Before the Hearings Commissioners
at Christchurch

in the matter of: a submission on the proposed Hurunui and Waiau River Regional Plan and Plan Change 3 to the Natural Resources Regional Plan under the Resource Management Act 1991

to: **Environment Canterbury**

submitter: **Meridian Energy Limited**

Brief of evidence of Nicholas Charles Eldred

Dated: 12 October 2012

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BRIEF OF EVIDENCE OF NICHOLAS CHARLES ELDRED

INTRODUCTION

1 My full name is Nicholas Charles Eldred.

2 I am the Water Infrastructure Development Manager for Meridian Energy Limited (*Meridian*). I have worked in the Renewable Development group of Meridian for 8 years and my team and I are responsible for identifying, securing and developing new hydro electric power schemes, irrigation projects and other water related infrastructure, including marine energy opportunities that may become available in the future.

3 I am authorised to give this evidence on Meridian's behalf.

4 I have the following qualifications:

4.1 Bachelor of Science (1987, University of London, Queen Mary College, Engineering Geomorphology (Hons));

4.2 Master of Science (1988, University of London, Queen Mary College, Geomaterials).

5 The majority of my 24 years of professional experience has been involved in the design and construction of major infrastructure projects including several tunnels and hydro electric power schemes. Prior to joining Meridian in 2004 I worked as a consultant engineering geologist in the UK, New Zealand and many other countries. My experience also includes the investigation of groundwater issues for both engineering and environmental projects and I have been involved with numerous resource consent applications since moving to New Zealand in 1992. I was also the chair of the Aotearoa Wave and Tidal Energy Association for three years until September 2012.

6 Other roles I have fulfilled at Meridian include responsibility for investigating and identifying hydro and geothermal development opportunities and as the project manager for the North Bank Tunnel Project; an 1100 to 1400 GWh hydro proposal on the lower Waitaki River. This project has obtained the key consents to enable the taking, use and discharge of water and is currently progressing through the process for obtaining the remainder of the consents required.

7 Examples of some of my other experience specifically relevant to hydro development includes: investigations and consenting of a hydro dam on the Mokihinui River approximately 40km north of Westport; tunnel design and construction supervision of the Second Manapouri Tailrace Tunnel; construction supervision of the Matahina

Hydro Electric Scheme dam reconstruction project; tunnel design for the Channel Tunnel, Jubilee Underground railway line extension and London water supply ring main in the UK; and road and rail tunnels in Hong Kong, Spain, Australia and Singapore.

8 Immediately prior to joining Meridian I was involved as a Project Manager at URS New Zealand Ltd in both the engineering geology and groundwater aspects of Project Aqua, a proposed canal hydro electric power scheme on the Lower Waitaki that was cancelled in 2004 and superseded by the North Bank Hydro Project. I was responsible for the design and supervision of the geotechnical investigations for the project.

9 In preparing my evidence I have reviewed the evidence of:

9.1 Mr Jeff Page;

9.2 Mr Rob Potts; and

9.3 Ms Sarah Dawson.

10 I am also familiar with the applications for consents for the take, use and discharge of water lodged by Meridian and Ngai Tahu Property Limited (*NTPL*) for the Amuri Hydro Project (*AHP*) and the application that is being prepared for the take, use and discharge of water for the Balmoral Hydro Project (*BHP*). I describe AHP and BHP in more detail below.

SCOPE OF EVIDENCE

11 In this evidence I outline:

11.1 the role of electricity, electricity policy, and Meridian's renewable generation portfolio and commitment to renewable generation;

11.2 the need for more electricity generation and the specific issues associated with electricity demand and supply in the Upper South Island;

11.3 Meridian's relationship with Ngai Tahu Property Limited (*NTPL*) and opportunities for hydro generation development on the mid Hurunui River and mid Waiau River in a manner generally consistent with the provisions of the Proposed Hurunui and Waiau River Regional Plan;

11.4 comments on matters in the Proposed Plan which impact on the hydro generation opportunities referred to in paragraph 11.3; and

11.5 how the effects of hydro-electricity schemes can be mitigated and the ability to protect and maintain environmental values through the design and construction of an appropriate scheme.

MERIDIAN AND RENEWABLE GENERATION

12 Meridian is a limited liability company currently wholly owned by the New Zealand Government. It is one of three companies formed from the split of ECNZ on 1 April 1999.

13 Meridian's Statement of Corporate Intent states that: *"Meridian Energy's nature and scope of activities are the generation of electricity (including the ownership and operation of related assets), the management of water related infrastructure, and the marketing, trading and retailing of energy and wider complementary and adjacent products, solutions and services, primarily within New Zealand."*

14 As a State-Owned Enterprise, Meridian is required by statute to operate as a successful business. A component of that requirement is to be an organisation that exhibits a sense of social responsibility by having regard to the interests of the community.

15 Meridian's objectives include maximising long-term shareholder value by its commitment to the environment and the sustainable management and development of the natural, physical and human resources utilised in its business. Meridian generates only from renewable resources – hydro and wind.

16 Meridian is the single largest generator of electricity in New Zealand. Following the transfer of the Tekapo hydro generation assets to Genesis Energy, Meridian's total generation capacity is currently 2,644 MW. Its hydro generation accounts for approximately 44% of New Zealand's electricity generating capacity and 55% of New Zealand's hydro storage capacity[1].

17 When Meridian was formed on 1 April 1999 the assets associated with the Waitaki Power Scheme, the Manapouri Power Scheme and the Brooklyn wind turbine were acquired. Since then Meridian has successfully completed the 90 MW Te Apiti wind farm in the Manawatu in 2004, the 58 MW White Hill wind farm in Southland in 2007, the 143MW West Wind wind farm near Wellington in 2009 and most recently the 64MW Te Uku wind farm near Raglan in autumn 2011. Meridian has recently commenced construction of the 60 MW Mill Creek wind farm near Wellington. Meridian is also currently

[1] Meridian hydro storage (Waitaki system and Manapouri) is 2,118GWh. Nationally, hydro generation capacity is approximately 5,361MW and storage is 3,845GWh. Source: Meridian.

involved in an Environment Court hearing considering its applications for resource consents for the Hurunui wind farm near Greta Valley in North Canterbury.

18 Meridian has also applied for and obtained the principal water consents associated with the North Bank Tunnel project to take, use and discharge water for hydro generation in the Lower Waitaki River.

19 It has also applied for and obtained the principal water consents for the Hunter Downs Irrigation Scheme which involves the taking of 20 m^3/s of water from the Lower Waitaki River for the irrigation of 40,000 hectares of land in the Canterbury region south of Timaru. This application was made jointly with the South Canterbury Irrigation Trust and demonstrates Meridian's commitment to partnering with parties with irrigation interests.

20 As part of its ongoing operations Meridian is continually investigating and pursuing options for new renewable generation capacity and is investigating a number of sites that have potential for wind and hydro development. As part of that Meridian is also open to investigating the synergies between storage for hydro generation being made available for irrigation.

ELECTRICITY IS A NECESSITY IN MODERN LIFE

21 The electricity system from its generation to its local distribution is critical infrastructure in the New Zealand economy. Over the past 120 years electricity has reshaped how New Zealanders live and work. Electricity has also become so central to day to day life that there are frequently no substitutes, and its availability is often taken for granted. This is due to its unique advantages over other forms of energy, specifically:

> *flexibility – it can be transmitted over large distances instantly in the quantity required;*
>
> *versatility – it can be converted into three major uses of energy: heat, light and motion power;*
>
> *efficiency – it can be controlled and used with unparalleled precision; and*
>
> *availability – it can be produced from a number of different sources.*

22 As a result, reliable and cost-effective access to electricity is fundamental to the ongoing progress of both New Zealand and its economy.

23 Electricity is an essential resource input for industry. Without modern electric devices and technology New Zealand's industry

would be uncompetitive in the world market. Accordingly, electricity is a critical ingredient to industry and commerce in support of jobs.

24 Electricity supply is also critical to the ongoing operation of communication networks and other infrastructure, as well as the operation of banks, hospitals, schools and other public and private institutions. These make up the fabric of social, economic, and cultural wellbeing and ensure the health and safety, of people and communities.

ELECTRICITY POLICY

25 The future electricity market outlook is determined by growth in demand and supply, and the design of the policy and regulatory framework. Ms Dawson will discuss further the role of the policy framework in the Canterbury region, and I will briefly outline the relevant overarching national policy issues.

26 The Government has established a number of strategies and targets to help shape this future market. These include the Government's NZ Energy Strategy and NZ Energy Efficiency & Conservation Strategy which retains the challenging but realistic[2] target that 90% of electricity generation be from renewable sources by 2025 (in an average hydrological year) providing this does not affect security of supply. The Government has also set a target to reduce net greenhouse gas emissions by 50% from 1990 levels by 2050.

27 In January 2011 the Government also announced the establishment of an Advisory Group on Green Growth in enabling New Zealand to grow the economy while enhancing New Zealand's clean, green brand. The terms of reference focus on:

27.1 how Government agencies can help exporters leverage greater value from New Zealand's clean, green brand;

27.2 how Government can assist the growth of clean technologies; and

27.3 how Government can assist small and medium-size businesses move to a low-carbon economy.

28 In support of its Energy Strategy and greenhouse gas emission targets the Government has also introduced the New Zealand Emissions Trading Scheme (NZETS) whereby since July 2010 thermal electricity generators have faced a cost for greenhouse gas emissions. To the extent thermal power stations endeavour to recover increased operating costs, higher thermal electricity prices make renewable generation investments become more economic.

[2] Page 25 in the NZ Energy Efficiency & Conservation Strategy

The NZETS imposes a 2:1 obligation and a price cap of NZ$25 per tonne of CO_2e – or effectively a price of $12.50/tonne of CO_2e and government policy is that the 2:1 obligation finishes on 31 December 2012. For coal-fired plant this increases its "short-run" cost of operation by around 50% from what it would be without a carbon charge[3].

29 In economic terms, the carbon charge associated with the NZETS is the only instrument currently directly affecting the relative economics of new generation builds.

30 Government policy is clearly supportive of renewable generation. The policy approach is two pronged. Firstly: improving the relative economics for renewable electricity generation projects (against new thermal projects) via the NZETS described above. The second policy approach is the recently released National Policy Statement for Renewable Electricity Generation. This policy statement requires decision makers to consider the development, operation, maintenance and upgrading of all renewable generation as a matter of national significance. It includes specific considerations in the consenting processes of renewable energy developments and regional and district councils must take this policy into consideration when preparing Regional Policy Statements and regional and district plans such as the Proposed Hurunui-Waiau Catchment Regional Plan. Clearly the Government welcomes and expects to see considerably more investment in renewable electricity generation.

MERIDIAN'S COMMITMENT TO RENEWABLE ENERGY

31 On 22 November 2004 Meridian announced its commitment to continue to generate electricity solely from renewable sources into the future. This decision was not made because we think it will be easy. Meridian has chosen this path because it considers it is the right thing commercially for its business and it is an environmentally responsible choice for New Zealand, now and in the future. As discussed above, Meridian's commitment is also aligned with past and current Government policy.

32 These various initiatives provide strong direction to the electricity market with respect to a preference for the generation of electricity from renewable sources providing it does not affect security of supply. However, if our collective commitment to renewables is to succeed it is important that New Zealanders engage in mature and rational debate about the impact of specific proposals. Renewable electricity generation resources are not distributed evenly

[3] Calculated using the Electricity Authority's short-run marginal cost calculator http://www.ea.govt.nz/document/13550/download/our-work/consultations/uts/26Mar11/.

throughout the country. Projects must be located where the resources, e.g. water and other technical constraints allow.

33 Therefore, when evaluating each option New Zealand must be careful to consider the proposal in a national context as well as at regional and local levels. The temptation is to focus too much on localised adverse effects and not enough on the wider regional and national picture. The result may be to conclude that generation should occur "somewhere else" rather than at a given location where the resource is available so that the localised effects are avoided.

34 The reality of the situation is that the use of a resource within New Zealand will never be free from some degree of adverse effect or tension between local and regional or national interests. It is easy for opponents, when seeking to avoid those effects at a specific location, to point to another solution without having to apply either commercial, social acceptability or environmental rigor to their opinion. The risk is that New Zealand ends up chasing highly idealised solutions that will never be delivered by the current electricity system.

35 In addition, a further problem with this approach is that it implicitly assumes there is a large pool of other suitable renewable options to draw upon to replace each opportunity which is foreclosed because it gives rise to some localised adverse effect. I certainly do not subscribe to the idea that renewable generation should be built at any cost in terms of adverse effects. I am strongly of the view that developers of new generation need to work hard to mitigate, remedy or avoid any adverse effects of their developments to the greatest extent possible. However over the years I have become convinced that there is a sizable gap between New Zealander's aspirations to have reliable and affordable energy on one hand, and our willingness to accept that a price needs to be paid (in terms of localised effects) in order to realise those aspirations.

36 Furthermore, the upper South Island (including the West Coast) has a number of specific characteristics in terms of an electricity demand/supply imbalance and constraints with respect to future development options. I will describe these constraints later in my evidence and why potential renewable development projects should be considered very seriously in these regions.

THE NEED FOR MORE GENERATION (DEMAND GROWTH), ENERGY EFFICENCY AND DEMAND SIDE MANAGEMENT

37 Looking into the future a range of projections have been made by a number of different parties regarding the likely continued growth in demand for New Zealand. While it is inherently difficult to

accurately predict demand growth over the long term what all parties do agree on is that demand will grow.

38 Net demand growth is a combination of this increased demand tempered by Demand Side Management (DSM) measures. DSM initiatives range from measures to reduce energy consumption by employing more efficient technologies and the use of alternative energy sources at a consumer level, including solar and gas, through to reducing energy consumption.

39 Energy efficiency is defined, in simple terms, as doing something that enables the consumer to use less input energy to achieve the same outputs. Making better use of electricity is part of our sustainable practice and Meridian is a strong supporter of this objective. We work with our customers to develop, sell and promote energy efficient practices and products.

40 It is anticipated that DSM measures will make a contribution to meeting New Zealand's energy requirements into the future. However, despite energy efficiency measures, demand is anticipated to continue to grow and there will be a substantial energy balance gap that needs to be met from new power generation sources.

41 A range of estimates are available regarding likely future demand scenarios. Of these estimates, the Ministry for Economic Development's (MED's) Energy Outlook 2011 provides some useful insights about the projected demand and supply requirements for the electricity system into the future.

42 There is reasonable consensus that over the longer term the rate of demand growth is likely to be lower than historic levels. The MED Reference scenario indicates average growth rates to 2030 of approximately 1.2% per annum. This estimate compares with the average historical annual growth rate from 1992 to 2005 of 2.2%.

43 It should also be noted that since 2005 the growth rate has been very small reflecting the ongoing world wide and national economic downturn.

44 Assuming the MED Reference growth scenario of 1.2% and for the Government's 90% target to be met in 2025 and sustained to 2030, 3,040 MW of new installed generation capacity will need to be constructed. These are significant quantities of new generation. For example, Meridian's total installed hydro capacity is 2,288MW in the Waitaki and Manapouri catchments.

GENERATION OPTIONS

45 If the Government's target of 90% renewable generation by 2025 is to be met with the associated estimate of a further 3,040 MW of

new renewable generation, I have already stated that we need a reasoned discussion around renewable development options.

46 In terms of the types of generation that might go towards meeting this target I have the following comments:

46.1 **Gas -** unless there is a large gas discovery, current contract gas prices make gas fired generation more expensive than many renewable projects. Such a gas discovery is highly uncertain. Furthermore, a significant increase in gas generation does not fit with current Government renewable energy targets.

46.2 The importation of liquefied natural gas (LNG) was under investigation by some parties. However, at current delivered prices, it is very likely to be uneconomic. In addition, this option also faces the issues associated with the Government's renewable energy targets and has the disadvantage of further exposing New Zealand to global energy market prices.

46.3 **Coal -** Most coal options, because of their infrastructural requirements, are expensive and also face the Government's emission trading scheme.

46.4 **Geothermal -** Geothermal developments are economic in proven brown field sites and are an area of current active consenting and construction. However, the number of proven and accessible brown field sites are limited, and uncertainty and costs are likely to both rise significantly when developers start to investigate green field sites in future years. In addition, geothermal resources are located in the North Island.

46.5 **Wind -** Wind energy is a corner stone of Meridian's future energy development plans and is expected to supply an increasing proportion of New Zealand's energy over the next few decades. The uptake of wind is constrained in some power systems elsewhere in the world because it is an intermittent source of energy (which means that generation is entirely dependant on the instantaneous wind speed at the point of generation). However, in New Zealand wind energy at around 20% of total energy would still only impose low system costs because of the existing flexible hydro plant. Wind energy is a development option for the Upper South Island's east coast with a number of proposed projects including Meridian's proposed Hurunui Wind Farm at Greta Valley (up to 76MW) and Mainpower's proposed Mt Cass Wind Farm (up to 78MW) near Waipara.

46.6 **Hydro –** Hydro remains the cornerstone of New Zealand and Meridian's existing fleet of renewable generation plant. In addition to its renewable nature, hydro plant has a number of additional attractive characteristics from a electricity system operation perspective. These include predictability, which means it has the ability to work well with intermittent forms of generation such as wind energy.

46.7 As well as offering a number of operational benefits that intermittent generation does not, further hydro development is important to allow the ongoing development of wind resources in the future. Nonetheless, I envisage that future hydro development is likely to be limited. Only a limited number of new proposals of scale (>30MW) have been announced over the past 10 years. I believe it is unlikely that many further hydro proposals will be announced in the future because of factors such as difficulty in obtaining consents, transmission constraints, technology and assessment by developers as to cost. Therefore, given the support that hydro offers to intermittent energy generation such as wind (and in the future solar and marine) the few hydro options that have been proposed, including the two North Canterbury opportunities I will describe, should be given careful consideration.

46.8 **Marine** - Marine energy is still at a very early phase of its development cycle. For it to become a feasible option considerable time is needed to establish the technologies and the necessary understanding of our marine resources. Marine energy is unlikely to make a significant contribution to the 2025 90% renewables target.

46.9 **Biomass -** Biomass, because of its very limited output, and photo voltaic solar energy, because of its high costs, are unlikely to make any significant contribution to new generation in the near future.

46.10 **Nuclear** - Aside from its prohibited status under New Zealand legislation, there are major economic and technical issues that render nuclear power an unlikely option.

47 In summary, hydro, wind and geothermal are economic propositions now, and in the future, depending on the site and the resource.

NEED FOR MORE GENERATION IN THE UPPER SOUTH ISLAND

48 In addition to the national growth in electricity demand I have just described, the upper South Island and West Coast has some location specific issues which further generation located in the region will help address.

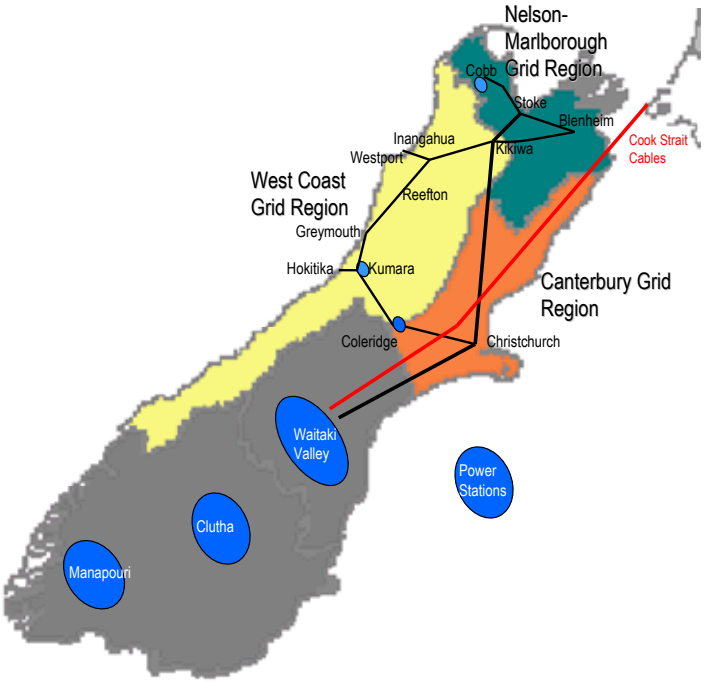
Supply and demand

49 In principle, new generation requirements could be developed anywhere provided there is adequate transmission system capacity available to transport electricity around New Zealand. To the extent that there is sufficient generation around the country to match overall consumer demands, all regions will benefit.

50 In practice, electricity related benefits will vary depending on where new generation requirements are developed. This is particularly relevant to electricity projects in North Canterbury because of a lack of generation in upper South Island regions compared to demand in this region.

51 The transmission grid in the upper South Island comprises three 'electrical' regions - the West Coast, Canterbury and Nelson-Marlborough. Figure 1 shows, in stylised form, the main transmission lines serving these regions.

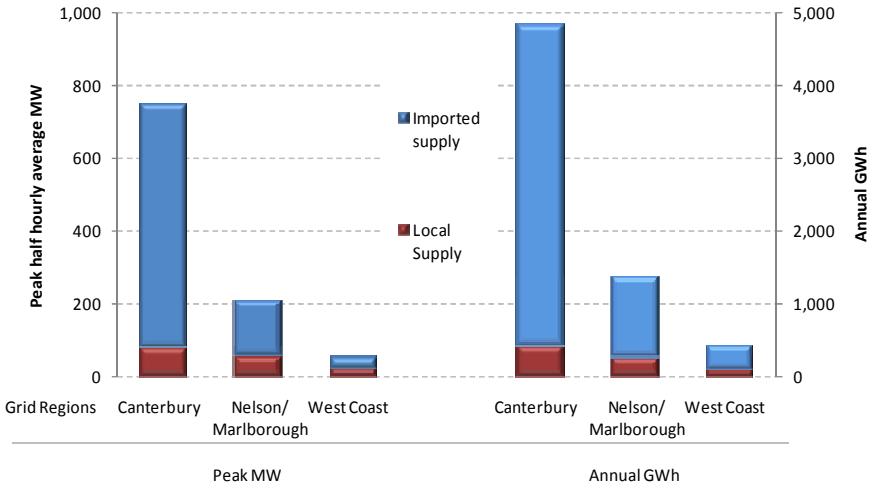
Figure 1: High level overview of the South Island electricity system[4]



[4] Note that this is a stylised map and does not include all power stations and transmission lines. It is representative for the purpose of this document.

52 In each of these three upper South Island regions of the grid, both peak (MW) and annual (GWh) electricity demand significantly exceed generation as shown in Figure 2.

Figure 2: Grid demand[5] and generation[6] by grid region



53 'Peak' demand is the maximum amount of electricity (MW) used by consumers at any time during the year. Annual 'energy' demand is the amount of energy (GWh) used by consumers during the year[7]. It can be seen that peak demand and annual energy demand both exceed respective generating capabilities by substantial margins. Upper South Island regions are thus heavily dependent on imported supply, i.e. electricity always flows northwards through the grid from the Waitaki region which is both the central location for electricity generation in the lower South Island and the southern termination of the HVDC Cook Strait cable. The HVDC link can transport electricity to the South Island from the North Island during times of low South Island generation (and visa versa when required).

5 Year ending Mar 2011 (Electricity Authority Centralised Data Set).

6 Electricity Authority List of Stations (MW capacity and average GWh pa).

7 MW is a measure of the rate at which electricity is consumed or generated. For example, one hundred thousand 100 Watt light bulbs consume electricity at the rate of 1 MW. GWh is measure of the amount of electricity used over time. For example, consuming 1 MW continuously for 1,000 hours equates to 1 GWh of energy consumption.

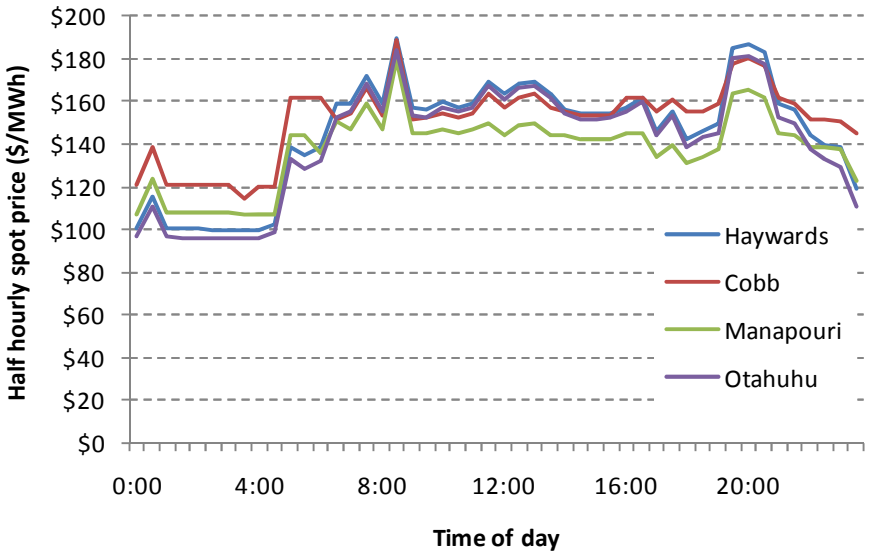
Impact of Imbalance Between Supply and Demand on Locational pricing

54 In general, the further electricity needs to be transported through the transmission system the greater the losses in electricity that occur. This is due to heat and other resistance issues in the AC transmission network. For example, if 1.0 MW is required at point x located 400km from the point y where the electricity is being generated it may be that point y has to inject 1.1MW of electricity to ensure 1.0MW can be used at point x.

55 In dispatching generation around the country to minimise the overall cost of supplying demand, the electricity market takes these transmission losses and constraints into account. In doing so, separate spot prices are established at over 200 locations every half hour, reflecting the variable cost of transporting electricity around the country. Spot prices are therefore generally higher in regions where local demand exceeds local generation and lower in regions where local generation exceeds local demand.

56 Figure 3 illustrates how half hourly spot market prices can vary by location during the day[8].

Figure 3: Spot market prices at different locations (23 March 2010)



[8] There is no particular reason for the day selected other than to illustrate the points that follow. Relationships vary depending on the time of year and direction of electricity flows around the grid but any day would enable a similar discussion about location pricing.

57 Price differences between locations vary reflecting electricity flows around the grid. In the example in Figure 3 it can be seen that in the early hours, when demand is low:

57.1 all prices shown were low but prices in Otahuhu (Auckland) and Haywards (near Wellington) were lower because surplus generation from the upper North Island was being sent southwards (including to the South Island via the Cook Strait cables);

57.2 prices at Manapouri in the lower South Island were correspondingly higher because the level of generation there was reduced to avoid drawing the level of Lakes Manapouri and Te Anau lakes down too low and regional demand was high due to aluminium smelter requirements; and

57.3 prices at Cobb (near Nelson) were highest because electricity had to be imported into the region from South Canterbury (where the Cook Strait cables connect into the South Island transmission grid, and were delivering electricity from the North Island).

58 At other times of the day, when demand was higher:

58.1 Otahuhu prices were highest because electricity was being transferred into the upper North Island to meet additional peak demand requirements;

58.2 prices at Haywards were higher than in the South Island but lower than Otahuhu, as electricity was being transferred through the Cook Strait[9] cables into the North Island; and

58.3 prices at Cobb remained high because electricity still had to be imported into the upper South Island region due to a lack of local generation.

59 In addition to the issues described above, if a transmission line reaches its physical limit and constrains the transfer of electricity into a region with limited generation, spot prices within that region can rise to much higher levels than in other parts of the country.

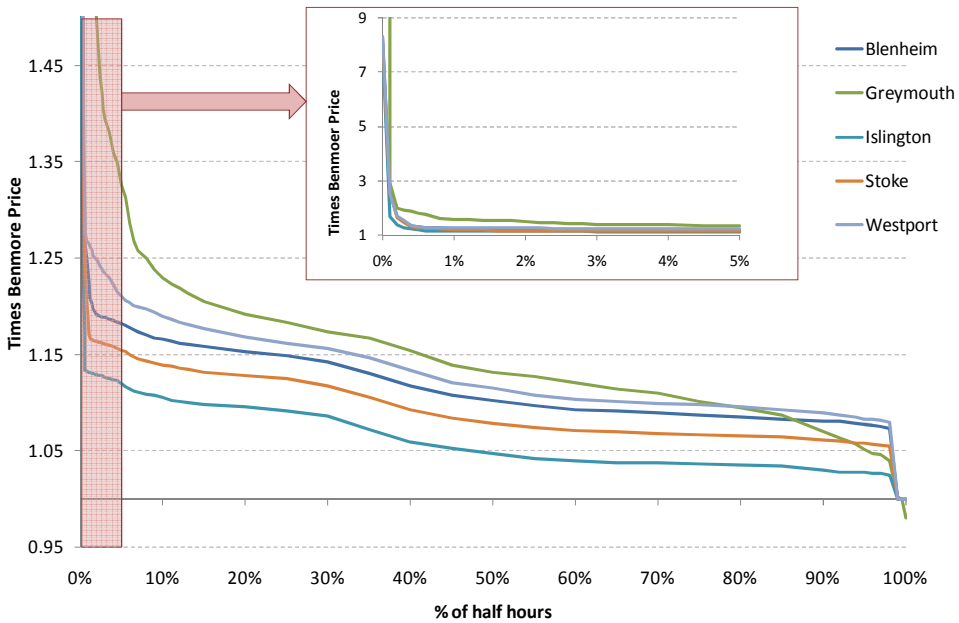
60 Over the longer term, locational prices send important signals about where generation and/or transmission investments are needed to reduce losses and to mitigate regional security of supply risks. This point is relevant in relation to the North Canterbury and the Upper South Island and I discuss this later in my evidence.

[9] Electricity from the Cook Strait cables arrives in the North Island at Haywards.

61 From a consumer perspective, higher electricity spot prices in a region have flow-on effects to retail prices. As noted above, local spot prices will rise when electricity has to be imported into a region reflecting associated transmission losses and, particularly so, if the technical limits of transmission lines are reached preventing additional supply being imported.

62 By way of example, Figure 4 shows how electricity spot prices in upper South Island locations varied relative to spot prices at Benmore between March and September 2010. Islington is near Christchurch and Stoke is near Nelson. The key point to note with respect to this data is that electricity always flows northwards through South Canterbury to North Canterbury, Nelson/Marlborough and the West Coast, irrespective of the flow of electricity into or from the South Island, even during a drought. That is because as I have already shown under all circumstances electricity demand in the upper South Island significantly exceeds existing generation. Spot prices therefore rise north of Benmore as shown in the chart. Further, at times when transmission constraints into the region are active, upper South Island prices can rise to very high levels relative to Benmore. This can be seen in the inset chart in Figure 4 which expands the highlighted section of the main chart for the worst 5% of half hours during this six month period.

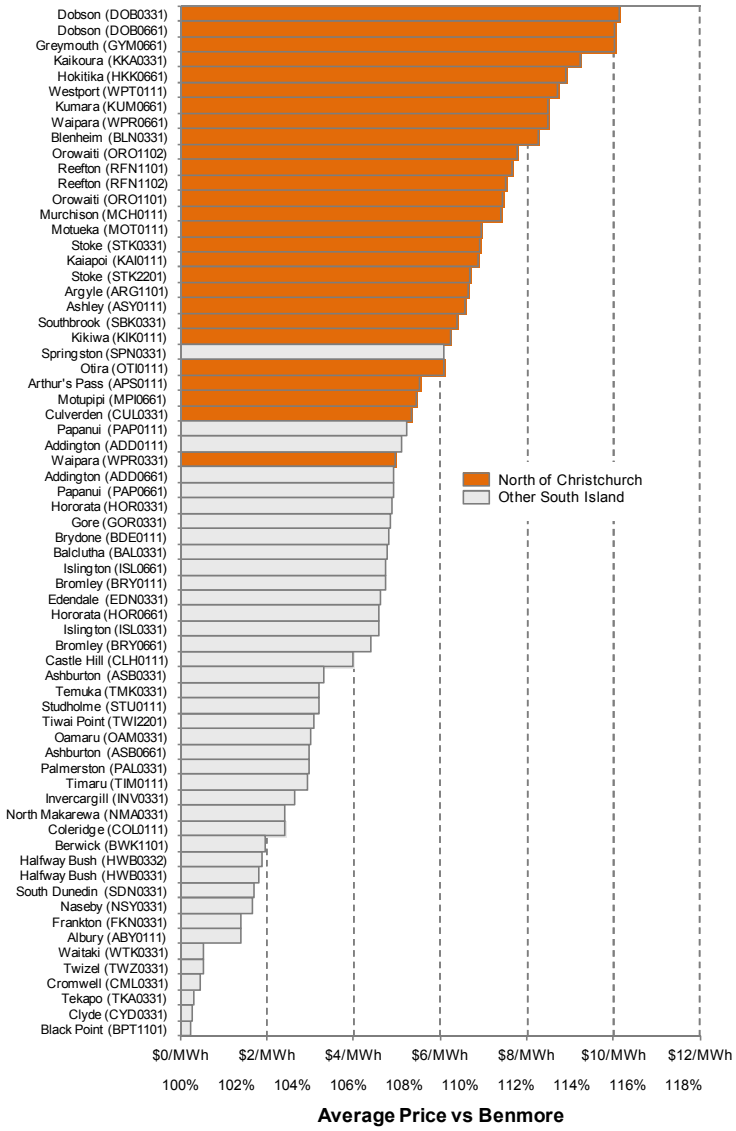
Figure 4: Spot price multiples compared to Benmore (Mar to Sep 2010)



Pricing implications

63 Heavy dependence of the Upper South Island regions on the grid, with corresponding transmission losses and at times transmission constraints, is reflected in Figure 5. It shows the average difference between the spot price at grid off-take locations in the South Island relative to Benmore spot prices, with locations in the top of the South Island north of Christchurch highlighted.

Figure 5: Average spot prices vs Benmore (2007-11)[10]



[10] Derived from Electricity Authority Centralised Data Set.

64 The implications to North Canterbury and the Upper South Island from this imbalance in supply and demand and the associated transmission constraints are that spot price trends and pricing risks will be reflected in the prices retailers offer their customers. Therefore, customers will generally have higher retail prices than elsewhere in the country.

65 In this context, further generation development north of Christchurch will help address this imbalance in supply and demand and the associated effects on pricing. At this time two wind farms are proposed in North Canterbury (Mt Cass proposed by Mainpower, which has resource consents. and Hurunui Wind proposed by Meridian) which is currently the subject of an Environment Court hearing. If these projects along with Meridian and NTPL's proposed hydro developments for the Waiau and Hurunui Rivers are constructed this will add up to an additional 208MW to the local supply. This will, on average, reduce the need to import electricity into the Upper south island region and is therefore likely to have a beneficial effect on spot prices. This effect is likely to be observed in North Canterbury and to a lesser extent other Upper South island regions.

DEVELOPMENT PROCESS

66 I will now describe:

66.1 the Meridian and NTPL relationship;

66.2 the relationship Meridian and NTPL have with the Hurunui-Waiau Zone Committee of the Canterbury water Management Strategy;

66.3 the possible North Canterbury hydro development options AHP and BHP;

66.4 the development process related to AHP and BHP; and

66.5 the provisions of the Proposed Plan which are relevant to AHP and BHP.

Meridian and Ngai Tahu

67 NTPL owns 8,596 hectares of land adjoining and adjacent to the Hurunui River below its confluence with the Mandamus River. Of this 8,037 ha is in Balmoral Forest on the north bank, while the balance is in a relatively small block on the south side of the river.

68 This land is primarily used for the forestry operation known as "Balmoral Forest". It is presently being converted to agriculture. The forest falls in elevation at a relatively constant rate of about 5% from west to east, parallel with the river.

69 In 2005 NTPL undertook pre-feasibility studies to investigate the conversion of this land to irrigated pasture and development of an integrated irrigation and hydro generation scheme associated with Balmoral Forest and the Hurunui River between the top and bottom of the forest (a river length of approximately 28 km). The hydro generation aspect of this study is now called the Balmoral Hydro Project (*BHP*).

70 In 2008 NTPL and Meridian entered into an arrangement where they have agreed to jointly investigate in more detail the technical feasibility of constructing and operating a hydro-electricity generation scheme using water taken from the Hurunui River below its confluence with the Mandamus River. The investigation also considers how an irrigation scheme and the hydro scheme could complement each other.

71 Subsequently the Canterbury Water Management Strategy was established and the Hurunui- Waiau Zone Committee was created to, amongst other matters, consider the use of water resources in the area. Given this region wide approach to water management, Meridian and NTPL have worked closely with the zone committee and other developers over the past few years to create an integrated approach to water use and management in this North Canterbury zone.

72 Through this process a second hydro electricity generation canal based option was identified on the Waiau River between Twin Bridges located just below the Marble Gorge and the eastern edge of the Amuri Plains, below Waiau Township.

73 The hydro generation aspect of the scheme is now called the Amuri Hydro Project (*AHP*).

74 I describe both hydro generation schemes in more detail later in my evidence and Mr Page will provide more information on the proposed water abstraction scenarios which are required to enable both schemes.

75 The proposed approach is to develop both hydro schemes and to ultimately integrate with existing and proposed irrigation schemes. The benefits of this approach are:

75.1 sharing of infrastructure such as intakes and canals helps reduce both capital construction costs and operational maintenance costs for all parties;

75.2 the Proposed Hurunui and Waiau River Regional Plan envisages that use of water for irrigation will have priority over hydro generation. However, when irrigation water is not being used for irrigation due to climatic conditions or outside

the irrigation season it can continue to be used for electricity generation; and

75.3 where water storage for irrigation is contemplated, integration with hydro generation provides a significant advantage. The canal constructed for hydro generation is generally much larger than would be constructed for an irrigation scheme. This means that when water is available in the river storage facilities can be filled comparatively quickly, increasing the efficiency of a given water storage facility.

76 I will now describe the two proposed hydro development schemes.

Balmoral Hydro Project

77 The details of the scheme will continue to develop but in summary it is intended that it will consist of the following components:

77.1 water will be diverted from the north bank of the Hurunui River at approximately Point A on Appendix 1. The intake is likely to be integrated with the existing Amuri Irrigation Company Ltd (AICL) irrigation water intake, which takes up to 5 m^3/s for the existing Balmoral Irrigation Scheme, and any additional irrigation water takes for Balmoral Forest or the wider Amuri area;

77.2 the scheme will divert up to 15 m^3/s for hydro generation;

77.3 point A is located immediately downstream of the proposed Hurunui Water Project (*HWP*) intake/discharge location on the south bank of the river (Point B on Appendix 1). Therefore, BHP does not impact on HWP's proposed takes for irrigation, and any additional water they are utilising for hydro generation will be returned to the river above the BHP intake and available for hydro generation. Meridian and NTPL are working with HWP to investigate the potential for further synergies between the two schemes;

77.4 the diversion and intake structure will need to incorporate some means of controlling diverted flows and excluding fish. Diversion systems for these types of size of schemes typically include the use of gravel bars and/or low level weirs to control and direct flows from the river to the intake, and there are well proven fish screening options available;

77.5 these types of low level (less than 3 metres) structures are often crucial to accurately managing flow while not acting as a barrier to the movement of gravel down the river and the upstream and downstream migration of fish. However, I have observed in a number of locations around New Zealand where planning tools designed to prohibit damming of rivers

also makes the implementation of these types of structures very difficult. I would request that the panel carefully consider this issue when making any decisions around what activities are prohibited and ensure that it does not inadvertently preclude this type of structure;

77.6 diverted water will then flow in a canal through the Balmoral Forest. Energy will be generated by creating "head" via the canal and then dropping the water through a series of power stations. The final layout of the scheme and number of stations is yet to be confirmed. However, work completed to date indicates that up to 110 GWh of energy can be generated on average on an annual basis at a cost which is competitive with other hydro and wind developments currently under development. To help put this in context 110 GWh is sufficient energy for approximately 12,200 households;[11]

77.7 the water will then be returned to the river in the vicinity of Point C on Appendix 1; and

77.8 it should be noted that whilst BHP is a hydro generation scheme there is the potential for the canal through Balmoral Forest to be integrated with any irrigation distribution system that NTPL wishes to advance. I am aware that NTPL are separately advancing their own plans for irrigation development and that Mr Edwin Jansen and Dr Brent Cowie will be giving evidence outlining NTPL's plans.

Amuri Hydro Project

78 The applications for the primary water consents associated with take, use and discharge for hydro generation were lodged in October 2011. These are a joint application by Meridian and NTPL to take up to 50 m^3/s from the Waiau River, use that water for hydro generation, and discharge water back to the river.

79 The details of the scheme will continue to develop but in summary it currently consists of the following components:

79.1 water will be diverted from the river at approximately Point A on Appendix 2. The intake is likely to be integrated with the existing AICL irrigation water intake at Twin Bridges;

79.2 AICL currently divert and take up to 11 m^3/s for irrigation purposes. The scheme proposes to divert and take up to an additional 50 m^3/s for hydro generation. As with BHP, fish exclusion will be part of the hydro scheme;

[11] Based on annual average household consumption of 9,000 kWh.

79.3 diverted water will then flow in a canal across private properties on the Amuri Plains. Energy will be generated by creating "head" via the canal and then dropping the water through two power stations although the final design and layout of the scheme is yet to be confirmed. Work completed to date indicates that up to 218 GWh of energy can be generated on average on an annual basis at a cost which is competitive with other hydro and wind developments currently under development. To help put this in context 218 GWh is sufficient energy for approximately 24,000 households;[11]

79.4 to the extent possible the canal will be integrated with AICL's existing and proposed infrastructure. This may include an upgrade of an existing irrigation race which could then potentially carry water south to NTPL's Balmoral Forest and a potential water storage site at Isolated Hill (Point B on Appendix 2). **Mr Potts** will describe in more detail his assessment of the quantity of water needing to be stored for irrigation in the Waiau catchment and the role that the Isolated Hill site may play in that storage; and

79.5 the water will then be returned to the river in the vicinity of Point C on Appendix 2.

IMPACTS OF THE PROPOSED PLAN ON AHP AND BHP

80 Mr Page and Ms Dawson have discussed in their evidence AHP and BHP in the context of the provisions of the Proposed Plan.

81 I comment on a couple of issues from my perspective as the potential developer of AHP and BHP:

81.1 Meridian needs to be satisfied before it commits to consenting or build of infrastructure that the development will produce an acceptable financial return. As a State Owned Enterprise we have a responsibility to operate commercially like any other private developer;

81.2 the current provisions of the Plan require 20 Mm^3 of storage to be provided before the C Block water can be accessed. The advice to us is that there is not sufficient irrigable area to be developed economically to support this quantity of storage. We consider that Meridian would be acting uncommercially if it committed to the provision of this amount of storage;

81.3 the Proposed Plan contemplates storage being provided at Isolated Hill. The work we have done indicates that storage is best provided close to the source of demand. The work

carried out by Mr Potts indicates that only 7.8 Mm^3 is required at Isolated Hill, or 3.5 Mm^3 in the Lower Waiau South Bank and 4.3 Mm^3 at Isolated Hill.

82 As I understand it the Proposed Plan makes it mandatory for Meridian/NTPL to have to provide 20 Mm^3 of storage before it can access the C Block for hydro generation. The rationale for this appears to be to ensure that storage is provided to offset a loss in reliability for existing irrigators due to changes in the minimum flow. I am concerned as to the logic as to why a new user (in this case a non-consumptive use) should be required to cross subsidise a loss in irrigation reliability when the decrease in reliability is not as a result of the use of the C Block water for hydro generation but as a result of changes to the minimum flow. The requirement is not sufficiently linked to the effect that it is dealing with.

83 Meridian's position is that it fully recognises that developing a hydro generation scheme can provide opportunities for the sharing of infrastructure and if the commercial drivers are right we could even commit to building infrastructure such as irrigation storage.

84 However, before we could contemplate such a move we would need to be satisfied that the building of storage for irrigation purposes would be a commercially prudent investment which would result in an acceptable financial return. On the basis of the information available to me at the moment it would not meet this commercial investment test to be providing 20 Mm^3 of storage for irrigation where the information available to us indicates that there is not a demand for this amount of storage, nor would building that amount of storage ever be a good investment as part of a hydro generation scheme.

85 My other concern is with a policy in the Plan (Policy 6.9) that requires all consents for a project to be lodged at one time. As I have previously outlined in my evidence Meridian has been involved in the consenting of two very significant projects (one hydro project relating to North Bank Tunnel) and a large irrigation scheme (Hunter Downs) where the obtaining of consents has been *"staged"*. This has occurred in a scenario where we considered, and ECan using its discretion under section 91 agreed, that it was appropriate and prudent to consider whether the key water consents required for the project were acceptable (particularly in terms of effects on in stream values) before Meridian should be put to the significant costs of the design work which would be associated with obtaining other consents for the construction, operation and maintenance of those schemes.

86 The approach we have taken to AHP and will take to BHP is that similarly to the North Bank Tunnel and Hunter Downs example that it is appropriate for Meridian/NTPL and potentially interested parties

to have the issue as to whether the taking, use and discharge of water is acceptable before they are required to commit to the significant volume of work and cost which is involved in putting together the other consents related to any scheme. In relation to North Bank Tunnel concept the feedback from submitters (who had had previous experience with Project Aqua) was that the staging of consents was appropriate as submitters can sometimes feel overwhelmed by the sheer volume of assessment material where all consents are applied for at once and where the primary focus of their concerns lies with issues such as effects on in stream values relating to the taking, use and discharge of water.

MITIGATING THE EFFECTS OF HYDRO-ELECTRICITY GENERATION

87 At its very simplest, the hydro proposals being considered by Meridian and NTPL are non-consumptive and do not result in any significant reduction in flows in the Waiau or Hurunui Rivers downstream of the points of discharge. In addition, the proposals do not involve damming the main-stem of either river. Accordingly, the issues associated with the direct construction of a dam, such as barriers to fish passage and bedload transport, are not applicable to the current concept proposals. The principal issues will be the reduction in river flow between the intakes and outfalls (Points A and C on Appendix 1 and 2) and any effect this will have on matters such as instream values, existing users and amenity and natural character.

88 Meridian has a long track record of mitigating the effects of hydro-generation on braided rivers such as the Hurunui and Waiau Rivers. A good example of this is Project River Recovery which focuses on the restoration of ecological habitat and pest control in the upper Waitaki Catchment. This has been undertaken in association with the Department of Conservation since 1991.

89 More recently Meridian has proposed extensive braided river mitigation associated with the proposed North Bank Hydro Project, the tunnel diversion hydro scheme located on the lower Waitaki River. Consents, including the proposed mitigation, have been granted for this scheme by Environment Canterbury and upheld by the Environment Court. Proposed mitigation includes:

89.1 mitigation of braided river birds including habitat enhancement through control of weeds and pest control management;

89.2 mitigation of in-stream habitat, including periphyton, invertebrate and fish (both native and salmonid) issues through design of an appropriate flow regime for the river; and

89.3 mitigation of in river and riparian vegetation issues, including wetlands that border the river.

90 The scale and type of effects associated with any lower Hurunui River or Waiau River project will be different to the North Bank Tunnel project which involves diverting up to 260 m^3/s.

91 However, in the context of the Waiau and Hurunui River proposals, there are clearly several mechanisms that could be implemented to mitigate the effects of hydro-electricity development. Some of these are described in the evidence of other witnesses, such as Dr Hayes and Dr Olsen.

92 Meridian has considerable experience in habitat and environmental enhancement through the development and ongoing management of its existing hydro-electricity infrastructure. It would be well placed to provide these skills were they required to be developed as part of lower Hurunui River proposal.

CONCLUSIONS

93 Meridian's economic analysis suggests that the best of New Zealand's renewable generation opportunities are also the lowest-cost new electricity options at this time. New Zealand has benefited from many decades of low-cost electricity from the nation's hydro stations.

94 Over the past few years around 15 new hydro-generation proposals have been put forward by both established participants and new entrants to the industry. These proposals are at various stages, from initial pre-feasibility proposals through to committed projects.

95 There have also been public announcements relating to over 30 wind farm proposals at different stages of evaluation, planning or construction. There are similarly a number of geothermal and natural gas, coal, cogeneration or landfill gas options at various stages. These projects have a combined potential production of over 25,000 GWh.

96 In addition to these projects, there are other options available, such as those on the lower Hurunui River which are not yet, at least in the form of an application, in the public arena.

97 However, it is important to emphasise that many of the apparently possible projects are unlikely to proceed - at least in the short to medium term due to a number of factors including project economics, technology, transmission constraints and consentability.

98 Given this, it is Meridian's view that quality proposals such as that which might be possible on the mid Hurunui River and mid Waiau

River considerably more limited. I also consider that the opportunities for experienced and credible developers with strong track records are comparatively limited, making any opportunity to sustainably meet new demand critical to our future growth.

99 In summary, I view these North Canterbury opportunities as very important projects. As I have described:

99.1 hydro schemes have inherent characteristics which make them attractive to an electricity system that is targeting a 90% renewable component;

99.2 any additional generation north of Christchurch is likely to have a beneficial effect on wholesale spot prices throughout the upper South Island; and

99.3 integration of hydro electricity and irrigation development has a number of attractive commercial and operational synergies for all parties.

100 If a scheme is developed, Meridian can bring considerable expertise to the design of mitigation measures to address any potentially significant effects. The specific nature of these mitigation measures would be dealt with through consent conditions for the scheme. However, I believe that the panel should take note that commissioners for both Meridian and other similar recent hydro applications have accepted that effects of hydro development on braided rivers can be mitigated.

Dated: 12 October 2012

Nicholas Charles Eldred

Appendix 1: Balmoral Hydro Project – Locations of BHP Intake, HWP Intake and BHP Discharge

Appendix 2: Amuri Hydro Project – Locations of AHP Intake, Storage and AHP Discharge