to line renewal. This is discussed in section 6.9.

9.3.8 Overhead conductor renewals forecast

MLL's renewal forecast is based on the replacement of 20km of line, in RY2021, and building to 40km p.a. by RY2025 for the balance of this AMP's planning period. This rate of renewal will replace all at-risk conductor (old copper and galvanised steel) over a 15-year period and, at 40km per year (from RY2025), represents a replacement rate of approximately 1.4% per annum against the total high voltage distribution conductor.

MLL's distribution conductor age profile in relation to the all NZ EDB combined profile is illustrated in Figure 46 where the red line is the MLL

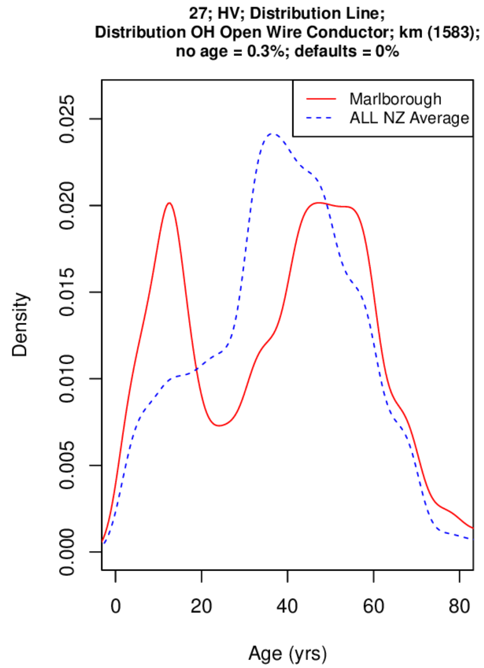


Figure 46: MLL's distribution conductor age profile

distribution overhead conductor age profile and the blue dotted line is the all NZ EDB combined age profile (based on RY2019 disclosure data).

As shown, the MLL conductor age profile is now advanced past the all NZ profile indicating that an increase in renewal should be anticipated. However, the inland Marlborough area provides a more benign environment than other parts of New Zealand and over the life of the assets they have been properly maintained. Further, analysis of the manner in which the all NZ age profile advances leads to a gross expectation on the rate at which conductor will be renewed as it ages. Figure 47 applies this rate expectation to the MLL copper and GZ conductor and compares it with the planned renewal rate. This shows the conductor renewal proposed in this AMP is in keeping with that indicated by the all NZ conductor ageing model.

The renewal projects will be directed to replace conductor using a priority scoring system that includes conductor age, condition, and avoided risk (i.e., lines crossing vineyards, fire risk areas, public places, etc.).

The forecast replacement will renew a significant amount of the approximately 1,600 iron rail structures on the network as well as a number of the older reinforced concrete poles, which generally support the copper and GZ conductor targeted under the conductor renewal programme. MLL has adjusted its replacement forecasts for these pole types to ensure these over-lapping works are not double counted.

Forecast expenditure in this category is provided in the Expenditures section of this plan.

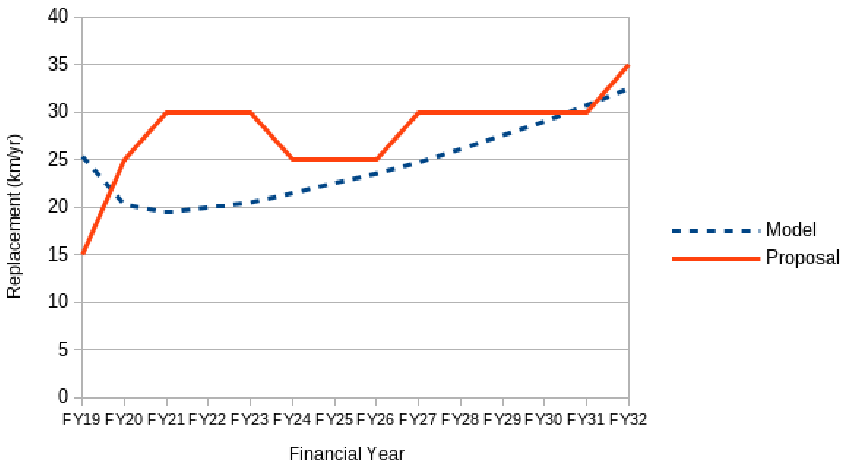


Figure 47: Proposed distribution conductor renewal rate

9.4 Cables

9.4.1 Asset management objectives

Being an underground asset, public safety is less of an issue with the main focus being on achieving lifecycle and reliability objectives.

9.4.2 Sub-transmission cables

9.4.2.1 Fleet overview

The MLL sub-transmission cable network consists of approximately 22km of paper insulated lead alloy sheathed (PILC) and cross-linked polyethylene (XLPE) cables energised at 33kV, including all ancillary components including joints and cable termination structures.

9.4.2.2 Populations and ages

Of the 22km of sub-transmission cable installed within the network, the majority of the cables have been installed within the last 20 years, and typically XLPE type cables.

Figure 48 provides a summary of MLL's sub-transmission cable age profile.

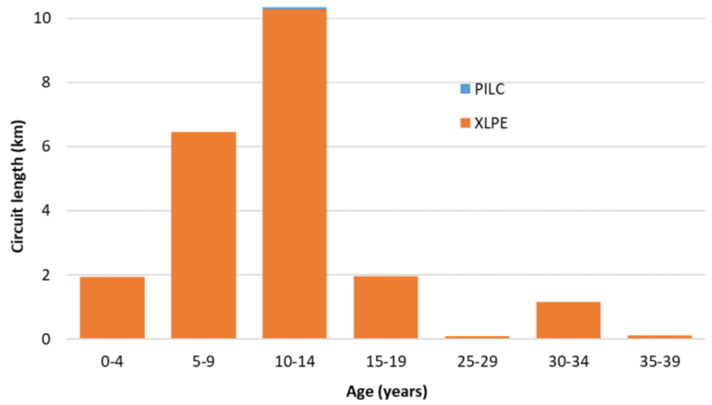


Figure 48: Sub-transmission cable age profile

9.4.2.3 Condition, performance and risks

Given the age, and the manner in which it has been installed, the sub-transmission cable network is in good condition. Furthermore, sub-transmission cables typically have a greater capacity than the loading required, reducing aging effects from heating etc. that would otherwise be experienced.

The Wairau River Bridge 33kV crossing, built in 1985, is a bridge suspended PILC cable that is a component of the sub-transmission network which supplies the Havelock and Linkwater zone substations. Although alternate supplies to these substations are available, a failure on this cable would result in a short duration outage for more than 2,000 consumers.

An issue has been identified with certain types of 33kV heat shrink terminations due to the environmental conditions when installing the terminations, possibly resulting in future premature failure of the termination. To counter this, MLL has moved to a cold-applied alternative installation method.

9.4.2.4 Design and construct

All new sub-transmission cable circuits that MLL installs are constructed to 33kV, utilise the most recent XLPE insulating materials, and are standardised on size either being single core 300mm^2 or 630mm^2. Standardisation of size assists in ongoing cable management by reducing spares holdings, reducing cost and simplifying installation and repair practices. The capacity of cables of this size is expected to be sufficient for the foreseeable future.

9.4.2.5 Operate and maintain

Generally, PILC and XLPE cables are maintenance free. Oil filled or gas filled cables require regular maintenance due to pressurised components, but MLL does not own or operate any oil filled or gas filled cables. On occasion inspections and diagnostic testing is performed, especially when cables are being removed from service for other works. However, this is typically performed on an infrequent basis and as the opportunity arises.

9.4.2.6 Renew or dispose

MLL has no plans to renew any of its sub-transmission cables during the period covered by this AMP.

9.4.3 Distribution cables

9.4.3.1 Fleet overview

The MLL fleet of distribution cables operates at 11kV, including some examples of 11kV SWER cabling that is installed within the distribution system. The distribution cable system is comprised of approximately 190km, installed within the major townships of the Blenheim CBD, Renwick, Picton and Havelock.

9.4.3.2 Populations and ages

As with the sub-transmission components, the underground distribution network is relatively young, with the bulk of this asset installed within the last 20 years – represented in Figure 49.

The key driver for installation of significant amounts of distribution cable in urban areas has been to increase network reliability and aesthetics in built up areas.

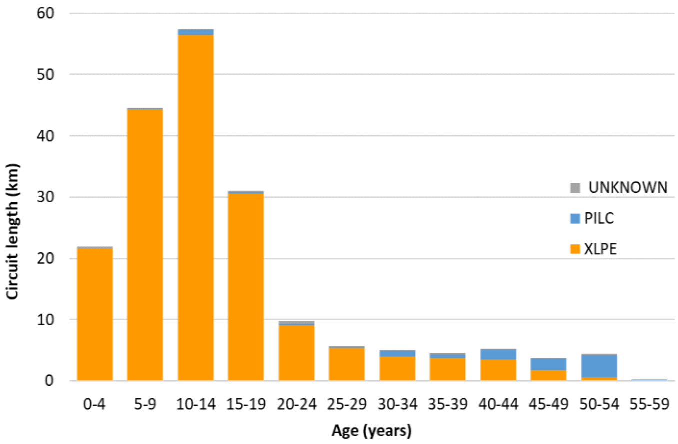


Figure 49: Distribution cable age profile

As work is performed on the urban distribution network within the Blenheim CBD area, such as planned cable renewals, circuit capacity upgrades, or ring main unit replacements, replacement of older generation distribution cable is performed simultaneously, where achievable. This has gradually seen a decline in first generation XLPE cables and PILC cables within the Blenheim CBD. However, there are still sections of cable that are approaching end of life that will demand replacement over the planning period to avoid unreliability.

9.4.3.3 Condition, performance and risks

Cable degradation is impacted by the combination of a number of factors including:

- Design and manufacture including insulation material;
- Installation type and environment;
- Electrical loading;
- Cable exposure;
- Cable age; and
- External factors (third party damage, ground movement, etc).

Given the relatively new age of the distribution cable fleet, the majority utilises modern XLPE plastic insulation technologies including water

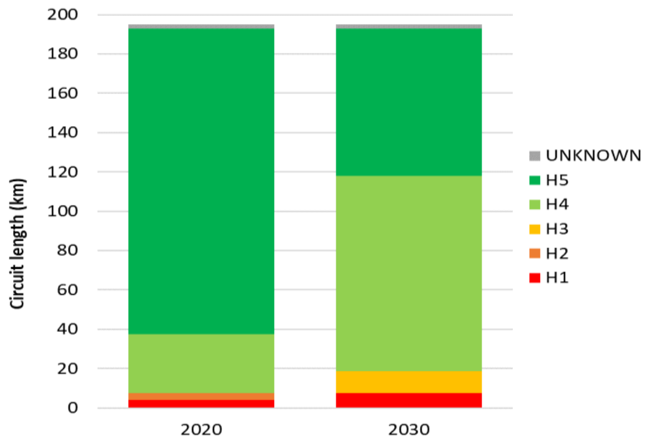


Figure 50: Distribution cable AHI summary

blocking and water-tree retardant properties. This newer cable imposes minimal risk to network reliability until well beyond the current planning period. Overall, the distribution cable fleet is assessed as being in good condition, depicted in Figure 50.

As noted above, a number of sections of cable, typically PILC, may be approaching or beyond their estimated onset of unreliability although this has yet to be experienced. MLL has a continuous program in action to replace aged underground distribution assets at risk where no alternatives exist.

9.4.3.4 Design and construct

When installing new sections of underground distribution network during new-builds or cable replacement, MLL has a standardised set of cable sizes. MLL will utilises 50mm^2, 95mm^2 or 300mm^2 multicore aluminium cables with XLPE insulation. Single core cables and other conductor sizes may be utilised for specific applications, such as when increased current ratings are demanded. Standardisation of cable size allows for the reduction in the requirements for critical spares, such as jointing kits, etc., as well as ensuring staff are competent in handling and working with regular sizes.

Where cable installation is required in rural areas of the distribution network, MLL installs 22kV cable to be energised at 11kV, in preparation for a potential 22kV operational voltage upgrade. These are standardised to the same sizes mentioned above, although single core cables are utilised for larger sized 22kV cables. The marginal cost difference in doing so is minimal, higher voltage cables have a greater life expectancy when energised below their rated voltage, and in conjunction with overhead reconstruction projects, places the distribution network in a position where voltage upgrade is feasible.

9.4.3.5 Operate and maintain

Cables are generally maintenance free as they are typically buried, with the only exposed sections being at the overhead to underground transitions, or at termination onto switchgear and other plant.

MLL regularly performs asset inspections, which includes visual inspection of cable termination poles and ground-mounted switchgear for obvious signs of wear or damage, including condition degradation due to exposure to UV. Thermovision diagnostic testing on cables and switchgear terminations is also performed regularly. Inspections and testing regimes are summarised in Table 33.

Table 33: Maintenance schedule for distribution cables

Maintenance/inspection task	Frequency
Visual inspection of cable termination poles.	5 yearly
Switchgear cable termination box partial discharge testing.	6 yearly
Thermographic imaging of cable terminations. Tan Delta diagnostic testing and VLF testing of cables.	Irregular, when need arises

Cable faults most commonly occur due to interference from third parties during activities such as excavation or underground thrusting. Where distribution cables have been damaged resulting in increased risk of failure, corrective action is immediately taken by MLL to avoid a fault developing. Actions include:

- Replacement of mechanical protection on cable termination pole;
- Replacement of the cable termination due to degradation; or
- Removal of failed/damaged section and cable replaced or jointed.

9.4.3.6 Renew or dispose

MLL's renewal approach for distribution cables is to replace on condition (when and where known) and/or age. Assessing cables' condition through testing can be difficult (largely due to the time and cost involved, and the nature of the testing –some tests can "age" cables). The AHI guide provides end of life drivers for cables based on known issues, loading history, partial discharge and failure history which can be used to deduce condition. Another of the key determinants of the life of a cable can be the manner of installation and the ground conditions within which it is installed.

MLL will consider renewal of cables based on the condition values deduced based on the AHI guide.

9.4.4 Low voltage cables

9.4.4.1 Fleet overview

This fleet includes low voltage cables, link boxes, cabinets and pillars.

The LV distribution network provides the typical interface between the distribution system and consumer installations. The typical consumer installation is supplied from either an overhead service line or from a service cable connected to an LV underground distribution box.

The MLL LV cable fleet operates at 230V/400V. The main assets within this class are cables and LV boxes which include link boxes, LV cabinets, service boxes and pillar boxes.

9.4.4.2 Populations and ages

MLL's LV underground cable network consists of nearly 400km of circuit length, including street light circuits. The bulk of the LV cable population has been installed within the last 20 years, during new subdivision installations or overhead to underground conversions. There are portions of the LV cable network that employ early types of XLPE or PILC insulated cables that are approaching end of life.

Figure 51 provides detail on the age profile of MLL's LV cables.

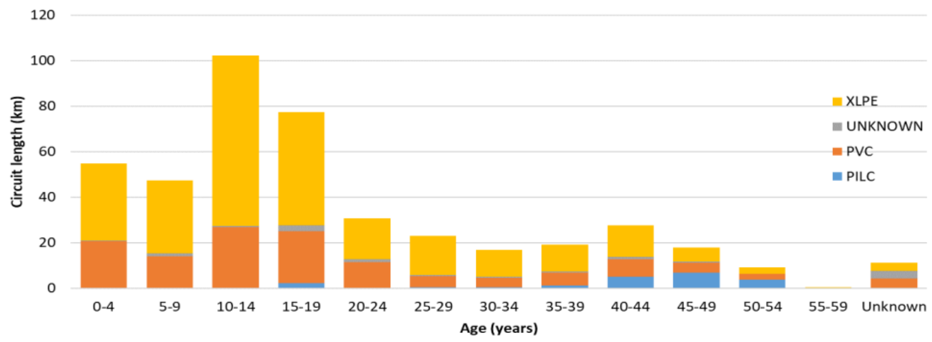


Figure 51: Low voltage cable age profile

9.4.4.3 Condition, performance and risks

Consumer service lines connect to the LV cable network from an LV service fuse box (usually located on the property boundary or on the street frontage near the property).

MLL is aware of a design flaw of an older type of link box where there are uncovered energised terminals within the box, and the exterior metal door is not physically earthed. This could pose a potential health and safety risk to staff working on these link boxes. This is being mitigated through a clear work instruction for staff working on these boxes, and a replacement programme to eliminate the risk continues under this AMP.

When a portion of the LV network is approaching the end of its useful life and is supplying numerous consumers of high importance, such as in the CBD area, MLL will give consideration to results of a condition assessment based on the AHI guide before renewing/replacing it.

LV cables are typically buried or surrounded by mechanical protection where the cable transitions above ground to overhead connections on a cable termination pole. As a result, excluding damage from third parties, LV cable failures are relatively rare. A large number of LV outages might typically be caused by failure at the transformer LV box from causes such as external interference including vehicle contact and vandalism, or failure of terminations and joints. To overcome this, LV boxes are typically installed in protected areas, sheltered from external influences, and regular inspections are performed.

9.4.4.4 Design and construct

MLL carries stock of numerous sizes of aluminium and copper cables for use on the LV cable network or to perform consumer work. Due to the simplicity of performing cable terminations on LV cables over that of distribution or sub-transmission, there is reduced need to standardise on a reduced selection of cable sizes. Irrespective, it is necessary to utilise the right size cable for the application required, considering voltage drop, continuous loading, fault current capacity and mechanical performance when selecting LV cable sizes.

LV box types are thoroughly scrutinised before being approved for use on the MLL LV network. Considerations include the ability to cover metallic bus sections, ability to accept approved fuse carriers, mechanical performance, locking ability, etc.

9.4.4.5 Operate and maintain

Maintenance of the LV cable network focuses on the inspection of LV boxes. The frequency of inspections is based on safety factors and the criticality of the asset, with boxes in public areas or high-risk exercises being inspected annually.

The occurrences of detailed visual inspections and the thermal imaging of LV boxes is summarised in Table 34.

Table 34: Maintenance schedule for LV boxes

Area	Frequency
CBD and Public Places	1 yearly
Other Locations	3 yearly

9.4.4.6 Renew or dispose

As mentioned above, renewal of LV cables is generally managed using a run to failure strategy, unless the cable supplies critical consumers where alternative supply options are limited or non-existent. LV cable renewal is expected to remain relatively minor and constant given the age and quantity of the existing LV cable population.

The older LV link boxes with uncovered energised terminals will be renewed. The order of renewal is based on a series of criteria.

9.5 Zone substations

Zone substations are the link between the sub-transmission and the distributions system by transforming the voltage, generally from 33kV to

11kV and allowing for bulk supply of electricity to end users over a number of distribution feeders radiating out from the zone substation. The supply of electricity to thousands of consumers sometimes depends on a few critical assets within the zone substation.

Section 9.5 describes MLL's portfolio of assets within its zone substations. The portfolio includes:

- Power transformers;
- Switchgear;
- Impedance support; and
- Site and buildings.

Across the Marlborough region, MLL operates 16 zone substations set in both urban and rural environments.

9.5.1 Asset management objectives

The primary objectives are supply security, voltage quality and lifecycle outcomes. Safety objectives generally derive from ensuring adequate site security and electrical clearances, particularly from the fence lines, and in maintaining an adequate earth to control earth potential rise on internal faults.

9.5.2 33/11kV transformers

9.5.2.1 Fleet overview

Within MLL's 16 zone substations, 31 power transformers are in operation, ranging from 3MVA to 16.5MVA capacity. All but one (Leefield) of MLL's zone substations have N-1 security at the transformer level, allowing for the removal from service of any one transformer without impacting end users.

9.5.2.2 Populations and ages

The age and oil natural air natural (ONAN) rating details of MLL's zone substation power transformer fleet are shown in Figure 53.

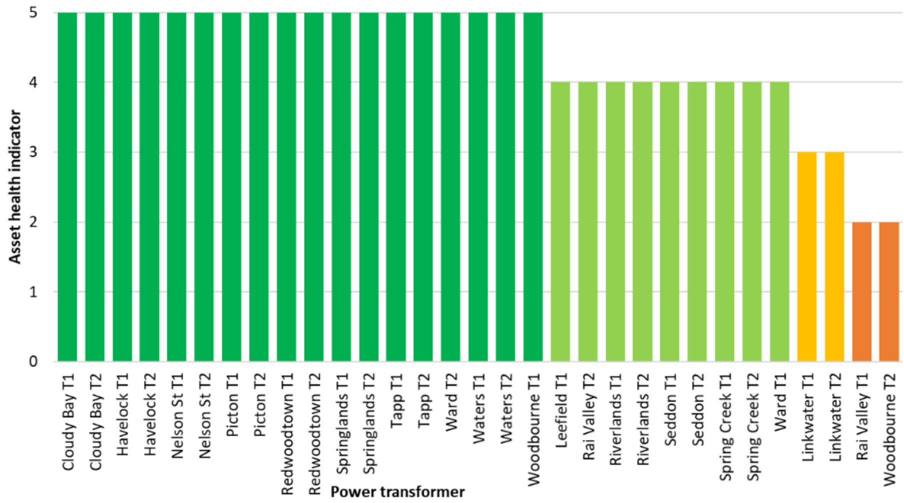


Figure 52: Summary of power transformer AHI profile

The majority of the transformer fleet is relatively new due to a number of recent out-door to in-door upgrades within urban areas of the network over the last ten to fifteen years. However, there are a further two power transformers approaching the end of their anticipated 65-year life span. These have been targeted for renewal within the period covered by this AMP. The power transformers are regularly inspected and maintained, most have not been heavily loaded and none are therefore considered to be at the point of imminent failure.

The average age of the MLL power transformer fleet is approximately 15 years.

9.5.2.3 Condition, performance and risks

Power transformer failures are rare, with the main causes generally arising from wear on moving parts within on-load tap changers, or defects related to lack of maintenance or age and loading or insulation failures of the bushings. However, failures can have a major impact on network outages, result in fire or oil discharge or reduced levels of security until repair or replacement is completed.

Given that MLL has achieved N-1 at nearly all zone substations, transformers almost never operate above half their ONAN rating, which means that the risk of accelerated ageing through overloading is mitigated.

Using the EEA Guide to Asset Health Indicators, MLL has ranked the condition of its fleet, and this is shown in Figure 52. From this, two transformers at the Woodbourne and Rai Valley zone substations are budgeted for replacement within the planning period, targeted in RY2023 and RY2024 respectively.

9.5.2.4 Design and construct

Where practicable, MLL has standardised on its transformer size and configuration across the transformer fleet, allowing for flexibility, interchangeability and reduction of spares inventory. This includes transformer components as well as tap changing hardware.

The indoor 16.5MVA transformers (which are installed at most of the major zone substations) can be further uprated by up to 5MVA with the addition of cooling fans.

Where new zone substation transformers are purchased for upgrade of existing substations, or construction of new substations, MLL takes advantage of technological improvements for the transformer and ancillary components to ensure continual improvement across the MLL transformer fleet. The benefits include:

- Nitrogen seals;
- Reduced losses;
- Seismic performance;
- Reduced noise emissions; and
- Improved condition and performance monitoring.

All power transformers are purchased in accord with industry standards.

9.5.2.5 Operate and maintain

The MLL power transformer fleet undergoes regular routine inspections and maintenance to ensure continued reliable and safe operation. The details of routine maintenance tasks are summarised in Table 35.

Table 35: Maintenance schedule for power transformer fleet

Maintenance/inspection task	Frequency
Visual inspection of foundations, main tank, OLTC and cooling system. Recording of operational temperatures and oil levels, and, tap changer activity.	1 monthly
Transformer and OLTC dissolved gas analysis. OLTC operational checks.	1 yearly
Transformer condition assessment. In depth visual inspection, insulation and winding resistance tests.	3 yearly
Power transformer major service and tap changer service.	6 yearly

Given the ability to remove transformers from service at any of MLL's zone substations without the need for planned customer outages, the ability to maintain the existing transformer fleet is straightforward.

9.5.2.6 Renew or dispose

Since the majority of MLL's zone substation transformer fleet has rarely operated above half their ONAN rating, they are not exposed to significant long-term stresses and, as such, over their useful life, transformers rarely need to be removed from service for major refurbishment activities.

When transformers approach end-of-life, it is MLL's philosophy to initiate a transformer replacement project rather than to refurbish the existing transformer. This is due to the cost of refurbishment relative to that of replacement given the relatively small transformer sizes that make up the power transformer fleet. This also allows MLL to sustain a modern transformer fleet.

Over the planning period, MLL has budgeted for replacement of two power transformers (Rai Valley T1 and Woodbourne T2) subject to condition assessments. Further detail is provided in Section 9.12.

9.5.3 Zone substation switchgear

9.5.3.1 Fleet overview

Zone substation switchgear provides for the connection/disconnection of the sub-transmission and distribution network. Depending on the locality and criticality of the zone substation, the 33kV and/or 11kV switchgear may be individually pole-mounted, or contained within indoor switchboards.

9.5.3.2 Populations and ages

MLL currently has 221 zone substation circuit breakers in service across the network, excluding field reclosing devices installed within the distribution network. Of this total, 155 can be remotely controlled. The majority of these is 11kV, due to the multiple radial 11kV feeders emanating from each of MLL's zone substations.

As with the transformer fleet, MLL's zone substation switchgear fleet is relatively new (refer to Figure 54) due to conversions from outdoor to indoor of urban-based zone substations undertaken in the last 10 years.

There are two sites where the 11kV indoor switchboards are approaching the end of their useful life and pose a risk to reliability. These are proposed for replacement in the first five years of this AMP.

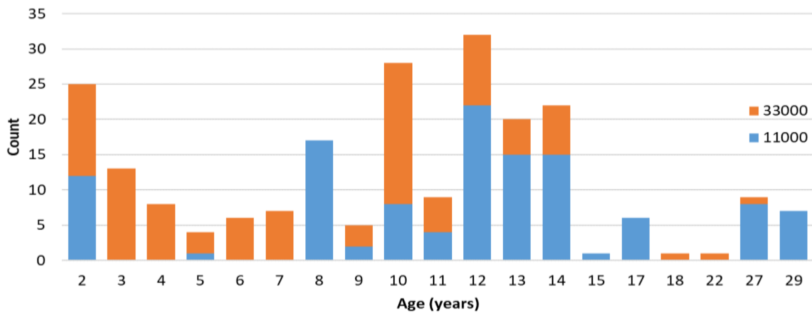


Figure 54: Zone substation switchgear by voltage

Switchgear technology has changed dramatically over time. Prior to the 1990s, switchgear typically used mineral oil as the insulation and arc-extinguishing medium. However, in modern designs this has been replaced by insulating gasses (for example, sulphur-hexafluoride, or SF_6) or vacuum systems. Where practical MLL utilises vacuum based switchgear, due to its environmental benefits over SF_6. However, the majority of recent replacements at sub-transmission (33kV) level have required the implementation of SF_6 due to its compact design, demanding less floor space in indoor applications.

Figure 55 provides a breakdown of both indoor and outdoor zone substation switchgear by voltage and insulation type.

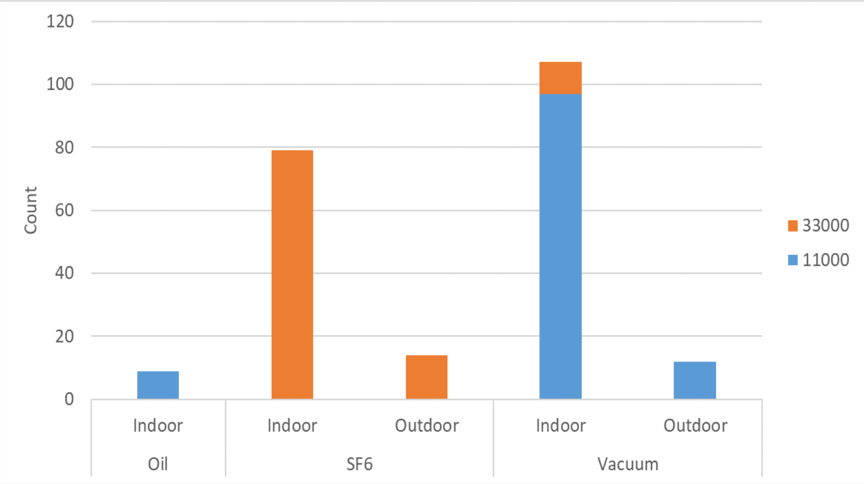


Figure 55: Zone substation switchgear by insulation type and voltage

9.5.3.3 Condition, performance and risks

Given recent investment into urban zone substations, including the replacement of switchgear, the bulk of the MLL zone substation switchgear fleet is in good condition.

Older switchgear is typically pole-mounted reclosers or 11kV indoor switchboards. Pole-mounted reclosers can pose an operational risk due to the fact that they are exposed to the elements over their lifetime, and are more difficult to maintain. MLL has standardised the type of pole-mounted switchgear across the outdoor zone substation fleet and carries sufficient spares to replace switchgear and/or control cubicles readily in the event of component failure.

Arc-flash risk is a serious safety concern which is considered. Modern switchgear is rated to contain arc-flash or to deflect arc-gas into external venting in the event of an electrical explosion to prevent or limit harm to the operator during such switchgear failures. However, older styles of switchgear do not provide the same levels of arc-flash protection to that as do modern types. Older indoor switchgear, especially oil filled switchgear, can also be more challenging to maintain. It is MLL's preference is to replace this type of switchgear with new arc-flash rated equipment as part of its commitment to continuous improvement. Over the AMP period, MLL intends to replace 11kV switchboards at two zone substations to remove aged switchgear.

In past years, MLL has implemented a programme to remotely control zone substation switchgear which has improved network reliability especially where significant travel time is eliminated. All 11kV switchgear, and approximately 85% of the 33kV switchgear across the MLL zone substation fleet is autoenabled (remotely controllable). The remaining 15% of the 33kV fleet is automation ready. MLL intends to implement automation at these sites (Waters and Springlands) over RY2021 and RY2022.

9.5.3.4 Design and construct

Given the importance of zone substation switchgear, reliability and safety considerations are paramount when it is purchased. Accordingly, all switchgear has been reviewed to ensure adequate arc fault containment ratings, mechanical longevity and other safety considerations.

MLL currently has both withdrawable- and non-withdrawable type circuit switchgear installed within the network. Withdrawable type circuit breakers allow for critical parts to be maintained, allowing for a longer useful life. This is important for oil-filled circuit breakers, where regular maintenance of moving components is required.

Medium voltage breakers utilising vacuum or SF_6 often do not require servicing over their useful life and thus can be made in a non-withdrawable arrangement, removing the risk of failures from connecting or disconnecting as with withdrawable types. However, in the event of failure of non-withdrawable type switchgear, an outage on the complete enclosure or board may be required.

Another function that is desirable with new switchgear is the ability to operate the disconnector and earthing mechanism remotely. Most switchboards now allow for the remote operation of the circuit breaking mechanism to isolate supply together with the ability to remote earth. This provides an immediate safety measure and reduces the need for manual switching in the field when isolating the network to perform works.

9.5.3.5 Operate and maintain

Zone substation switchgear undergoes routine inspections and maintenance to ensure its continued safe and reliable operation. These preventative tasks are summarised in Table 36.

Table 36: Maintenance schedule for zone substation switchgear

Maintenance/inspection task	Frequency
Visual inspection of foundations, main compartments, rear covers, cyclometer reading, oil/gas levels (where applicable).	1 monthly
Functional test.	1 yearly
Partial discharge survey of board and cable compartments.	3 yearly
General service. Removal of trucks (where applicable), and overhaul.	5 yearly

MLL performs all routine maintenance tasks, including major overhauls, of zone substation switchgear with its own trained in-house staff.

9.5.3.6 Renew or dispose

Decisions regarding switchgear renewal are based on the age and condition of the switchgear, as well as reliability and safety metrics relative to what could be achieved through renewal. These factors include:

- General condition (including number of operations);
- Insulating medium;
- Current make/break capacity;
- Arc-flash risk; and
- Reliability issues (parts, type, etc).

Under this AMP, MLL has budgeted to replace two 11kV switchboards in the existing zone substation switchgear fleet due to their age and condition. These will be at Riverlands and Woodbourne and are targeted for RY2024 and RY2022 respectively.

9.5.4 Ground fault neutralisers and neutral earthing resistors

9.5.4.1 Fleet overview

Zone substation impedance support is the general term for electrical devices used to alter the power system impedance at the zone substation for fault reduction or voltage control. This includes items such as ground fault limiters, neutral earthing resistors, capacitors and other reactive compensation schemes. The fleet of impedance support hardware on the MLL network is relatively minimal, with all alternate grounding systems other than direct earthing being installed only within the last six years.

Due to the relatively recent adoption and commissioning of these assets, no renewals are anticipated within the planning period.

9.5.4.2 Populations and ages

9.5.4.2.1 Neutral earthing resistors

MLL generally has low fault level due to the nature of operating a radial network, supplied from a single Transpower GXP. However, a low fault level can be troublesome at the farthest reaches of the network where high impedance faults may not allow sufficient fault current to flow to operate upstream protection devices.

At some locations of MLL's network, due to the proximity to Transpower's GXP, or the capacity of the sub-transmission network between the GXP, fault levels need to be reduced.

Accordingly, MLL has installed neutral earthing resistors on the two paralleled zone substation transformers at the Springlands zone substation, and plans to do the same at the Nelson Street zone substation.

Fault levels are reviewed as part of MLL's design and review when considering changes to the network.

9.5.4.2.2 Inductive ground fault limiters

In recent years devices have become available to reduce the impact of earth faults both in terms of network reliability and reduction of fire risk.

Following the successful performance of the first ground fault neutraliser installed at Havelock zone substation, further similar equipment (resonant earthing system) was installed at the Linkwater and Tapp (Renwick) zone substations in RY2020, principally for enhancement of public safety.

9.5.4.2.3 Reactive Compensation

MLL has an obligation to minimize its reactive power demands at the single GXP to maintain a near unity power factor. This is so that transmission assets are utilised to their full capacity for the conveyance of real power, and to reduce voltage disturbances on the transmission network.

At the Ward zone substation, two wind farms are connected to the 11kV distribution network. Due to their construction, the wind farms demand significant amounts of reactive power from the distribution network. Given the above requirements, MLL has opted to install reactive compensation at the Ward zone substation instead of supplying this from the GXP. This static compensation VAr consists of two 500kVAr low voltage STATCOMs, connected to the 11kV via a ground-mounted 1MVA transformer.

9.5.5 Zone substation buildings and earth grids

9.5.5.1 Fleet overview

MLL's 16 zone substations comprise both outdoor and indoor zone substations. Typically, this is a reflection of the environment they are in (i.e., urban vs rural). The zone substations comprise critical electrical assets, which are often located inside buildings. Earthing systems (grids) are also installed at zone substations. These earthing systems are an essential part of the network and ensure the grounding of the voltage source to enhance supply, facilitate operation of protection and provide a safe environment within the substation and its vicinity.

9.5.5.2 Populations and ages

MLL's zone substation fleet varies in age, from the early days of MLL's network (circa late 1920s initial commissioning) through to more recently commissioned zone substations such as Tapp zone substation in 2019.

9.5.5.3 Condition, performance and risks

The primary risk of buildings is their failure in a significant seismic event, which could damage the critical infrastructure housed within them. To address this risk, MLL recently undertook a programme of seismic strengthening (outlined in the following subsection).

Another risk which is addressed at zone substations is electrical hazards which result from the return of earth fault current to the zone substation in the event of faults on the distribution network. This includes a possible rise of earth potential, or possible risks to personnel through step and touch potential.

9.5.5.4 Design and construct

New zone substations are constructed to integrate with their surrounding environments. As Tapp zone substation is located in a residential area, the building is designed to look like a residential dwelling. Other, relatively recent examples of this nature are the Springlands and Waters zone substations.

MLL commissioned seismic strengthening programme of works involving structural assessments of the zone substation buildings, and strengthening works to the buildings that were deemed earthquake prone (i.e., <34% of the New Building Standard). This work has increased the resilience of MLL's critical network infrastructure to a large seismic event.

9.5.5.5 Operate and maintain

MLL undertakes monthly inspections of its zone substations' grounds and buildings. This reflects the critical nature of the assets at these locations. Inspections are undertaken of the assets at the zone substations, as well as the security of the sites.

9.5.5.6 Renew or dispose

MLL is not forecasting any renewal of zone substation buildings or zone substation earth grids during the planning period.

9.6 Distribution transformers

9.6.1 Asset management objectives

Distribution transformers convert electrical energy from the reticulated voltage of 11kV to low voltage 400/230V. Their effective performance is essential for maintaining a safe and reliable network at an appropriate voltage.

Transformers come in a variety of sizes, single or three phase, and ground- or pole-mounted. MLL's transformers are oil filled. These have inherent environmental and fire risks. Managing the lifecycle and risks of distribution transformers assets, including correctly disposing of these assets when they are retired, is the key objective of this asset management strategy.

9.6.2 Pole mount transformers

9.6.2.1 Fleet overview

There are approximately 3,500 pole-mounted transformers on the network. These are located in rural or suburban areas where the distribution network is overhead. The pole mount transformer fleet ranges in sizes from 1kVA up to 300kVA (being the largest pole mount transformer).

MLL's standards set the maximum allowable capacity for a new single pole-mounted transformer at 200kVA. This means any pole-mounted transformers greater than 200kVA that require replacement will be converted to a ground-mounted equivalent.

Larger pole-mounted transformers, particularly those serving urban areas, may be mounted in a 2-pole or pole-and-a half configuration. MLL is undertaking a programme of replacing those pole-mounted transformers where there is considered to be a risk of structural or mechanical failure, or where age or condition demands renewal.

In rural areas, 11kV lines are generally built with a 80m to 100m pole spacings on the flat and greater distances depending on terrain. These distances make the installation of LV impractical in many situations and, combined with a low density of consumers, necessitate many rural consumers being supplied from dedicated transformers. This results in a lower coefficient of utilisation than would be achieved in an urban area with greater ICP density, with fewer transformers, closer pole spacing and more LV conductor run. However, it is the most cost-effective solution to supply voltage at regulatory levels.

There are approximately 320 distribution transformers operating on the SWER network.

Reactive replacement of pole-mounted transformers can usually be undertaken quickly, affecting a relatively low number of consumers. Suitable spare transformers are held in stock at MLL's contracting depot. This ensures a fast response time to return the supply service.

In remote areas, the most practical method of transformer installation can be by helicopter.

9.6.2.2 Populations and ages

Table 37 summarises the population of pole-mounted distribution transformers by kVA rating. Many are very small, around 40% are 15kVA or smaller. A transformer of this size typically supplies one or two houses in a rural area.

Table 37: Pole-mounted distribution transformer population by kVA rating

Rating	Numbers of transformers	% of total
≤ 15kVA	1383	40%
> 15 and ≤ 30kVA	997	29%
>30 and ≤ 100kVA	832	24%
>100kVA	246	7%
Total	**3458**	

The data in Table 38 shows MLL's pole-mounted distribution transformer age profile. This is depicted also in Figure 56. The expected life of these units ranges from 45 to 60 years. Approximately 10% of MLL's fleet within this age group and is due for replacement based on age.

Table 38: Pole-mounted distribution transformer population by age

Age	Numbers of transformers	% of total
≤ 10 years	646	19%
> 10 and ≤ 20 years	1007	29%
> 20 and ≤ 45 years	1428	41%
> 45 and ≤ 70 years	357	10%
> 70 years	0	0%
Unknown age	20	1%
Total	**3458**	

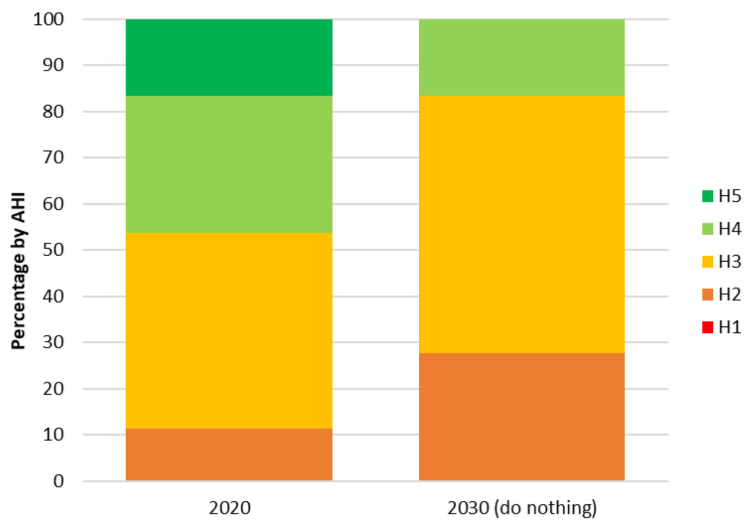


Figure 57: Pole-mounted distribution transformer age-based AHI profile

9.6.2.3 Condition, performance and risks

The main reasons for replacing pole-mounted transformers are equipment degradation and unexpected failures, usually caused by third parties (e.g., vehicle accidents) or lightning strikes. The predominant causes of equipment degradation are:

- Deterioration of the insulation, windings and/or bushings;
- Moisture and contaminant concentrations in insulating oil;
- Thermal failure because of overloads;
- Mechanical loosening of internal components, including winding and core;
- Oil leaks through faulty seals;
- External tank/enclosure damage and corrosion; and/or
- Lightning strikes.

Distribution transformers are generally reliable and although the risks of oil fires and oil leakage are ever present, the incidence of such events is low especially with properly installed quality transformers. MLL has oil spillage mitigations and MLL staff are trained in their use.

Figure 57 presents a summary of the pole-mounted transformer fleet condition scores, based on age.

9.6.2.4 Design and construct

To improve resilience to major seismic events, pole-mounted transformers above 200kVA are, where practical, replaced with a ground-mounted transformer of equivalent or greater size (see condition, performance and risks sections). Smaller pole-mounted transformers are replaced like-for-like.

9.6.2.5 Operate and maintain

Pole-mounted transformers are reasonably robust and do not require intrusive maintenance. Maintenance is generally limited to visual inspections. Small pole-mounted distribution transformers are less critical than ground-mounted equivalents. It is often cost effective to replace them when they are close to failure, rather than carry out rigorous maintenance to extend their life particularly if they have to be removed and taken to a workshop.

MLL's preventive inspections for pole-mounted distribution transformers are summarised in Table 39.

Table 39: Maintenance schedule for pole-mounted distribution transformers

Item	Action	Period	Maintenance level
Distribution transformers in public places	Distribution transformer visual inspection	1 Year	SHI
All other distribution transformers	Distribution transformer visual inspection	6 Year	SHI

9.6.2.6 Renew or dispose

Pole-mounted transformer renewal is primarily based on condition. The renewal need is often only identified when the transformer is close to failure and sometimes after they fail. Some in-service failure of smaller units is accepted because the consumer impact is limited, the cost of obtaining better condition information is high, and their maximum asset life is typically realised. Renewals are often combined with pole replacements or increases in consumer capacity.

9.6.3 Ground-mounted transformers

9.6.3.1 Fleet overview

There are approximately 460 ground-mounted distribution transformers on MLL's network. These are usually located in suburban areas and CBDs with underground networks. Ground-mounted transformers are generally more expensive and serve larger and more critical loads compared with pole-mounted transformers.

Ground-mounted transformers may be enclosed in a consumer's building, housed in a concrete block town substation, or berm mounted in a variety of enclosures. Ground-mounted transformers require seismically designed separate foundations (if not housed in a building), along with earthing and a LV panel.

Their capacity depends on load density but is generally 50kVA or 100kVA in lifestyle areas, 200kVA or 300kVA in newer suburban areas, and 500kVA to 1MVA in CBD areas. The most important substations within the CBD have dual 1MVA transformers for reliability.

This fleet includes the kiosks and LV distribution panel (i.e., ground-mounted-substation).

9.6.3.2 Populations and ages

Table 40 summarises the population of ground-mounted distribution transformers by kVA rating. The smallest units have a size of approximately 50kVA, with larger units used for higher capacity installations.

Table 40: Ground-mounted distribution transformer by kVA rating

Rating	Numbers of Transformers	% of Total
≤ 50kVA	59	12%
> 50 and ≤ 100kVA	80	16%
>100 and ≤ 200kVA	87	18%
>200 and ≤ 500kVA	166	34%
>500kVA	96	20%
Total	**488**	

The data below (both Table 41 and Figure 58) shows MLL's ground-mounted distribution transformer age profile. The expected life of these units ranges from 45 to 60 years. Only 2% of the fleet is within this age group and candidates for replacement.

Table 41: Ground-mounted distribution transformer by age

Rating	Numbers of transformers	% of total
≤ 10 years	139	28%
> 10 and ≤ 20 years	236	48%
> 20 and ≤ 45 years	99	20%
> 45 and ≤ 70 years	10	2%
> 70 years	0	0%
Unknown	4	1%
Total	**488**	

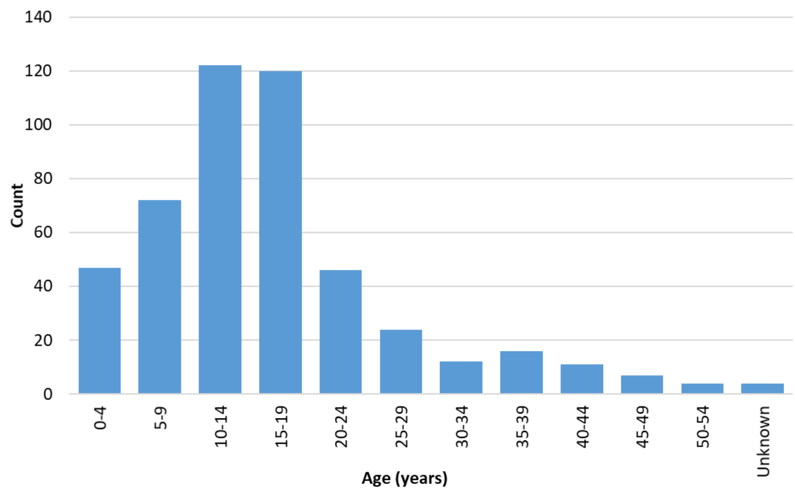


Figure 58: Ground-mounted distribution transformer age profile

9.6.3.3 Condition, performance and risks

The main reasons for replacing ground-mounted transformers are equipment degradation and unexpected failures, sometimes caused by third parties (e.g., vehicle accidents) or through faults. The predominant causes of equipment degradation are:

- Deterioration of the insulation, windings and/or bushings;
- Moisture and contaminant concentrations in insulating oil;
- Thermal failure because of overloads;
- Mechanical loosening of components, including winding and core;
- Oil leaks through faulty seals;
- External tank/enclosure damage and corrosion; and/or
- Lightning strike.

Figure 59 summarises the age based condition for MLL's ground-mounted distribution transformers.

9.6.3.4 Design and Construct

Maximum Demand Indicator (MDI) readings are performed on all large distribution transformers to assess capacity usage. The frequency of the readings increases as the transformer capacity margin decreases. MLL utilises electronic loggers which provide load profile data together with MDIs which record peaks. MDIs are being replaced by these new loggers.

9.6.3.5 Operate and maintain

Transformers used for large industrial loads can be exposed to more onerous load conditions than residential transformers, making critical that they are regularly visited and tested.

MLL's routine inspections involve visual checks and data capture, as well as oil testing for transformers greater than 500kVA. This information assists in assessing internal health of transformer for remedial action.

9.6.3.6 Renew or dispose

Inspections have revealed the population of large transformers to be in relatively good condition. The oil within a few transformers has failed crackle tests indicating the ingress of water, and some have had oil leaks which ultimately (if left) could have had significant consequences. These transformers have been replaced or subject to corrective maintenance.

9.6.4 SWER isolation transformers and voltage regulators

9.6.4.1 Fleet overview

Other types of distribution transformers include three phase isolation and single wire earth return (SWER) isolation transformers, capacitors and

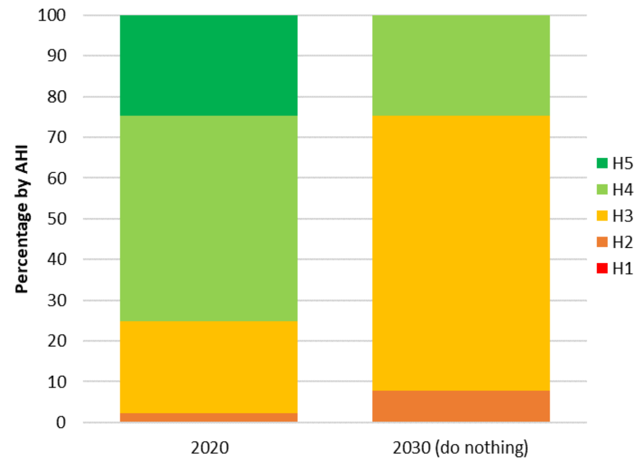


Figure 59: Ground-mounted distribution transformer asset health indicators

voltage regulators. The population of this sub-fleet is a small part of the distribution transformer portfolio and is varied.

A three-phase isolation transformer provides isolation of supply between two earthing systems, preventing transferred earth potential rise (EPR) between the sites and has a specific use within a substation.

SWER isolating transformers are only installed in rural areas and convert from 11kV phase to phase, to a single wire earth return system at 11kV phase to ground. SWER is a cost-effective form of reticulation in remote rural areas to supply light loads over long distances. SWER transformers are generally mounted on a two-pole structure with a recloser.

Voltage regulators are typically a pair of pole-mounted single phase 11kV transformers fitted with controls, used to lower or increase the voltage in response to load conditions. There are several three phase configured units used where the reticulation suffers from excessive voltage fluctuation, long lines where voltage rises with light load and drops with heavier load.

9.6.4.2 Populations and ages

Table 42 summarises the population of other distribution transformers by type. SWER isolation transformers make up the largest portion of the fleet installed over a number of small SWER networks.

Table 42: SWER isolation transformers and voltage regulators by type

Type	Number of assets	% of total
Voltage regulator	28	47%
SWER isolation transformer	32	53%
Total	**60**	

Table 43 summarises the SWER transformer fleet by age.

Table 43: SWER isolation transformers and voltage regulators by age

Rating	No. of assets	% of total
≤ 10 years	13	22%
> 10 and ≤ 20 years	30	50%
> 20 and ≤ 45 years	12	20%
> 45 and ≤ 70 years	5	8%
Total	**60**	

Figure 60 shows "other" distribution transformers age profile. The voltage regulator population is relatively young, with an average age of 14 years. In recent years, a number of SWER isolation transformers have been replaced, leading to a wide variation in age. Approximately 8% of the fleet

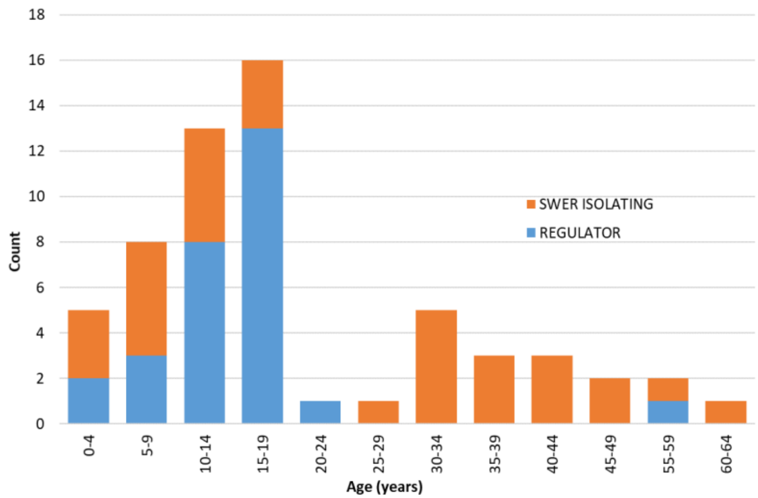


Figure 60: SWER isolation transformer and voltage regulators age profile

within this age group is a candidate for replacement. SWER transformers are typically installed in remote areas and the cost of accessing and replacing a transformer can be greater than the cost of the transformer itself.

9.6.4.3 Condition, performance and risks

These transformers are of similar construction to pole-mounted distribution transformers and so their failure modes are similar. Many of the SWER transformers are installed in relatively lightning prone areas and as such they are at increased risk of failure from this.

Both in service capacitors are assessed as H2 condition-based on age, and as such are approaching their end of life. MLL will target replacement (or removal) within this AMP period (subject to further assessment).

The condition of the regulator fleet is relatively good with no known type issues. MLL does not anticipate a need for a significant renewals programme for the transformers. It may be necessary, however, to replace the controllers to simplify SCADA connectivity.

One regulator that is targeted for renewal in RY2021 is the Wairau Regulator, east of the Wairau Valley township. This regulator has been shown to be overloaded at certain times of the year when high demand occurs.

9.6.4.4 Design and construct

MLL has a replacement programme in place for all SWER isolation transformers supplying more than eight consumers. This involves a new structure and electronic circuit breaker for improved reliability.

9.6.4.5 Operate and maintain

SWER isolation transformer maintenance is similar to ground-mounted or pole-mounted transformers. They share the same physical attributes and failure modes.

Voltage regulators require more frequent inspections and maintenance. Currently, each site is visited once a month for visual inspection.

9.6.4.6 Renew or dispose

Our renewal strategy for this fleet is condition-based replacement. Units are generally replaced as part of the defect management process when a significant defect is identified. Some units fail and they are immediately replaced to minimise the impact on consumers.

It is expected renewals for this fleet will remain fairly constant over the planning period and in line with historical quantities.

9.6.5 Distribution transformers renewal forecast

Aside from the inspection and maintenance regime, transformers are generally run to failure unless potential problems or poor condition are detected from network surveillance. Failure rates are also monitored to look for any systemic problems with the transformer stock.

Renewal forecasts are based on:

- historic renewal rates;
- Weibull survival analysis (using rates reported from other networks) with pole-mounted and ground-mounted considered separately; and
- an age-based replacement model derived from observed shifts in the all-NZ reported age profile for this asset class.

These three models report similar outcomes being 30 to 35 pole mount transformers p.a. and approximately five ground-mounted transformers p.a. This represents a renewal rate of approximately 1% p.a. on the installed base. The age-based models indicate that a slowly increasing replacement rate should be anticipated.

Renewals will also focus on the older two-pole-mounted distribution transformers in public places.

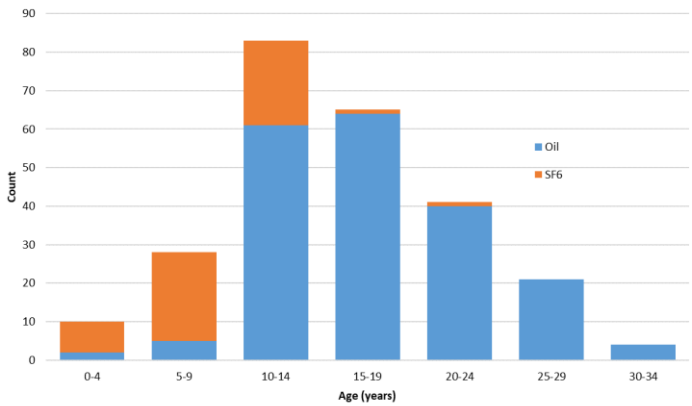


Figure 61: RMU age profile by insulation type

9.7 Distribution switchgear

9.7.1 Asset management objectives

The key asset management objectives for the distribution switchgear fleet are safety and lifecycle.

9.7.2 Ground-mounted switchgear

9.7.2.1 Fleet overview

MLL's fleet of ring main unit (RMU) switches is deployed within the cable distribution network. Almost all the RMUs are located in the urban, newer residential and the industrial areas and as such they have significant public exposure.

MLL primarily operates two types of ring main units, the ABB SD style oil switch and the ABB Safelink2 SF_6 gas switches. A programme to remove orphaned models from the network is now mostly completed with only one remaining.

MLL also has a small population of station style switchgear banks installed predominantly at the larger distribution substations in Blenheim's CBD. Due to being installed within secure substation buildings, any risk of public exposure to these assets is mitigated.

9.7.3 Populations and ages

Figure 61 summarises the RMUs condition-based on AHI grades (deduced from age). The fleet is relatively young but a small number of older oil filled ring main units are still in sevice.

9.7.3.1 Condition, performance and risks

As part of its commitment to continuous improvement, MLL has lifted its benchmark for operator and public safety for new RMUs to require an internal arc classification (IAC) of AB (operator and public). For this reason, very few of MLL's existing fleet achieve an AHI score of H5 (noting that this doesn't correspond with age-based scoring as seen in Figure 62).

National and international safety bulletins indicate that there has been a small number of recent failures of oil ring main units. As a result, the industry as a whole is trending towards a more cautious approach to oil RMU operation. While MLL has not had any failures of the type reported within its own population, MLL has changed its switching procedures for its oil RMU fleet to include remotely operated motorised actuators. This change has and will continue to minimise risk during switching operations.

Figure 62: RMU aged based AHI summarises age-based AHI scores for MLL's RMU fleet.

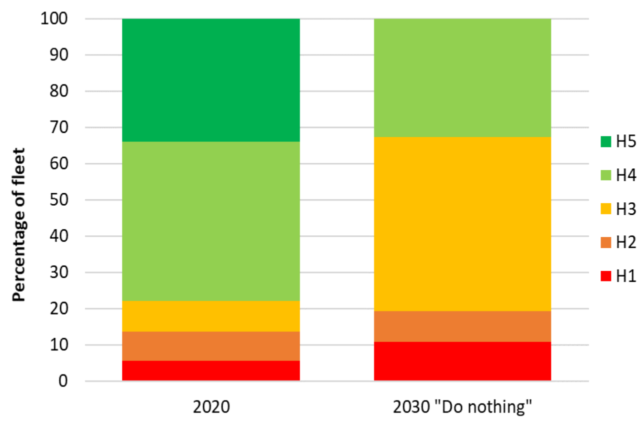


Figure 62: RMU aged based AHI

9.7.3.2 Design and construct

In keeping with public safety standards, MLL has recently updated its purchase specification for ring main units to require an internal arc classification for both operator and public safety.

MLL orders new RMUs with switching motors installed, ready to be made for remote control when a suitable communications link to the RMU is available.

9.7.3.3 Operate and maintain

Visual inspections of RMUs are undertaken on either a three-yearly basis, or annually if the asset is in a designated public place. For efficiency, these inspections are combined with the inspection of any associated transformer and testing of earth grids at the same site.

MLL also undertakes partial discharge testing, with focus on discharge in cable compartments. MLL responds to identified partial discharge issues.

Table 44 summarises the maintenance schedule for MLL's RMUs.

Table 44: Maintenance schedule for ring main units

Item	Action	Period	Maintenance level
Oil switches	Oil switch visual inspection	3 Years/1 Year*	SHI
Gas switches	Gas switch visual inspection	3 Years/1 Year*	SHI
Switches with batteries	Battery test	3 Years	OSCA
All switches	Partial discharge survey	6 Years	SS

*Visual Inspections undertaken annually at sites designated as a public place.

9.7.3.4 Renew or dispose

MLL has a programmed budget for the gradual replacement of its oil RMU fleet with remotely operated gas switches.

MLL prioritises replacement of RMUs based on a combination of the AHI calculation, public exposure, criticality and the operational configuration of the RMU.

This plan calls for the replacement of the two remaining orphan RMUs in RY2021 plus the gradual replacement of one oil RMU per annum over the planning period.

Where possible, MLL looks to remove single switch units with bus connected cables. These are generally replaced with a three-switch unit, with consideration given to a four-switch unit for either future extension or generator connection.

9.7.4 Pole mount switches

9.7.4.1 Fleet overview

MLL has a population of just over 1,000 pole-mounted air break switches (ABSs) within its network.

On the sub-transmission network, ABS's have been historically utilised for circuit isolation and circuit changeover points between feeders. The latter application has been superseded by smaller 33kV RMU based switching stations which offer remote controllability, more precise protection and enable the creation of "self-healing" restoration schemes.

Within the distribution network, ABSs are used for circuit isolation and reducing the impact of outages.

MLL does not yet use vacuum or SF_6 based pole-mounted switches on the network but is considering these as an alternative to the traditional air break switch.

9.7.4.2 Populations and ages

Figure 63 illustrates MLL's pole-mount switch age profile by operating voltage (sub-transmission vs distribution).

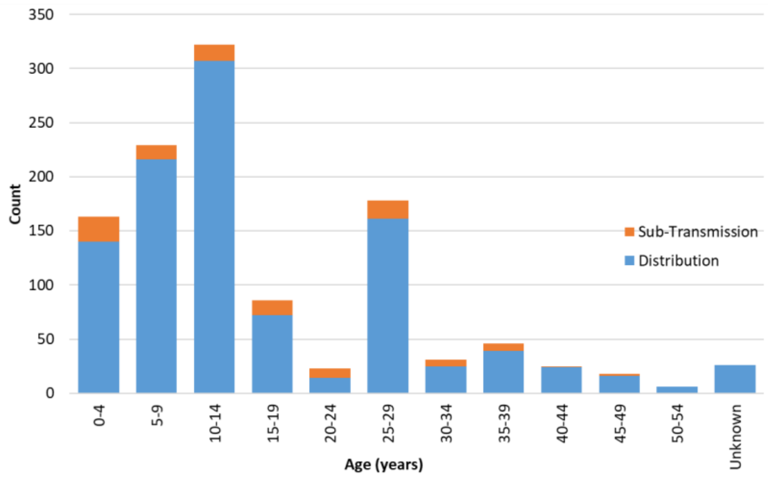


Figure 63: Pole mount switch age profile by operational voltage

9.7.4.3 Condition, performance and risks

MLL has experienced a small number of failures of ABSs over the last eighteen months. This is typically due to cracking and subsequent failure of the porcelain insulators.

Some of the ABS fleet has an alignment issue with the flickers, which can require the operator to reset the flicker after a closing operation. These issues are relatively low risk and rectified when other maintenance is undertaken in the same area.

9.7.4.4 Design and construct

MLL will generally use ABSs on distribution lines for:

- Sectionalising feeders to reduce outage impacts for construction, maintenance and fault work.
- Preventing ferroresonance when installed at the overhead to underground interface.
- Normally open tie points within or between feeders.
- Bypass connections to facilitate maintenance of reclosers.

Like other standard pole top equipment, new ABSs in rural areas are specified as 22kV for distribution and 66kV for sub-transmission.

When in public places, operating handles are mounted above standing reach to reduce the exposure of touch potential to the public and minimise opportunities for vandalism.

9.7.4.5 Operate and maintain

MLL does not undertake regular maintenance on the ABSs but the associated earthing systems are tested on a periodic basis.

Maintenance on ABSs occurs on condition when reported by field staff. Maintenance work may include greasing or component replacement – typically insulators. Depending on the work required, complete renewal is considered as an alternative.

In response to a small number of failures (refer to 9.7.4.3), MLL has undertaken a programme of inspections of it's fleet of ABSs utilising an unmanned aerial vehicle (UAV), or drone, to photograph insulators in attempt to detect hairline cracks in porcelain insulators, which could lead to failures. Where hairline cracks are detected, operational measures are put in place and the switch is replaced.

9.7.4.6 Renew or dispose

ABSs are generally disposed of during the process of a line rebuild. The new line will generally be specified with new ABSs located in positions appropriate to the new route configuration.

A small number of ABSs are renewed reactively if failure occurs. If MLL, through its UAV inspection programme, identifies porcelain insulators with hairline cracks, replacement of these ABS are scheduled (the timing of the replacement may depend on the particular ABS, i.e., the environment within which it is located, its criticality on the network, etc.).

9.7.5 Reclosers and sectionalisers

9.7.5.1 Fleet overview

As part of MLL's programme to increase the reliability of the distribution network, MLL has made substantial investment in remote controllable reclosers over the last 15 years. The distribution fleet consists of mostly vacuum type reclosers. There are a small number of older mechanical oil reclosers and sectionalisers located in the extremities of the network.

There are a number of SF_6 33kV reclosers utilised on the sub-transmission network used as line reclosers. These are occasionally utilised in auto changeover between lines.

Reclosers also feature as protection for power transformers and feeders at outdoor substations – refer to section 8.5.3 for details on these units.

9.7.5.2 Populations and ages

Figure 64 and Figure 65 summarise MLL's reclosers and sectionalisers age profiles by voltage and breaking medium respectively.

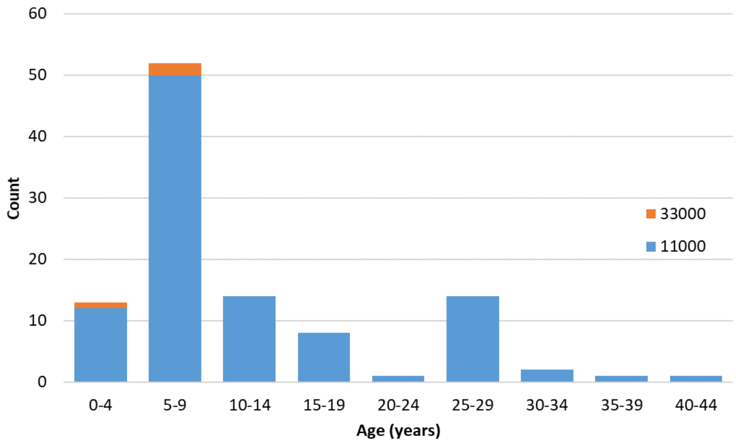


Figure 64: Recloser and sectionaliser age profile by voltage

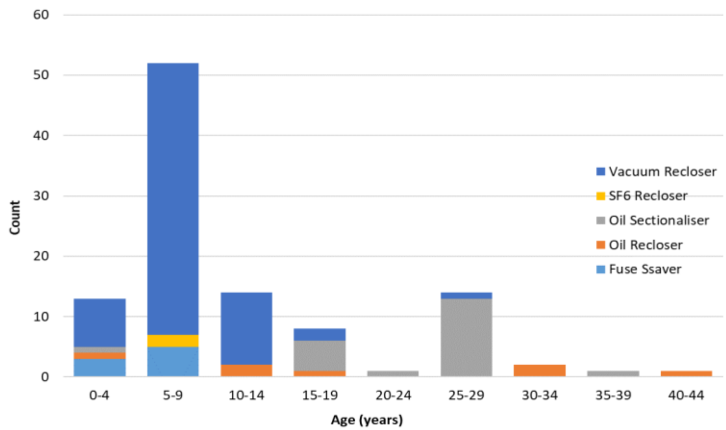


Figure 65: Recloser and sectionaliser age profile by breaking medium

9.7.5.3 Condition, performance and risks

Most of ther recloser and sectionaliser fleet is in good condition with few known design or maintainability issues. The oil breakers are beginning to age. This can be reflected in minor leaks around seals which result in higher maintenance costs or replacement to eliminate the risk of failure.

A summary of the age-based condition profile for sectionalisers and reclosers is summarised in Figure 66. Note that the 100% H5 assessment is directly related to there being only a limited number of these assets, all of which are relatively young.

9.7.5.4 Design and construct

The reclosers MLL has installed operate primarily with overcurrent and earth fault protection. Due to the high penetration of reclosers installed within the distribution network, there are very few remaining locations where new reclosers can be installed and still achieve effective protection

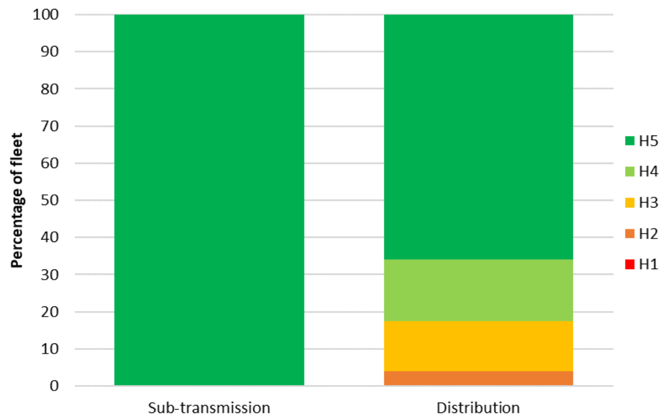


Figure 66: Recloser and sectionaliser condition-based AHI

discrimination with upstream devices. Continuation of distribution automation will therefore shift to the installation of remote-controlled line sectionalisers (switches).

Communications connectivity is a critical feature for new recloser and sectionaliser sites because remote monitoring and control are important benefits gained from the installation of the recloser or sectionaliser.

Reclosers are also fitted with a backup battery system designed to provide eight hours of operability after loss of mains supply.

Reclosers are installed with isolating links and bypass switches to facilitate maintenance.

9.7.5.5 Operate and maintain

Modern reclosers have online monitoring systems which reduces the requirement for site visits. Visual inspections are undertaken with testing of the associated earth.

Table 45 presents a summary of the maintenance schedule for MLL's reclosers and sectionalisers

Table 45: Maintenance schedule for reclosers and sectionalisers

Item	Action	Period	Maintenance level
SWER recloser/sectionaliser	Recloser visual inspection	3 Years	SHI
General recloser/sectionaliser	Recloser visual inspection	6 Years	SHI
Reclosers with batteries	Battery test	3 Years	ISCA

9.7.5.6 Renew or dispose

MLL is gradually replacing the oil recloser fleet with new vacuum reclosers. Replacement with a new recloser with the benefits of better protection functionality, monitoring and remote controllability, is preferred to the mechanical maintenance and overhaul required on older oil reclosers.

Other replacement is done on condition, with consideration given to asset refurbishment and other relevant criteria.

The ability to remotely alter protection settings of reclosers is of particular benefit at times of high fire risk.

Many of the existing oil reclosers are utilised protecting SWER networks and are prioritised over those protecting more remote standard construction.

Occasionally vacuum and SF_6 reclosers are removed from service as part of overhead to underground conversions. These units are returned to stock for use in other projects.

9.7.6 Distribution switchgear renewal forecast

The forecast amount for distribution switchgear included in the overall system renewal budget forecasts are largely based on the following renewal programmes:

- Oil insulated RMUs;
- 11kV switchgear at zone substations; and
- Pole-mounted reclosers.

9.8 Earthing Systems

9.8.1 Fleet overview

Earthing Systems provide three main functions:

- A voltage reference to earth for the power system.
- An effective fault return path, enabling protection to trip quickly.
- Reduce earth potential rise (EPR)[24];
    - in the event of an earth fault on conventional circuits; and
    - during normal operation of a SWER network.

Every metal clad piece of network equipment that is installed at ground level or designed to be operated from the ground using uninsulated tools should be bonded to earth to protect both the public and MLL staff from the risk of EPR.

As earthing systems may be shared between different assets at the same site and assets like transformers and switches may be replaced without affecting the earthing system, MLL treats earthing systems as a separate asset class.

MLL operates one of the largest SWER networks in New Zealand by combined length. A significant amount of this network was constructed with a subsidy from the Rural Electric Reticulation Council and located in rural and/or remote areas and largely in the Marlborough Sounds. Because EPR is ever present at SWER transformer sites, the integrity of the earthing systems must always be such that EPR across the ground is kept to a level which is not injurious to human life or livestock.

9.8.2 Populations and ages

The ages of MLL's earthing systems population is summarised in Figure 67.

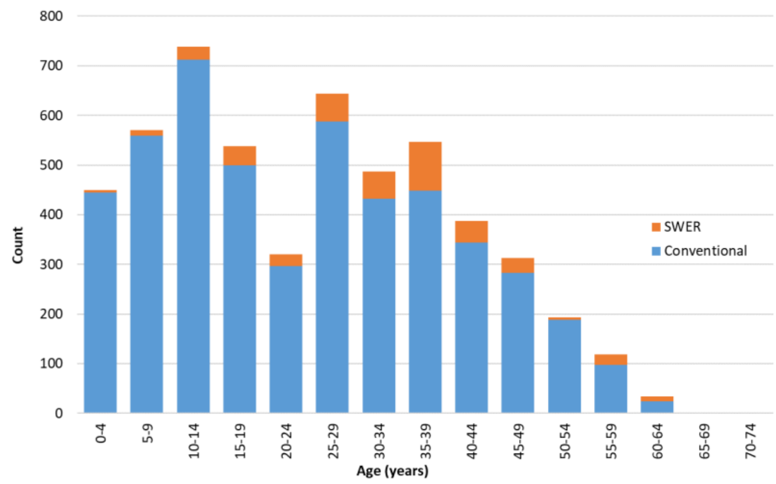


Figure 67: Distribution earthing systems age profile

9.8.3 Condition, performance and risks

Historically, MLL has taken a conservative approach to the electrical requirements of earth grids and has ensured minimum regulatory

[24] EPR occurs when current returns via the earth rather than through a conductor. On conventional networks, this only occurs as intended through the earthing system at times of fault or when a conductor's insulation has failed. However, in a SWER network, conductors for the return circuit run from the transformer down the pole and into the ground where there is extensive bare conductor which makes contact with the earth. All current flows through the earthing system as part of normal operation. This means that, while loaded, EPR of some magnitude is always present on SWER earthing system.

requirements are met. Earthing systems are regularly checked. Overall, it can be said MLL's earthing systems are in a very good condition.

From a materials perspective, the soils around Marlborough are benign, and corrosion of earth grids is not an issue that has been observed to date. This also indicates that age-based renewal is not an effective strategy for this asset class.

The most common cause of earthing system defects is from civil or horticultural conversion works on the land causing damage where the earthing system is located.

The risk associated with an earthing system's EPR is assessed with a probabilistic methodology based off the EEA's Guide to Power System Earthing. This takes into account:

- the probability of human exposure to an EPR hazard at the site; and
- the probability of an EPR event occurring.

9.8.3.1 SWER earth grids risks

The EEA probabilistic method presents SWER earthing systems as a higher risk because the probability of EPR occurring is virtually constant for SWER sites. A more deterministic method must be used to either ensure the EPR at the site does not reach harmful levels or reduce the public (and livestock) exposure to the site.

The trade-off is that due to their configuration, SWER networks are only used in low loaded and usually remote areas, meaning they are generally installed in areas with low public exposure.

Design and installation practices of SWER earthing has changed significantly since the original installation of the SWER network. Original earthing conductors were often mole-ploughed into the ground at relatively low depths where there was optimum conductivity within the ground. As a consequence, if there were earthworks in the vicinity, buried earthing systems would be at risk. MLL mitigates this risk by:

- improving the data on where the SWER earthing systems run;
- running an education campaign targeting the owners of the land where SWER earthing systems are present (this has been done in the last two years and MLL will look to undertake this again; and/or
- prioritising the rebuild of high risk SWER sites.

9.8.4 Design and construct

MLL has a series of standard earthing designs for various asset classes which have been externally reviewed with some changes arising from the review. These changes include improved control of the EPR contours as a mitigation strategy. There are areas in Marlborough where the soil resistivity is not ideal for the construction of earthing systems. MLL mitigates this risk by:

- increasing the size of the earthing system installed;
- installing conductivity enhancers around the earthing conductors; and/or
- importing and placing soil of greater conductivity around the conductors.

Consideration is also given to where an HV earthing system may potentially transfer EPR onto a LV multiple earthed neutral system (the standard LV system in New Zealand utilised for the provision of ICP supply) and mitigating measures are effected as required.

Due to their configuration, SWER networks can only be safely used in low load scenarios. Supply via SWER imposes limitations for any future growth. MLL avoids the construction of new SWER networks where possible due to the lack of future capacity as well as the operational risks and maintenance costs associated with SWER installations.

9.8.5 Operate and maintain

The resistance of earthing systems is periodically tested at frequencies based on the risk profile of the site as further described in 9.8.3.1. The inspection periods applied are summarised in Table 46. For efficiency, earth tests are also combined with visual inspections of the transformers or switches at the same site.

Table 46: Maintenance schedule for distribution earthing systems

Item	Action	Period	Maintenance level
Earthing systems in public places	Inspection/earth test	1 Year	ISCA
Earthing systems in public places	Classification review	3 years	OSM
SWER earthing systems	Inspection/earth test	3 Years	ISCA
Other earthing Systems	Inspection/earth test	6 Years	ISCA

The need for corrective maintenance is driven by the earth test results and is evaluated recognising the risks described in section 9.8.3.1.

Emergency repairs are also made after damage by external parties.

9.8.6 Renew or dispose

Earthing systems are not generally renewed on condition of age but are improved or added to if the performance of the earth is subject to deterioration. The latter is determined by testing or effecting reinstatement after damage has occurred. In some cases (SWER in particular), there may be a safety reason to rebuild the earthing system to improve the EPR exposure at the site.

Disposal of an earthing system may occur when an entire site is decommissioned – generally due to asset relocation.

9.8.7 Distribution earthing systems renewal forecast

Earthing systems are incrementally maintained rather than renewed. No capital expenditure is allocated against this fleet strategy.

9.9 Mobile generators

9.9.1 Fleet overview

Diesel generators are used within MLL's network to:

- provide supply to areas when planned or unplanned works would require an area to have no mains supply;
- reinforce supply lines where an alternate temporary feed does not have the capacity to maintain voltage;
- provide security of supply during network maintenance; and
- reduce MLL's contribution to regional power consumption peaks.

MLL has several generators used for operational support, split into a mixture of mobile units and fixed sites, with a cumulative capacity of over 3.7MW.

Mobile units are used to minimise outages when work is required on radial lines and/or during emergencies (e.g., earthquakes) when supply from upstream lines is not available. MLL has installed generation connection points at strategic locations of the 11kV network to provide safe and efficient deployment of mobile generators into the network.

There are two remotely controlled fixed generation sites in the Marlborough Sounds at Elaine Bay and Kenepuru Heads. These sites are embedded midway along two of MLL's longest and most remote feeders. In fault situations, these sites often enable supply to be restored to the remote ends before fault response staff can be deployed into the area.

MLL has a range of generator sizes to enable matching of capacity and load. A summary of MLL's mobile generator fleet is provided in Table 47.

Table 47: Mobile diesel generator fleet

Generator	Standby Rating @ 0.8 pf (kW)	Output Voltages	Mounting type
Gen 1	720	11kV, 400V	Flatbed Trailer
Gen 2	440	11kV, 400V	Curtain Sider Truck
Gen 3	440	11kV, 400V	Fixed (Elaine Bay)
Gen 4	440	11kV, 400V	Fixed (Kenepuru Heads)
Gen 5	440	11kV, 400V	Fixed (Kenepuru Heads)
Gen 6	440	11kV, 400V	Fixed (Kenepuru Heads)
Gen 7	160	400V	Skid
Gen 8	132	400V	Fixed (Taylor Pass)
Gen 9	240	11kV, 400V	Curtain Sider Truck
Gen 10	80	11kV, 400V	Folding Sided Truck

The capabilities of the current mobile generator fleet meets requirements. There are no plans to expand this fleet further.

9.9.2 Populations and ages

The age profile of MLL's generator fleet, including both fixed and mobile, is summarised in Figure 68.

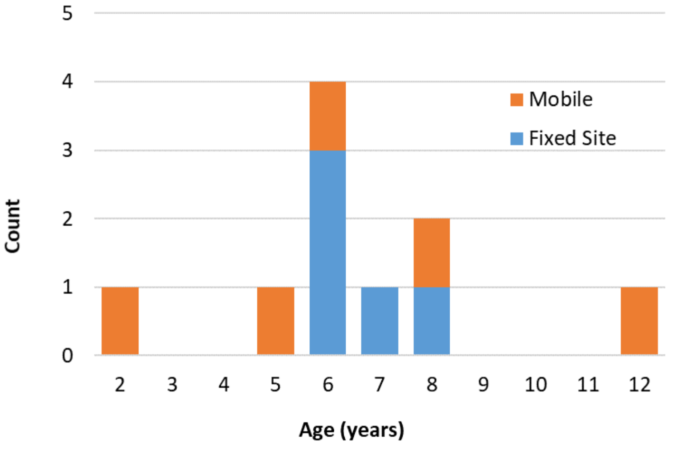


Figure 68: Diesel generator age profile

9.9.3 Condition, performance and risks

Due to the small size of the mobile generator fleet, the relatively young age and scheduled maintenance undertaken, MLL has a good understanding of the health of the mobile generator fleet and considers it to be in good condition.

The generator/engine controller has recently been standardised amongst the fleet to facilitate ease of operation.

The electrical protection configured with a diesel generator is typically more sensitive than what would be installed within the standard line recloser or feeder protection due to the need to protect the generators themselves. This makes the generators inherently less robust than the mains supply so the mains supply is restored as soon as this is viable. At all times diesel generators are operated in a manner to minimise fuel costs.

Figure 69 summarises the AHI scores of the mobile generator fleet.

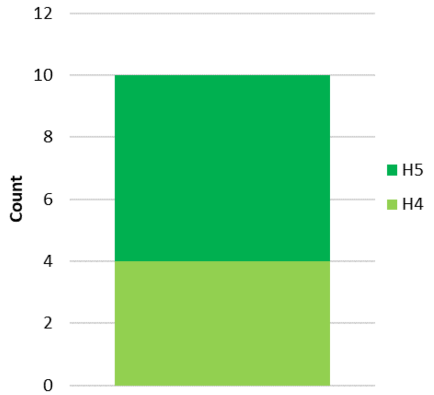


Figure 69: Diesel generator condition-based AHI

9.9.4 Design and construct

Demand for generators is driven by reliability improvement to provide enhanced service and improve network reliability. The key performance indicator is the amount of SAIDI minutes saved.

MLL's mobile generators are typically mounted on the back of a "curtain sided" or folding side style truck, along with a step-up transformer, isolating switches and protection and control modules. The mobile generators are relatively easy to use and operate, and, have proven to be of significant benefit to the network.

9.9.5 Operate and maintain

The generators' diesel engines are serviced in accord with manufacturer requirements for both hours run or periods between service.

The vehicle mounted generators have flexible 11kV cables used to connect to the network. These cables are regularly moved as part of connection and disconnected activities and will suffer wear as part of these procedures. The cables are electrically tested every three months and visually inspected before each use.

Table 48 summaries MLL's maintenance schedule for the mobile generator fleet.

Table 48: Maintenance schedule for MLL's generator fleet

Item	Action	Period	Maintenance
All generators	Visual Inspection and run loaded.	1 Month	ISCA
Mobile generators	Cable test	3 Months	OSCA
All applicable generators	250 Hour service	6 Months or 250 running hours	NIM
All generators	Electrical inspection	1 Year	OSCA
All generators	500 hour service	1 Year or 500 tunning hours	NIM
All generators	2,000 hour service	2 Year or 2,000 running hours	NIM
All generators	3,000 hour service	3 Years or 3,000 running hours	NIM
All generators	4,500 hour service	4,500 running hours	NIM
All generators	12,000 hour service	6 Years or 12,000 running hours	NIM
All generators	Overhaul	Based off condition assessment	OSIM

9.9.6 Renew or dispose

The diesel generator life expectancy is placed at 20 to 30 years. Due to its maintenance practices, MLL is not expecting to have to renew or dispose of any of its fleet during this AMP due to asset health, although changes in operational requirements may affect these plans.

9.9.7 Diesel generator systems renewal forecast

No capital renewal is expected within this AMP. Inspection and routine maintenance is minor and is included in the routine opex budget.

9.10 Secondary systems (assets)

9.10.1 Asset management objectives

Secondary systems (such as protection systems) are a critical part of operating a safe and reliable electricity network. Their useful lives can be shorter than assets in other areas due to ongoing improvements in technology and a commitment to continually improve the performance of the network to meet ICP requirements. Assets in this class are growing in complexity due to the uptake in "smart grid" applications and typically have to be considered in conjunction with the operation of a number of network components.

Protection assets ensure the safe and correct operation of the electrical network. They detect network faults and operate circuit breakers to prevent harm to the public and staff, or damage within consumer installations or to network assets. The SCADA and communications assets provide network visibility and remote control, allowing MLL's operators to operate the network with a greater level of efficiency.

9.10.2 SCADA and communications

9.10.2.1 Fleet overview

MLL operates the iFix Open Database Connectivity (ODBC) based SCADA system. The system has been designed to allow monitoring and remote control of devices in the network, including circuit breakers, transformer tap changers, line reclosers, voltage regulators and the load management system.

A central server communicates with remote terminal units (RTUs) over a wide range of communications mediums. The RTUs then interface with network equipment such as transformer control units and circuit breaker control systems. DNP3.0 is MLL's standard communications protocol for RTUs.

The communications network carries MLL's SCADA system traffic as well as protection and voice (DMR) systems. MLL's communications network consists of different data systems and physical infrastructure, including fibre optic circuits, UHF point-to-point digital radios, microwave point-to-point digital radios, point-to-multipoint UHF repeaters and cellular/ADSL circuits. Protection circuits are typically direct inter-relay fibre circuits between substations. All communication operates over TCP/IP Ethernet protocol.

The communications fleet also covers the infrastructure that houses communication systems, including masts, huts, cabinets and RF equipment.

The SCADA system has been operating for approximately 15 years. During this time, it has had new servers and software upgrades to ensure stability and reliable operation.

Over the past nine years there has been significant expansion of the SCADA communications network to provide coverage to the remote parts of MLLs network in the Marlborough Sounds and the East coast. Consequently, most of the communications equipment is at a young age and is not due for replacement within this planning period.

The expansion of the SCADA coverage area has enabled the connection of a number of three phase and SWER reclosers to MLL's SCADA system. Table 49 depicts the devices connected and the methodology.

9.10.2.2 Condition, performance and risks

Some aspects of the SCADA system are becoming limited in terms of compatibility with the latest available technology and could inhibit further development of the network unless upgraded.

The majority of MLLs communication network is in new condition and is at little risk of failure due to old components. During the 2016 earthquake some damage to an analogue voice repeater site was sustained but the rest of the network performed well.

Figure 70: Communications mast at Takorika with varying antenna

Table 49: SCADA equipment population by communication method

Type	Fibre optic	Licensed radio	Unlicensed radio (WiFi)	Cellular/ ADSL	Not connected (but capable)
33/11kV circuit breakers	92	30	30	7	5
33kV reclosers	2	6	7	3	-
11kV reclosers	1	47	4	13	1
SWER reclosers	-	8	2	1	-
Voltage regulators	-	-	3	18	1
Zone substation transformers	16	7	4	2	-
RMUs	4	4	4	4	1
Enclosed switches	-	3	-	1	-

The key perceived risk from the SCADA system is the loss of network visibility and control. MLL prefers to operate equipment remotely for a number of reasons, including safety, speed of operation and improved operator feedback. Enhanced status information from the field through the use of SCADA minimises outage durations and requires less staff on the ground and achieves faster response times.

A significant risk is a cyber-attack on the SCADA system where a party gains control of devices or blocks MLL from controlling them. The increasing risk of a cyber-attack on MLLs network requires ongoing vigilance and improvement to the security levels of MLL's SCADA system.

The potential safety, reliability and cost consequences from an attack on the system is increasingly serious.

9.10.2.3 Design and construct

All new SCADA-connected equipment must be capable of TCP/IP communications with DNP3.0 protocol.

The latest standard RTU and protection relays that are being installed provide remote engineering access. This allows technicians and engineers to access information remotely removing the need to download the data at the site. This reduces the time required to understand and react to a fault.

Communications systems have Ethernet IP based technology, often layer 3 capable, allowing for smart routing of packets such that any device or site can fail and not impact a wide area.

9.10.2.4 Operate and maintain

The SCADA system is continuously monitored through self-checking systems and a third-party monitoring system. The communications network is part of this monitoring system and alerts operators to communication failures or overloaded networks. Further staff resource will be required to monitor the network as it develops.

MLL's preventive maintenance schedule is outlined in Table 50.

Table 50: Maintenance schedule for SCADA and comms equipment

Asset type	Maintenance description	Frequency
Communications equipment	Visual inspection of radios, switches, antennas at zone substations and radio sites.	Yearly
SCADA master station	Software upgrades, database checks	3 monthly
SCADA master station	Hardware upgrades follows IT server replacements	5 Yearly

9.10.2.5 Renew or dispose

It is planned to upgrade the SCADA master station software within the next five years to provide more functionality and add additional support for managing the greater quantity of data being generated.

Other communications assets, such as radio links and their associated hardware, are typically replaced due to obsolescence. The opportunity is taken to replace legacy communication assets with modern more functional assets.

9.10.3 Protection relays

9.10.3.1 Fleet overview

Protection assets ensure the safe and correct operation of our electrical network. They detect network faults and operate circuit breakers to prevent harm to the public and staff, or damage to network assets, or to ICP installations.

Protection relays or integrated controllers are installed to detect and measure faults on the HV electricity network. They directly trip circuit breakers or operate switches to clear and isolate faults. They provide significant benefit to the network reliability through auto reclosing features for transient faults.

Protection systems include all associated parts such as CTs and VTs, communication interfaces, auxiliary relays and interconnecting wiring.

The MLL network has predominately numerical relays installed. There are now less than five remaining electromechanical relays installed. It is intended that these will be replaced over the planning period.

The expected life of a numerical relay is approximately 20 years. Obsolescence is the main driver for replacement, and, this is typically dictated by functions available, network standardisation and communication protocols. In all cases relays are purchased from suppliers of quality equipment to recognised standards.

9.10.3.2 Populations and ages

Simple phase over current and earth fault (OC/EF) relays are generally used on zone substation feeders. 21 of the 31 zone substation transformers have dedicated differential protection. Figure 71 shows the protection relay age profile, with Table 51 providing the population breakdown by relay type

MLL installed its first numerical relay in 2002. These first-generation relays will require renewal during the next five years as they near end of life.

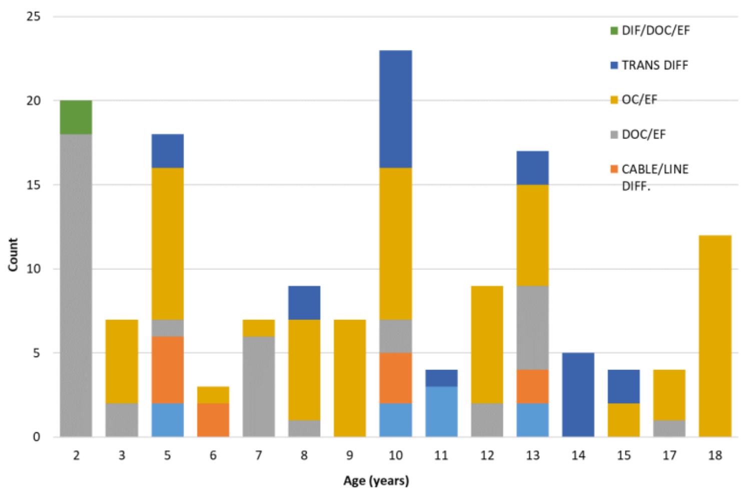


Figure 71: Protection relay age profile by type

Table 51: Quantities of protection relays by type

Relay type	Quantity
Bus differentials	9
Cable/line differential	11
OC/EF with directional	38
OC/EF	68
Transformer differential	21
Transformer differential with directional	2
Total	**149**

9.10.3.3 Condition, performance and risks

The primary safety risk for a protection device is that it fails to clear a fault. This can put the public or staff at risk, impact on ICP installations, cause network equipment failure, overload, high or low voltage, etc.

Backup protection is a requirement for all circuits but these inherently take longer to clear a fault to ensure protection discrimination. Longer fault clearance times are a considerable risk to the network.

9.10.3.4 Design and construct

Protection system design must balance many competing requirements to ensure the overall system is effective.

The protection equipment must operate correctly when required, despite sometimes not operating for long periods. It must operate with speed and precision as part of an overall protection system. It must provide safety to the public and staff, as well as minimise damage to network equipment. Correct operation is fundamental to providing reliable supply.

In 2018/2019 MLL undertook a review of all protection relays and selected a single supplier's relays as the standard.

9.10.3.5 Operate and maintain

Numerical relays require less detailed and less frequent checks. They are also able to provide alerts regarding their condition, prompting a maintenance callout if necessary.

The preventive maintenance schedule for protection relays is outlined in Table 52.

Table 52: Maintenance schedule for protection relays

Maintenance description	Frequency
Visual inspection of protection relays at zone substations, checking any alarm flags and resetting them.	Monthly
Detailed secondary testing and operational checks for numerical relays. Perform diagnostic tests relevant to relay function (e.g., overcurrent, distance).	6 yearly
Relay battery replacement (storage battery)	10 yearly

9.10.3.6 Renew or dispose

The strategy is to replace relays on the basis of functionality and age. MLL's costs and the risk of having odd spares increase with age. First generation numerical relays can increasingly be expected to diminish in functionality and as such MLL typically deems that replacement of these is required.

9.10.4 Load control relays

9.10.4.1 Fleet overview

Metering in consumer installations is owned by metering equipment owners, including ripple relays. MLL operates a ripple control system for peak lopping of system load at certain periods of the year.

MLL operates both 217Hz and 1050Hz ripple injection systems. These inject at 33kV with the injection equipment installed at the Springlands zone substation site. The first 1050Hz relays were originally installed in 1967. All new ripple relays are 217Hz and the 1050Hz relays are being phased out.

9.10.4.2 Populations and ages

The 1050Hz plant was commissioned in 1967, although the rotary generator has been changed to solid state. The 217Hz plant was commissioned in late 2009. The ages of the plants are therefore 53 years and 11 years.

9.10.4.3 Condition, performance and risks

There is currently only one 217Hz ripple controller available for service. Should this fail, control signals could not be provided and may put MLL at risk of exceeding the load target during shedding periods. Conversely, there is a second 217Hz system out of service that can be used for parts. The maintenance contract with the supplier should enable major faults to be rectified within 48 hours provided the failure was not catastrophic.

9.10.4.4 Design and construct

MLL plans to replace the ageing 1050Hz plant with a second 217Hz plant to operate as backup and to complement the other system within the planning period.

9.10.4.5 Operate and maintain

Regular inspection and testing of the ripple injection system assets is undertaken to ensure their continued and reliable operation. The controllers have a number of check alarms programmed to provide the early identification of any problems. The preventive maintenance schedule is outlined in Table 53.

Table 53: Maintenance schedule for load control relays

Maintenance description	Frequency
Visual inspection of ripple plant, checking any alarm flags and resetting them.	Monthly
Onsite testing and physical inspection of ripple plant.	Yearly

9.10.4.6 Renew or dispose

MLL plans to dispose of the 1050Hz system within the next two to five years. Metering equipment owners and retailers were notified to transfer their consumers to 217Hz relays by 1 April 2021. MLL will continue to renew the existing 217Hz plant and plans to install a second 217Hz system, once the 1050Hz plant is decommissioned, to improve operability and reliability.

9.10.5 Secondary systems renewal forecast

MLL is considering replacement of its existing SCADA management system within the first five years of the planning period, a project that is expected to take approximately 18 months to complete.

Protection relay replacement work is, as far as practical, coordinated with zone substation works – typically power transformer or switchboard replacements. At these times the protection systems may also be replaced depending on the technology and condition of the existing relay assets.

A new 217Hz Ripple Control system is forecast to be installed within five years. Refer to the network development section for project details.

9.11 Non-Network assets

9.11.1 Information systems

MLL has extensive IT systems which are critical to supporting the everyday business needs. IT systems cover all aspects of the business - payroll for staff, asset data management, monthly billing, GIS viewers, financial information, purchasing and stock, scheduling and estimating of work, storage of electronic files, and running engineering analysis of capacities and loads on the network for example – all related directly or indirectly to achieving MLL's asset management objectives.

MLL's IT infrastructure is generally managed by the ICT team which comprises four full time staff members. External consultants are engaged at times to assist the IT team as and when specific advice and input is required.

IT-related assets such as computer hardware and software have relatively short lifespans as new and improved technologies become readily available.

MLL's forecast IT related capital expenditure is summarised in the regulatory schedule (11a) which can be found in Appendix 1.1. The amounts forecast are relatively constant across the planning period.

9.11.2 Vehicle fleet

9.11.2.1 Description

MLL owns and manages a significant vehicle fleet across the business (including the contracting division). Vehicles are an essential asset to enable and facilitate MLL's activities and to meet MLL's asset management objectives. MLL's vehicle fleet as at February 2020 includes:

- 58 utility vehicles (utes);
- 28 trucks (including crane and bucket trucks, mobile generators;
- 17 light vehicles (cars and SUV);
- 3 forklifts; and
- 61 other (ATVs/quad bikes, chippers, trailers etc).

When procuring vehicles, MLL considers safety (largely based on the Australasian New Car Assessment Programme (ANCAP) rating), environmental impacts (including fuel efficiency) and operational requirements (i.e., suitability for intended use).

MLL's vehicle procurement policy is reviewed and updated when deemed necessary. It is envisaged that the policy will develop to include greater focus on procuring vehicles, where appropriate, that are fully electric, or electric hybrid.

9.11.2.2 Management

Records of MLL's vehicles are maintained in the asset management system, Infor's EAM. Vehicles are split into various classes and categories, and relevant attributes are recorded against each vehicle. The records allow easy visibility and tracking of when maintenance activities are required against each vehicle.

MLL's vehicles are regularly maintained to ensure operational effectiveness and to minimise the potential for componentry failure which could contribute to an accident or lessen reliability.

MLL's utility vehicles travel the greatest distances often on gravel and/or rough roads. These vehicles are typically replaced between three to six years depending on the make and models, distance travelled and performance. Other vehicles are replaced on a case by case basis.

9.11.2.3 Forecast costs

MLL's capital expenditure on vehicles has averaged approximately $500,000 over the past three years. The expenditure on vehicles is forecast to increase for the first three years of the planning period, then reduce. The annual expenditure on vehicles will be reviewed and any adjustments to forward forecasts will be made as appropriate, i.e., reflecting any changes in MLL's vehicle requirements to support asset management objectives.

9.11.3 Buildings and land

9.11.3.1 Description

MLL owns and maintains a number of non-network properties and buildings, including:

- The main office building/property at 1 Alfred Street, Blenheim.
- The Taylor Pass depot which comprises land and a series of buildings – offices, workshops and sheds/warehouses to store electrical and non-electrical goods.
- Residential property (including a dwelling) at 34 Budge Street, Blenheim. This was purchased several years ago for a possible future zone substation development site.
- The D'Urville Island depot building/property at Kapowai Bay. This is used to store materials and equipment to assist work that is undertaken on D'Urville Island and provides limited accommodation for staff.
- A 60-hectare eucalypt plantation in the Wakamarina Valley, Marlborough.
- A vacant lot at 287 Hammerichs Road, Rapaura. Site of a potential future zone substation development.
- The property/building on the corner of Old Renwick and Thomsons Ford Road housing the historic (out of service) diesel generators.

- The System Control building adjacent to the Springlands zone substation on Murphys Road. The System Control building currently houses MLL's ripple plant (i.e., it is a system asset). The building has historically served as a backup network Control Room.
- The Picton depot building/property at 15 Market Street, Picton. In past years this was utilised by field staff based in Picton to respond to faults and carry out work in the Picton area. It is now used for adhoc projects and available for emergency purposes.
- The Havelock depot building/property at 24 Lawrence Street, Havelock. This was also used as the base for field staff carrying out work in the Havelock area. It is now used for adhoc projects and is available for emergency purposes.

MLL's main office building is located at Alfred Street, Blenheim. The main office houses engineering, network, financial, commercial and corporate services staff. The property also includes an adjacent building housing MLL vehicles as well as the network control room in which four network controllers work. Adjoined to this building is the former workshop which is currently leased out.

MLL's contracting business is located at Taylor Pass Road, and it comprises an office building, electrical workshop, stores warehouse, plant and vehicle sheds and other buildings housing materials and/or equipment. The Taylor Pass office houses contracting staff, including management, supervisors, design estimators, fault men and administrative support staff.

9.11.3.2 Management

MLL aims to provide staff with secure, safe and functional office environments that facilitate efficient work and allow for future growth. Security of critical non-network services and infrastructure, such as IT servers and the Network Control Room are also considered, including contingency (i.e., backup) in the (unlikely) event of failure.

Maintenance of the properties outlined is undertaken as and when required with painting occurring at appropriate intervals. The grounds of all properties are maintained and care taken to ensure they integrate with the environment.

9.11.3.3 Forecast costs

During the planning period, it is anticipated that a review of the current office location and layout will occur to ensure that it is fit for purpose, both currently and into the future. Until the review is undertaken, MLL is unable to forecast costs or indeed whether the project will materialise. The review may recommend, for example, that due to capacity constraints a new office building is required to meet MLL's aims or a reconfiguration/refurbishment of the existing office.

A review will be undertaken of the existing back up Network Control and IT server rooms at System Control. The building's structural integrity has been assessed and deemed to be inadequate if the building is to be classified as Importance Level 4. The main Network Control Room is also deemed to be structurally inadequate (earthquake prone) if assessed at Importance Level 4. MLL's strategy for the Network Control Room is to have a facility rated at 100% New Building Standard (NBS). MLL is still considering its options with regards to its control room.

The Taylor Pass depot in RY2021 will see a new fully contained truck shed constructed (included under non-system growth), as well as pavement rehabilitation works, stormwater upgrades and improvements, an all-weather area for storing cable drums, and other miscellaneous site improvement works.

MLL incurs expenditure as required for maintenance of non-network buildings but overall this is not material relative to other expenditure.

9.11.4 Other non-network renewal forecast

Other non-network asset capital expenditure will cover plant, tools and equipment, and office and IT equipment. Expenditure for these assets is expected to be relatively constant over the planning period and is presented within the regulatory schedules in Appendix 1.1.

9.12 Major renewal projects

9.12.1 Network (system) renewal projects

The following sub-sections provide a breakdown of the more significant planned renewal projects identified at the time of preparing this AMP.

9.12.1.1 Year one (RY2021) – detailed descriptions

9.12.1.1.1 Distribution pillar (DP) replacement programme.

This programme intends to replace a number of aged (some over 50 years) DP boxes, many of which are in the urban environment.

The DP box replacement programme has been determined from a risk assessment which is based on criteria such as safety, age, number of consumers, type and location. The works to replace any one DP box broadly comprises isolating the site, civil works (potentially) to open up the footpath/ground immediately surrounding the site, removing the old box and switchgear and installing new switchgear and box and connecting to existing cables. Significant planning is required for each box to enable the work to be carried out with minimal disruption to customers (which may include businesses), which may mean carrying out the work outside normal hours or using generators where appropriate.

9.12.1.1.2 Distribution transformer replacement programme

As detailed in the fleet management section, MLL has several distribution transformers which are at or nearing end of life. This programme will involve replacing those transformers. A prioritised list will be developed (based on factors such as condition, environment, number of consumers supplied, size and loading). MLL intends to replace up to fifteen of the oldest distribution transformers in the fleet each year of the planning period.

9.12.1.1.3 33kV rebuild Casey's Road to Marfell's Beach Road section

The 33kV power poles between Seddon and Ward were installed over 55 years ago (based on asset data) and are showing signs of deterioration. The section between Casey's Road and Marfell's Beach Road is adjacent to Dominion Salt Works salt ponds and is in relatively poor condition. Spalling is evident on a number of the power poles, and pole components are in relatively poor condition (a number of defects have been recorded from condition assessments).

Landowner consultation and design work commenced in 2019 and the plan is to carry out the rebuild in RY2021. The rebuild will consist of new steel poles, new conductor and includes an overhead earth wire. The pole positions will in general be in the same location although some may be moved slightly to improve the design or to accommodate landowner requests.

9.12.1.1.4 Oil RMU replacement programme

MLL has several older oil insulated RMUs in service on the network. Some of these have an enclosed bus extension which have a known susceptibility to moisture ingress (an inspection programme was completed in 2018 to identify the at risk RMUs' and remedial action has been taken which involves filling the bus extensions with resin for insulation purposes).

While these measures have mitigated the risk of failure due to moisture ingress, a replacement programme is considered appropriate for selected units. This is based on the age, condition and location of the asset. As part of the planning for replacement, consideration will be given to the required isolation of the RMUs which can impact in some instances hundreds of consumers

9.12.1.1.5 Wairau Valley voltage regulator replacement

The voltage regulator located near the Wairau Valley township is nearing end of life and is experiencing loads above its rating in peak loads during summer. MLL intend to replace this unit, which subject to detailed design will be of the type that provides commonality with others operating on the network. This project is scheduled for the second half of 2020.

9.12.1.1.6 11kV Line Rebuild Programme

There is over 400km of 11kV and LV copper and steel conductor throughout the network. Much of this conductor is aged (some is over 60 to 70 years old), has capacity limits, and is in many cases supported by old iron rail poles which themselves are aged and condition largely unknown (difficult to assess their structural capacity). Accordingly, it is intended to phase much of the 400km out over the course of the planning period by continuing the line rebuild programme that in most cases replaces both the poles and the conductor – as outlined in the full 2018 AMP. These rebuilds typically position the structures in the same locations however where there is an advantage to MLL and the landowner the new line may be relocated.

Sections for replacement will be determined by criteria such as age, condition, consumers affected, access, land use etc. For RY2021, $1.7m has been provided for this work and includes the following project sites:

- East Coast SH 1 section of 11kV feeder.
- Ward Beach Road to Kaka Road. This section of line covers approximately 1200 metres and consists of aged copper conductor and a mixture of iron rail and reinforced concrete poles. These poles are generally in poor condition and some have sustained damage from the 2016 Kaikoura earthquake.
- Wither Hills eastern section 11kV spurline. This section of line extends for approximately 2.3km and supplies communication facilities on the Wither Hills near Blenheim. The iron rail poles are being replaced as part of our continued programme, in this instance access to the pole sites is poor, and a robust line is necessary due to the high fire risk in summer.
- Kaituna to Waikaho SWER substation. This is the final stage in the rebuild of this line and consists of approximately 1.5km of line length between the upgraded section and the SWER transformer. The project will replace iron rail poles and aged copper conductor.
- Jamies Knob 11kV spurline. This line extends for approximately 2.2km and supplies communication facilities for MLL and Chorus. The line is aged copper conductor on iron rail poles, is generally in poor condition and is prone to faults. MLL will investigate to determine the best option to maintain this power supply which may be replacement/rebuild or another solution such as a remote power supply system

9.12.1.1.7 Treated pine pole replacement project

As described more fully in section 9.2.3.2 MLL has an aging population of this pole type which based on condition data will reach end of life in the 15 to 20 years. To avoid this occurring concurrently MLL intends to replace the TP lines in Archers road and Avon Valley.

9.12.1.1.8 Spring Creek 11kV switchgear upgrade

The Spring Creek Substation 11kV bus currently consists of a combination of Reyrolle and AEI/GEC switchgear that has been migrated from other sites. This is getting to the stage where increased maintenance will be required over the next few years. Spare parts for the AEI/GEC model in particular are becoming hard to procure.

Replacement of the existing switchgear will:

- Improve network safety;
- Increase reliability; and
- Reduce maintenance requirements

The project commenced in late 2019 with the installation of temporary Circuit Breakers to allow the existing switchgear to be removed and the building to be modified. Most of the project will be completed by the close of RY2020, but is it expected that minor works will still be required prior to commissioning in RY2021.

9.12.1.1.9 Redwood Pass 33kV (No 1 circuit to Seddon)

The No 1 circuit between Riverlands and Seddon was constructed over 80 years ago, largely supported on steel lattice tower poles. This circuit has been rebuilt progressively over a number of years and after the completion of a section near the Seddon end of the line in 2019 there now remains a relatively small section (13 poles) to complete the rebuild of the entire circuit to Seddon.

The lattice towers and reinforced concrete poles will be replaced with new 16.3m steel poles, with new pole hardware/components and AAAC conductor and the work is scheduled to be carried out in RY2021.

9.12.1.1.10 Waihopai 33kV tower replacement

The single 33kV circuit that supplies Leefield Substation has been upgraded to new steel poles in stages over a number of years. The 33kV line continues on past the substation and connects the Trustpower Waihopai power station to the MLL system. This portion consists of the original steel lattice towers that are now over 90 years old.

Subject to further condition assessment of these steel lattice towers (which is likely to include engagement of an external specialist to provide specialist advice on their condition and structural capacity) MLL may renew a further section containing 24 steel lattice towers. At the same time, MLL would renew the aged (and capacity constrained) 11kV conductor, replace the crossarms and insulators. Regardless of the findings of the condition assessment/structural review, MLL is intending to proceed with the 11kV conductor upgrade and insulator replacement.

9.12.1.1.11 Wairau river crossing tower replacement

MLL has an 11kV circuit mounted on three steel lattice towers that span the Wairau river 4km north of Renwick. Following a detailed condition assessment of these towers in 2019 MLL has now included the replacement of these towers in RY2021. Resource consent is required to carry out the civil works in the river bed. The intention is to replace the towers with steel monopoles on concrete pile foundations, and to replace the conductor with new AAAC.

9.12.1.1.12 Kinross Street Substation renewal

The Kinross Street substation is one of several indoor town substations that MLL has and comprises 11kV switchgear and a single 1MVA 11kV/400V transformer. The substation and its assets are approximately 50 years old. It supplies approximately 45 consumers on the southern side of the Blenheim CBD, including several bars, restaurants, and numerous other businesses. It also houses HV switches for transformers at the post office and central developments which cover a large part of the Blenheim CBD.

The substation will be rebuilt with new HV and LV switchgear and dual transformers. Doing so will increase safety through including arc fault contained switchgear (the existing switchgear has exposed live terminals). The addition of a second transformer will increase security of supply for the area and the SCADA system will now be utilised to provide monitoring and control with faster restoration times in the event of faults.

The switchgear for this project has been procured and the design and planning are substantially complete. Work will commence on this project in mid-2020, at the completion of the Spring Creek switchgear replacement project

9.12.1.2 Years two to five (RY2022 to RY2025) – Summary descriptions

9.12.1.2.1 Distribution Pillar replacement programme.

This will be a follow on from the programme described under Year one projects. Up to 10 DP boxes being replaced each year of the programme from Year 2 on through to Year one0 of the planning period, with priority based on a criteria driven assessment, including condition.

9.12.1.2.2 Wynen Street and Arthur Street substation upgrades

Wynen Street substation will be, along with Arthur Street substation, the last town substations to be renewed. Both substations have transformers nearing the end of their serviceable life, aged switchgear which is difficult to maintain and operate, and which does not have arc-flash rating.

The project will involve the replacement of this equipment with new and modern equivalents connected to the SCADA system. Benefits will include greater network resilience, increased reliability (less likelihood of equipment defects), and easier and safer maintenance and operation of the equipment. Wynen Street will be the priority due to planned redevelopment in the area and is planned for RY2022 with Arthur street planned for RY2024.

9.12.1.2.3 Riverlands 11kV switchgear replacement

The 11kV switchgear at Riverlands zone substation is aged and has limitations including an inability to be operated remotely. MLL intends to replace the switchgear with new and modern equivalents in RY2024.

9.12.1.2.4 Woodbourne zone substation upgrade – Stage 1 and stage 2 (T2 and switchgear)

An upgrade at Woodbourne zone substation is planned to be carried out over two stages across RY2022 and RY2023. The project involves the replacement of a power transformer (T1) which is over 50 years old and the replacement of 11kV and 33kV switchgear. The 11kV switchgear is aged and has operational constraints. The 33kV switchgear is part of an outdoor bus which MLL has been progressively replacing due to exposed bus-work and low clearances, aged equipment and limited functionality.

Stage 1 will involve detailed design, procurement and construction of a new building to house the 33kV switchgear. Replacement of both suites of switchgear and the transformer will be completed in the second year (stage 2).

9.12.1.2.5 33kV overhead renewals

Generally, the 33kV overhead lines are high criticality assets, distributing electricity between MLL's zone substations. Some sections of the 33kV network are original late 1920s and 1940s reinforced concrete poles, with original components and conductor. Naturally, these assets are showing the signs of ageing and some relatively poor condition, with some concrete spalling evident on poles. During the planning period, between years two to five and 6 to 10, the following sections of line will be considered for renewal, and prioritised on the basis of condition and network criticality: Seddon to Ward, Alabama Road to Riverlands, Murphy's Road and Old Renwick Road. Where appropriate, the sections will be split out into smaller sub-sections which may be split over multiple years.

9.12.1.2.6 Pole replacement programme

As detailed in the fleet management section, there are significant volumes of TP poles, primarily in the Marlborough Sounds, that are approaching or exceed 50 years of age. MLL recognises a systematic programme of renewal of these poles will be required over a number of years.

Included under this programme is the replacement of iron rail poles. These poles are aged and present difficulties for faults and maintenance due to MLL's policy of no climbing allowed.

All poles selected for replacement under these programmes will be prioritised on a number of factors including condition (risk of failure), age, customers affected and location.

9.12.1.2.7 Casey's Road to Marfell's Beach Road 11kV renewal

The 11kV Grassmere feeder has mostly been replaced over recent years. One remaining section is between Casey's Road and Marfell's Beach Road. MLL intends to renew this section of line, upgrading the conductor to higher capacity Iodine type. This will result in the entire feeder being constructed with Iodine. This will facilitate parts of Ward typically fed from Ward zone substation to be able to be fed by this feeder in the event of an outage at Ward zone substation.

9.12.1.2.8 Rai Valley T1 power transformer renewal.

Rai Valley power transformer T1 is nearing end of life (almost 60 years in age). Subject to condition assessment and testing, MLL is proposing to replace the 3MVA Rai Valley T1 power transformer with a new 3MVA or 5MVA power transformer (the benefits of any capacity increase will also be assessed as part of the project evaluation).

9.12.1.2.9 11kV recloser renewal programme

The aged 11kV reclosers on the network are beginning to show signs of deterioration. This programme will see a gradual replacement of the fleet, with one to two reclosers targeted for replacement each year.

9.12.1.2.1 11kV Line Rebuild programme

This is a continuation of the line rebuild programme described under year one where complete replacement of both poles and conductor is required. Projects are selected based on criteria such as condition, age, criticality and these rebuilds typically position the structures in the same locations however where there is an advantage to MLL and the landowner the new line may be relocated.

9.12.1.3 Years six to 10 (RY2026 to RY2030) – An overview

Years six to 10 of the planning period are more difficult to forecast with certainty. At this time, the following projects are forecast:

- A continuation of the DP box replacement (up to 10 DP boxes per year), copper and steel conductor replacement (up to 40km per year), oil RMU replacement (one RMU per year), 33kV renewal programme, 11kV recloser renewal programme (one to two per year) and the TP pole (Marlborough Sounds) and iron rail pole replacement programmes.
- Renewal of the Picton 11kV and LV network programme. Much of the Picton HV and LV overhead assets are showing signs of deteriorated condition (based on recent asset inspections) and a number of defects (such as split cross arms). Subject to further inspections in future, MLL propose to systematically renew these assets to improve network reliability and resilience. The work will be split across multiple years.
- 11kV town cable replacement programme. Many of Blenheim's 11kV cables will be approximately 60 years in age during Years six to 10 of the planning period. MLL intends to phase out the older cables (subject to testing results) and replace them with new equivalents. This work will be complex due to the confined and developed nature of many parts of town.

9.12.2 Non-Network (non-system) renewal projects

There is no significant non-network capital expenditure planned within the next five years for vehicles and land and buildings.

9.12.2.1.1 Buildings

In the next two years, MLL intends to review its existing office facilities against future needs. Depending on the outcome of the review, the following options are considered possibilities:

- do nothing;
- upgrade existing Alfred Street office building and facilities; or
- construct new office building at a to be determined location.

As outlined in section 9.11.3, MLL is intending to renew its pavement and stormwater system at the Taylor Pass contracting depot. This work has been budgeted at $0.5m.

9.12.2.1.2 IT systems

MLL has no committed material IT capital expenditure at the time of writing. However, MLL will be undertaking review of some of its core IT systems during RY2021 to determine whether they are still meeting the business needs, and if not, will consider other alternatives in the market. Any decisions made from these reviews will be reflected in subsequent AMPs (or updates).

9.13 Operational expenditure

9.13.1 Overview

Operational expenditure (opex) is essential in meeting asset management objectives. Opex is a very broad category – it includes work on the network such as restoration of network outages, inspections of assets, and vegetation management as well as non-network support activities, corporate and administrative costs, and vehicle operation costs for example.

Generally, opex activities on the network are more broadly termed as "maintenance". Maintenance work on the network is split into maintenance portfolios. These are reactive (reacting to network outages and incidents, repair to assets, or to make sites safe) and scheduled or planned maintenance (preventative and corrective).

MLL's opex is outlined in the following subsections. Further detail on the planned maintenance regimes can be found in Sections 6.5 to 6.7.

9.13.2 Routine and corrective maintenance and inspection (network)

This section of expenditure covers asset patrols, inspections and testing, rectification work from faults (excluding initial fault restoration work undertaken), maintenance of zone and distribution substation sites and maintenance (such as vegetation clearance) of access tracks. Within MLL this is referred to as preventive maintenance – inspections of equipment to identify defects and the rectification of defects identified when and where appropriate (differentiated from faults which result in power outages).

When defects are identified, they are recorded in the asset and works management system. Each defect is assigned a priority, urgent, high, medium or low. The priority assigned is based on the nature of the defect, the criticality of the asset, and the safety implications (potential consequences) which may arise from the defect worsening or resulting in a more substantial failure.

The inspection of the assets to identify any defects are undertaken on a scheduled basis or as a result of changed circumstances. The regularity of inspections varies across different asset classes, and for different voltages. For example, a pole carrying dual sub-transmission circuits would be subject to more regular inspections than a pole carrying low voltage conductor only.

The amount forecast for the planning period is typically between $2.9m and $3.1m per annum (escalated by inflation). This has been based on analysis of the trend of the last four years of actual expenditure. No drivers have been identified that would cause a variation from the historical trend with inspection, maintenance and testing cycles well established, however, MLL will continue to work towards identifying areas where improvements and efficiencies can be made which should translate to minor cost reductions, or at the very least, mitigating significant increases.

9.13.3 Service interruptions and emergencies (network)

This section of expenditure covers works undertaken during or immediately following unplanned events which interrupt the normal operation of network assets (i.e., fault work). The drivers of this expenditure include earthquakes, weather events, human interaction (car vs pole, cable strike, machinery), animal interaction (possums, swans, geese) and asset failure.

The amount forecast for the planning period is approximately $1.1m per annum (escalated by inflation). This has been based on historic levels of expenditure after removing non-routine expenditure such as from the November 2016 earthquake. MLL has seen improving levels of underlying network reliability over the last 10 years through a number of initiatives including remote system control, introduction of long run possum guards and bird spikes, vegetation management, relocating at risk assets, and general asset upgrades.

There will always be the potential for events such as weather, human and animal interaction with the network and asset failure. MLL is cognisant that while consumers want a reliable network, they also want it to be cost effective. Accordingly, any improvements to network reliability need to be measured against the cost of achieving them.

MLL intends to maintain or ideally improve on current target levels of network reliability although it is inevitable the need for fault expenditure will continue and so is forecast to remain flat.

9.13.4 Vegetation management (network)

This section of expenditure covers the felling, removal or trimming of vegetation (and associated costs) in the proximity of electrical assets. This includes:

- inspection of electrical assets for the purposes of identifying vegetation in the vicinity of the assets;
- liaising with landowners;
- physical work involved with felling or trimming vegetation including operational support (such as mobile generation); and
- use of helicopters for spraying.

Details on MLL's vegetation management strategy is presented in Section 6.6.

MLL faces high costs in relation to vegetation management largely because of the extent of indigenous and native forested areas coupled with difficult to access terrain that exists in the Marlborough Sounds.

The amount forecast for the planning period is $2.1m for RY2021 and reducing to between $1.9m and $2.0m across the planning period. This has been based on two criteria:

- The first is that MLL is now moving into the second trim phase of tree management under the Electricity (Hazards from Trees) Regulations 2003. This requires that the tree owners pay for the second trim rather than the network owner.
- The second reason for decreased spend is that MLL works with tree owners to, where possible, remove trees under the line before they encroach within the growth limit zone and create clearance zones wider than the statutory limits. Once these clearances have been created there will be less ongoing cost to maintain them.

There will always be cyclical tree inspections and costs to manage the trees outside the statutory clearance zones.

It should be noted that the MBIE is currently considering a review of the tree regulations (Electricity (Hazards from Trees) Regulations 2003). The outcome of any review and introduction of new regulations may impact on the forecast amounts proposed in this AMP for the planning period. At this time, it is too early to comment on potential impacts given the uncertainty with any regulatory change, if any.

9.13.5 Asset replacement and renewal (network)

This section of expenditure covers mainly cross arm replacement, single structure replacements and replacement of network consumables such as recloser batteries.

The amount forecast for the planning period is typically between $0.7m and $0.8m per annum (escalated by inflation) based upon an average level of historic expenditure and current information on assets from available attribute data and condition assessments undertaken.

There are no drivers to suggest that the replacement and renewal opex activities on MLL's network will step away from historic trends as assets continue to age.

9.13.6 Systems operation and network support (non-network)

This section of expenditure covers a range of management activities of the network. Some of the more significant activities falling under this section include:

- Policy, standard and manuals development and management;
- Outage recording and data management;
- Data recording and management, support (administration) and management of IT systems (including GIS, Milsoft, EAM and others);
- Asset management planning, load forecasting, network modelling, engineering design, technical advice, procurement, contract and inventory management, (excluding project costs capitalised);
- Training;
- Easements (creation of new and management of existing);
- Vehicle operation and management (maintenance);
- Consumer enquiries, records and other activities; and
- Other office based and control room system operations.

The amount forecast for the planning period is $4.3m for RY2021 increasing to approximately $5.1m for RY2030 (escalated by inflation). This has been based on recent levels of historical expenditure and forecast requirements. All expenditure is subject to regular review to maximise benefits relative to costs in all aspects of MLL's operations.

9.13.7 Business support (non-network)

This section of expenditure covers corporate activities including:

- CEO and director costs, legal services, non-engineering/technical consulting services;
- commercial activities including pricing, billing, revenue collection and marketing;
- compliance related activities (finance and regulation);
- HR and training (non-operational);
- property management; and
- support services such as IT, secretarial etc.

The amount forecast for the planning period is $4.2m for RY2021 increasing to approximately $5.0m for RY2030 (escalated by inflation). This has been based on the historical level of expenditure and forecast requirements. No structural changes to this support function are forecast.

10. Expenditure forecasts

10.1 Overview

This section collects together the forecast costs of the network development, fleet strategy actions and other business-related costs required to meet the asset management objectives, risk mitigations and network performance targets set out in this AMP.

10.1.1 Assumptions on cost inflators

MLL faces cost pressures from a number of sources, including labour, fuel, construction costs, and international commodities such as copper and aluminium. Exchange rates will also impact on the final prices MLL pays for many inputs that are utilised into its business. Escalation in these cost drivers affects MLL's estimation of the nominal values of its cost forecasts over the planning period.

Rather than taking an overly complex approach to escalate expenditure forecasts from constant to nominal dollars given there are large inherent uncertainties, MLL has instead applied an index based upon a long run CPI rate of 2%, consistent with the RBNZs mid-point target.

This is a relatively straightforward approach and is considered unlikely to be materially different from an approach using a combination of Labour Cost, Producer Price and Capital Goods Price indices.

10.2 Capex

MLL's capex is charted in **Error! Reference source not found.** over the period RY2015 to RY2020 (actual) and RY2021 to RY2030 (forecast). Values are expressed in nominal dollars.

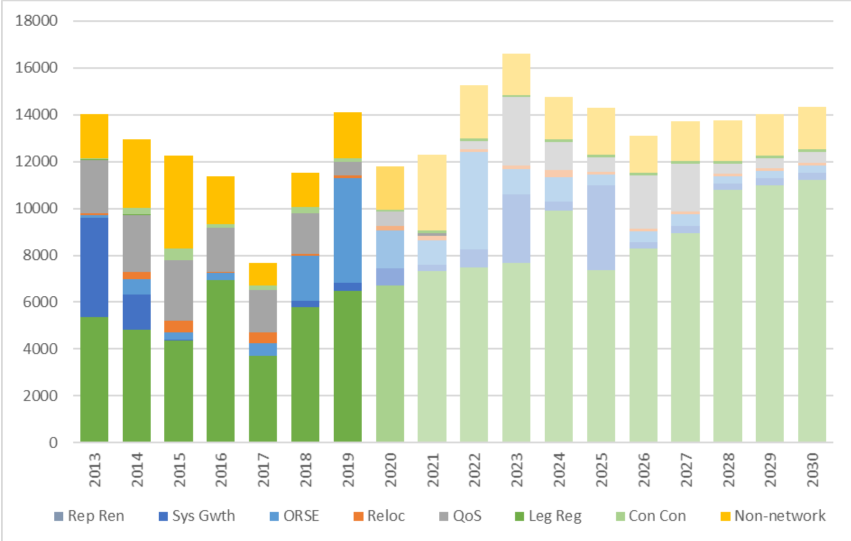


Figure 72: Summary of actual and forecast Capex ($000) by primary driver

This shows the network capex forecast increasing from approximately $10m to $12m per annum across the planning period, reflecting inflation and MLL's intention on focusing more expenditure towards distribution asset replacement and renewal as outlined in this AMP.

The more significant increases in RY2022 through to RY2024 reflects the material "one off" projects for 33kV network improvements, and the proposed Kaituna zone substation for example. The low capex outcome evident in RY2017 arose due to the Kaikoura earthquake interrupting planned works.

The largest component of the historic and forecast capex expenditure is for asset replacement and renewal. This component of capex expenditure is forecast to trend up in average over the planning period, reflecting the renewal programmes outlined in this AMP.

10.2.1 Contribution to drivers

For accounting and regulatory disclosure, system capex projects and programmes are allocated over the eight categories of:

- growth and security;
- replacement and renewal;
- asset relocations;
- quality of supply;
- legislative and regulatory;
- reliability, safety & other;
- overhead to underground conversion; and
- consumer connections

Accounting allocation is against the category most applicable to the works expenditure. However, in most cases any particular project will impact across multiple objective drivers. For example, a line renewal may be driven by the age and condition of the line and therefore be allocated to replacement and renewal, but renewal will also impact the line reliability and safety implications from avoided faults. In order to show the effect of the forecast expenditure against its asset management objectives, MLL has also allocated to the works costs against multiple asset management driver categories in proportion to their assessed benefit. Figure 73 illustrates this assessed benefit return to MLL in proportion to the total expenditure over the forecast period.

This benefit return to MLL and its stakeholders is reflective of the general themes in this AMP; that network capacity is adequate and not expected to be challenged by growth over the forecast period; that the expenditure focus is shifting towards renewal with it benefits in ensuring network continuance, improved supply quality and safety; and the addressing of MLL's risk evaluations for liability from fire risk and the network's resilience to major events like earthquakes.

Line breakdowns of the capital expenditure are provided in the regulatory schedules included in Appendix 1.1.

10.3 Opex

MLL's opex forecast is discussed in section 9.13 and charted in Figure 73 for the period RY2015 to RY2020 (actual) and RY2021 to RY2030 (forecast). Note that RY2020 is extrapolated through to 31 March 2020 from data through to 29 February 2020.

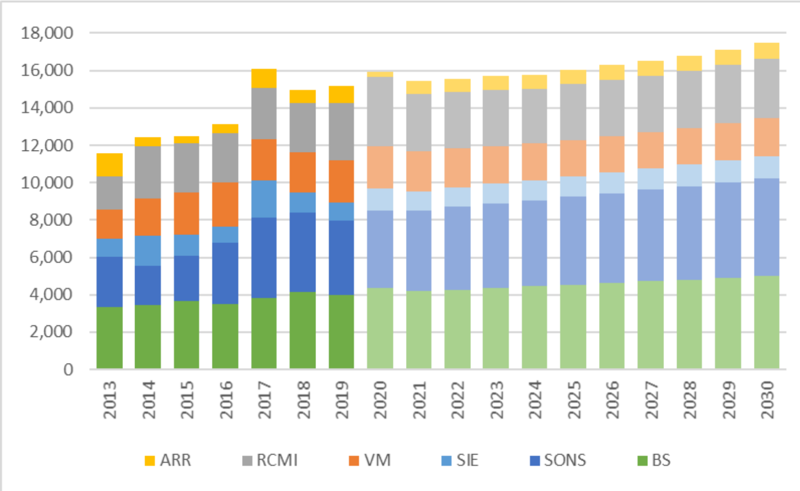


Figure 73: Summary of actual and forecast opex (nominal $000)

MLL’s opex forecast slightly increases over the forecast period, relatively in line with the trend seen over the previous six years (including current year).

The basis for the expenditure categories in this forecast are discussed in section 9.13 where forward forecasts are based off historic averages where there is an expectation of continuance at the past levels and after adjustment for any one-off factors.

At a high level MLL is seeking to hold non-network expenditure increases to a minimum where possible. Making do with existing resources and looking to offset cost pressures by making efficiency improvements. MLL will be seeking to advance its asset management capability to make the best use of existing systems and processes.

MLL is forecasting a small reduction in vegetation management expenditure (for reasons discussed previously), but, forecasting the other maintenance expenditure categories to be held to modestly increasing levels in real terms. Unforeseen events such as storms or seismic events and individual projects arising from circumstances as yet unknown will cause actual results to vary. However, MLL believes this to be a reasonable long-term view.

A more detailed breakdown of the forecast opex expenditure by opex cost category is presented in 10.4. Note that RY2020 is extrapolated through to 31 March 2020 from data through to 29 February 2020.

10.4 Capex/opex trade-off and overlapping works

MLL’s’ capital investment is directed at network restoration, load growth, utility enhancement or improvement or holding of the service reliability. While some works, such as remote-controlled network switches, will reduce the need for manual switching, by and large, the capital programme set out in this plan does not encompass productivity improvement projects of any significance that would see an offset in opex costs. MLL will always seek opportunities for productivity improvement but in this current round it has not identified projects that net benefits above costs in this area.

In preparing its budget forecasts, MLL has been cognisant not to “double count” activity costs from programmes with overlapping works. The main area where this is a possibility is with pole and crossarm replacements coincident with the planned conductor renewals – that is, the same poles are not represented in different renewal programmes. MLL has placed the majority of the required iron rail pole replacements within the conductor renewal programme as the conductor targeted for replacement is associated to this pole type. The replacement of TP poles is treated separately as these poles are generally located with the Marlborough Sounds area and not associated to the target conductor types.

10.5 Capacity to deliver

The expenditure levels forecast in this AMP, while representing a change in emphasis towards renewal works, do not represent a significant change from historic levels of capital or operational expenditure and, as such, MLL foresees no issue in managing and achieving the outcome expenditures set out in this plan. Additionally, the nature of the works planned does not represent any significant change from the business’s skills base for their execution. Again, MLL does not hold any reservation about its ability to achieve the works it has planned.

MLL has its own in-house contracting division that completes most of the maintenance, vegetation management and replacement upgrades on our network on a cost basis, although MLL utilises external resources as necessary to manage the peak workload. Examples of the use of external resources in recent years include:

- following the November 2016 earthquake MLL brought in a number of crews from neighbouring electricity distribution businesses to assist with earthquake repairs;
- in May 2017 MLL had a major line re-build project between Tuamarina and Picton. We contracted resources from neighbouring distribution businesses to assist with general work;
- In February 2018 MLL utilised external resources to backfill to enable employees to complete a major streetlight upgrade project;
- in RY2019 and RY2020, MLL engaged external contractors to undertake distribution switchgear and overhead lines renewals projects respectively; and
- on a regular basis MLL contracts vegetation companies to complete work on the network to take the peak off heavy workload.

MLL believes maintaining its own Contracting division enables it to maintain the resources it requires to manage and retain key staff and maintain standards and quality of workmanship. This approach also means it has control of the size of the workforce available to it and ensures the work plan can be delivered.

11. Appendices

11.1 Glossary

Term	Meaning
AAAC	All aluminium alloy conductor.
AAC	All aluminium conductor.
ABS	Air Break Switch – used in the 33kV and 11kV networks.
ACR	Asset Critically Ranking, a measure of important of asset for providing service.
ACSR	Aluminium conductor steel reinforced
AHI	Asset Health Index – a measure of an assets remaining life. Defined in the EEA guide to this measure.
ALARP	As Low as Reasonably Practicable – a principle of risk management.
AMMAT	Asset Management Maturity Assessment Tool.
AMP	Asset Management Plan.
ArcGIS	Geographic Information System from ESRI used by MLL.
CAIDI	For the Total of All Interruptions (Consumer Average Interruption Duration Index). CAIDI is the average duration of an interruption of supply for consumers who experienced an interruption of supply in the period. The CAIDI for the total of all interruptions is the sum obtained by adding together the interruption duration factors for all interruptions *divided by* the sum obtained by adding together the number of electricity consumers affected by each of those interruptions.
Capex	Capital expenditure.
CBD	Central Business District.
CDMA	Data system provided by Spark, uses Cell network, MLL uses this for some SCADA communications.
CPI	Consumer Price Index.
DGA	Dissolved Gas Analysis.
DNP3	Distributed Network Protocol (version 3) – a communications protocol.
DOC	Department of Conservation.
DP	Degrees of Polymerisation.
EAM	Info's enterprise asset management software for managing assets and works.

EDB	Electricity Distribution Business.
EEA	Electricity Engineers Association.
ENA	Electricity Networks Association.
EPV	Elevating Platform Vehicle – Used in Live Line work and for ease of maintenance on various assets.
GAAP	Generally Accepted Accounting Principles.
GFC	Global Financial Crisis.
GIS	Geographic Information System – a way of storing information in a computer such that the location of the equipment is also stored and various maps/views can be produced.
GPS	Global Positioning System. Receivers utilise satellites to accurately locate themselves on the earth's surface. This information is then used to locate items such as power poles.
GXP	Grid Exit Point, connection between Distribution Network and National Grid.
Hiab	Trade Name for truck mounted hydraulic crane.
HV	High Voltage – voltage equal or above 1,000 volts.
ICP	Installation Control Point – point of connection of a consumer to the network.
IntraMaps	Map viewer of electrical assets and other map features.
kVA	10^3 VA. Measure of apparent power.
kWh	10^3 Wh measure of energy.
Live Line	Various techniques for working on the network with the power on. Procedures range from connection of transformers to complete pole replacement.
LV	Low Voltage – voltage below 1,000 volts.
Mango.	Document repository and control software that holds MLL's policies and procedures.
MangoLive	Web access into Mango documents.
MDC	Marlborough District Council.
Milsoft	Network analysis software; records and manages network outage data.
MLL	Marlborough Lines Limited.
MVA	10^6 VA. Measure of apparent power.
N-1	A security level whereby the loss of any 1 device or circuit will not lose supply. N level security, any one failure causes loss of supply. N-1 level security, two failures required before loss of supply.

Number of Faults per 100km of Prescribed Voltage Line	This is a measure of the number of faults in relation to the total length of the network 6.6kV and above
NZTA	New Zealand Transport Agency.
ODV	Optimised Deprival Value, a method of valuing assets laid down in regulations.
Opex	Operational expenditure
PILC	Paper Insulated Lead Covered – a type of cable
PSTN	Public Switched Telephone Network, i.e., standard telephone system.
RAPS	Remote Area Power Supply
Ripple Control	System which uses frequencies >50Hz to transmit information across power system. Mainly used to control water heating/night store loads and street lighting.
RTU	Remote Terminal Unit.
RY	Regulatory Year (as year ending 31 March)
SAIDI	For Total of Interruptions (System Average Interruption Duration Index). SAIDI is the average total duration of interruptions of supply that a consumer experiences in the period. The SAIDI for the total of interruptions is the sum obtained by adding together the interruption duration factors for all interruptions *divided by* the total consumers.
SAIFI	For the Total Number of Interruptions (System Average Interruption Frequency Index). SAIFI is the average number of interruptions of supply that a consumer experiences in the period. The SAIFI for the total number of interruptions is the sum obtained by adding together the number of electricity consumers affected by each of those interruptions *divided by* the total consumers.
SCADA	Supervisory Control and Data Acquisition**,** computer and communications system to monitor and control equipment in the network, e.g., circuit breakers.
SCI	Statement of Corporate Intent.
SF_6	Sulphur hexafluoride – an electrical insulating gas
SWER	Single Wire Earth Return. A system which uses a single wire (compared with two for convectional single phase or three for three phase) to transmit power. MLL uses this system at 11kV.
Thermovision	Using infra-red technologies to locate hot spots/faults in network Assets.
VHF	Very High Frequency, radio frequency used by MLL primarily for voice communications.
XLPE	Cross-Linked Poly Ethylene – a type of cable insulation

11.2 Regulatory schedules

Regulatory schedules have been completed to complement this AMP. The regulatory schedules have been disclosed as a separate document and include:

- S11a. Capex Forecast;
- S11b. Opex Forecast;
- S12a. Asset Condition;
- S12b. Capacity Forecast;
- S12c. Demand Forecast;
- S12d. Reliability Forecast;
- S13. AMMAT; and
- S14a Mandatory Explanatory Notes on Forecast Information.

11.3 Regulatory requirements look-up

Regulatory Requirement (Attachment A)	Corresponding AMP Section(s)
3.1 A summary that provides a brief overview of the contents and highlights information that the EDB considers significant;	1. Summary
3.2 Details of the background and objectives of the EDB's asset management and planning processes;	6 Asset management strategy
3.3 A purpose statement which- 3.3.1 makes clear the purpose and status of the AMP in the EDB's asset management practices. The purpose statement must also include a statement of the objectives of the asset management and planning processes; 3.3.2 states the corporate mission or vision as it relates to asset management; 3.3.3 identifies the documented plans produced as outputs of the annual business planning process adopted by the EDB; 3.3.4 states how the different documented plans relate to one another, with particular reference to any plans specifically dealing with asset management; and 3.3.5 includes a description of the interaction between the objectives of the AMP and other corporate goals, business planning processes, and plans;	2.1 Purpose of this AMP 2.2 Basis of AMP 4.3.1 Strategic Planning Documents 4.3.1.4 Interaction between Planning Documents
3.4 Details of the AMP planning period, which must cover at least a projected period of 10 years commencing with the disclosure year following the date on which the AMP is disclosed;	2.5 Period covered
3.5 The date that it was approved by the directors;	2.5 Period covered
3.6 A description of stakeholder interests (owners, consumers etc) which identifies important stakeholders and indicates- 3.6.1 how the interests of stakeholders are identified 3.6.2 what these interests are; 3.6.3 how these interests are accommodated in asset management practices; and 3.6.4 how conflicting interests are managed;	4 Stakeholder interests and objectives alignment
3.7 A description of the accountabilities and responsibilities for asset management on at least 3 levels, including- 3.7.1 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; 3.7.2 executive—an indication of how the in-house asset management and planning organisation is structured; and 3.7.3 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;	11.6 Business organisation and role responsibilities
3.8 All significant assumptions- 3.8.1 quantified where possible;	1.1 Highlights of this AMP

Regulatory Requirement (Attachment A)	Corresponding AMP Section(s)
3.8.2 clearly identified in a manner that makes their significance understandable to interested persons, including- 3.8.3 a description of changes proposed where the information is not based on the EDB's existing business; 3.8.4 the sources of uncertainty and the potential effect of the uncertainty on the prospective information; and 3.8.5 the price inflator assumptions used to prepare the financial information disclosed in nominal New Zealand dollars in the Report on Forecast Capital Expenditure set out in Schedule 11a and the Report on Forecast Operational Expenditure set out in Schedule 11b;	
3.9 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;	1.1 Highlights of this AMP
3.10 An overview of asset management strategy and delivery; To support the Report on Asset Management Maturity disclosure and assist interested persons to assess the maturity of asset management strategy and delivery, the AMP should identify- • how the asset management strategy is consistent with the EDB's other strategy and policies; • how the asset strategy takes into account the life cycle of the assets; • the link between the asset management strategy and the AMP; and • processes that ensure costs, risks and system performance will be effectively controlled when the AMP is implemented.	6 Asset management strategy
3.11 An overview of systems and information management data; To support the Report on Asset Management Maturity disclosure and assist interested persons to assess the maturity of systems and information management, the AMP should describe- • the processes used to identify asset management data requirements that cover the whole of life cycle of the assets; • 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; • the systems and controls to ensure the quality and accuracy of asset management information; and • the extent to which these systems, processes and controls are integrated.	6.2 Systems and information management
3.12 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;	6.2.4.2 Data limitations
3.13 A description of the processes used within the EDB for- 3.13.1 managing routine asset inspections and network maintenance; 3.13.2 planning and implementing network development projects; and 3.13.3 measuring network performance;	6.5 Lifecycle management 6.8 Network development strategy

Regulatory Requirement (Attachment A)	Corresponding AMP Section(s)
	5 Network performance and service levels
3.14 An overview of asset management documentation, controls and review processes.	6 Asset management strategy and 11.6 Business organisation and role responsibilities
3.15 An overview of communication and participation processes;	4 Stakeholder interests and objectives alignment and 6 Asset management strategy and 11.6 Business organisation and role responsibilities
3.16 The **AMP** must present all financial values in **constant price** New Zealand dollars except where specified otherwise; and 3.17 The **AMP** must be structured and presented in a way that the **EDB** considers will support the purposes of **AMP** disclosure set out in clause 2.6.2 of the determination.	10 Expenditure forecasts; and throughout
The **AMP** must provide details of the assets covered, including- 4.1 a high-level description of the service areas covered by the **EDB** and the degree to which these are interlinked, including- 4.1.1 the region(s) covered; 4.1.2 identification of large **consumers** that have a significant impact on **network** operations or asset management priorities; 4.1.3 description of the load characteristics for different parts of the **network**; 4.1.4 peak demand and total energy delivered in the previous year, broken down by **sub-network**, if any.	3 Network overview

Regulatory Requirement (Attachment A)	**Corresponding AMP Section(s)**
4.2 a description of the **network** configuration, including- 4.2.1 identifying bulk electricity supply points and any **distributed generation** with a capacity greater than 1 MW. State the existing firm supply capacity and current peak load of each bulk electricity supply point; 4.2.2 a description of the **subtransmission** system fed from the bulk electricity supply points, including the capacity of **zone substations** and the voltage(s) of the **subtransmission** **network**(s). The **AMP** must identify the supply security provided at individual **zone substations**, by describing the extent to which each has n-x **subtransmission** security or by providing alternative security class ratings; 4.2.3 a description of the distribution system, including the extent to which it is underground; 4.2.4 a brief description of the **network**'s distribution substation arrangements; 4.2.5 a description of the **low voltage network** including the extent to which it is underground; and 4.2.6 an overview of **secondary assets** such as protection relays, ripple injection systems, SCADA and telecommunications systems. *To help clarify the **network** descriptions, **network** maps and a single line diagram of the **subtransmission network** should be made available to interested **persons**. These may be provided in the **AMP** or, alternatively, made available upon request with a statement to this effect made in the **AMP**.*	3.3 Supply within Marlborough
4.3 If **sub-networks** exist, the **network** configuration information referred to in clause 4.2 must be disclosed for each **sub-network**.	N/A
Network assets by category 4.4 The **AMP** must describe the **network** assets by providing the following information for each asset category- 4.4.1 voltage levels; 4.4.2 description and quantity of assets; 4.4.3 age profiles; and 4.4.4 a discussion of the condition of the assets, further broken down into more detailed categories as considered appropriate. Systemic issues leading to the premature replacement of assets or parts of assets should be discussed.	9 Fleet management
4.5 The asset categories discussed in clause 4.4 should include at least the following- 4.5.1 the categories listed in the Report on Forecast Capital Expenditure in Schedule 11a(iii); 4.5.2 assets owned by the **EDB** but installed at bulk electricity supply points owned by others; 4.5.3 **EDB** owned mobile substations and generators whose function is to increase supply reliability or reduce peak demand; and 4.5.4 other generation plant owned by the **EDB**.	9 Fleet management

Regulatory Requirement (Attachment A)	**Corresponding AMP Section(s)**
Service Levels 5. 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**.	5 Network performance and service levels
6. Performance indicators for which targets have been defined in clause 5 must include **SAIDI values** and **SAIFI values** for the next 5 **disclosure years**.	5 Network performance and service levels
7. Performance indicators for which targets have been defined in clause 5 should also include- 7.1 **Consumer** oriented indicators that preferably differentiate between different consumer types; and 7.2 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.	5 Network performance and service levels
8. 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. 9. Targets should be compared to historic values where available to provide context and scale to the reader. 10. Where forecast expenditure is expected to materially affect performance against a target defined in clause 5, the target should be consistent with the expected change in the level of performance.	5 Network performance and service levels and 4 Stakeholder interests and objectives alignment
Network Development Planning 11. **AMP**s must provide a detailed description of **network** development plans, including— 11.1 A description of the planning criteria and assumptions for **network** development; 11.2 Planning criteria for **network** developments should be described logically and succinctly. Where probabilistic or scenario-based planning techniques are used, this should be indicated and the methodology briefly described;	6.8 Network development strategy and 7 Network development
11.3 A description of strategies or processes (if any) used by the EDB that promote cost efficiency including through the use of standardised assets and designs; 11.4 The use of standardised designs may lead to improved cost efficiencies. This section should discuss- 11.4.1 the categories of assets and designs that are standardised; and 11.4.2 the approach used to identify standard designs;	6.8.2 Standardising assets and designs
11.5 A description of strategies or processes (if any) used by the **EDB** that promote the energy efficient operation of the **network**;	6.8.3 Strategies for asset efficiency
11.6 A description of the criteria used to determine the capacity of equipment for different types of assets or different parts of the **network**.	6.8.4 Setting asset capacity

Regulatory Requirement (Attachment A)	**Corresponding AMP Section(s)**
11.7 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;	6.8.5 Prioritisation of development projects
11.8 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; 11.8.1 explain the load forecasting methodology and indicate all the factors used in preparing the load estimates; 11.8.2 provide separate forecasts to at least the **zone substation** level covering at least a minimum five year forecast period. Discuss how uncertain but substantial individual projects/developments that affect load are taken into account in the forecasts, making clear the extent to which these uncertain increases in demand are reflected in the forecasts; 11.8.3 identify any **network** or equipment constraints that may arise due to the anticipated growth in demand during the **AMP planning period**; and 11.8.4 discuss the impact on the load forecasts of any anticipated levels of **distributed generation** in a **network**, and the projected impact of any demand management initiatives;	7.2 Growth/demand projections 7.4.2 Embedded generation
11.9 Analysis of the significant **network** level development options identified and details of the decisions made to satisfy and meet target levels of service, including- 11.9.1 the reasons for choosing a selected option for projects where decisions have been made; 11.9.2 the alternative options considered for projects that are planned to start in the next five years and the potential for non-network solutions described; and 11.9.3 consideration of planned innovations that improve efficiencies within the **network**, such as improved utilisation, extended asset lives, and deferred investment;	7 Network development
11.10 A description and identification of the **network** development programme including **distributed generation** and non-network solutions and actions to be taken, including associated expenditure projections. The **network** development plan must include- 11.10.1 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; 11.10.2 a summary description of the programmes and projects planned for the following four years (where known); and 11.10.3 an overview of the material projects being considered for the remainder of the **AMP planning period**; *For projects included in the **AMP** where decisions have been made, the reasons for choosing the selected option should be stated which should include how target levels of service will be impacted. For other projects planned to start in the next five years, alternative options should be discussed, including the potential for non-network approaches to be more cost effective than **network** augmentations.*	7.5 Major network development projects 9.12 Major renewal projects 9.13 Operational expenditure
11.11 A description of the **EDB**'s policies on **distributed generation**, including the policies for connecting **distributed generation**. The impact of such generation on **network** development plans must also be stated; and	3.3 Supply within Marlborough

Regulatory Requirement (Attachment A)	Corresponding AMP Section(s)
	6.9 Non-network solutions
11.12 A description of the **EDB**'s policies on non-network solutions, including- 11.12.1 economically feasible and practical alternatives to conventional **network** augmentation. These are typically approaches that would reduce **network** demand and/or improve asset utilisation; and 11.12.2 the potential for non-network solutions to address **network** problems or constraints.	6.9 Non-network solutions 7.4.2 Embedded generation
Lifecycle Asset Management Planning (Maintenance and Renewal) 12. The **AMP** must provide a detailed description of the lifecycle asset management processes, including— 12.1 The key drivers for maintenance planning and assumptions;	6.5 Lifecycle management
12.2 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- 12.2.1 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; 12.2.2 any systemic problems identified with any particular asset types and the proposed actions to address these problems; and 12.2.3 budgets for maintenance activities broken down by asset category for the **AMP planning period**;	6.5 Lifecycle management and 9.13.2 Routine and corrective maintenance and inspection (network)
12.3 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- 12.3.1 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, and consideration of future demands on the **network** and the optimum use of existing **network** assets; 12.3.2 a description of innovations that have deferred asset replacements; 12.3.3 a description of the projects currently underway or planned for the next 12 months; 12.3.4 a summary of the projects planned for the following four years (where known); and 12.3.5 an overview of other work being considered for the remainder of the **AMP planning period**; and 12.4 The asset categories discussed in clauses 12.2 and 12.3 should include at least the categories in clause 4.5.	6.5 Lifecycle management throughout 9 Fleet management and 9.12 Major renewal projects
Non-Network Development, Maintenance and Renewal 13. **AMP**s must provide a summary description of material non-network development, maintenance and renewal plans, including— 13.1 a description of **non-network assets**;	9.11 Non-Network assets
13.2 development, maintenance and renewal policies that cover them; 13.3 a description of material **capital expenditure** projects (where known) planned for the next five years; and 13.4 a description of material maintenance and renewal projects (where known) planned for the next five years.	9.11 Non-Network assets and 9.12.2 Non-Network (non-system) renewal projects

Regulatory Requirement (Attachment A)	Corresponding AMP Section(s)
Risk Management 14. **AMP**s must provide details of risk policies, assessment, and mitigation, including— 14.1 Methods, details and conclusions of risk analysis; 14.2 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; 14.3 A description of the policies to mitigate or manage the risks of events identified in clause 14.2; and 14.4 Details of emergency response and contingency plans.	6.4 Risk management 11.10 Risk matrix
Evaluation of performance 15. **AMP**s must provide details of performance measurement, evaluation, and improvement, including— 15.1 A review of progress against plan, both physical and financial; 15.2 An evaluation and comparison of actual service level performance against targeted performance; 15.3 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 **EDB**'s asset management and planning processes; 15.4 An analysis of gaps identified in clauses 15.2 and 15.3. Where significant gaps exist (not caused by one-off factors), the **AMP** must describe any planned initiatives to address the situation.	5 Network performance and service levels and 11.7 Performance analysis of reliability and cost
Capability to deliver 16. **AMPs** must describe the processes used by the **EDB** to ensure that-	10.5 Capacity to deliver
16.1 The **AMP** is realistic and the objectives set out in the plan can be achieved; and	10.5 Capacity to deliver
16.2 The organisation structure and the processes for authorisation and business capabilities will support the implementation of the **AMP** plans.	10.5 Capacity to deliver

11.4 Single line diagram of 33kV Network

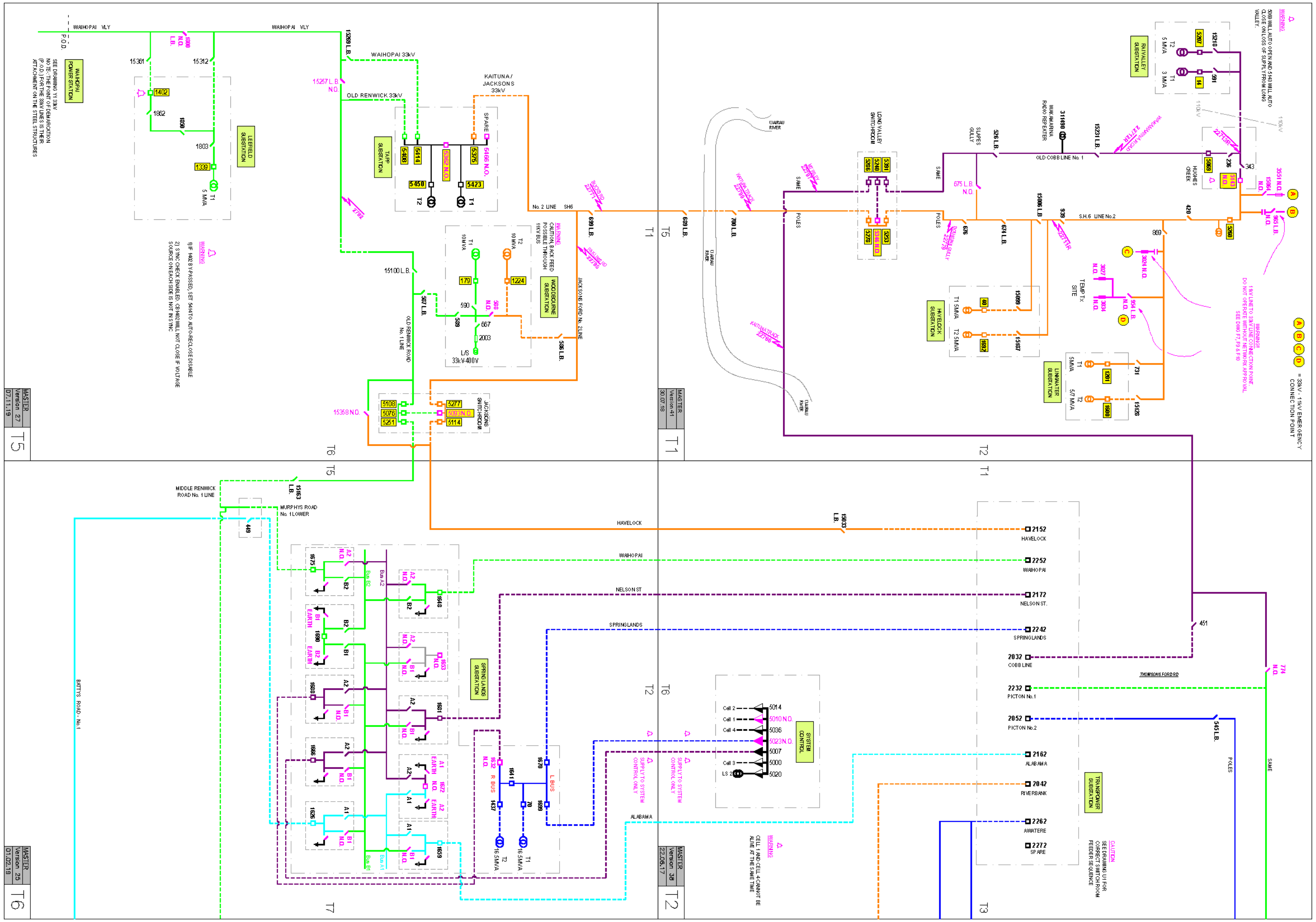


Figure 74: Single line diagram of 33kV network (A)

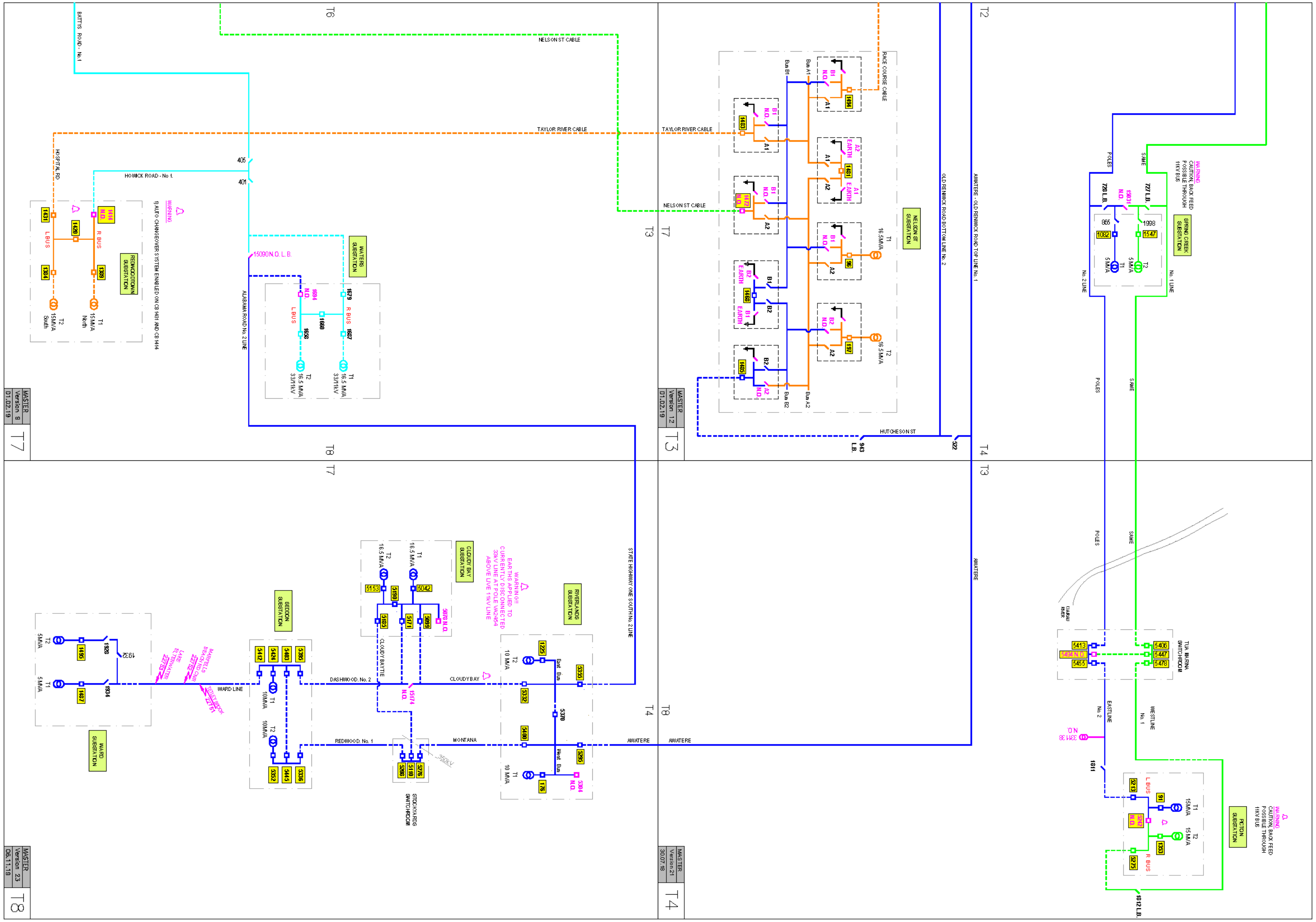


Figure 75: Single line diagram of 33kV network (B)

11.5 SCADA coverage map

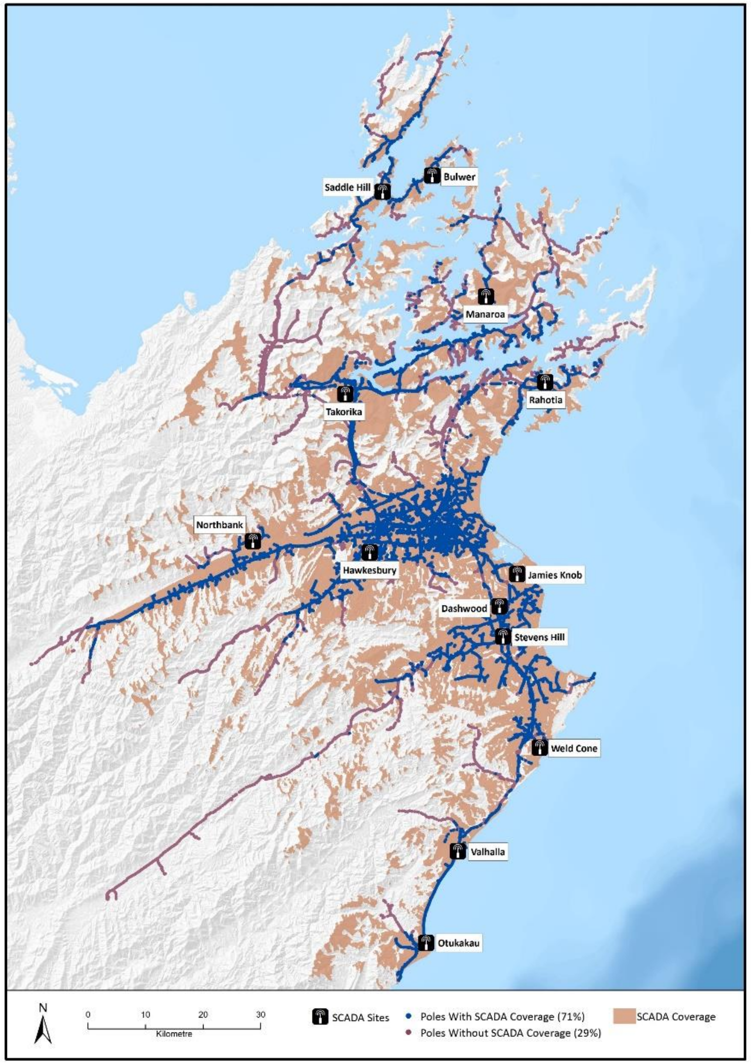


Figure 76: SCADA coverage map

11.6 Business organisation and role responsibilities

MLL's accountabilities and accountability mechanisms are shown in Figure 77 and are discussed in detail in the following sections.

The ultimate accountability is to connected consumers. The Commerce Amendment Act recognises this accountability and accordingly the price path threshold does not apply to beneficially owned EDBs such as MLL. MLL undertakes independent surveys of consumers annually and the overall satisfaction levels have been at or about 90 % for a number of years.

11.6.1 Accountability at ownership level

MLL has a single Shareholder – the Marlborough Electric Power Trust. The Trust currently has six trustees, each of whom holds 4,666,650 shares (with the exception of the Chair who holds 4,666,750 shares) in MLL on behalf of the Trust.

The Trust is subject to the following three accountability mechanisms:

- an election process;
- the Trust Deed which holds all Trustees collectively accountable for compliance with the Trust Deed; and
- the provisions of the Trustee Act 1956.

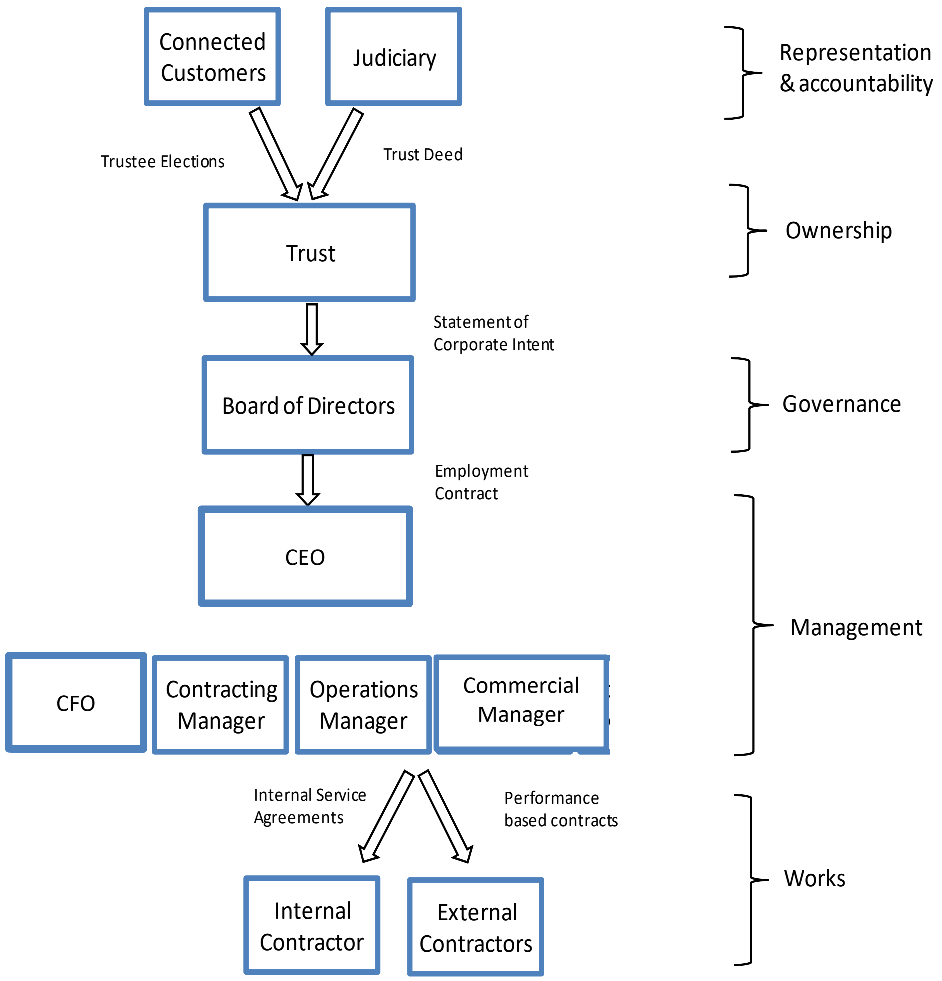


Figure 77: Summary of key MLL organisational responsibilities and accountabilities

11.6.2 Accountability at governance level

MLL currently has eight directors who are collectively accountable to the Trust through the SCI. The current directors are:

- David Dew (Chair);
- Alexandra Barton;
- Peter Forrest;
- Steven Grant;
- Phil Robinson;
- Jonathan Ross;
- Deborah Selby; and
- Ivan Sutherland.

The Board approves the annual budgets, SCI and this AMP. Each month it receives reports on the overall performance of MLL and the key activities undertaken.

11.6.3 Board reporting

MLL's regular board reports include the following:

- the capital expenditure program (progress and spend against budget);
- the maintenance program (progress and spend against budget);
- incidents and major outages; and
- any major changes to asset management processes or practices.

At each board meeting, a report on legislative compliance and risk management is presented, which includes:

- all health and safety accidents and near-misses;
- all incidents of third party contact with the network; and
- details of major consumer works.

11.6.4 Accountability at CEO level

The CEO is accountable for all aspects of MLL's operations to the directors primarily through his employment contract and the required objectives of the Board.

11.6.5 Accountability at management level

The second tier of management reports to the CEO. Accountability for asset management at the second tier is:

- Accountability for managing the existing assets and planning new assets lies with the Engineering Manager. This role addresses long-term planning issues such as capacity, security and asset configuration. At time of writing, this position is currently vacant.
- Responsibility for minute by minute continuity and restoration of supply lies with the Operations Manager, Warner Nichol, principally through control and dispatch, switching and fault restoration. The Operations Manager also has responsibility for asset maintenance.
- Accountability for the area of line delivery pricing lies with the Commercial Manager, Scott Wilkinson.
- Accountability for all administrative and financial activities lies with MLL's Chief Financial Officer, Gareth Jones.

The key accountabilities of the five second tier managers are to the CEO through their respective employment contracts and required performance criteria.

11.6.6 Accountability at works implementation level

MLL has an in-house contracting department. This operates as a separate division of MLL. With the implementation of the Electricity Industry Reform Act 1998, many EDBs sold their contracting operations. MLL recognised it was very unlikely that active competition would be present in the Marlborough market and therefore chose to retain its contracting staff, rather than being subject to limited competition and consequent price gouging.

MLL Contracting undertakes the majority of the physical work on the MLL network. Broadly, this is:

- construction of new assets;
- maintenance of existing assets; and
- operation of existing assets.

It also undertakes work such as the construction of line extensions for external consumers and the operation of hydroelectric schemes for Trustpower.

MLL retains relativity with prevailing market rates and undertakes testing from time to time to compare the commercial performance of MLL's Contracting division with other similar businesses in the area and throughout New Zealand.

The Contracting Manager, Stephen McLauchlan, is accountable both to the Operations Manager and Engineering Manager for the quality of work done, and to the CEO for the overall performance of the Contracting business unit.

11.7 Performance analysis of reliability and cost

This appendix extends the comparative assessments or reliability and cost and the Network reliability performance analysis presented in section 5 of this AMP.

Comparative charts provided in this section generally plot MLL's RY2019 performance as a red dot point; RY2018 performance as a dark blue dot point; and prior years back to RY2013 as light blue dot points. Regression lines are plotted as dark blue dash lines and their 95 percentile confidence bounds as yellow dash lines. Outlier data may be highlighted as orange points.

11.7.1 Comparative SAIFI

For comparison purposes, SAIFI is further divided between planned and un-planned (fault) SAIFI, both of which have been regressed against network size and network type and are plotted in Figure 78 (planned SAIFI) and Figure 79 (fault SAIFI) respectively.

The charts plot the expected SAIFI on the x-axis and the actual SAIFI on the y-axis. The expected SAIFI is derived through statistical deduction (multi-factor regression) but invariably comes back to practical explanations. In urban networks, there is greater meshing allowing for greater ability to isolate sections of the network for maintenance without dropping service to large numbers of consumers. For this reason, comparison between networks for planned SAIFI normalises based on the length of the rural and remote sections of each network. A similar normalisation applies to fault SAIFI but in this case an additional parameter also becomes significant being the length of urban underground network.

For planned SAIFI (Figure 78) the explanatory power of the regression is low – as the point scatter is very large – and so meaningful comparisons should be avoided. However, MLL plots at or below the mean expectation line indicating its comparative performance in both number and impact of planned outages is not unreasonable given its network characteristics.

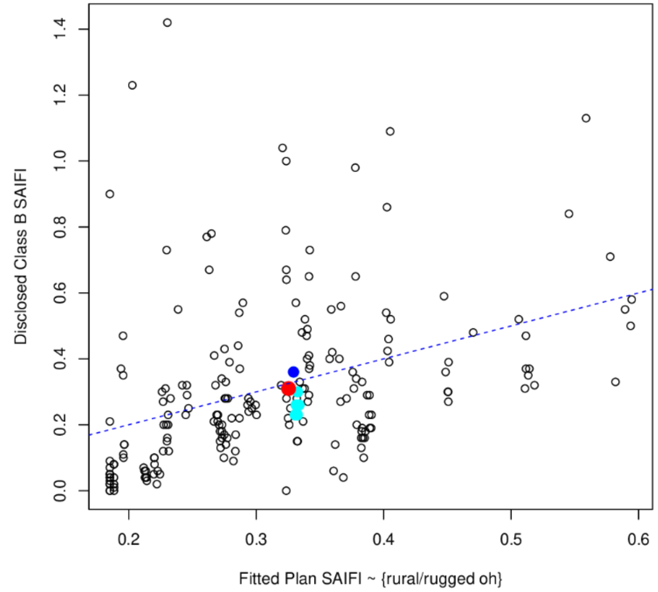


Figure 78: Regression of planned SAIFI

Unplanned (fault) SAIFI is also regressed on the basis of the scale of network exposure and plotted in Figure 79. The explanatory power of the regression is mildly better and shows MLL plotting below the expectation line for frequency of fault outages, even for RY2014 and RY2017, which were particularly onerous years for storms and unavoidable events (viz the Seddon and Kaikoura earthquakes).

Taking RY2019 as a more representative year for unplanned SAIFI (the red dot point), MLL shows good performance being approximately 0.5 below expectation. This would translate to a community value of approximately $0.9m per annum in avoided power losses.[25]

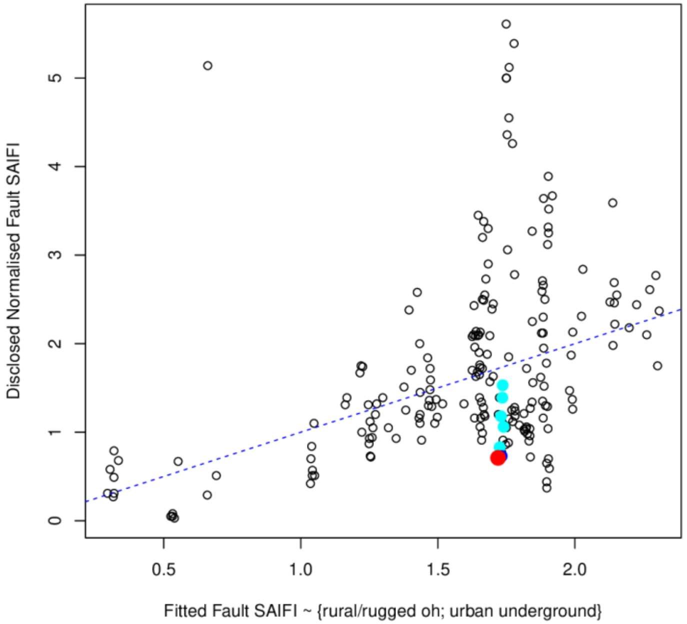


Figure 79: Regression of unplanned (fault) SAIFI

The MLL target for unplanned SAIFI is <0.67 to yield 80 SAIDI minutes at a target CAIDI of 120 minutes. As this level of unplanned SAIFI represents better than expectation performance on a comparative basis and remains a stretch target for the business (given the effect of irregular storm and other events), this target is retained for the duration of this planning period. However, the target SAIDI has been increased by five minutes to 85 minutes to reflect increased outages that have arisen since MLL's introduction of a 'lines down' safety policy.

The trend in overall (planned + unplanned) SAIFI is also downward for MLL compared to a relatively flat trend for all EDBs combined, as illustrated in Figure 80 (MLL=red line; includes the effect of the 2016 Kaikoura earthquake; cohort is for medium sized EDBs with mixed urban and rural networks). This, together with the comparatively low unplanned interruption frequency, shows the MLL network is responding to the reliability improvement strategies being applied.

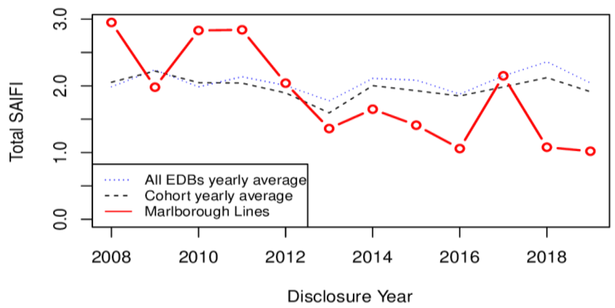


Figure 80: MLL's SAIFI trend (red line)

11.7.2 Comparative CAIDI

CAIDI measures the average duration of the interruptions and is generally highly variable between years, particularly when the total number of

[25] This calculation assumes average CAIDI of 120 minutes per interruption; a loss per connection of 1.5 kW; 26,000 network consumers; and a value of lost load of $25/kWh as used in the Electricity Authority modelling after adjusting for shifts in CPI.

interruptions is not large, as is the case for smaller distribution businesses like MLL. CAIDI is also affected by the types of faults occurring as some faults are more difficult to locate and repair, e.g., underground cable faults, access to fault location i.e., faults in the Marlborough Sounds. Multiple faults occurring simultaneously (i.e., storms) also impact CAIDI as fault restoration has to then be prioritised over the available fault crews.

Comparative analysis shows that MLL's CAIDI fits within the typical distribution of CAIDI times experienced by other distribution businesses as illustrated in Figure 81 where MLL is represented by the red points, (which include the earthquake years), and each row plots the disclosed CAIDI (on the x-axis) for each EDB from RY2008 to RY2019. MLL's CAIDI might also be expected to be larger in average than other EDBs that do not also have a significant proportion of remote lines.

MLL set a fault CAIDI target of 120 minutes, which is generally achieved in years without major storms or system events (e.g earthquakes). This target is therefore retained for this planning period given it remains a stretch target for the business and is at a reasonable level for a Network with MLL's characteristics.

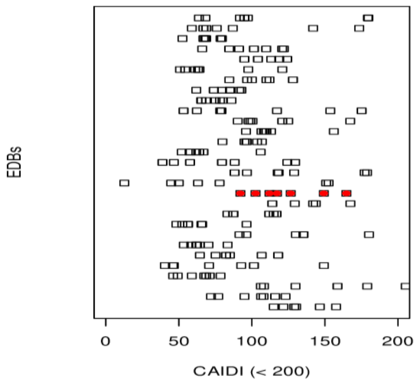


Figure 81: MLL's CAIDI

11.7.3 Comparative cost performance

EDBs may be broadly compared on cost as long as the limitations of such comparisons are recognised. In MLL's case, it has an extensive remote area to manage in the Marlborough Sounds, sometimes requiring helicopter access and/or long hours of travel for staff thereby increasing its costs.

The comparative assessments provided here are based on the public disclosure data up to RY2019.

11.7.3.1 Total cost

The comparison of the relative costs of electricity networks needs careful consideration. By way of example, any absolute comparison needs to take into account network age, condition, environment, level of reliability and the reasonableness of capital and maintenance expenditure. Postponement of prudent capital and maintenance expenditure is not a measure of efficiency as it shifts a likely greater cost to a future date.

EDBs are structured differently; for example, some, like MLL, have an internal contracting arm while others may fully contract out this service. Determining if and EDB is relatively efficient requires comparing the different EDBs total inputs against the output products and services they provide. This is the economic concept of total factor productivity.

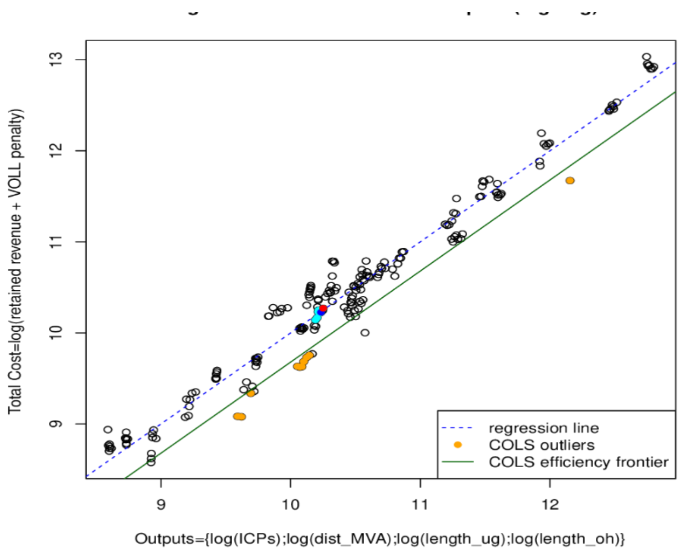


Figure 82: Comparison of total costs vs services provided

Figure 82 approximates the productivity of the different EDBs by comparing the retained revenue (income less pass-through costs) against the network services provided (line kms, transformation capacity, number of ICPs managed etc.)[26]. Whilst being an approximate measure of productivity, this shows MLL (coloured points) plotting close to the mean line indicating that MLL's total revenue is broadly in keeping, on a comparative basis, with the extent and capacity of the network services it provides.

11.7.3.2 Direct Opex

Direct opex is that proportion of operational expenditure spent directly on network assets (as opposed to expenditure operating the network and associated business support costs). Figure 83 shows a regression of direct opex in relation to the size of the assets being serviced – expressed in terms of a combination of the total circuit length and the transformation capacity.

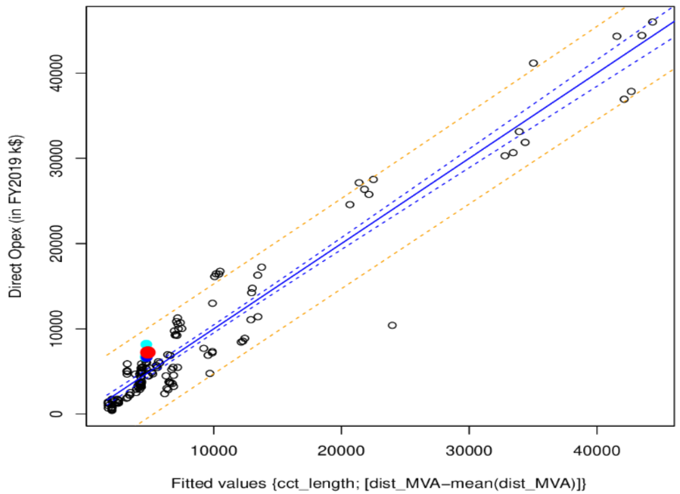


Figure 83: Direct opex – actual vs expected

This shows MLL's direct opex is relatively high, although still within the confidence bounds of the regression model. Of note is the high direct opex cost in RY2014 and RY2017 compared to other years which arose

[26] Based on the Hyland McQueen Ltd EDB comparative performance assessments for RY2019. Here, inputs to the businesses (capital materials and labour) are approximated using net revenue, an assumption which usually requires prices to be struck in a competitive market, so is a source of error in this comparison. Outputs are based on the found regression relationship between the log values of the main components of the network services provided (consumers managed, line length serviced, transformer capacity employed etc.). Point values are for each EDB from RY2013 to RY2019 and where dollar values have been corrected to RY2019 using CPI adjustment. Whilst reliability is an output, it has been included as a penalty or benefit on the revenue side being the assessed community value of reliability, where just meeting expectation reliability would incur a zero addition.

from wind storms and the Seddon and Kaikoura earthquakes occurring within those financial years.

Closer examination of the direct opex make-up reveals MLL's high vegetation management costs largely account for the opex variance in this comparison. High per km vegetation management costs are an issue for MLL with some parts of the Marlborough Sounds network only accessible by boat, helicopter and/or on foot. However, the community value created by the improved reliability, approximately $0.9m as noted earlier, offsets these costs when considered more broadly.

11.7.3.3 Indirect opex

Indirect opex is that portion of operational expenditure accounted to the operation of the network (i.e., switching and system control, etc.) and to the business support functions associated with running a network business. Comparison of MLL's indirect opex in relation to other EDBs shows MLL plots close to the regression expectation when compared using normalisers of both number of consumers serviced and on regulatory asset base value. This indicates that expenditure in this category is at appropriate levels when assessed on a comparative basis.

11.7.4 Utilisation and losses

11.7.4.1 Network losses

MLL has the objective of pursuing the most efficient use of energy and its delivery over its network. Figure 84 regresses the disclosed Network losses for all EDBs from RY2013 to RY2019 (with MLL being the coloured dot points) against the energy through-put and circuit length (on a log-log scale given that losses go as a square of current - and hence energy through-put - and the length of the lines that carry that current).

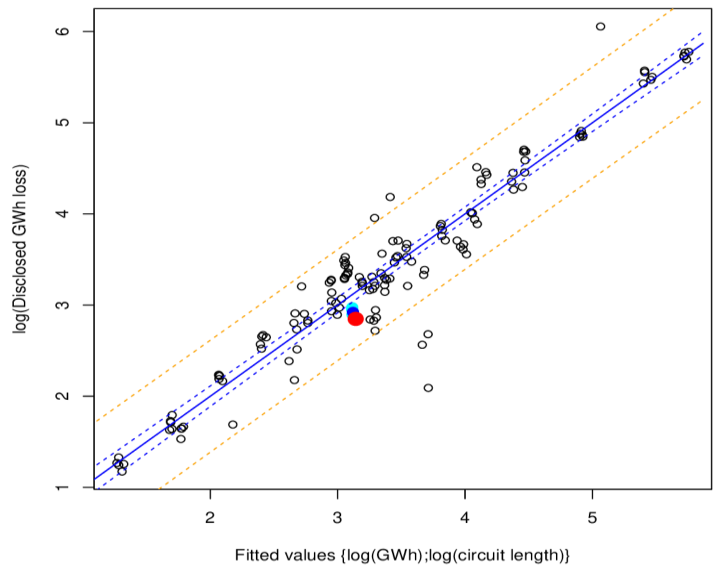


Figure 84: Regressed network losses

This shows MLL plots slightly below the network losses expectation given its circuit length and energy through-put. This indicates there are no issues of concern in terms of MLL's Network conductor sizing and circuit loading arrangements as, in general terms, the losses derived for the MLL network are consistent with those expected for a network of this kind i.e., a predominantly radial network supplied from a single point of supply and with inherently fewer consumers per transformer than in an urban area. MLL's line losses are approximately 5% and this is relatively consistent from year to year. In this AMP a target of 5% is retained across the planning period but may be reviewed in future plans.

11.7.4.2 Capacity of utilisation

Figure 85 regresses the disclosed distribution transformer utilisation (measured as the ratio of system maximum demand to the installed distribution transformer capacity) against a scale measure of energy density for each compared EDB. [27] In this measure, MLL plots close to the regression expectation indicating that, within the limitations of this performance measure, MLL's design practices for transformer sizing and loading appear reasonable.

MLL's Capacity of Utilisation (CoU) has declined over recent years and is expected to decline further in the coming years. This is due to the continued take up of energy efficient appliances, distributed generation and continued growth of electricity connections that do not typically contribute to maximum network demand within the Marlborough region. For example, baches in the Marlborough Sounds, wineries and irrigation all require transformer capacity, but these loads make little or no contribution to maximum demand set during winter months, thereby reducing capacity utilisation. However, as discussed above, the capacity of utilisation plots close to the expectation line in comparison to other distribution companies when scaled against network energy density, particularly after adjustment for non-standard loads. The current target of 21% for transformer utilisation is therefore retained in this AMP.

Overall, the reality is that the utilisation of transformer capacity cannot be regarded as a primary indicator of network performance given the location and number of transformers on a network are largely a function of ICP location, physics of supply and consumer utilisation of connected capacity, all of which is out of the control of the business.

11.7.5 Fault causes and response

Figure 86 shows the total consumer minutes lost to 11kV faults by fault cause over the period RY2015 to RY2019 (5 years) together with the

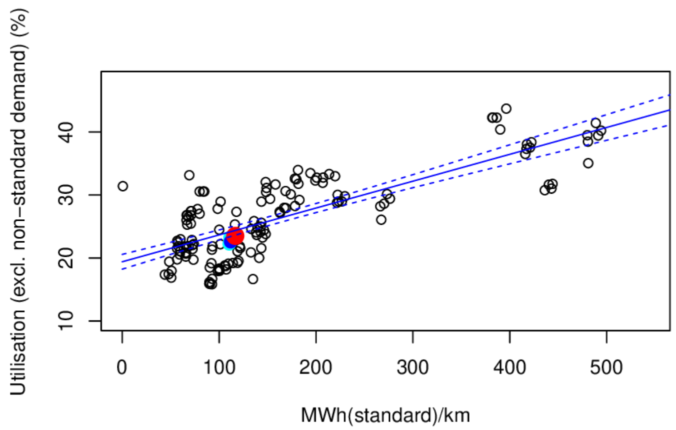


Figure 85: Regressed distribution transformer utilisation

average number of incidents per annum. This directs attention to the following:

- The major fault cause on the network is now failure of line components from a variety of causes followed by the effects of extreme wind and weather.
- Most vegetation related faults occur from vegetation outside the legal growth limit cutting zones indicating that MLL's vegetation management on the Network is working.
- Whilst conductor failure is rare and the reliability impact small, it is nevertheless an issue requiring active management due to the potential for public hazard and liability risk arising from such failures.

[27] Energy density is used as a normalising factor as in dense networks it is easier to leverage the diversity of individual demands in reducing the transformer capacity required.

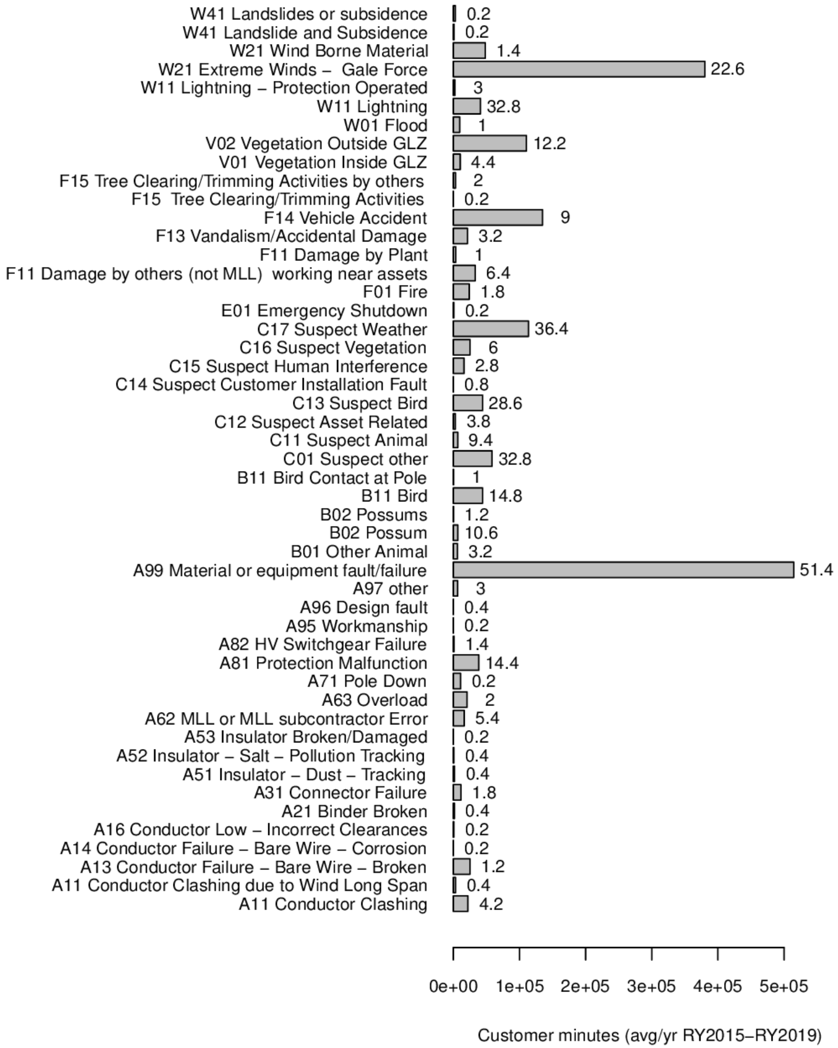


Figure 86: MLL's 11kV cumulative outage minutes vs cause

11.7.6 Network performance: planned outages

For the RY2019 year, MLL has set a service target of planned outages being less than 65 SAIDI minutes with less than 260 planned interruptions over the network. The recent performance for planned outages (RY2009 to RY2019) is illustrated in the six charts of Figure 87.

The top left chart shows the performance and trend in planned SAIDI and shows MLL outperformed its target in this area. It also shows a consistent downward trend on this measure, particularly in the rural and urban areas. The increase in planned outages in the remote areas (i.e., the Marlborough Sounds area) reflects the difficulty of supporting load while sections of the network are taken out for service and the increasing need to do so in these areas.

The top middle chart plots the distribution of planned outage times and compares year RY2009 to year RY2019 and shows improvement to almost zero planned outage minutes in urban areas achieved mainly through improved switching ability. Other areas show improvement largely through reduction in the average outage time.

The top right chart demonstrates the improvement from RY2009 to RY2019 where a greater proportion of the outages are of shorter duration achieved through better work planning. The bottom left chart shows the distribution of consumers affected per outage and indicates that most outages affect relatively small numbers of consumers. This arises from MLL's policy of supporting planned outage load through network re-configuration and placing mobile generation for outages affecting large numbers of consumers (where it is economically viable to do so).

The bottom middle chart shows the performance and trend in number of planned outages per year and compares the total number of outages to the service target of less than 260 outages. The bottom right chart plots the number of planned outages per ICP (viz planned SAIFI) and shows a decreasing trend much like the planned SAIDI trends of the top left chart. This indicates the gains made in planned outage performance have arisen largely through reducing the average number of consumers affected per planned outage; again, a result of the asset management policies employing mobile generation and network re-configuration supporting consumer load.

Given the comparative assessment of cost, further improvements in planned outage performance will come from initiatives that show a strong cost benefit. In this context, seeking further reductions in planned outage SAIDI is more likely through innovation in planning and work processes that reduce the average outage duration.

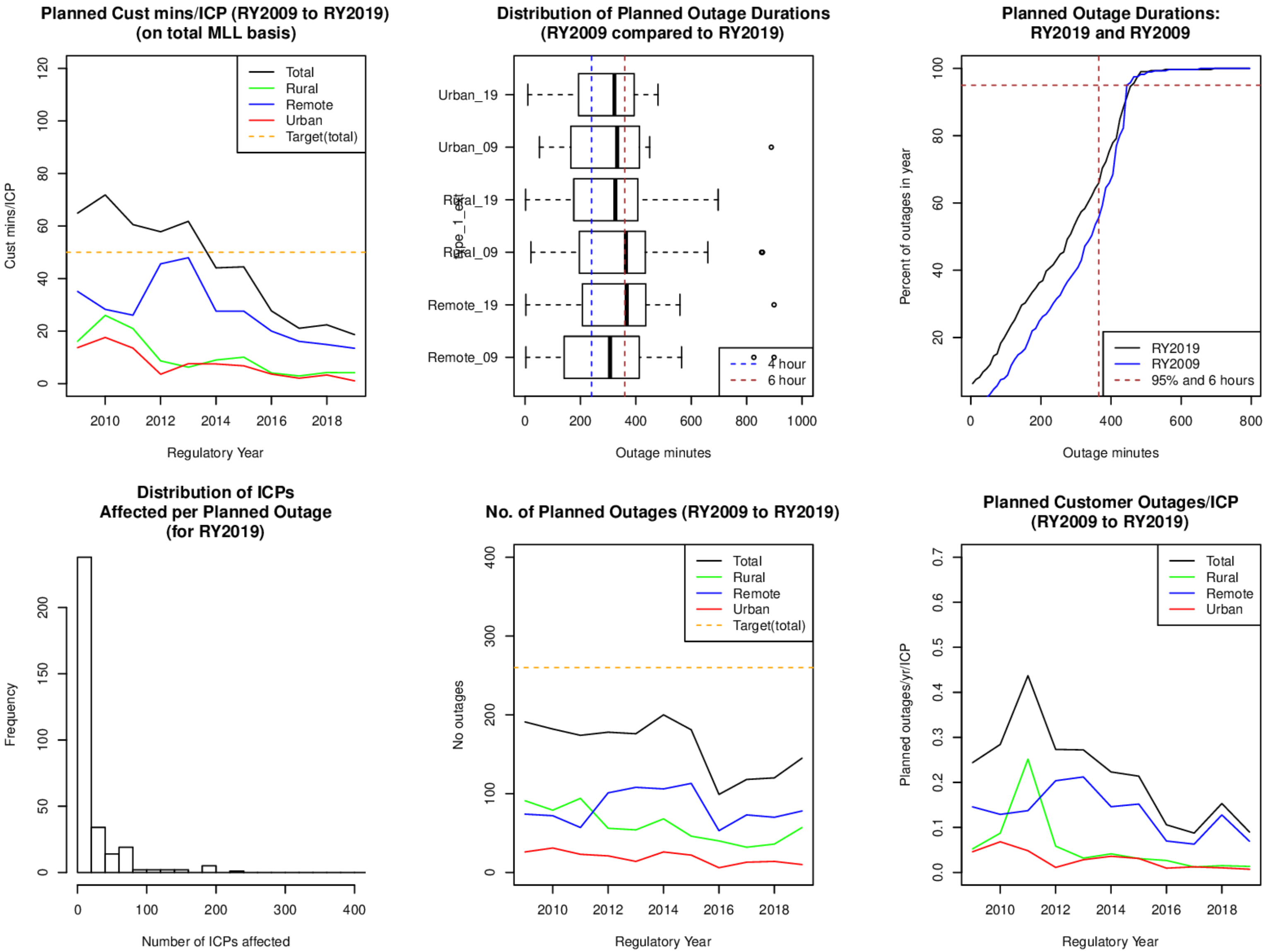


Figure 87: Planned outage analysis charts

11.7.7 Network performance – forced outages

For the RY2020 year, MLL set service targets for unplanned (forced) outages of:

1. Unplanned SAIDI <=80 comprised of SAIFI <=0.67 and CAIDI <=120 minutes
2. Fault response times of less than or equal to:
    a. Blenheim Urban 1.0 hours
    b. Urban Other 1.5 hours
    c. Rural 4.0 hours
    d. Remote Rural 8.0 hours
2. Total number of fault interruptions < 340

The performance and trend in forced outages is set out in the 6 charts of Figure 88 that also identifies the relevant targets. Note that these charts exclude the earthquake events but include any storm events.

The top left chart illustrates the unplanned SAIDI over time and reveals a falling trend in total although the internal SAIDI target has not always been met largely due to the variability in remote area faults. The top middle chart shows the distribution of outage duration times (the boxes represent the 50 percentile bounds) and compares year RY2019 performance to year RY2009 and shows improving performance, especially in urban areas and generally in the average outage duration. As shown, the outage times are most varied for the Remote (viz Sounds) consumers as might be expected due to the time and difficulty of getting work crews to the sites. It is also noted that the internal maximum response times remain stretch targets for MLL as they are not met in all cases.

The top right chart shows the distribution of all outage times and compares year RY2009 to year RY2019 noting marginal improvement and that approximately 95% of all unplanned outages are restored within six hours. The bottom left chart shows the distribution in number of consumers affected per outage and shows the majority are small consumer numbers. This reveals the benefit being returned from the automatic sectionalisers and re-closers that have been installed within the distribution network.

The bottom middle chart shows the number of unplanned outages per annum and where MLL's internal targets are met. Faults in the Remote/Sounds areas are now believed to be increasing and the management of this is becoming a key focus for MLL. However, analysis of the fault categorisations shows that many faults are caused by weather and/or wind-blown materials, which is a result of the "natural" environment that the overhead network exists within. These types of faults are difficult to deal with without resorting to expensive network re-design, which is not economically viable in these low-density areas.

The bottom right hand chart illustrates the trend in the average number of outages per consumer, which shows a downward trend much like the unplanned SAIDI trend of the top left chart. Taken together with the mostly flat trend seen in the total number of outages, this reveals that the effect of the reliability measures implemented has been to reduce the numbers of consumers affected by the outages that are occurring rather than the number of outages that are occurring. This is largely due to the operation of the automatic re-closing switches that have been strategically placed within the network.

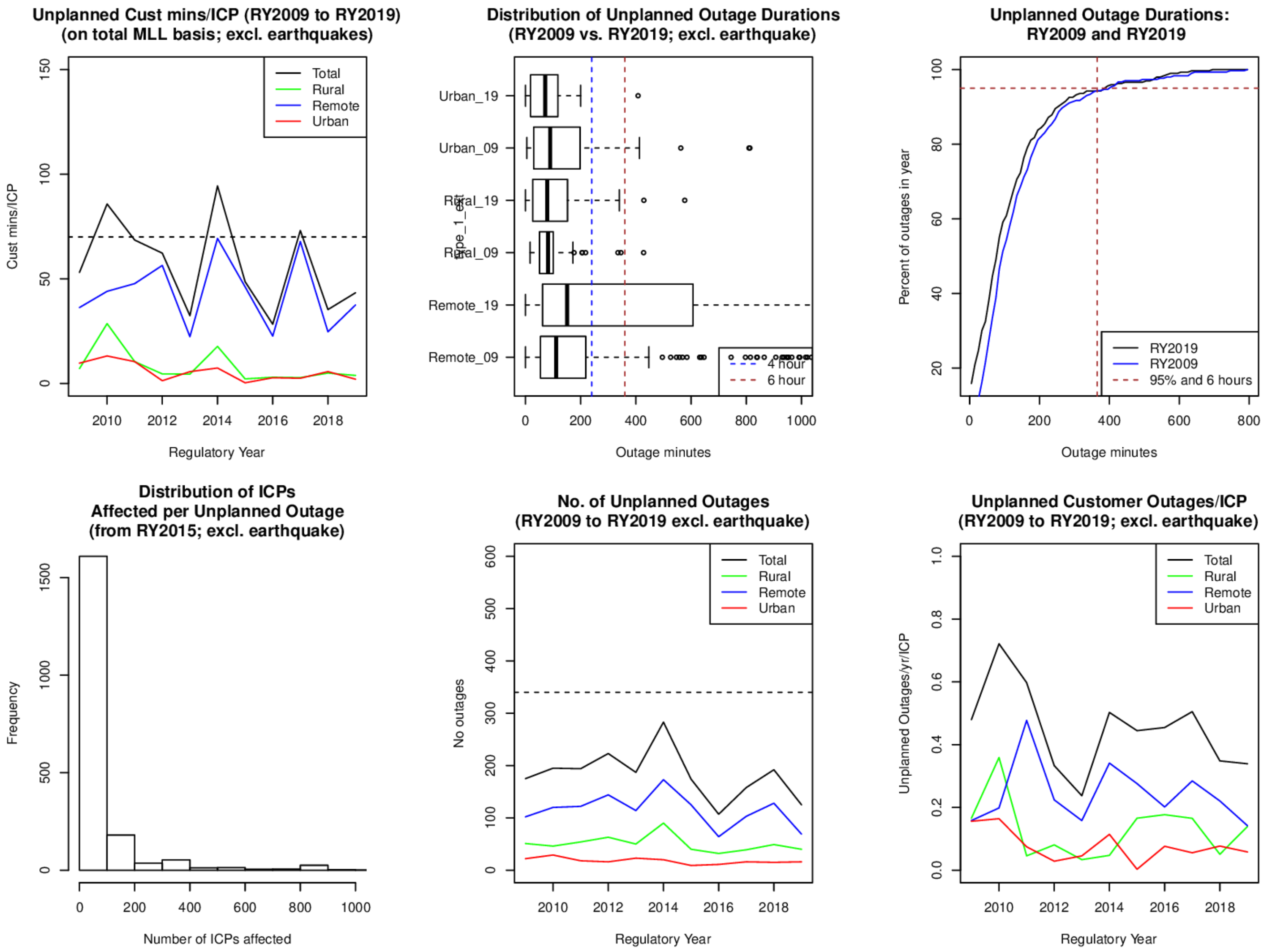


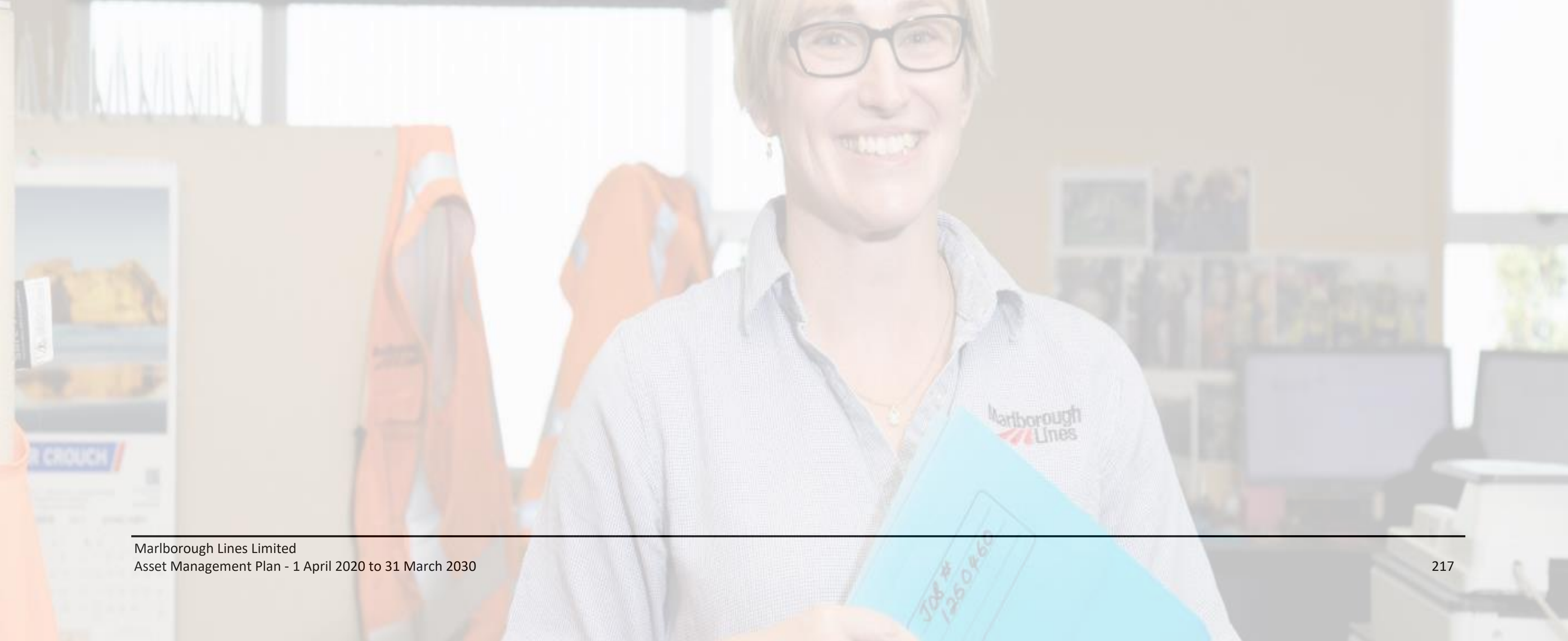
Figure 88: Unplanned outage analysis charts

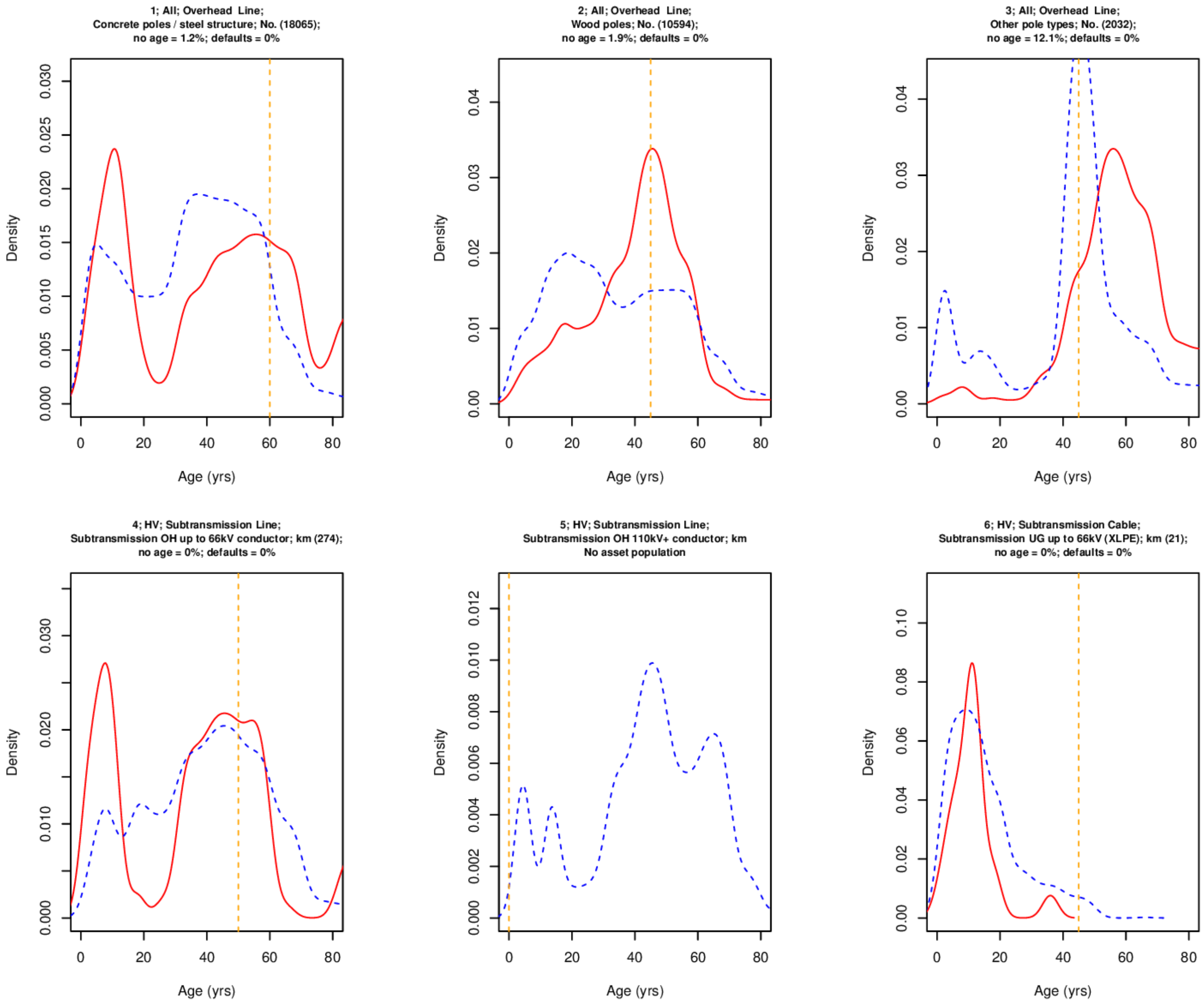
11.8 Comparative age profiles

This appendix sets out charts that compare the MLL asset age profiles against age profiles for comparable assets averaged over all New Zealand distribution businesses. The asset classes used are the 51 asset types listed in the Commerce Commission Disclosure reports for RY2019. Where charts are blank, MLL reports no assets of this type on its network.

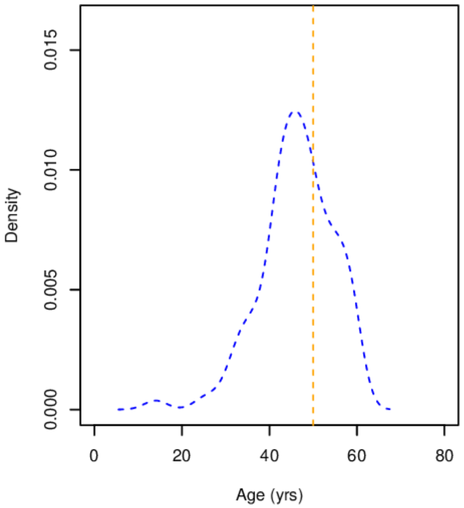
The charts are arranged 6 per page and the chart titles record the asset class, the total quantity (on the MLL network) and percentages of the total noted as having no age or having been assigned a default age. MLL advise caution in making age distribution comparisons where the percentage of the totals with no age or default ages are large as the algorithms used in creating the age profiles make assumptions in how these assets ages are spread (being generally spread over the top quartile of the available age bins).

The lines on the chart are red for the MLL age profile and blue dash line for the all NZ average age profile. The yellow dash vertical line marks the regulatory expected life for that asset class as used in ODV calculations.

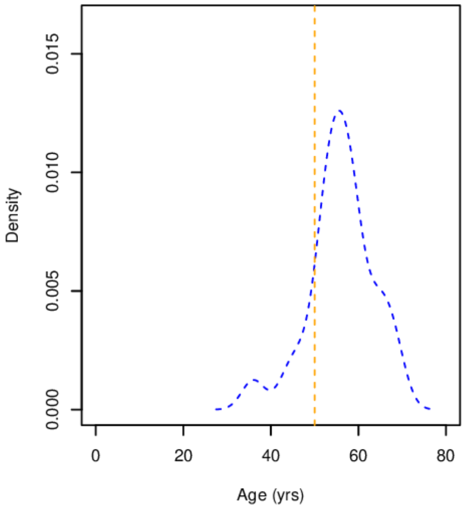



1; All; Overhead Line;
Concrete poles / steel structure; No. (18065);
no age = 1.2%; defaults = 0%
2; All; Overhead Line;
Wood poles; No. (10594);
no age = 1.9%; defaults = 0%
3; All; Overhead Line;
Other pole types; No. (2032);
no age = 12.1%; defaults = 0%
4; HV; Subtransmission Line;
Subtransmission OH up to 66kV conductor; km (274);
no age = 0%; defaults = 0%
5; HV; Subtransmission Line;
Subtransmission OH 110kV+ conductor; km
No asset population
6; HV; Subtransmission Cable;
Subtransmission UG up to 66kV (XLPE); km (21);
no age = 0%; defaults = 0%
Density
Age (yrs)

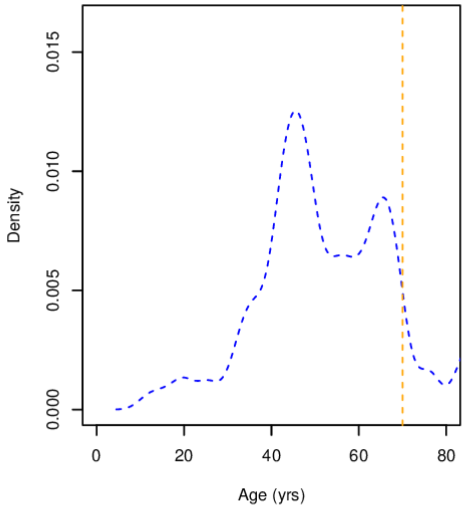
7; HV; Subtransmission Cable;
Subtransmission UG up to 66kV (Oil pressurised); km
No asset population



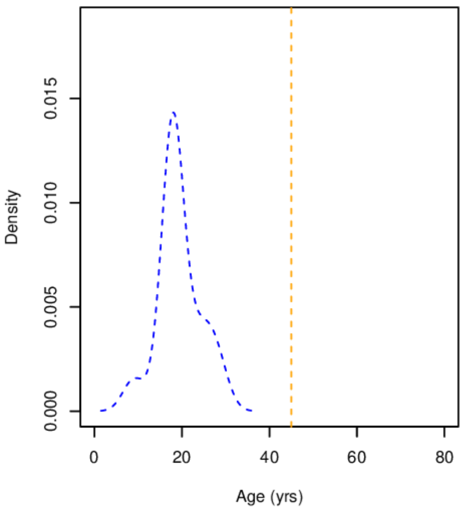
8; HV; Subtransmission Cable;
Subtransmission UG up to 66kV (Gas pressurised); km
No asset population



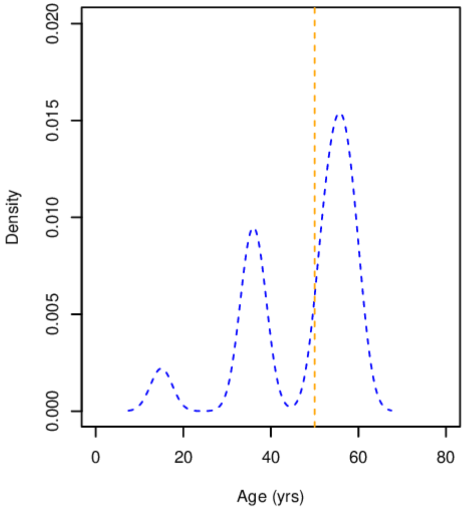
9; HV; Subtransmission Cable;
Subtransmission UG up to 66kV (PILC); km
No asset population



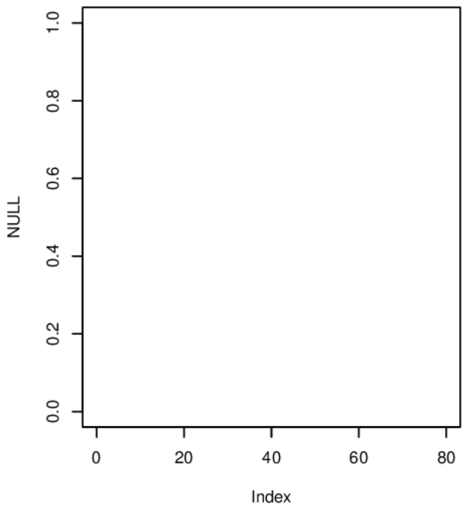
10; HV; Subtransmission Cable;
Subtransmission UG 110kV+ (XLPE); km
No asset population

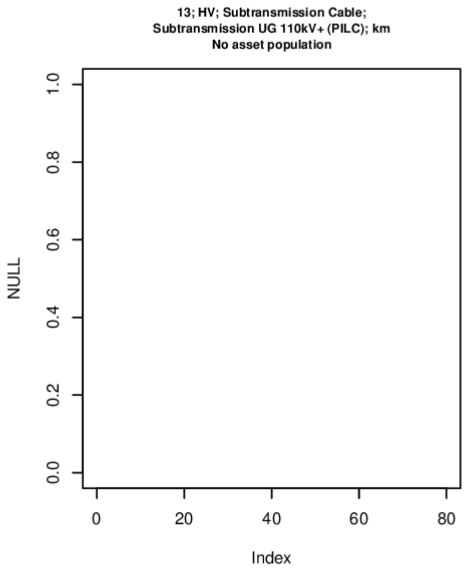


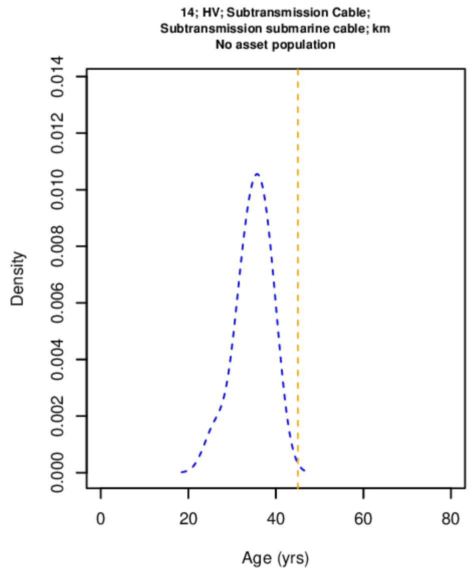
11; HV; Subtransmission Cable;
Subtransmission UG 110kV+ (Oil pressurised); km
No asset population

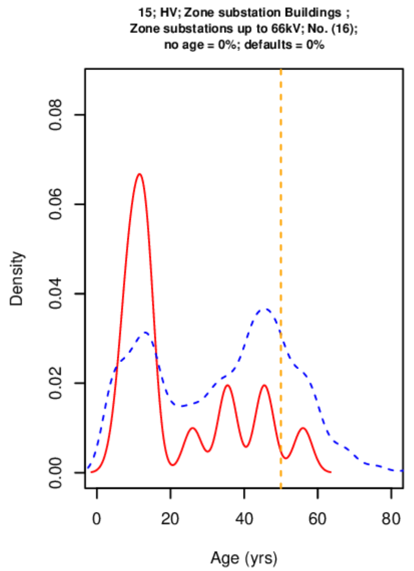


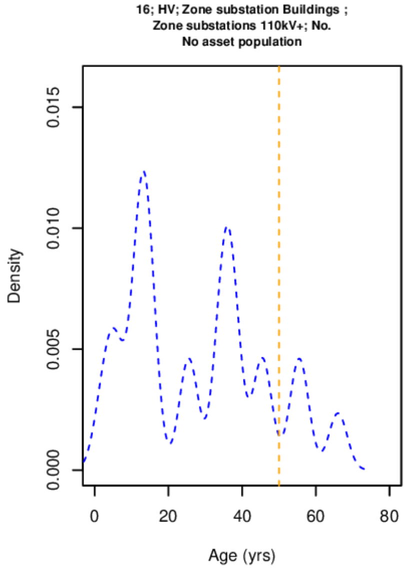
12; HV; Subtransmission Cable;
Subtransmission UG 110kV+ (Gas Pressurised); km
No asset population

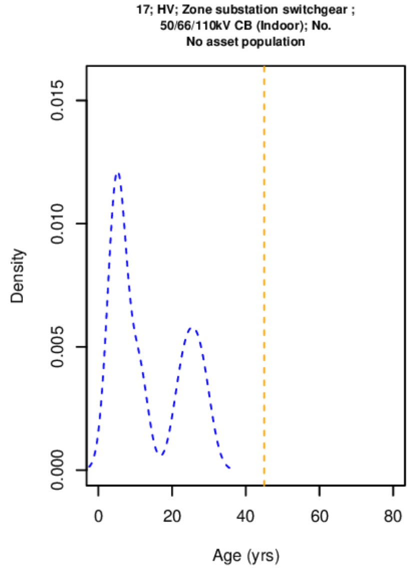


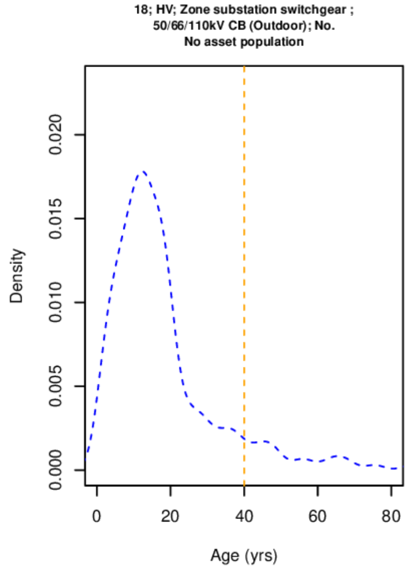

13; HV; Subtransmission Cable;
Subtransmission UG 110kV+ (PILC); km
No asset population
NULL
0.0 0.2 0.4 0.6 0.8 1.0
0 20 40 60 80
Index

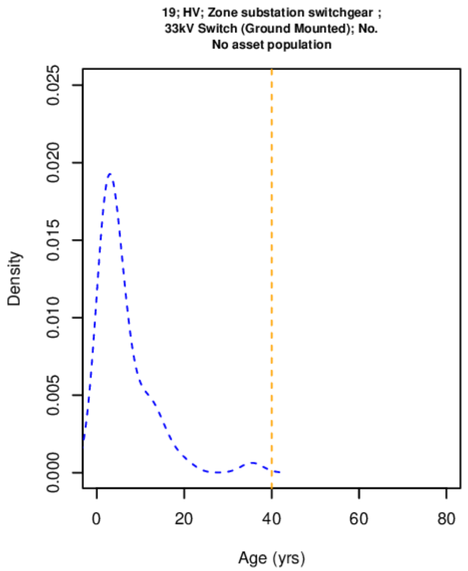

14; HV; Subtransmission Cable;
Subtransmission submarine cable; km
No asset population
Density
0.000 0.002 0.004 0.006 0.008 0.010 0.012 0.014
0 20 40 60 80
Age (yrs)

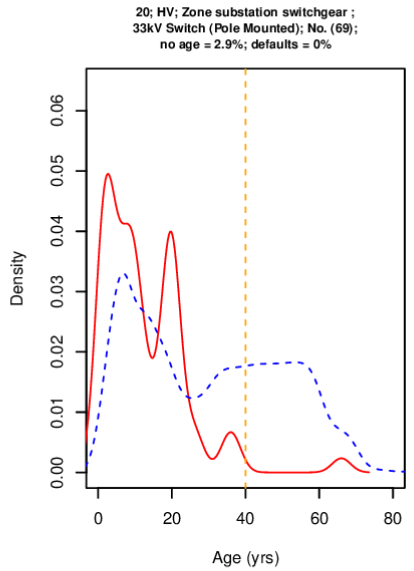

15; HV; Zone substation Buildings ;
Zone substations up to 66kV; No. (16);
no age = 0%; defaults = 0%
Density
0.00 0.02 0.04 0.06 0.08
0 20 40 60 80
Age (yrs)

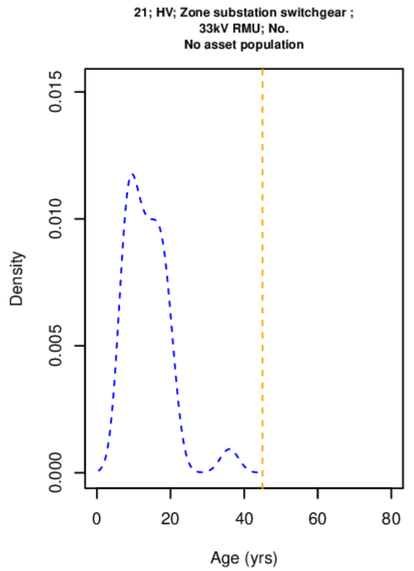

16; HV; Zone substation Buildings ;
Zone substations 110kV+; No.
No asset population
Density
0.000 0.005 0.010 0.015
0 20 40 60 80
Age (yrs)

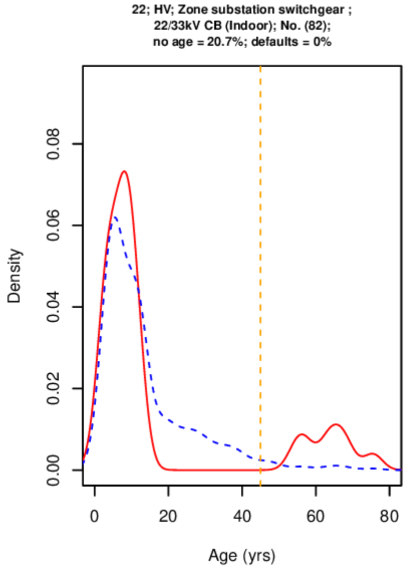

17; HV; Zone substation switchgear ;
50/66/110kV CB (Indoor); No.
No asset population
Density
0.000 0.005 0.010 0.015
0 20 40 60 80
Age (yrs)

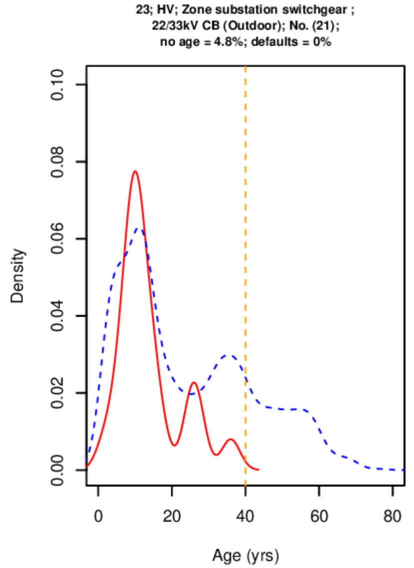

18; HV; Zone substation switchgear ;
50/66/110kV CB (Outdoor); No.
No asset population
Density
0.000 0.005 0.010 0.015 0.020
0 20 40 60 80
Age (yrs)

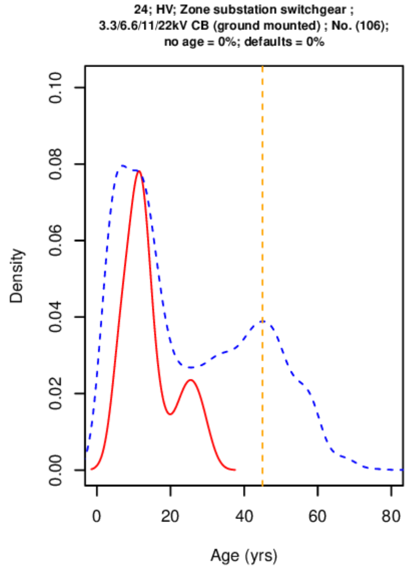

19; HV; Zone substation switchgear ;
33kV Switch (Ground Mounted); No.
No asset population
Density
Age (yrs)

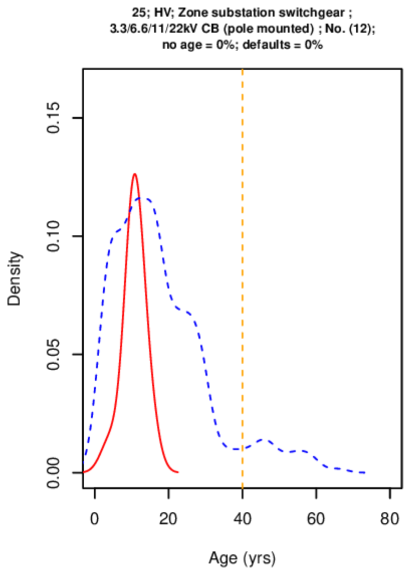

20; HV; Zone substation switchgear ;
33kV Switch (Pole Mounted); No. (69);
no age = 2.9%; defaults = 0%
Density
Age (yrs)

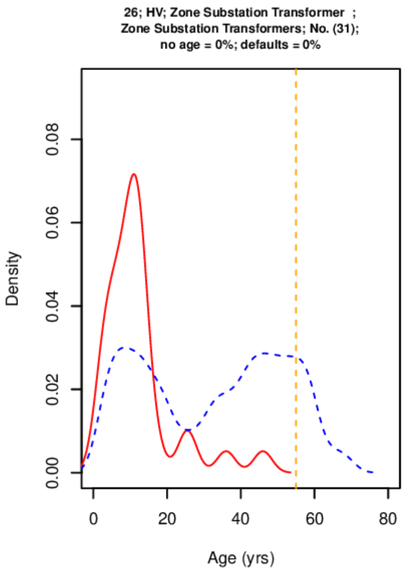

21; HV; Zone substation switchgear ;
33kV RMU; No.
No asset population
Density
Age (yrs)

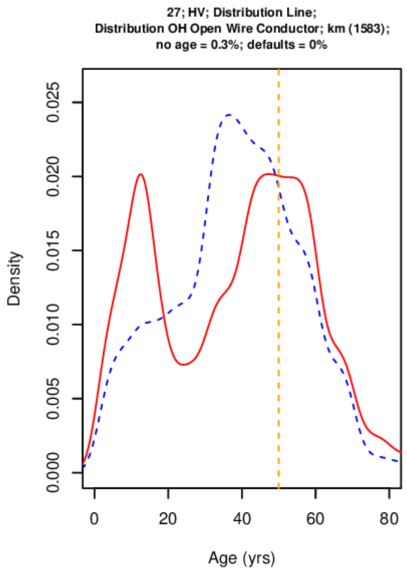

22; HV; Zone substation switchgear ;
22/33kV CB (Indoor); No. (82);
no age = 20.7%; defaults = 0%
Density
Age (yrs)

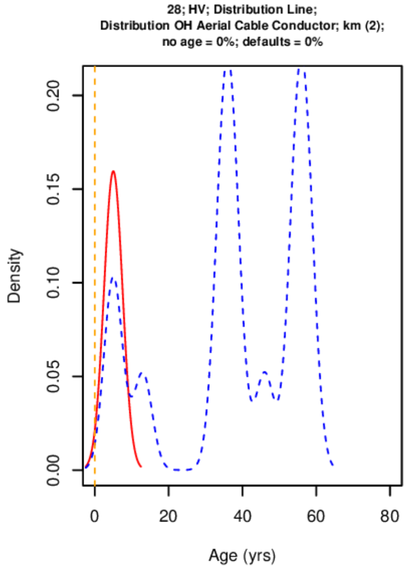

23; HV; Zone substation switchgear ;
22/33kV CB (Outdoor); No. (21);
no age = 4.8%; defaults = 0%
Density
Age (yrs)

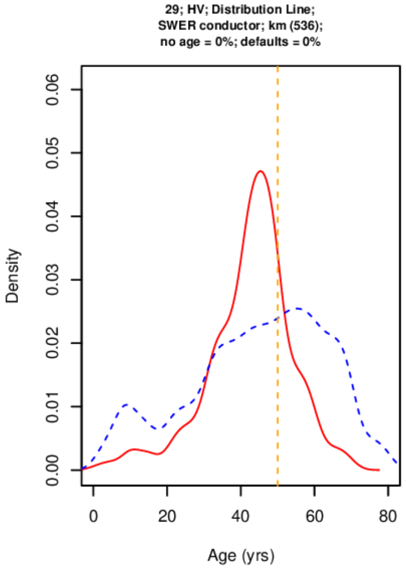

24; HV; Zone substation switchgear ;
3.3/6.6/11/22kV CB (ground mounted) ; No. (106);
no age = 0%; defaults = 0%
Density
Age (yrs)

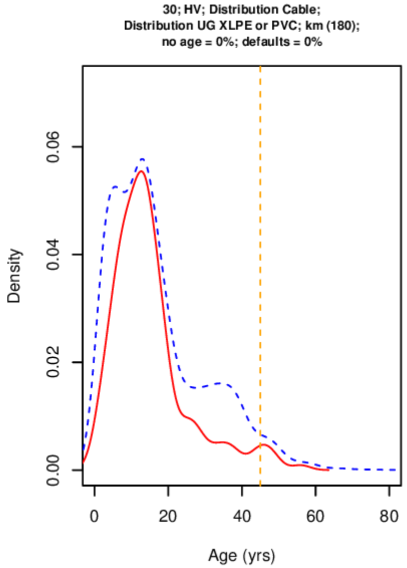

25; HV; Zone substation switchgear ;
3.3/6.6/11/22kV CB (pole mounted) ; No. (12);
no age = 0%; defaults = 0%
Density
Age (yrs)

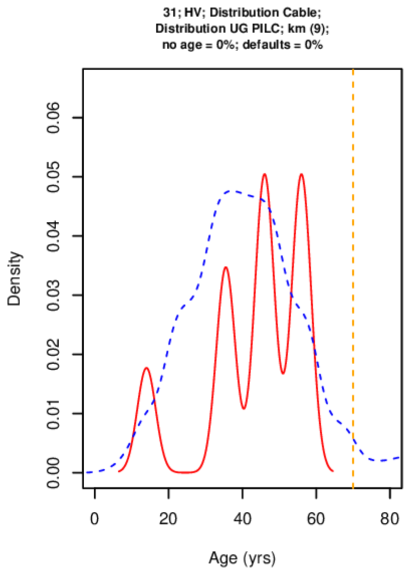

26; HV; Zone Substation Transformer ;
Zone Substation Transformers; No. (31);
no age = 0%; defaults = 0%
Density
Age (yrs)

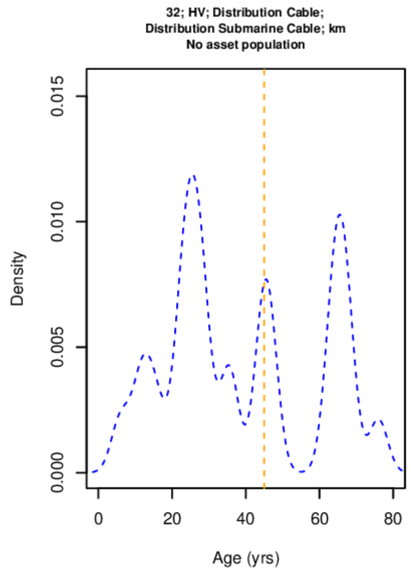

27; HV; Distribution Line;
Distribution OH Open Wire Conductor; km (1583);
no age = 0.3%; defaults = 0%
Density
Age (yrs)

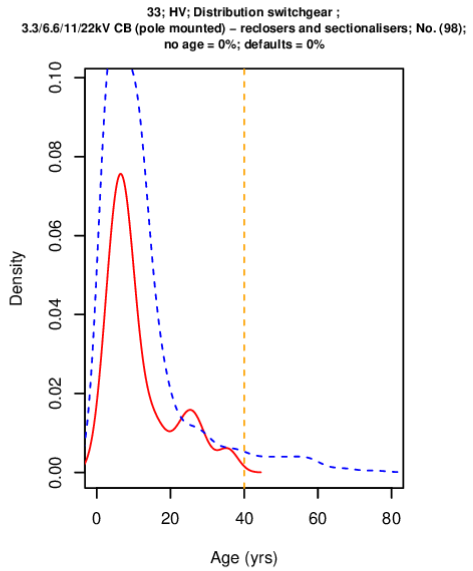

28; HV; Distribution Line;
Distribution OH Aerial Cable Conductor; km (2);
no age = 0%; defaults = 0%
Density
Age (yrs)

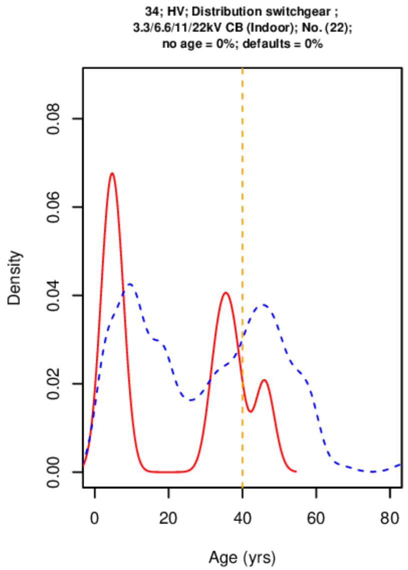

29; HV; Distribution Line;
SWER conductor; km (536);
no age = 0%; defaults = 0%
Density
Age (yrs)

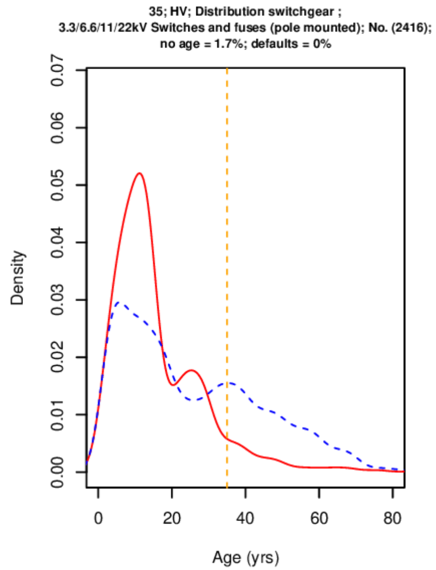

30; HV; Distribution Cable;
Distribution UG XLPE or PVC; km (180);
no age = 0%; defaults = 0%
Density
Age (yrs)

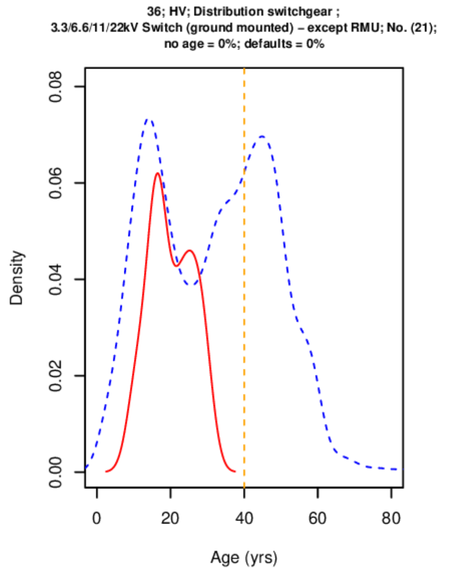

31; HV; Distribution Cable;
Distribution UG PILC; km (9);
no age = 0%; defaults = 0%
Density
Age (yrs)

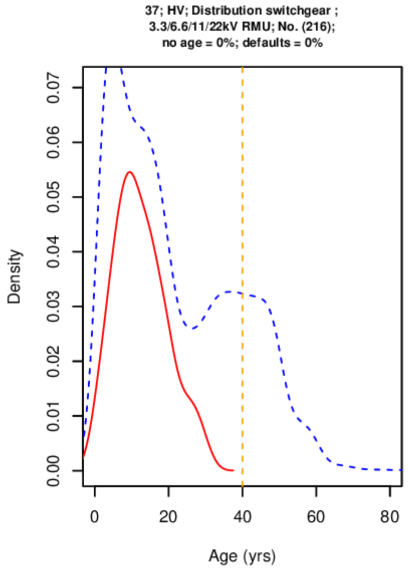

32; HV; Distribution Cable;
Distribution Submarine Cable; km
No asset population
Density
Age (yrs)

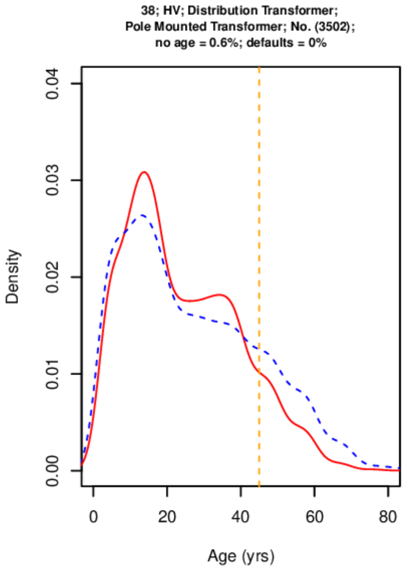

33; HV; Distribution switchgear ;
3.3/6.6/11/22kV CB (pole mounted) – reclosers and sectionalisers; No. (98);
no age = 0%; defaults = 0%
Density
Age (yrs)

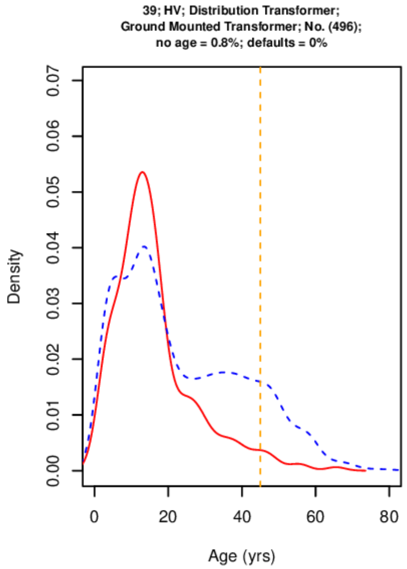

34; HV; Distribution switchgear ;
3.3/6.6/11/22kV CB (Indoor); No. (22);
no age = 0%; defaults = 0%
Density
Age (yrs)

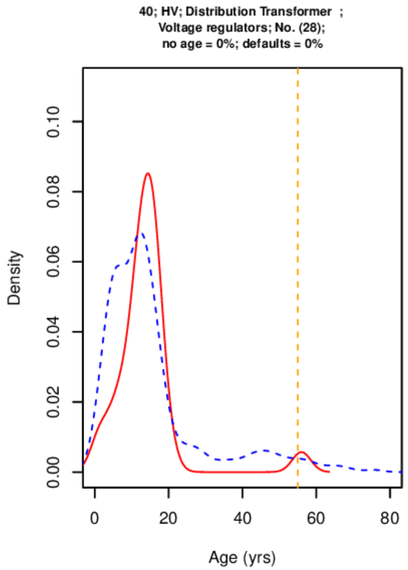

35; HV; Distribution switchgear ;
3.3/6.6/11/22kV Switches and fuses (pole mounted); No. (2416);
no age = 1.7%; defaults = 0%
Density
Age (yrs)

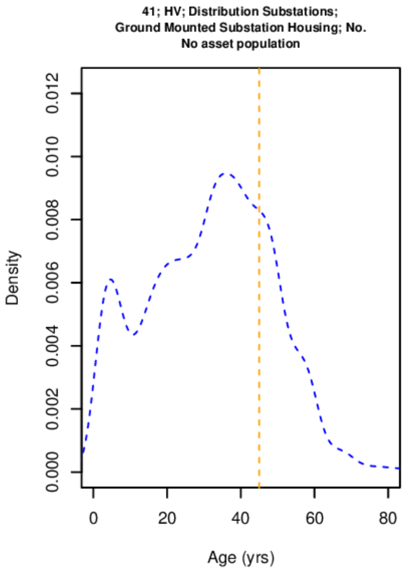

36; HV; Distribution switchgear ;
3.3/6.6/11/22kV Switch (ground mounted) – except RMU; No. (21);
no age = 0%; defaults = 0%
Density
Age (yrs)

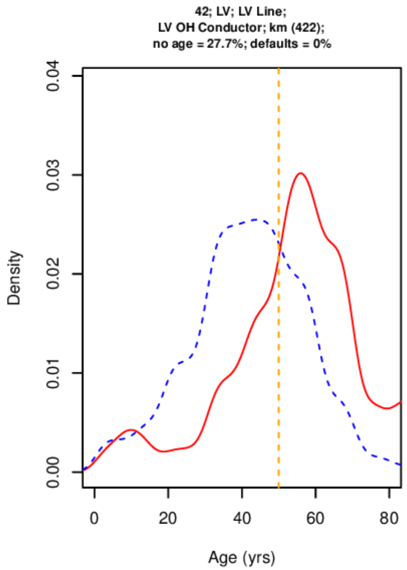

37; HV; Distribution switchgear ;
3.3/6.6/11/22kV RMU; No. (216);
no age = 0%; defaults = 0%
Density
Age (yrs)

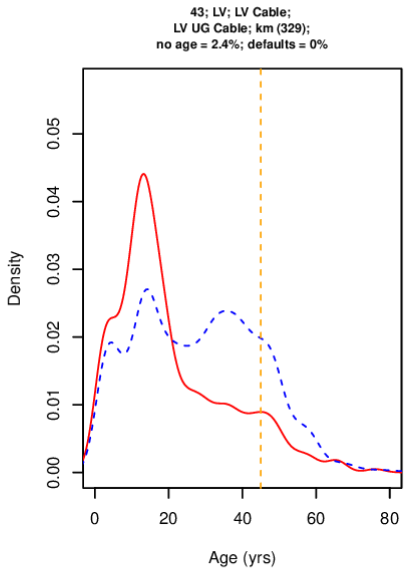

38; HV; Distribution Transformer;
Pole Mounted Transformer; No. (3502);
no age = 0.6%; defaults = 0%
Density
Age (yrs)

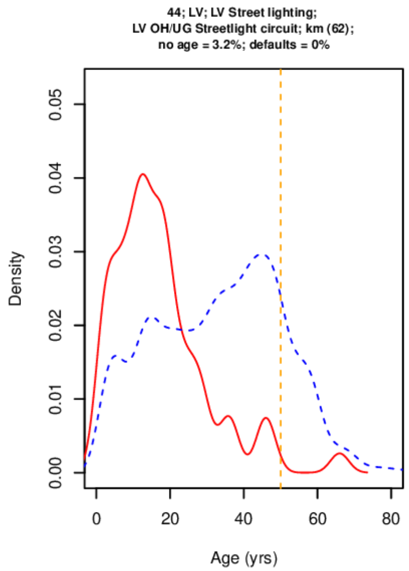

39; HV; Distribution Transformer;
Ground Mounted Transformer; No. (496);
no age = 0.8%; defaults = 0%
Density
Age (yrs)

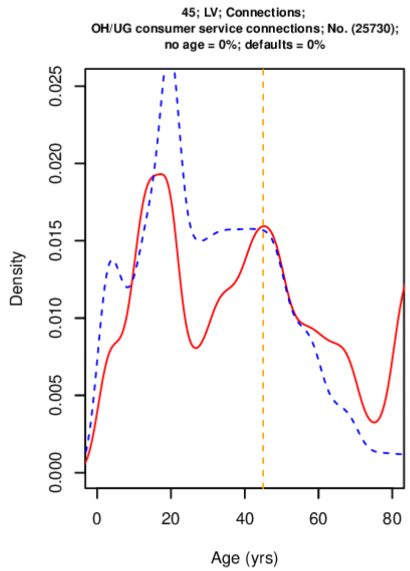

40; HV; Distribution Transformer ;
Voltage regulators; No. (28);
no age = 0%; defaults = 0%
Density
Age (yrs)

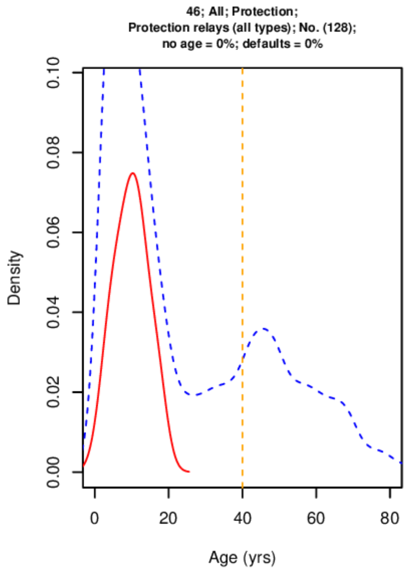

41; HV; Distribution Substations;
Ground Mounted Substation Housing; No.
No asset population
Density
Age (yrs)

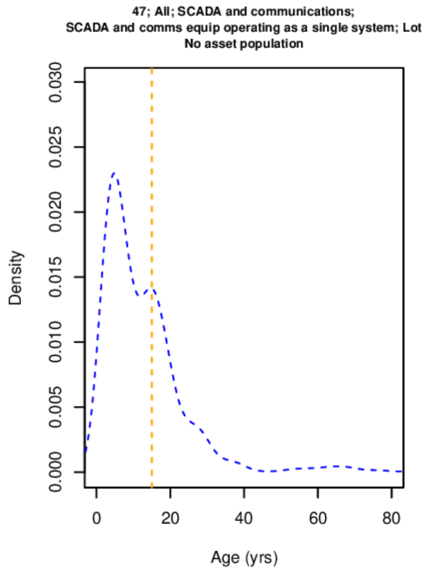

42; LV; LV Line;
LV OH Conductor; km (422);
no age = 27.7%; defaults = 0%
Density
Age (yrs)

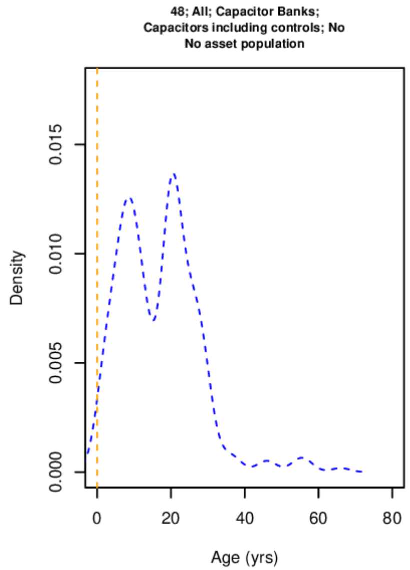

43; LV; LV Cable;
LV UG Cable; km (329);
no age = 2.4%; defaults = 0%
Density
0.00
0.01
0.02
0.03
0.04
0.05
0
20
40
60
80
Age (yrs)

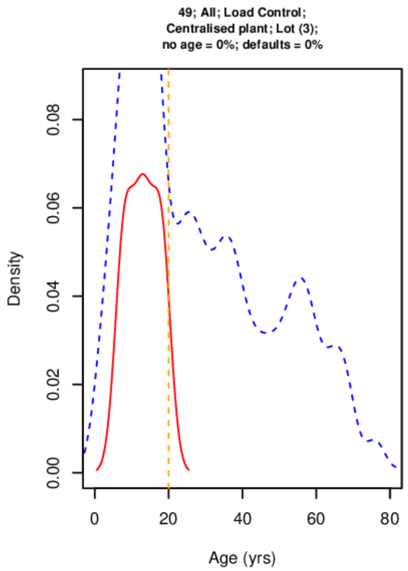

44; LV; LV Street lighting;
LV OH/UG Streetlight circuit; km (62);
no age = 3.2%; defaults = 0%
Density
0.00
0.01
0.02
0.03
0.04
0.05
0
20
40
60
80
Age (yrs)


45; LV; Connections;
OH/UG consumer service connections; No. (25730);
no age = 0%; defaults = 0%
Density
0.000
0.005
0.010
0.015
0.020
0.025
0
20
40
60
80
Age (yrs)

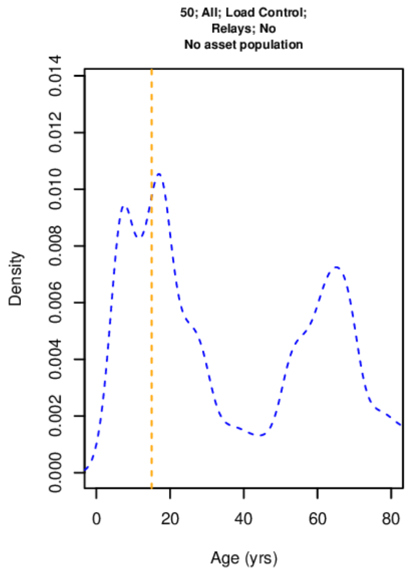

46; All; Protection;
Protection relays (all types); No. (128);
no age = 0%; defaults = 0%
Density
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Age (yrs)


47; All; SCADA and communications;
SCADA and comms equip operating as a single system; Lot
No asset population
Density
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0
20
40
60
80
Age (yrs)

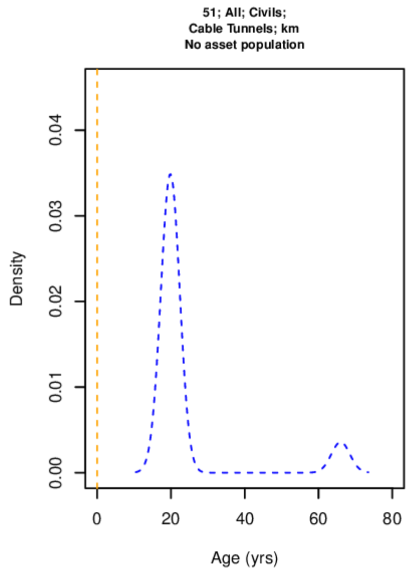

48; All; Capacitor Banks;
Capacitors including controls; No
No asset population
Density
0.000
0.005
0.010
0.015
0
20
40
60
80
Age (yrs)



49; All; Load Control;
Centralised plant; Lot (3);
no age = 0%; defaults = 0%
Density
0.00
0.02
0.04
0.06
0.08
0
20
40
60
80
Age (yrs)



50; All; Load Control;
Relays; No
No asset population
Density
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0
20
40
60
80
Age (yrs)



51; All; Civils;
Cable Tunnels; km
No asset population
Density
0.00
0.01
0.02
0.03
0.04
0
20
40
60
80
Age (yrs)

11.9 Data locations

The following table provides a summary of the key information held at MLL and where it is held.

Table 54: Information repositories

Repository	Information	Key users	Notes
Infor's EAM	• Network and non-Network equipment records (i.e., assets) • Location • Technical specifications • History • Test records • Network outages • Financial data • Asset Condition • Structural dependencies • Project and works records, including corrective and preventative maintenance regimes • Easement records	Most staff	Main asset data repository, also used for maintenance and capital works programs. Displays on the GIS and electrical equipment records also mostly replicated in Milsoft for connectivity and engineering analysis purposes.
GIS (ESRI)	• Line asset type • Line connectivity • Survey 123 (asset inspection data)	Most staff, especially GIS and Engineering	A map-based view of electrical asset data, as well as views of maps, and data relating to the environment such as roads, archaeological sites, DoC sites etc
Network folders	• Design records and project files Calculations, analysis of options, protection reviews. Includes drawings and drawing register.	Engineering, Project Management and Operations staff	
SCADA	• Network status e.g., loads, switch positions, tapchanger positions • Faults and outages • Inspection data	Engineering, operations and development staff	Current status as well as historical logs and graphs of loading etc.

Repository	Information	Key users	Notes
Milsoft	• Outage management system • Engineering Analysis	Operations, engineering and administration staff	Network status/electrical connectivity. Hold outage performance data.
Fault record sheets	• Description and duration • Likely cause	Operations manager, network management and staff	Reviewed regularly to look for systemic issues and ways to improve service.
Technology One's Financials	• Financial data • Inventory • Payroll	Administration, Stores, Finance and Project Management staff	Keeps financial records.
Velocity (Gentrack)	• Connection data • Billing data • ICP management • Load control relays not owned by MLL	Operations and administration staff Commercial Manager and billing team	ICP based data, Milsoft also displays some of this data.
Mango	Policies and procedures (Integrated Management System documentation)	All staff	Procedures, policies and guidelines related to design, operation, health and safety, public safety and environmental practice.
Network Standards	Design and policy information for design and construction of network assets	Contractors, MLL design staff, operators	
Emergency Response Plan	Information for use in civil emergencies, e.g., earthquake, major storms	Engineering, contracting and administration staff during severe events	

11.10 Risk matrix

The risk matrix used for risk categorisation and ranking is set out following together with the consequence assessment table and likelihood assessment table used to map risks onto the risk matrix.

Consequence Severity

Likelihood	Insignfiant	Minor	Moderate	Major	Catastrophic
Almost Certain	Priority 2	Priority 2	Priority 1	Priority 1	Priority 1
Likely	Priority 3	Priority 2	Priority 2	Priority 1	Priority 1
Possible	Priority 4	Priority 3	Priority 2	Priority 1	Priority 1
Unlikely	Priority 4	Priority 4	Priority 3	Priority 2	Priority 1
Rare	Priority 4	Priority 4	Priority 3	Priority 2	Priority 2

Priority 1	Immediate action required to actively manage risk and limit exposure.
Priority 2	Attention required to ensure risk exposure is managed effectively, disruptions minimised and outcomes monitored.
Priority 3	Cost/benefit analysis to assess extent to which risk should be mitigated. Monitor to ensure risk does not increase over time.
Priority 4	Effectively manage through routine procedures and appropriate internal controls.

	Consequence				
Risk Theme	**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
Health	*No illness or disease*	*Illness only*	*Illness with a possibility of leading to a disease*	*A disease, manageable*	*A disease, leading to fatality (terminal)*
Safety (incl. Public)	*No injury*	*First aid required*	*External medical treatment required*	*Extensive injuries, possibility of a fatality*	*Multiple fatalities*
Quality	*No quality incident*	*Less than $10,000*	*Less than $100,000*	*Less than $1m*	*Above $1m Extensive reputational damage*
Environmental	*Minor transient environmental harm*	*Transient environmental harm*	*Significant release of pollutants with midterm recovery*	*Significant long term envrionmental harm*	*Catatstrophic, long term environmental harm*
Financial	*Loss of assets or unbedgeted revenue loss or increased costs to NZ$2m*	*Loss of assets or unbudgeted revenue or loss or increased costs NZ$2m to NZ $5m.*	*Loss of assets or unbudgeted revenue loss or increased costs NZ$5m to NZ$50m.*	*Loss of assets or unbudgeted revenue loss or increased costs NZ$50m to NZ$100m.*	*Loss of assets or unbudgeted revenue loss or increased costs exceeding NZ$100m.*
Reputational	*Limited media attention - no impact on public memory*	*Local media attention - short-term impact on public memory.*	*Local media attention (not front page) and / or regular inquiry.*	*Local / national media news and / or regular investigation - medium term impact on public memory.*	*International media news headlines and / or government investigation / enquiry - long term impact on public memory.*
Business interruption	*Minor service disruption for up to 2 hours for major industrial/commercial customers; up to 3 hours for residential; up to 12 hours for rural.*	*Business interruption/service delivery failure between 2 and 6 hours fo rmajor industrial/ commercial customers; between 3 hours and 24 hours for residential; between 12 hours and 2 days for rural.*	*Total service cessation between 6 hours and 1 day for major industrial / commercial clients; between 1 to 2 days for residential; between 2 to 7 days for rural.*	*Total service cessation between 1 to 2 days for major industrial / commercial clients; between 2 and 7 days for residential; between 1 and 2 weeks for rural.*	*Disruption to supply (point of supply outage) exceeding 2 days for major industrial / commercial customers; exceeding a week for residential; exceeding 2 weeks for rural.*
Regulatory	*Verbal written concern.*	*Prosecution / improvement notice.*	*Prosecution of business / prohibition notice.*	*Prosecution and fines for Director and employee.*	*Imprisonment of Director or employee.*

Likelihood	Description	Likelihood Criteria
Almost Certain	Is expected to Occur in most circumstances	Likely to occur more than once per year
Likely	The event will probably occur in most circumstances	Likely to occur once per year
Possible	The event might occur at some time (would not be surprised either way: whether it happens or not)	Likely to occur once in 5 years
Unlikely	The event could occur at some time (would be surprised if it happens)	Likely to occur once in 10 years
Rare	The event may occur only in exceptional circumstances	Will occur less than once in 30 years

11.11 Directors certificate

CERTIFICATION FOR YEAR-BEGINNING DISCLOSURES

Pursuant to Schedule 17
Clause 2.9.1

We, David William Richard Dew and Philip Ian Robinson, being directors of Marlborough Lines Limited, certify that, having made all reasonable enquiry, to the best of our knowledge:

a) The following attached information of Marlborough Lines Limited prepared for the purposes of clauses 2.4.1, 2.6.1, 2.6.3, 2.6.6 and 2.7.2 of the Electricity Distribution 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.

c) The forecasts in Schedules 11a, 11b, 12a, 12b, 12c and 12d are based on objective and reasonable assumptions which both align with Marlborough Lines Limited's corporate vision and strategy and are documented in retained records.

Signed by:

DWR Dew	24/3/2020 Date
PI Robinson	24/3/2020 Date

EDB Information Disclosure Requirements
Information Templates
for
Schedules 11a–13

Company Name	Marlborough Lines Limited
Disclosure Date	31 March 2020
AMP Planning Period Start Date (first day)	1 April 2020

Templates for Schedules 11a–13 (Asset Management Plan)
Template Version 4.1. Prepared 21 December 2017

Table of Contents

Information disclosure asset management plan schedules

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**

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)

EDBs 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*
8		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
9		**11a(i): Expenditure on Assets Forecast**	**$000 (in nominal dollars)**										
10		Consumer connection	78	102	104	106	108	111	113	115	117	120	122
11		System growth	711	255	781	2,924	380	3,595	282	288	293	299	305
12		Asset replacement and renewal	6,727	7,345	7,480	7,675	9,900	7,372	8,275	8,956	10,784	11,000	11,220
13		Asset relocations	182	204	104	160	309	105	113	115	117	120	122
14		Reliability, safety and environment:											
15		Quality of supply	630	127	364	2,922	1,215	628	2,246	2,066	435	444	452
16		Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
17		Other reliability, safety and environment	1,628	1,019	4,154	1,061	1,038	473	482	492	279	284	290
18		**Total reliability, safety and environment**	2,258	1,147	4,518	3,983	2,253	1,101	2,729	2,558	714	728	743
19		**Expenditure on network assets**	9,956	9,053	12,987	14,847	12,951	12,284	11,512	12,032	12,026	12,267	12,512
20		Expenditure on non-network assets	1,842	3,637	2,096	1,451	2,256	1,494	1,670	1,704	1,740	1,776	1,812
21		**Expenditure on assets**	11,798	12,690	15,083	16,299	15,207	13,778	13,181	13,736	13,766	14,042	14,324
22													
23	*plus*	Cost of financing	-	-	-	-	-	-	-	-	-	-	-
24	*less*	Value of capital contributions	75	75	50	50	100	50	50	50	50	50	50
25	*plus*	Value of vested assets	-	-	-	-	-	-	-	-	-	-	-
26													
27		**Capital expenditure forecast**	11,723	12,615	15,033	16,249	15,107	13,728	13,131	13,686	13,716	13,992	14,274
28													
29		Assets commissioned	19,292	11,764	14,539	15,675	15,549	11,254	12,198	13,550	17,778	13,953	14,233
30			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
31		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
32			**$000 (in constant prices)**										
33		Consumer connection	78	100	100	100	100	100	100	100	100	100	100
34		System growth	711	250	750	2,750	350	3,250	250	250	250	250	250
35		Asset replacement and renewal	6,727	7,205	7,185	7,217	9,130	6,665	7,335	7,782	9,187	9,187	9,187
36		Asset relocations	243	200	100	150	285	95	127	132	138	143	149
37		Reliability, safety and environment:											
38		Quality of supply	630	125	350	2,748	1,121	568	1,991	1,796	371	371	371
39		Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
40		Other reliability, safety and environment	1,628	1,000	3,990	998	958	428	428	428	238	238	238
41		**Total reliability, safety and environment**	2,259	1,125	4,340	3,746	2,078	996	2,419	2,223	608	608	608
42		**Expenditure on network assets**	10,018	8,880	12,475	13,963	11,943	11,105	10,231	10,488	10,283	10,289	10,294
43		Expenditure on non-network assets	1,755	3,567	2,013	1,366	2,080	1,352	1,480	1,480	1,480	1,480	1,480
44		**Expenditure on assets**	11,773	12,447	14,488	15,329	14,023	12,457	11,711	11,968	11,763	11,769	11,774
46		**Subcomponents of expenditure on assets (where known)**											
47		Energy efficiency and demand side management, reduction of energy losses	-	-	-	-	-	-	-	-	-	-	-
48		Overhead to underground conversion	-	-	-	-	-	-	-	-	-	-	-
49		Research and development	-	-	-	-	-	-	-	-	-	-	-

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**

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)

EDBs 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												
50												
51		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
52	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
53	**Difference between nominal and constant price forecasts**	**$000**										
54	Consumer connection	-	2	4	6	8	11	13	15	17	20	22
55	System growth	-	5	31	174	30	345	32	38	43	49	55
56	Asset replacement and renewal	0	140	295	457	771	707	941	1,174	1,597	1,813	2,033
57	Asset relocations	(61)	4	4	10	24	10	(14)	(17)	(20)	(24)	(27)
58	Reliability, safety and environment:											
59	Quality of supply	(0)	2	14	174	95	60	255	271	64	73	82
60	Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
61	Other reliability, safety and environment	(0)	19	164	63	81	45	55	64	41	47	53
62	**Total reliability, safety and environment**	(1)	22	178	237	175	106	310	335	106	120	135
63	**Expenditure on network assets**	(62)	173	512	885	1,008	1,178	1,281	1,544	1,743	1,978	2,217
64	Expenditure on non-network assets	87	70	83	85	176	142	190	224	260	296	332
65	**Expenditure on assets**	25	243	595	970	1,184	1,321	1,471	1,768	2,003	2,273	2,550

67		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
68	**11a(ii): Consumer Connection** for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
69	*Consumer types defined by EDB**	**$000 (in constant prices)**					
70	Residential	72	80	80	80	80	80
71	General	6	20	20	20	20	20
72	Commercial and Industrial	-	-	-	-	-	-
73	Irrigation	-	-	-	-	-	-
74	Other	-	-	-	-	-	-
75	**include additional rows if needed*						
76	**Consumer connection expenditure**	78	100	100	100	100	100
77	*less* Capital contributions funding consumer connection	-	-	-	-	-	-
78	**Consumer connection less capital contributions**	78	100	100	100	100	100
79	**11a(iii): System Growth**						
80	Subtransmission	-	-	-	500	-	-
81	Zone substations	-	-	-	2,000	100	3,000
82	Distribution and LV lines	-	-	500	-	-	-
83	Distribution and LV cables	-	-	-	-	-	-
84	Distribution substations and transformers	711	250	250	250	250	250
85	Distribution switchgear	-	-	-	-	-	-
86	Other network assets	-	-	-	-	-	-
87	**System growth expenditure**	711	250	750	2,750	350	3,250
88	*less* Capital contributions funding system growth	-	-	-	-	-	-
89	**System growth less capital contributions**	711	250	750	2,750	350	3,250
90							

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

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This information is not part of audited disclosure information.

sch ref			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
91								
92		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
93	**11a(iv): Asset Replacement and Renewal**		**$000 (in constant prices)**					
94	Subtransmission		1,557	2,125	75	380	2,190	725
95	Zone substations		2,118	100	900	1,195	600	190
96	Distribution and LV lines		1,545	3,655	5,480	4,083	3,953	4,653
97	Distribution and LV cables		846	-	-	-	380	-
98	Distribution substations and transformers		238	850	300	1,128	975	523
99	Distribution switchgear		416	475	430	432	1,032	575
100	Other network assets		8	-	-	-	-	-
101	**Asset replacement and renewal expenditure**		6,727	7,205	7,185	7,217	9,130	6,665
102	*less* Capital contributions funding asset replacement and renewal		-	-	-	-	-	-
103	**Asset replacement and renewal less capital contributions**		6,727	7,205	7,185	7,217	9,130	6,665
104								

sch ref			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
105								
106		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
107	**11a(v): Asset Relocations**							
108	*Project or programme**		**$000 (in constant prices)**					
109	Roading		59	200	100	150	-	95
110	Other		184	-	-	-	285	-
114	**include additional rows if needed*							
115	All other project or programmes - asset relocations		-	-	-	-	-	-
116	**Asset relocations expenditure**		243	200	100	150	285	95
117	*less* Capital contributions funding asset relocations		84	-	-	-	-	-
118	**Asset relocations less capital contributions**		159	200	100	150	285	95
119								

sch ref			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
120								
121		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
122	**11a(vi): Quality of Supply**							
123	*Project or programme**		**$000 (in constant prices)**					
124	SCADA		61	-	-	-	-	-
125	Network Automation		296	125	100	323	133	133
126	Generators		32	-	-	-	-	-
127	Digitial Radio Network		126	-	250	-	238	-
128	Other		116	-	-	2,425	750	435
129	**include additional rows if needed*							
130	All other projects or programmes - quality of supply		-	-	-	-	-	-
131	**Quality of supply expenditure**		630	125	350	2,748	1,121	568
132	*less* Capital contributions funding quality of supply		-	-	-	-	-	-
133	**Quality of supply less capital contributions**		630	125	350	2,748	1,121	568
134								

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

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This information is not part of audited disclosure information.

sch ref							
135		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
136	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
137	**11a(vii): Legislative and Regulatory**						
138	*Project or programme**	**$000 (in constant prices)**					
143	N/A	-	-	-	-	-	-
144	**include additional rows if needed*						
145	All other projects or programmes - legislative and regulatory	-	-	-	-	-	-
146	**Legislative and regulatory expenditure**	-	-	-	-	-	-
147	*less* Capital contributions funding legislative and regulatory	-	-	-	-	-	-
148	**Legislative and regulatory less capital contributions**	-	-	-	-	-	-
149							
150		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
151	**11a(viii): Other Reliability, Safety and Environment**						
152	*Project or programme**	**$000 (in constant prices)**					
153	Earthing (NERs and Resonant)	155	-	-	-	200	-
154	Tee Joint Removal	59	100	100	95	95	95
155	SWER Reinsulation	-	-	-	-	-	-
156	Digital radio network	1,420					
157	Other	(6)	900	3,890	903	663	333
158	**include additional rows if needed*						
159	All other projects or programmes - other reliability, safety and environment	-	-	-	-	-	-
160	**Other reliability, safety and environment expenditure**	1,628	1,000	3,990	998	958	428
161	*less* Capital contributions funding other reliability, safety and environment	-	-	-	-	-	-
162	**Other reliability, safety and environment less capital contributions**	1,628	1,000	3,990	998	958	428
163							
164		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
165	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
166	**11a(ix): Non-Network Assets**						
167	**Routine expenditure**						
168	*Project or programme**	**$000 (in constant prices)**					
169	Test Equipment	67	25	25	25	25	25
170	Plant and Tools	166	400	400	400	400	400
171	Vehicles	930	980	808	411	700	447
	Radio Equipment	1	5	5	5	5	5
	Office Furniture & Equipment	31	25	25	25	25	25
172	Land and buildings (up til 2019 included office equipm)	151	1,325	125	125	125	125
	IT Computers	334	532	525	275	700	225
173	Software	76	275	100	100	100	100
174	**include additional rows if needed*						
175	All other projects or programmes - routine expenditure	-	-	-	-	-	-
176	**Routine expenditure**	1,755	3,567	2,013	1,366	2,080	1,352
177	**Atypical expenditure**						
178	*Project or programme**						
179	N/A	-	-	-	-	-	-
184	**include additional rows if needed*						
185	All other projects or programmes - atypical expenditure	-	-	-	-	-	-
186	**Atypical expenditure**	-	-	-	-	-	-
187							
188	**Expenditure on non-network assets**	1,755	3,567	2,013	1,366	2,080	1,352

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**

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. EDBs 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		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions and emergencies	1,202	1,019	1,041	1,063	1,084	1,106	1,128	1,151	1,174	1,197	1,221
11	Vegetation management	2,239	2,141	2,082	2,020	1,952	1,936	1,918	1,956	1,937	1,976	2,015
12	Routine and corrective maintenance and inspection	3,706	3,058	3,019	2,977	2,928	2,986	3,046	2,992	3,052	3,113	3,175
13	Asset replacement and renewal	310	714	729	744	759	774	790	806	822	838	855
14	**Network Opex**	7,456	6,933	6,871	6,806	6,723	6,803	6,882	6,905	6,984	7,124	7,266
15	System operations and network support	4,106	4,333	4,425	4,519	4,609	4,701	4,795	4,891	4,989	5,088	5,190
16	Business support	4,385	4,180	4,268	4,360	4,446	4,535	4,626	4,718	4,813	4,909	5,007
17	**Non-network opex**	8,492	8,513	8,693	8,879	9,055	9,236	9,421	9,609	9,801	9,997	10,197
18	**Operational expenditure**	15,948	15,445	15,564	15,685	15,778	16,039	16,303	16,514	16,785	17,121	17,464

19		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
20	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
21		**$000 (in constant prices)**										
22	Service interruptions and emergencies	1,202	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
23	Vegetation management	2,239	2,100	2,000	1,900	1,800	1,750	1,700	1,700	1,650	1,650	1,650
24	Routine and corrective maintenance and inspection	3,706	3,000	2,900	2,800	2,700	2,700	2,700	2,600	2,600	2,600	2,600
25	Asset replacement and renewal	310	700	700	700	700	700	700	700	700	700	700
26	**Network Opex**	7,456	6,800	6,600	6,400	6,200	6,150	6,100	6,000	5,950	5,950	5,950
27	System operations and network support	4,106	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250
28	Business support	4,385	4,100	4,100	4,100	4,100	4,100	4,100	4,100	4,100	4,100	4,100
29	**Non-network opex**	8,492	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350
30	**Operational expenditure**	15,948	15,150	14,950	14,750	14,550	14,500	14,450	14,350	14,300	14,300	14,300
31	**Subcomponents of operational expenditure (where known)**											
32 *33*	Energy efficiency and demand side management, reduction of energy losses	-	-	-	-	-	-	-	-	-	-	-
34	Direct billing*	-	-	-	-	-	-	-	-	-	-	-
35	Research and Development	-	-	-	-	-	-	-	-	-	-	-
36	Insurance	358	330	330	330	330	330	330	330	330	330	330

37 ** Direct billing expenditure by suppliers that direct bill the majority of their consumers*

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	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions and emergencies	-	19	41	63	84	106	128	151	174	197	221
43	Vegetation management	-	41	82	120	152	186	218	256	287	326	365
44	Routine and corrective maintenance and inspection	-	58	119	177	228	286	346	392	452	513	575
45	Asset replacement and renewal	-	14	29	44	59	74	90	106	122	138	155
46	**Network Opex**	-	133	271	406	523	653	782	905	1,034	1,174	1,316
47	System operations and network support	-	83	175	269	359	451	545	641	739	838	940
48	Business support	-	80	168	260	346	435	526	618	713	809	907
49	**Non-network opex**	-	163	343	529	705	886	1,071	1,259	1,451	1,647	1,847
50	**Operational expenditure**	-	295	614	935	1,228	1,539	1,853	2,164	2,485	2,821	3,164

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref

				Asset condition at start of planning period (percentage of units by grade)							
Voltage	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
All	Overhead Line	Concrete poles / steel structure	No.	0.3%	2.2%	26.3%	59.2%	12.0%	-	3	3%
All	Overhead Line	Wood poles	No.	0.5%	1.1%	73.5%	21.3%	3.6%	-	3	5%
All	Overhead Line	Other pole types	No.	-	-	-	-	-	-	N/A	-
HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km	6.3%	3.9%	37.8%	19.2%	32.7%	0.1%	3	10%
HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km	-	0%	-	6%	94%	-	3	-
HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km	-	-	-	-	100%	-	3	-
HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Subtransmission Cable	Subtransmission submarine cable	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Zone substation Buildings	Zone substations up to 66kV	No.	-	-	-	50%	50%	-	4	-
HV	Zone substation Buildings	Zone substations 110kV+	No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Zone substation switchgear	22/33kV CB (Indoor)	No.	-	-	-	-	100%	-	4	-
HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.	-	-	-	21.4%	78.6%	-	3	-
HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.	3%	5%	17%	30%	45%	-	3	8%
HV	Zone substation switchgear	33kV RMU	No.	-	-	-	-	100%	-	4	N/A
HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.	-	-	-	14.0%	86.0%	-	3	-
HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.	-	-	-	-	100%	-	3	-

Company Name **Marlborough Lines Limited**
AMP Planning Period **1 April 2020 – 31 March 2030**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref					Asset condition at start of planning period (percentage of units by grade)							
36												
37												
38	**Voltage**	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
39	HV	Zone Substation Transformer	Zone Substation Transformers	No.	-	6.5%	12.9%	29.0%	51.6%	-	4	7%
40	HV	Distribution Line	Distribution OH Open Wire Conductor	km	1.5%	16.1%	34.5%	18.9%	28.8%	0.2%	3	2%
41	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km	-	0.0%	0.0%	0.0%	100.0%	-	4	-
42	HV	Distribution Line	SWER conductor	km	-	11.3%	57.1%	26.7%	4.9%	-	3	2%
43	HV	Distribution Cable	Distribution UG XLPE or PVC	km	2.26%	1.8%	0.0%	11.9%	84.0%	-	3	2%
44	HV	Distribution Cable	Distribution UG PILC	km	-	0.0%	0.0%	86.4%	13.6%	-	3	-
45	HV	Distribution Cable	Distribution Submarine Cable	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
46	HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	-	3.8%	12.5%	15.4%	68.3%	-	3	5%
47	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.	-	14.3%	38.1%	0.0%	47.6%	-	3	14%
48	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	1.8%	5.7%	19.4%	40.1%	31.7%	1.3%	3	5%
49	HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.	-	1.2%	65.9%	31.8%	1.1%	-	3	-
50	HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.	-	3.7%	39.6%	35.4%	21.3%	-	3	6%
51	HV	Distribution Transformer	Pole Mounted Transformer	No.	-	11.2%	42.1%	29.6%	16.6%	0.5%	3	2%
52	HV	Distribution Transformer	Ground Mounted Transformer	No.	-	2.3%	22.5%	49.9%	24.5%	0.8%	3	2%
53	HV	Distribution Transformer	Voltage regulators	No.	8.60%	8.6%	2.8%	65.7%	14.3%	-	3	10%
54	HV	Distribution Substations	Ground Mounted Substation Housing	No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
55	LV	LV Line	LV OH Conductor	km	6.60%	14.9%	33.9%	10.6%	5.5%	28.5%	2	4%
56	LV	LV Cable	LV UG Cable	km	-	0.1%	9.4%	24.6%	62.7%	3.3%	3	1%
57	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km	1.8%	7.3%	5.6%	45.2%	36.6%	3.5%	2	1%
58	LV	Connections	OH/UG consumer service connections	No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
59	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	-	0.0%	52.4%	29.5%	18.1%		4	-
60	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot	-	0.0%	0.0%	100.0%	0.0%	-	3	-
61	All	Capacitor Banks	Capacitors including controls	No.	-	100.0%	0.0%	0.0%	0.0%	-	2	-
62	All	Load Control	Centralised plant	Lot	-	0.0%	0.0%	33.0%	67.0%	-	4	-
63	All	Load Control	Relays	No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64	All	Civils	Cable Tunnels	km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Company Name **Marlborough Lines Limited**
AMP Planning Period **1 April 2020 – 31 March 2030**

SCHEDULE 12b: REPORT ON FORECAST CAPACITY

This schedule requires a breakdown of current and forecast capacity and utilisation for each zone substation and current distribution transformer capacity. The data provided should be consistent with the information provided in the AMP. Information provided in this table should relate to the operation of the network in its normal steady state configuration.

sch ref

7 ### 12b(i): System Growth - Zone Substations

sch ref	*Existing Zone Substations*	Current Peak Load (MVA)	Installed Firm Capacity (MVA)	Security of Supply Classification (type)	Transfer Capacity (MVA)	Utilisation of Installed Firm Capacity %	Installed Firm Capacity +5 years (MVA)	Utilisation of Installed Firm Capacity + 5yrs %	Installed Firm Capacity Constraint +5 years (cause)	Explanation
9	Cloudy Bay	4	17	N - 1	8	25%	17	47%	No constraint within +5 years	Planned load shift from Riverlands
10	Havelock	3	5	N - 1	2	59%	5	59%	No constraint within +5 years	
11	Leefield	2	5	N	1	36%	5	40%	No constraint within +5 years	
12	Linkwater	4	5	N	1	83%	5	84%	No constraint within +5 years	
13	Nelson St	14	17	N - 1	10	87%	17	96%	Transformer	Possible installation of fans to increase transformer ratings
14	Picton	7	17	N - 1	-	43%	17	43%	No constraint within +5 years	
15	Rai Valley	2	3	N	1	69%	3	69%	No constraint within +5 years	
16	Redwoodtown	13	17	N - 1	8	77%	17	83%	No constraint within +5 years	
17	Riverlands	9	10	N - 1	8	91%	10	71%	No constraint within +5 years	Planned load shift to Cloudy Bay
18	Seddon	7	10	N - 1	1	67%	10	66%	No constraint within +5 years	
19	Spring Creek	5	5	N - 1	4	90%	5	100%	Transformer	Possible transfer of load to Springlands
20	Springlands	10	17	N - 1	10	61%	17	65%	No constraint within +5 years	
21	Tapp	11	17	N - 1	5	66%	17	73%	No constraint within +5 years	
22	Ward	1	5	N	1	28%	5	28%	No constraint within +5 years	
23	Waters	7	17	N - 1	10	45%	17	49%	No constraint within +5 years	
24	Woodbourne	8	10	N - 1	5	82%	10	86%	No constraint within +5 years	
25						-				
26						-				
27						-				
28						-				

29 *[1] Extend forecast capacity table as necessary to disclose all capacity by each zone substation*

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**

SCHEDULE 12C: REPORT ON FORECAST NETWORK DEMAND

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

sch ref

sch ref								
7	**12c(i): Consumer Connections**							
8	*Number of ICPs connected in year by consumer type*				**Number of connections**			
9			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
10		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
11	*Consumer types defined by EDB**							
12	Residential		180	160	150	160	170	180
13	General		25	20	20	25	25	25
14	Commercial and Industrial		4	3	3	3	3	3
15	Irrigation		2	2	2	2	2	2
16	Other (MLL, unmetered, Street lights etc)		1	1	1	1	1	1
17	**Connections total**		212	186	176	191	201	211
18	**include additional rows if needed*							
19	**Distributed generation**							
20	Number of connections		153	125	135	150	165	185
21	Capacity of distributed generation installed in year (MVA)		1	1	1	1	1	1
22	**12c(ii) System Demand**							
23			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
24	**Maximum coincident system demand (MW)**	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
25	GXP demand		74	74	75	75	76	76
26	*plus* Distributed generation output at HV and above		1	1	2	2	2	2
27	**Maximum coincident system demand**		75	76	76	77	77	78
28	*less* Net transfers to (from) other EDBs at HV and above		-	-	-	-	-	-
29	**Demand on system for supply to consumers' connection points**		75	76	76	77	77	78
30	**Electricity volumes carried (GWh)**							
31	Electricity supplied from GXPs		396	398	400	402	404	405
32	*less* Electricity exports to GXPs		-	-	-	-	-	-
33	*plus* Electricity supplied from distributed generation		15	17	18	18	19	19
34	*less* Net electricity supplied to (from) other EDBs		-	-	-	-	-	-
35	**Electricity entering system for supply to ICPs**		411	415	417	420	422	424
36	*less* Total energy delivered to ICPs		395	397	399	401	403	405
37	**Losses**		17	18	18	19	19	19
38								
39	**Load factor**		63%	63%	62%	63%	63%	62%
40	**Loss ratio**		4.1%	4.3%	4.3%	4.5%	4.6%	4.5%

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
Network / Sub-network Name	

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned and unplanned SAIFI and SAIDI on the expenditures forecast provided in Schedule 11a and Schedule 11b.

sch ref		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
8							
9	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	56.8	65.0	65.0	65.0	65.0	65.0
12	Class C (unplanned interruptions on the network)	124.7	85.0	85.0	85.0	80.0	80.0
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.34	0.35	0.35	0.35	0.35	0.35
15	Class C (unplanned interruptions on the network)	1.50	0.71	0.71	0.67	0.67	0.67

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'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?	2.5	MLL has no dedicated/specific asset management policy aside from Section 6.1.1 of the previous AMP (revised in the under development AMP), however, asset management through public safety, H&S, environmental, quality management (IMS) system which is fully endorsed by top management. Key people invovled in development of IMS system. Also, SCI, AMP (although this isn't dissemintated as well as it could be to staff). Ultimately, no change from last AMMAT response. MLL should consider a dedicated AM Policy outside of the AMP which is readily available and clearly articulated to		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?	2.5	The 2018 AMP contains an AM Strategy which expands on the AM Policy. This AM Strategy was deliberately written in conjunction with the AM Policy to ensure consistency. A review of this AM Strategy indicates that it is aligned to Marlborough Lines overall corporate direction. The strategy has been reviewed/updated for the 2019 AMP.	Mll has a number of strategies, policies and stakeholders. The AMP provides a summary of these.	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?	2.5	MLL's AMP covers asset classes and lifecycle maintenance approach to assets (i.e. is effectively MLL's asset strategy). The lifecycle strategies are heavily dependent on the asset class. Strategy drivers include economic, public safety, asset criticality etc.	MLL owns and operates a large volume of assets, many of which serve very different purposes. Even within the same asset classes, some assets are highly critical while others are not (e.g. 33kV poles vs low voltage poles).	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?	2.5	MLL has an AMP which is compiled by several key staff. The AMP firstly breaks down the network by asset class, and then secondly considers activities that are required as an assets' life progresses (principally through testing and inspections, minor mainteance and renewals). MLL acknowledges that further focus/planning could be placed around decommissioning and disposal of assets.		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	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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?	2.5	No change from 2018 AMMAT response. MLL should consider formalising the communications through the development of a communications plan so that there is more structure around the dissemination of the AMP and records of its dissemination	MLL disseminates/communicates the plan to relevant parties but not necessarily in a formalised manner.	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?	2.5	Key staff's job descriptions reference AMP activities and objectives. The AMP itself details repsonsiiblities for senior staff in the accountibilities and responsibilities for asset management section.		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)	2.5	Expenditure set out in the AMP (both capex and opex) is relatively consistent year on year. As such, the resourcing currently in place is generally sufficient. Major unplanned events such as the November 2016 earthquake resulted in additional OPEX and a reallocation of resources to focus on that. Additional external resource was brought in to assist with that. Where there are resource constraints, external contractors have been brought in on rare occasions (Havelock Zone substation transformer replacement and Rai Valley Zone substation upgrade are relatively recent examples) to ease		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?	2.5	No siginficant changes from 2016 AMMAT response. The MLL AMP includes a high level risk register that identifies high level exposure to 'Electricity Network Risks'. Such risks have been used to compile the MLL Emergency Preparedness Plan, an in depth procedure for network recovery and operation following/during major events. The EPP was recently revised to ensure appropriateness and current relevance.	Emergency events can cause major interuptions to MLL's Network so appropriate plans need to be in place to minimise the effect of these.	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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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	No significant changes from 2018 AMMAT response. The AMP sets out the responsibilities and accountability of Management staff		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?	2.5	No siginficant changes from 2018 AMMAT response. Because of the relatively consistent nature of work programmes and resulting expenditure (including forecasts), resourcing is largely a contium of what has gone before. However, asset management is generally one of many focuses for a limited number of key staff. To faciliate improvements in Asset Management, MLL could consider creating a role primarily to asset management. This would	Resources include finance, staff, plant and materials etc.	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?	2.5	No significant changes from 2018 AMMAT response. Key AM targets and annual performance against those targets are published annually within the MLL Annual Report. The report includes several supply reliability measures that were achieved. AM requirements are also discussed during regular board meetings and management meetings		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	If works are outsourced then they are overseen/managed by an MLL staff member (engineer or project manager). Also, MLL Network Design and Construction Manuals are provided to all major contractors. Deviations from plans are limited through the control of components allocated to each task. Asset inspections are performed through the use of internal asset inspectors; data collection is controlled through the use of infield electronic devices for recording asset data.	MLL occassionally sources external contractors to undertake asset inspections and/or maintenance and more rarely, asset renewal works.	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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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)?	2.5	MLL AMP and position descriptions largely cover this off. MLL does not have a formal succession plan or assessment of human resource requirements which is a potential area for improvement. As per previous comment, MLL could consider creating a role specifically dedicated primarily to asset management.		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?	3	Fundamentally, the recruitment of people to fit job descriptions who already largely have required competenices. For graduates, training programmes/external courses are attended to develop competencies. MLL has a competency framework which is managed. Mango also houses training records for all staff. Annual professional development plans are also carried out by managers with their staff.		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?	3	No significant change from 2018 AMMAT response. Competency requirement registers for Network and Contracting staff are maintained though the ISO9001 system. This highlights regular training requirements, levels of staff competency, and required refresher training dates. A key focus of the organisation is continued training and professional development for all staff. Key staff attend various industry training and/or conference events such as EEA Asset management training and the EEA asset management forum.		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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	3	A number of artefacts here - Annual Report, quarterly newsletters, AMP, specifc letters to targetted stakeholders (e.g. vineyards and tradespeople working near overhead lines). In addition to what is disclosed annually through the MLL AMP, regular planning meetings between the BoD and exec staff, Network and Contracting management, and Network and Operations/Faults staff are held. Annual releases of the company report and Statement of Corporate Intent both communicate the importance of network reliability.		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	MLL's AMP largely covers this off and outlines the asset management system and interactions between them. The ISO9001 system provides an overall process map of how these systems inter-relate with one another.		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	Information systems are in place for the management of asset data. The primary system is the EAM asset database, as well as MLL's GIS. MLL SCADA also collects real time data on asset utilisation in the field. Primary users of asset data and asset management staff have been consulted to determine the level and type of data required for planning asset management related tasks.	MLL has a number of information systems which provide various functionalities for the recording and management of asset data. The data is used for various means - reporting purposes, asset management planning etc.	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?	3	Staff are employed to populate asset databases and the GIS when asset inspections, renewals or replacements occur. MLL has developped a mobile application for collecting asset information in the field and is currenlty expanding the use of the mobile applications. MLL could potentially improve in this area by creating an asset management/data team with more		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.	

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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.	

Company Name	Marlborough Lines Limited	
AMP Planning Period	1 April 2020 – 31 March 2030	
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
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	3	The AMP discloses what information systems are in place within the company, what information they hold and the typical users of such systems. All systems used within MLL are typical to those used in other EDBs and have been selected based on their abilities to fulfil the identified needs of MLL through a detailed procurement process.		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	The AMP and Emergency Preparedness Plan develop a risk register and disclose risk mitigation strategies. Physical asset risks are implicitly considered when new assets are designed or when opportunities arise to renew assets arise. Asset failures are examined to identify any systematic issues. Executive staff are involved in regulatory working groups with the aim of minimising regulatory risk.		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	The risk chapter of the AMP develops a number of risk treatments, which in turn determines required activities and resources to mitigate risks. This is a key driver in determining training and competency needs of MLL staff		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	Regular contact is maintained with the Electricity Authority and the Commerce Commission to ensure currency with existing and emerging regulations, including the attendance of industry workshops. Executive Staff regularly receive bulletins, alerts and newsletters from consultants, regulators and government agencies.		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

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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	The Network Design Standards manual are controlled documents, where changes must be approved by the Engineering Manager or Operations Manager. Most other processes affecting AM outcomes such as billing, payments, new connections etc are covered by ISO9001 document controls. Components are procured from specified sources only, and these are documented within the Standards. MLL is also accredited with ISO14001, 18001 and NZS7901		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.
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?	2.5	All major maintenance tasks are performed by MLL Contracting after provision of an estimate to Network, which is then accepted dependant on cost. All work performed within the network is performed to the level demanded by the Design and Construction Standards. Asset inspections are performed by experienced individuals and information collected on inspections is controlled through the use of asset inspection templates.		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?	3	Asset condition and performance is firstly monitored by strict adherence to the Network Design and Construction Standards, with tight control of variations from the Standards. Failure of in-service assets is monitored, with serious failures or possible patterns being referred to Engineering for analysis. Regular field inspections are carried out and result trending provide ongoing condition assessment.		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	First response for asset failures impacting is to the Control Room who will dispatch staff to isolate and inspect faulted assets. Asset faults and failures are investigated to identify any systematic failures or recurring fault causes that can be corrected. Major incidents are investigated by engineering and management staff to identify point of failure and likely causes to prevent recurrences.		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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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.
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.	

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	3	MLL undergoes a formal audit procedure for all major compliance standards including ISO 9001, ISO 14001, ISO 18001 and NZS 7901 on an annual basis. Reports are provided with areas where potential improvements can be focussed upon.		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.
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	Faults or defects within the network discovered by maintenance or fault staff are reported to the control room if a safety or network integrity issue may arise and reported to Engineering for analysis and correction. Network fault reviews identify sections of the network where issues regularly arise and can be minimized by the installation of protective devices.		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?	2.5	Continual improvement is a core element of ISO9001. Risk is continually considered in ongoing engineering design. Network fault reviews occur to identify regular defects which are then remedied where possible. Annual customer surveys are performed with regard to electricity lines charges and quality of supply to ensure customer satisfaction.		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	Key staff involved with AM regularly attend industry conferences, courses and trade shows, such as those hosted by the EEA. MLL staff perform visits to other EDBs around the country and AM methods are discussed and reviewed. MLL moved to modern GIS and AM software packages in order to perform AM related activities at an increased level.		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.

Company Name	**Marlborough Lines Limited**
AMP Planning Period	**1 April 2020 – 31 March 2030**
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
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.
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.

Company Name Marlborough Lines Limited

For Year Ended 31 March 2020

Schedule 14a Mandatory Explanatory Notes on Forecast Information

(In this Schedule, clause references are to the Electricity Distribution Information Disclosure Determination 2012 – as amended and consolidated 3 April 2018.)

1. This Schedule requires EDBs to provide explanatory notes to reports prepared in accordance with clause 2.6.6.

2. This Schedule is mandatory—EDBs must provide the explanatory comment specified below, in accordance with clause 2.7.2. This information is not part of the audited disclosure information, and so is not subject to the assurance requirements specified in section 2.8.

Commentary on difference between nominal and constant price capital expenditure forecasts (Schedule 11a)

3. In the box below, comment on the difference between nominal and constant price capital expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11a.

Box 1: Commentary on difference between nominal and constant price capital expenditure forecasts

Please refer to section 10.1.1 of the AMP.

Commentary on difference between nominal and constant price operational expenditure forecasts (Schedule 11b)

4. In the box below, comment on the difference between nominal and constant price operational expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11b.

Box 2: Commentary on difference between nominal and constant price operational expenditure forecasts

Please refer to section 10.1.1 of the AMP.