Before an Independent Hearings Panel
appointed by the Waimakariri District Council

under: the Resource Management Act 1991

in the matter of: Submissions and further submissions in relation to the proposed Waimakariri District Plan, Variation 1 and Variation 2

and: Hearing Stream 1: Part 1 General Matters, Definitions, Strategic Directions and Urban Form and Development.

and: **MainPower New Zealand Limited**
Submitter 249

Statement of Evidence of Mark Appleman

Dated: 1 May 2023

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STATEMENT OF EVIDENCE OF MARK APPLEMAN

INTRODUCTION

1 My full name is Mark Henry Appleman.

2 I am the General Manager of Network Strategy and Planning at MainPower New Zealand Limited (*MainPower*) (submitter number 249).

3 In this role I am responsible for developing the strategy for managing MainPower's network assets and then delivering the annual work plan to develop and maintain the MainPower network.

4 I have a BE (hons) in electrical engineering from Canterbury University.

5 I have over 20 years' experience working within the electrical energy sector. I have held my current role at MainPower since 2016. Prior to this my work experience includes:

5.1 working as the Electrical Systems and Energy Manager at Perth Airport from 2012 to 2016; and

5.2 more than 11 years working at Schneider Electric, first as a Research and Design Engineer and later as National Manager Engineering and Projects.

6 In these roles I have been responsible for managing the capital development and maintenance of strategic assets.

7 I am authorised to provide evidence on behalf of MainPower for the proposed Waiamakriri District Plan review.

Code of conduct

8 While I am an employee of MainPower, I have expertise in the field of electrical engineering and confirm that I have read and agree to comply with the "Code of Conduct for Expert Witnesses'" contained in the Environment Court Practice Note 2023. In particular, unless I state otherwise, the technical matters on which I give evidence arewithin my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

SCOPE OF EVIDENCE

9 My evidence will address:

9.1 MainPower's role as the electricity distribution network for the North Canterbury and Kaikōura regions, specifically in the Waimakariri District;

9.2 MainPower's operations and the importance of enabling the efficient maintenance, use, development and upgrade of electricity infrastructure; and

9.3 The reasons for MainPower's submissions on the proposed Waimakariri District Plan (*Proposed Plan*).

SUMMARY OF EVIDENCE

10 MainPower, as an electricty distributor or lines company, is responsible for constructing and maintaining safe, secure and reliable network services to the people of North Canterbury.

11 MainPower's core purpose is to enable a cleaner and brighter future for our communities. MainPower is owned by the electricity consumers of North Canterbury and our corporate vision is "creating a smarter future to deliver local value".

12 MainPower's goal is to lead the transition to a smarter network of the future. This requires us to understand how our customers will use electricity and network services as new technologies, increased consumer choice and control, and the decarbonisation of the economy continues.

13 MainPower's electricity network comprises underground cables, overhead lines, substations, transformers, kiosks, electricity structures (poles/pylons, earth rods and associated buildings) and access tracks. MainPower is responsible for the establishment, operation, maintenance and upgrade of the electricity distribution network in North Canterbury.

14 MainPower undertakes, and will continue to undertake, these activities in accordance with relevant legislation, particularly the Electricity Act 1992 and the Utilities Access Act 2010, National Industry Codes of practice and Electricity Network Technical Specification Standards and Council requirements.

15 Like other electricity distribution businesses MainPower is required to disclose its network performance, particularly in respect of quality and reliability of supply, under Part 4 of the Commerce Act 1986. We are exempt from regulation under Part 4 of the Commerce Act 1986, due to our consumer ownership

16 We are customer driven and customer focussed. The location of the network and its development is driven by demand for electricity.

17 MainPower in general supports the direction of the Proposed Plan and the approach taken by the Council in its development. We do however seek amendments to various plan provisions to provide greater clarity and certainty around the application and interpretation of proposed rules and to better enable the secure and efficient operation of the electricity distribution network.

18 MainPower's submissions are based on a desire to achieve sustainable environmental outcomes and meet customer requirements for a safe and reliable electricity distribution network.

19 This evidence provides an overview of MainPower's importance in the District and its primary concerns with the Proposed Plan as notified. I understand future hearings will consider MainPower's relief in more detail, and so further evidence will be filed for those relevant topics.

OVERVIEW OF MAINPOWER

20 MainPower owns and operates the electricity distribution network that provides power to North Canterbury. Our aim is to consistently deliver a safe, secure and reliable supply of electricity to our customers. MainPower has a long history in the North Canterbury region distributing electricity for around 100 years.

21 MainPower's distribution network spans from the Waimakariri River in the South up to the Puhi Puhi Valley north of Kaikōura, and from the Canterbury coast inland to Lewis Pass. We provide electricity distribution services to more than 43,000 North Canterbury homes and businesses.

22 Growth in the region, particularly with new subdivisions, has brought us close to 3,000 new consumers during the past three years. We are committed to contributing to a bright future for our region by delivering an electricity distribution network that is ready and fit for purpose for the future.

23 MainPower's network serves a diverse range of customers, spread over a variety of terrains with different challenges. For planning purposes, our network is divided into three regions:-

23.1 Kaikōura;

23.2 Hurunui; and

23.3 Waimakariri.

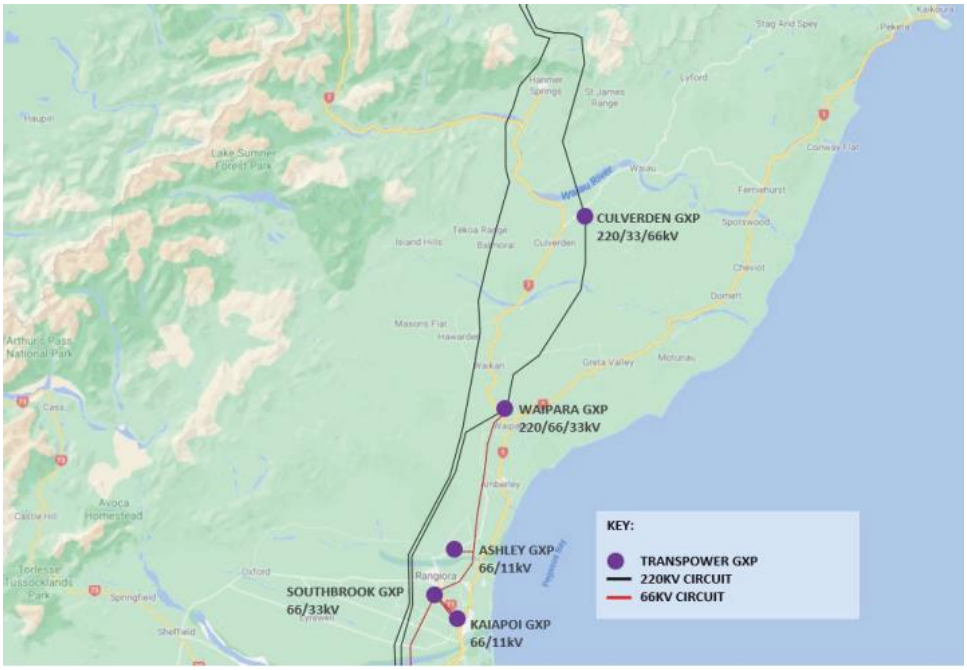
Figure 1: MainPower Network Area

24 In New Zealand, electricity produced by generation companies (like Trustpower, Meridian, and Contact) is transmitted from the point of generation around the country via the National Grid (which is owned and operated by Transpower).

25 Electricity distribution network operators like MainPower take delivery of electricity from Transpower at various locations in the National Grid known as Grid Exit Points (*GXPs*).

26 The purpose of such facilities is to connect and transform the very high voltages of electricity transmitted by Transpower's network (typically 220,000 Volts in North Canterbury) down to sub-transmission voltages that are managed by MainPower (typically at 66,000V or 33,000V). Currently there are three GXPs within the Waimakariri District – at Southbrook, Kaiapoi and Ashley. There are also GXPs at Culverden and Waipara.

Figure 2: MainPower's North Canterbury Transmission Grid



27 MainPower distributes these sub-transmission voltages to several substations located around its network via a series of critical sub-transmission lines and cables. At zone substations, electricity is transformed from these sub transmission voltages down to lower voltages. Power is then further distributed via a high and low voltage local network (either via overhead lines or underground cables) which serves anywhere between one and a few hundred (or even a thousand customers). Often the transformation of sub transmission voltages is 66,000V or 33,000V to 11,000V, and then from 11,000V to the 400V (three phase) / 230 volts (single phase) used in the home.

28 Electricity is distributed by a linear and interconnected network. As a distribution business, MainPower has no option but to receive electricity from the small number of fixed GXPs within its network area. The configuration of our network is constrained or shaped by where our electricity comes from, and the capacity of supply that each GXP can provide.

29 The sub-transmission lines and substations owned by MainPower are key to distributing electricity to communities and business across North Canterbury.

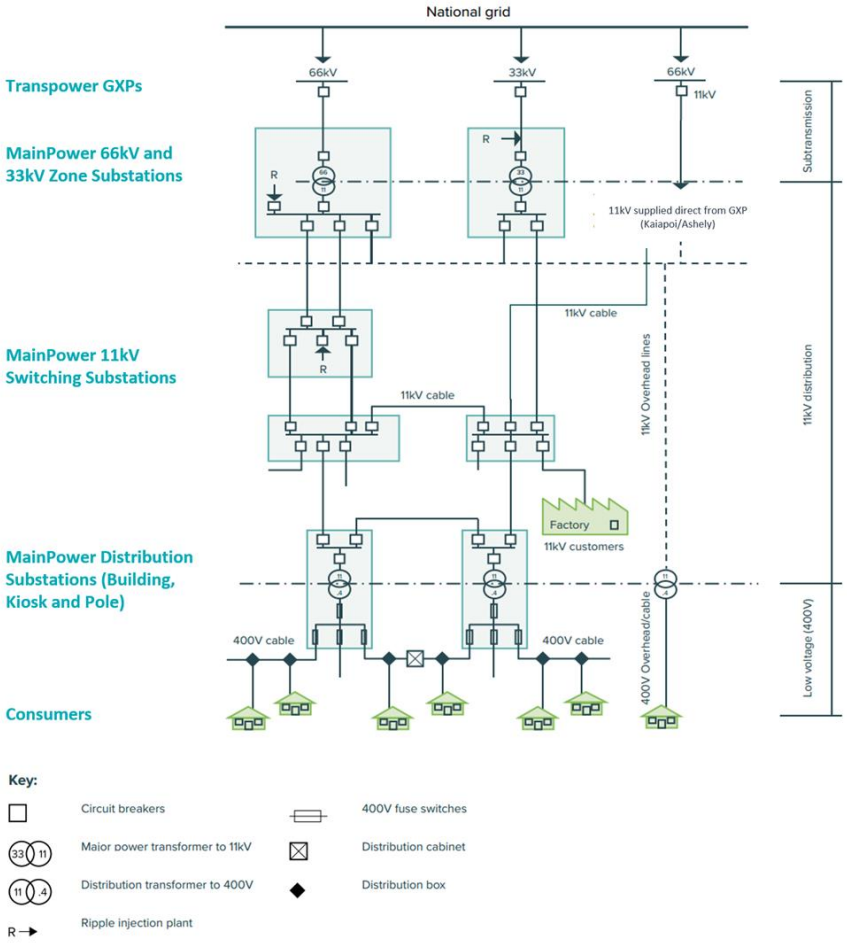
30 As a result:

30.1 A substation or sub transmission line in one part of the network or district can be critical to the supply of electricity to customers or areas a considerable distance away; and

30.2 If these assets are impacted or constrained in any way the scale of disruption can be significant.

31 To support safe reliable power supply to our consumers, a number of MainPower assets can be interconnected. In some cases, mainly rurally, this is not the case.

Figure 3: Basic MainPower network architecture



32 MainPower's role as an electricity distribution business in the electricity sector does not include the selling of electricity direct to consumers. This is true for all modern electricity distribution businesses in New Zealand. Rather, the day-to-day sale of electricity to consumers is undertaken by electricity retailers who purchase the electricity from generators on the wholesale market and sell it to their customers. MainPower owns a small electricity retail brand (Kakariki Power Limited) which supplies electricity to MainPower's own sites and retails to a small number of commercial and industrial customers.

33 MainPower also owns a small hydrogeneration plant at Mount Hutt and is undertaking the development of the Mt Cass Wind Farm at Waipara through its subsidiary Mt Cass Wind Farm Limited. We are exploring options for solar generation through solar panels on our own building and a feasibility study on establishing a solar farm at West Eyreton.

34 MainPower is continually investing in the operation and development of its network to cater for growth and to enhance the resilience of the network. Over the next ten years, we are forecasting network operational expenditure of $90 million, underpinned by our programme of inspection, testing and monitoring. Over the same period, we are forecasting total capital expenditure of $250 million across our network. This expenditure is necessary to meet increased demand for electricity from major industrial customers and continued growth in residential locations, as well as maintenance of safety levels and asset condition.

35 We have seen unprecedented growth in electricity demand from rapid large-scale development in the Waimakiriri District. This growth is from both residential and commercial electricity users and exists across urban and rural areas. Rapid and extensive growth of residential areas around Rangiora, Pegasus, Ravenswood and Kaiapoi has necessitated reinforcement of the network, as has the expansion of commercial and industrial areas and major electricity users in the District.

36 In rural areas, we have continued to reinforce and upgrade our network to meet the needs of our primary producers. Irrigation infrastructure across North Canterbury is powered by MainPower's network and significant investment has been made over the past 10 to 15 years to ensure users have the electricity they need.

37 While conventional demand increases, MainPower is also subject to (and is adapting to meet) rapidly evolving customer expectations of what an electricity distribution business is and should or could be. These expectations are fuelled by new technology that is quickly changing customer behaviour – as the uptake in electric vehicles gathers momentum, the electrification of process heat shifts gears and the greening of infrastructure becomes more widespread.

38 As business and communities increasingly rely on technology, and as New Zealand steps up its decarbonisation to respond to climate change and reduce carbon emissions, the need for a reliable, secure, and efficient electricity network is becoming ever more critical. This is both a significantly challenging time for MainPower, and an incredibly exciting one.

39 In response to these challenges MainPower has developed a strategy for how it responds to these challenges and continues to

provide value to its communities – MPowered Future. The network is a key part of this strategy as is MainPower's generation and retail activities.

MAINPOWER'S NETWORK AND ACTIVITIES IN THE WAIMAKARIRI DISTRICT

40 MainPower's network in Waimakariri includes:

40.1 Five zone substations, where electricity is managed and transformed from sub-transmission voltages down to lower voltages;

40.2 Sub transmission lines and associated support structures – which provide the critical link between zone substations;

40.3 High and low voltage lines and associated poles (as well as various pole mounted equipment) which connect zone substations with hundreds of distribution or building substations and kiosks, and ultimately to electricity customers; and

40.4 Ground mounted distribution cabinets and distribution boxes that manage the supply of power to individual locations.

41 Through our network, we provide electricity to approximately 29,800 individual customers or connection points throughout Waimakariri. Individual customers or connection points range from single dwellings requiring approximately 5KW at peak demand through to major industrial users who require many megawatts at their peak.

42 The vast majority of MainPower's network in the Waimakariri District is overhead in rural areas and underground in urban townships. In more recently established urban/residential and commercial areas around Waimakariri, the electricity network is largely underground.

43 Individual poles or spans (i.e. sections of line) will often support or contain multiple circuits - which are usually three individual lines or conductors operating at the same voltage. Specifically, many poles will support both 11,000V and 400V circuits, with the higher voltage located one meter or so directly above the lower voltage. Similarly, poles or spans may include sub transmission circuits located above 11,000V and / or 400V circuits. In some cases, poles and spans will include two different circuits operating at the same voltage. These arrangements are standard practice around the New Zealand.

44 The vast majority of MainPower's sub-transmission network in Waimakariri (whether overhead or underground), as well as its ground mounted distribution substations, kiosks and cabinets, are

located within the road corridor. This is standard practice throughout the country as the location of utilities within the road corridor is enabled, authorised and protected by legislation. In a small number of areas, the sub transmission network extends over boundary.

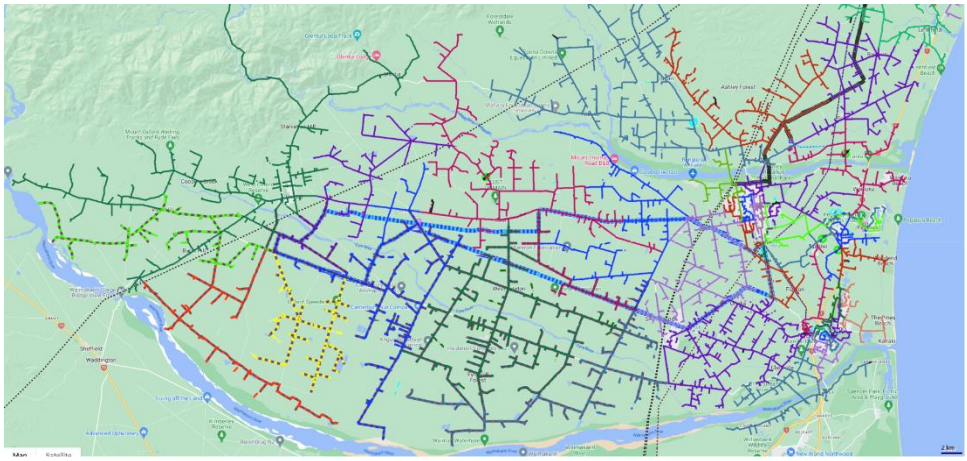
45 MainPower's 11,000V network is predominantly located within road corridors. However, where electricity is supplied to large rural landholdings and / or to major commercial or industrial users, the 11,000V network will often extend over boundary to meet customer needs.

46 The low voltage network frequently traverses both road reserve and over boundary. Particularly in rural areas, the low voltage network is characterised by pole-mounted transformers in the road reserve converting electricity down to 400V, with long over boundary spans then transporting power to rural residential dwellings and / or farm buildings etc.

47 Networks located over boundary and established prior to 1993 are enabled, authorised and protected by the Electricity Act 1992. Over boundary networks established after this date are generally authorised by private property arrangements – particularly easements.

48 Zone substations are located on MainPower or Transpower owned sites.

Figure 4: MainPower's sub transmission and distribution network



DAY TO DAY WORK ON THE NETWORK

49 Our work frequently involves installing, maintaining/repairing, and upgrading our lines, poles, and cables, as well as maintaining and upgrading equipment such as transformers (at ground level or on

poles), substations (both large and small), kiosks and distribution cabinets. We also have a building, facilities and ground works program.

50 MainPower has a suite of specifications and standards which govern our assets and how work on the network is to be carried out. These apply consistently across our activities and assets on the entire MainPower network (whether in Waimakariri or elsewhere) and include:

50.1 Design standards – which contain numerous detailed requirements setting out how components of the network and particular equipment are designed and configured. Among other matters, these set the design of substations, cable arrays, earthing systems and overhead lines around our network. These are often based on industrial or manufacturer standards and specifications, applied to our specific network context.

50.2 Equipment specifications – which set out the individual equipment, materials and components to be used on the network. The specifications cover off numerous matters as diverse as the selection criteria for soft and hard wood power poles; the particulars of metal shells, cabinets, or kiosks within which distribution transformers and switchgear are housed; and the circuit breakers we use within our zone substations.

50.3 Technical specifications – which dictate how our network is managed and activities in relation to it are carried out. These include asset inspection regimes; requirements for excavation, backfilling and the restoration of services; the management of hazardous substances; environmental management; and procedures when installing specific equipment.

51 Technical specifications also set out specific maintenance programmes for each of our asset classes. All works roughly fall into the following categories:

51.1 Scheduled Maintenance – work carried out on network assets to a predetermined schedule and allocated budget;

51.2 Non-scheduled Maintenance – work that must be performed on network assets outside a predetermined schedule, but which does not constitute emergency work; and

51.3 Emergency Maintenance – work that must be carried out on network assets that requires immediate repair.

52 Maintenance work also involves activities such as cutting trees near lines where they threaten the safe operation of the network, re-tightening components (such as the lines themselves), and pole or tower foundation refurbishment.

53 Our approach to asset replacement (which we define as works to restore, replace or renew an existing asset) is based on asset health modelling which we are in the process of moving to a condition based risk management framework. This framework utilises asset information, engineering knowledge and experience to define, justify and target asset replacements.

54 MainPower also has works that create a new asset or improve an existing asset beyond its existing capacity as defined in the Electricity Act 1992.

55 Most of the works we undertake are largely of short duration and take less than a day. This minimises any disruption to the public.

56 To undertake this work, we employ 190 people. Our staff are either based at our head office in Rangiora or in our depots at Culverden and Kaikōura.

NETWORK REINFORCEMENT IN THE WAIMAKARIRI DISTRICT

57 MainPower's activities and operations in the Waimakariri District (and across our wider network) are guided by a rolling 10-year asset management plan. This sets out our asset management policy, strategy, practices, work plan and expenditure forecasts for the next decade.

58 As part of our asset management programme, we are constantly monitoring, modelling and forecasting low, mid and high electricity peak load demand and growth scenarios across the network.

59 For the Waimakariri District we are currently forecasting electricity network peak load growth in excess of 15% over the next 10 years.

60 This increase is particularly related to electricity demand from the residential sector, with significant ongoing growth expected - particularly around Rangiora and Ravenswood/Pegasus. At the same time, we are also projecting growth in electricity demand from commercial premises, businesses and industrial uses as the region continues to prosper and from increased uptake in electric vehicles as New Zealand looks to electrify transport.

61 This is placing increased demand on the network and our existing infrastructure. While there is some nuance to these demands, they can be broadly summarised as a heavy reliance on a small number

of GXPs and capacity constraints on our sub transmission network and at certain zone substations.

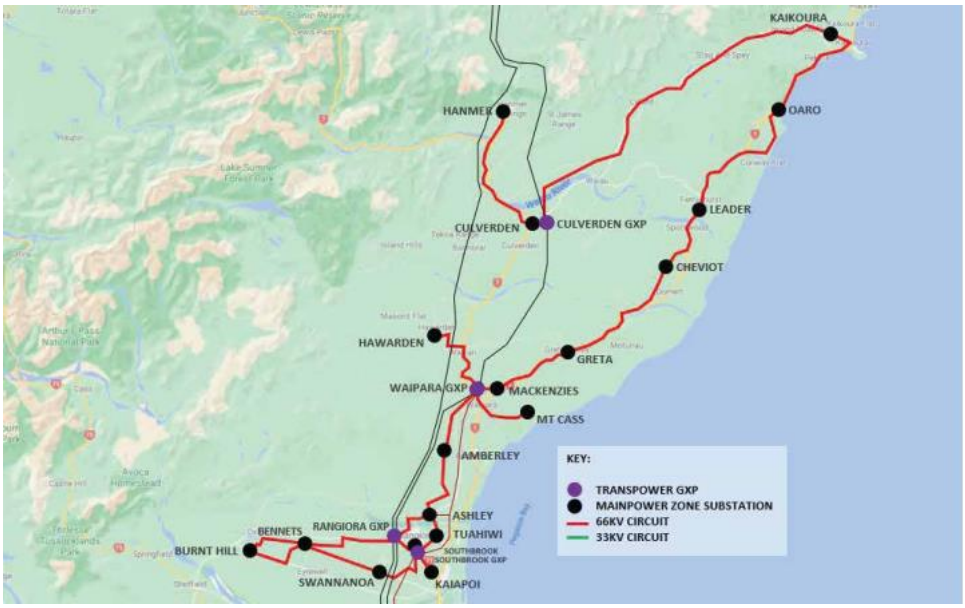
62 To meet this expected demand, significant reinforcement of our network is both required and planned.

63 MainPower is working closely with Transpower to co-ordinate integration between the Transpower and MainPower networks.

64 MainPower is planning for the establishment and development of a new zone substation in Tuahiwi. To connect this key facility MainPower will again reinforce and upgrade parts of our sub transmission lines network.

65 Numerous other smaller substation reinforcement and lines upgrading activities are also planned throughout the district over the same period. Collectively, this work programme will ensure MainPower can continue to meet electricity needs of our customers in the Waimakariri District into the future.

Figure 5: Long-Term reinforcement of network to meet electricity demand



66 Our programme of work in the Waimakariri District is (and will continue to be) updated annually – always ensuring that MainPower effectively has a rolling 10-year network investment, reinforcement and upgrade plan in place. Depending on how forecast demand materialises, certain projects may be brought forward or pushed back. Similarly, new projects (not currently in train) may be brought online, and / or previously planned projects may be not be pursued. This flexibility and agility ensures MainPower can take in to account actual / observed demand, and any unexpected changes in our

operating environment. It is a fine balance however, as we seek to provide an upgraded network in step with customer requirements, whilst also ensuring installed assets are not underutilised.

67 The need for flexibility in our work programme is increasingly important as forecasting the specifics of load growth is ever more complex. Customer behaviour and demand is increasingly influenced by a range of factors and new technologies that do not neatly fit within traditional models. There is a degree of uncertainty over the medium term regarding the rate of electric vehicle uptake; how (or when) large industrial boilers will be converted to renewable electric alternatives; and the future use of solar voltaic, distributed generation and battery systems across our network.

68 MainPower seeks a number of amendments to the Proposed Plan to ensure our most critical assets are appropriately protected, and continued investment in the network is supported and enabled. These amendments will ensure we can continue to power the homes, business and communities of the Waimakariri District.

KEY CONCERNS AS PART OF THE STRATEGIC DIRECTIONS CHAPTER AND BROADER PLAN PROCESS

69 Below I address MainPower's key issues in the broader plan process – focussing on the issues that are particularly relevant to the Strategic Directions Chapter and broader plan process.

70 As stated in our original submission, MainPower supports the intention and approach of the Strategic Directions chapter to the extent that it relates to the electricity distribution network. We do however consider that amendments are necessary to address potential reverse sensitivity effects on MainPower's Significant Electricity Distribution Lines (SEDL as defined in the Proposed Plan), particularly when buildings and other activities get too close to electricity lines.

71 MainPower supports the overall approach of the Proposed Plan, but we believe it could be improved by providing better linkages between the Energy and Infrastructure chapter and the rest of the Plan. This would make it easier for Plan users to understand the effect of rules that protect electricity infrastructure and reduce the risk of interference with our assets.

72 In the final section of my evidence, I will address the potential issues that could arise if the protection corridors are not maintained.

REASONS FOR INCLUDING SEDLS THROUGHOUT THE RELEVANT ZONE CHAPTERS

73 MainPower's lines and other assets are legally protected either by easements in the case of assets built after 1993 and by the Electricity Act 1992 in the case of assets built pre-1993.

74 The Electricity Act 1992 does not prescribe what activities landowners can undertake in the vicinity of lines. The New Zealand Electrical Code of Practice for Safe Electrical Distances (*NZECP 34:2001*) sets minimum safe electrical requirement for structures and activities in relation to overhead lines and support structures.

75 MainPower's view is that clear rules throughout all sections of the Proposed Plan would improve clarity and reduce the likelihood of breaches of NZECP 34:2001and Electricity Act arising. This would then result in a reduced risk to landowners, and assist MainPower in safely and efficiently operating, maintaining and upgrading the SEDL network.

76 Having structures/fences under, or very near to, one of MainPower's SEDLs, and carrying out earthworks in close proximity to them:

76.1 Increases risk to people (particularly via electric shock or electrocution) and property (through increased risk of outages);

76.2 Complicates operation, maintenance and upgrading activities by adding significantly to costs and duration of works;

76.3 Can annoy occupiers;

76.4 Potentially impacts on the reliability of electrical supply as repair, maintenance and upgrading can be delayed and/or take longer; and

76.5 Can, if an electrical fault occurs, have the potential to cause significant harm as the structure may incur hazardous voltages.

77 I wish to address the main and most obvious risks relating to health and safety and the very real risk of electric shock in circumstances where structures are permitted to be built in close proximity to electrical hazards.

78 Electric shock can be caused by:

78.1 Reach and touch voltages (i.e. where a person or animal comes into direct contact with a conductor);

78.2 Line or conductor drop (where a line or conductor falls to the ground or structure);

78.3 Earth potential rise (i.e. an earth fault at a tower or pole);

78.4 Step and touch voltages (i.e. where a fault arises which raises the voltage at the base of the tower or pole and the surrounding ground);

78.5 Flashovers (i.e. where the electricity arcs from a conductor onto an object such as structure or fence); and

78.6 Proximity of vegetation growing too close to a line and causing a flashover.

79 The severity of the shock depends on the current's path through the body, the current intensity and the duration of the contact. All may occur because of third-party activities coming into proximity with conductors. Exposure to such a risk can result in damage to property and injury to people or animals ranging from a mild tingling sensation to serious injury or death.

80 In the rural context, issues with sensitive activities such as houses are less likely to occur (although MainPower still seeks to avoid them locating in proximity to its lines) than the risk caused by ancillary buildings and fences underneath MainPower's lines.

81 Whilst existing cases of under build or encroachment will not be affected or be able to be reversed by the insertion of the corridor protection rules MainPower seeks, it will reduce the likelihood of more instances occurring going forward. There remain many places on MainPower's SEDL network where such underbuilding and encroachment is possible.

82 Having a structure under or in close proximity to a line can cause various issues, including some which a property owner may not be aware of before taking ownership of the property or building. Similarly, where a power line or pole is located within the road corridor but adjacent to a boundary, landowners often fail to consider the line when planning and carrying out development or activities on their land.

83 While these issues arise in relation to any voltage of conductor, they are particularly acute where SEDLs are involved. Issues associated with reduced clearances include:

83.1 Maintenance, replacement and upgrading: Periodically conductors and support structures need to be replaced or upgraded. As explained earlier in my evidence, MainPower will be upgrading parts of the SEDL network over the next 10

years to ensure we can continue to meet the electricity needs of the Waimakariri District. Under build and encroachment on clearances makes maintenance, replacement and upgrading far more complex. In some cases, it can prevent these activities entirely. Similarly, where SEDL support structures are being upgraded, encroachment can make this significantly more difficult. All of the above adds time, cost and safety risks to the network activity.

83.2 Communication and Logistics: Having structures near SEDLs and associated support structures complicates communication and coordination with owners as to our maintenance, upgrade and replacement plans. This in turn means that we need to work in with any requests of the property owner for timing of works and nature of reinstatement.

83.3 Ancillary structures and extensions: With any under build or encroachment, there is the risk that landowners will over time install additional extensions or structures and aerials and other ancillaries too close to live conductors. This puts both the landowner and the security of electrical supply at risk. It is simply not possible for MainPower to regularly check the SEDL network for this incremental encroachment.

83.4 Maintenance of third-party structures: Maintenance of the buildings and structures under or adjacent to a line also becomes problematic and can be fatal if electrical clearances are not maintained at all times. Replacing roofing and guttering can be particularly hazardous. MainPower's experience is that these issues are best managed by ensuring clearances are maintained at the outset.

83.5 Reverse sensitivity: Two types of noise occur with high voltage overhead lines. The first is caused by wind blowing across the conductors, insulators and structures. The second is caused by electrical discharges (corona) along insulators and conductors which produce a crackling sound. While this noise is not particularly loud, it can be unpleasant and lead to complaints.

84 Electricity lines can also be compromised by earthworks and excavations. In particular, excavations near poles and towers can destabilise these structures and result in poles and lines leaning over. Where this occurs, conductor-to-ground or conductor-to-building clearances are compromised as line sag increases. This can increase the risk of electric shock and many of the issues described above. In extreme cases, earthworks near poles or towers can cause these structures to fail completely. While this is rare, the consequences are potentially fatal for those in the immediate vicinity, and they can cause significant disruption to the network.

While these activities present risks to all overhead lines and support structures, the consequences are higher where the SEDL network is concerned.

CONCLUSION

85 In conclusion, MainPower again highlights the critical nature of our electricity network to the Waimakariri District. Ultimately, every resident, business and community in the District is directly reliant on and / or substantially benefits from the electricity network. The Proposed Plan's treatment of electricity infrastructure must be seen in that context. Any consent cost or obligation on MainPower is ultimately borne by our customers. I also refer back to my earlier comments regarding new technologies and the future of electricity networks. In the context of network utilities, MainPower seeks a plan that is flexible, pragmatic and sees the bigger picture.

Dated: 1 May 2023

Mark Appleman