BEFORE THE SPECIAL TRIBUNAL

No.

In the matter of	The Resource Management Act 1991
And	
In the matter of	an application to amend the Water Conservation (Kawarau) Order 1997 by The New Zealand & Otago Fish & Game Councils

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EVIDENCE OF PETER THOMAS MULVIHILL

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Introduction

1. My name is Peter Thomas Mulvihill. I currently work for Pioneer Generation Ltd as Asset Manager.

2. My qualifications include:

   - Master of Engineering Science (Civil and Environmental) from the University of New South Wales (Sydney) 2002,
   - Bachelor of Engineering (Civil) from the University of Canterbury 1985, and
   - New Zealand Certificate in Engineering (Civil) 1980.

3. I am a Fellow of the Institution of Professional Engineers, New Zealand. I am a Chartered Professional Engineer and Recognised Engineer under the Building Act 2004.

4. I am the past Chair of the New Zealand Society on Large Dams (NZSOLD) and have been an executive member of the Society for the past 12 years. I currently represent NZSOLD on the government sponsored Regional Authority Working Group on dam safety legislation and regulation.

5. I am a Vice President and an executive member of the International Commission on Large Dams (ICOLD). I Chair the Public Awareness and Education Committee, a technical committee of ICOLD. I also Chair the Africa-Australasia Association affiliated to ICOLD.

6. I recently represented ICOLD as convener of a session of the 5th World Water Forum held in Istanbul, Turkey.

7. My 32 years in civil engineering includes employment with the Westland Catchment Board, Ministry of Works and Development, and State Coal Mines. For the past 21 years I have held positions involving asset management and development with Pioneer Generation and its predecessors Central Electric Ltd and the Otago Central Electric Power Board.

8. My experience with the Company includes public consultation, assessment of environmental effects, resource consent applications and conceptual design work associated with proposed hydro electric schemes ranging from 1.2 to 45MW. I have also been involved in investigation, design, and construction work associated with the redevelopment of the Roaring Meg and Wye Creek and Monowai Hydro Schemes, and new projects such as Horseshoe Bend and Falls Dam. Apart from these specific projects I have also been involved in works associated with asset management and operation of the company's seven existing small hydroelectric schemes including dams, weirs and associated hydraulic structures.

9. My involvement with the Nevis Valley and associated hydroelectric potential began in 1990 during the application for the current Water Conservation Order (Kawarau)1997 (KWCO 1997). I attended the tribunal hearings and played a support role in the company through the proceedings that led to the Kawarau Conservation Order in 1997.

10. For the past 10 years I have project managed the engineering and environmental investigations into potential hydroelectric developments in the area of the lower Nevis Valley downstream to the Kawarau River. I have also project managed tenure review processes for land adjacent to the River on Ben Nevis and Craigroy Stations.

11. I have been provided with a copy of the Code of Conduct for Expert Witnesses in the Environment Court Practice Note (2006). I have read and agree to comply with that Code. Except where I state that I am relying upon the specified evidence of another person, my evidence in this statement is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

12. While there are topographic features of the lower Nevis River that enable or define specific concept options for potential hydro development, Pioneer Generation has focused on a process rather than a final concept when investigating and defining options for potential future hydroelectric development.

13. The reasons for this are that it has long been recognised that it is not only engineering parameters that govern the final form of any

consentable scheme. Other factors such as the environmental, recreational and social aspects of such a development also play a significant part in defining a viable proposal in the future. All these factors impact on the economics and overall viability of a potential scheme.

14. While significant work has been carried out to establish the engineering and environmental context Pioneer Generation has not yet embarked on a consultation phase with the community and stakeholders. There are some preferred options within elements of the project but Pioneer Generation has not settled on a preferred overall design concept at this stage. We consider that consultation is a vital part of the process to establish the most appropriate option and to gauge the overall viability of the project.

15. It should also be noted that a vital aspect of the development process is to negotiate a suitable tenure over the land required to construct and operate a scheme. To establish a case in the future for a viable scheme is clearly dependant on the outcome of tenure review for properties associated with the scheme. While Pioneer has initiated this process the final outcome is still unknown and appears to be some time away.

BACKGROUND

16. The Nevis Valley was identified as having hydro potential back in the early 1960's. Various concepts for harnessing this potential were considered in the late 1960's.

17. There is currently a small hydro facility on Ben Nevis Station that supplies farm operations. There is also historical evidence of small hydro schemes that were operated by miners further up the valley.

18. Various concepts for harnessing this hydro potential were considered in the late 1960's. As a result of the investigation work at that time a concept was derived which included a powerhouse approximately 4.5 km upstream of the confluence with the Kawarau River, a penstock, tunnel, an intake dam downstream of the Dell or Nevisburn Creek and a storage reservoir above Nevis Crossing. The electricity market and

environmental setting in which that conceptual design for the scheme was produced in 1967 is significantly different from what exists today.

19. During that time there was significant pressure to supply increasing power demands and the focus for development of any hydro- scheme concept was to maximise generation and peak output. Unlike today there was limited consideration of environmental and recreational impacts during this process. The concept of consultation with stakeholders was in its infancy.

20. I consider that if this 1967 proposal was to be initiated today, although the basic geographical parameters and characteristics that afford hydro potential still exist, the concepts considered would have greater focus on and consideration of environmental and recreational impacts. The differences between the concept which evolved in 1967, and what is to be discussed in my evidence shortly, primarily relate to the fact that in the 1960's any dam built would have been much higher than any that Pioneer Generation would contemplate. Furthermore, that project considered a substantial storage reservoir which, because available storage is small compared to the catchment size, would have been drawn down for significant periods of time to allow the reservoir to capture freshes in the river. As a consequence, ramping rates (that is the controlled rate of change of water entering or leaving) would have been high and residual, or environmental flows in the river, would have been small.

21. The conceptual design as outlined above does not meet current acceptable practice. The 1967 proposal has been abandoned so far as Pioneer Generation is concerned.

22. In the late 1960's, due to limitations of cost and transmission options at the time, the scheme was mothballed..

23. The application for the Kawarau Water Conservation Order was lodged in the early 1990's. The application included all the waterways upstream of the proposed Lake Dunstan including the Nevis River and all its tributaries. The Otago Central Electric Power Board considered the impacts of an order on both existing and potential hydro schemes and made submissions objecting to the proposed order.

24. At about the same time the Board lost the advantage of franchise areas, held under the previous Power Board legislation, and as a strategic move took out a financial interest in the leaseholds of Ben Nevis and Craigroy Stations which border the river.

25. The Otago Central Electric Power Board Submission to the KWCO application in July 1991 identified 34 significant waterways that would be covered by the order should it proceed. The Board took a measured stance and supported the inclusion of 9 of these waterways for coverage by a Water Conservation Order. Many of those waterways the Board supported for inclusion had significant hydro potential. The waterways supported for inclusion were Lake Wakatipu, and the Kawarau, Shotover, Rees, Dart, Routeburn, Caples, Greenstone and Von Rivers. The Board opposed the inclusion of 25 other smaller waterways including the Nevis River.

26. After a lengthy public process the Tribunal decided to recommend an order over the waterways of the Kawarau Catchment including the Nevis River. However despite a prohibition on damming of some of the Nevis River, the Tribunal recommendation allowed for the possibility of pursuing hydro development over a section of the River subject to meeting a set of conditions relating to wilderness, fishing and kayaking.

27. At the time Central Electric Ltd, the Boards successor, considered that the order as proposed provided sufficient protection for existing investments and that the opportunity remained to develop the hydro potential of the Nevis River within a defined geographic window under some stringent conditions. The company accepted that the order fairly assessed the relevant interests in the river and that while any future development would have to pass through those stringent conditions, that the order was appropriate. Therefore Central Electric Ltd did not appeal.

Recent Work

28. Since 2000 Pioneer Generation has carried out studies on the Nevis River to establish the environmental context, along with limited hydrological, transmission, sedimentation and geotechnical studies to assist in gauging the overall viability of a possible scheme. Desktop

studies have also been carried out on possible development concepts and economics.

29. Many of these studies have been carried out over a number of years. For example the gathering of hydrological data over a long period has provided an insight into both the seasonal and long term variability of flows in the river. To gain a comprehensive picture of the aquatic environment both on a seasonal and long term basis investigation work has been carried out by Mr Dungey over a number of years. Much of this work is ongoing.

30. Pioneer Generation has initiated tenure review for both Craigroy and Ben Nevis Stations adjacent to the Nevis River. The proposal is currently with the Minister of Lands awaiting approval to be advertised for public submission. As part of the tenure review process botanical, cultural and archaeological studies were also initiated.

31. Over the past 10 years Pioneer Generation has also submitted on various District and Regional plan proposals.

PARAMETERS THAT IMPACT ON FUTURE HYDROELECTRIC POTENTIAL

32. As a result of previous studies and Pioneer' s current investigations, a series of options have been investigated based on the basic physical parameters of the locality and the restrictions in the current order.

33. These physical parameters include:

    (a) The fall in the River of approximately 300 metres in the section between the Nevisburn, or Dell Creek, and a point approximately 4.5 km upstream of the Kawarau River. While locating the powerhouse further downstream would result in greater fall in the scheme, studies so far indicate that any increased benefit is offset by the increased cost of extending the water conveyance structures

    (b) The hydrology and flow characteristics of the catchment.

    (c) The potential development envelop available on the Nevis River which is limited by the geographical constraints and conditions of the KWCO 1997.

(d) The transmission options of either connecting into the Transpower Network or alternatively embedding the scheme into the Aurora Energy local distribution network.

(e) Road access to structures especially at the downstream area of any potential scheme.

(f) Storage potential in the valley. Studies by NIWA indicate that the storage potential in the valley is small relative to the size of the catchment and there is limited opportunity to store flows on a seasonal basis. Any potential storage has the ability to capture high flows over a short period but not store this water long term i.e. from season to season or year to year. This relatively small storage has therefore focused the potential benefits of storage on being short term and mainly for peaking generation capacity. As background many of Pioneer's run of river schemes are base load schemes with little ability to match seasonal or daily peaks in power demand[1]. On the Teviot Scheme the main storage in Lake Onslow is relatively large compared to the size of catchment therefore Pioneer Generation has the ability to match seasonal and some daily peak demands for electricity. Any potential storage in the Nevis River is too small to enable the scheme to operate in this manner.

(g) Potential impacts of the scheme especially the impacts on landscape, wilderness, fishery, kayaking and cultural values

Current Concepts Derived from Engineering Investigations

34. As a result of previous studies it has been identified that the main energy production section of the river is below the Nevisburn to 4.5 km upstream of the confluence with the Kawarau River. To harness that potential two concepts have been considered at this stage. The first concept is a small intake dam and reservoir flooding back into the Nevisburn Creek and transporting the water via a tunnel and surface penstock to a powerhouse on the bank on the Nevis River upstream of the confluence of the Kawarau River. This concept would

[1] Base load generation is generally provided by "run of the river" hydro-stations that generate to match the available water. Peaking stations generally have a storage facility upstream that enable them to generate at higher levels for short periods of time to meet short term demands.

essentially operate as a “run of river” scheme with generation matching the available flow with possibly a small peaking capacity dependant on the volume and operating range of the small intake reservoir. Mr McKenzie’s attachment 2, which for convenience I attach to my evidence, is a representation of this concept.

35. The second concept includes the structures in Concept 1 with the addition of storage reservoir above Nevis Crossing which creates an impoundment up to the area adjacent to the confluence of Schoolhouse Creek and downstream the geographical limits of the KWCO 1997 (Refer to McKenzie 2). Although the storage potential above Nevis Crossing is small compared to the size of catchment, the use of storage to cover winter peaks alone has been investigated.

Engineering Investigations

36. The following is a summary of preliminary engineering investigations carried out and the results to date.

37. There is significant hydrological information regarding flows in the Nevis River. Measurement of river flows has been carried out since 1977. These flows are derived from a recording station at Wentworth near the confluence with the Kawarau River and a recently installed recorder below the confluence of the Nevis River and Nevis Burn Creek. The upper site at Nevisburn has established a good relationship between flows in the upper and lower river enabling the longer Wentworth flow record to be used to establish accurate inflows into any proposed scheme. Evidence on the hydrology of the river will be given by Mr David Stewart.

38. General aerial contour mapping has been completed of areas above Potters Creek, the valley upstream of Nevis Crossing and in the area of the proposed penstock slope. These surveys have been used to evaluate possible locations for intakes, water transport and storage structures. They have also been used to quantify storage volumes, areas of inundation for various reservoir options and the impacts of potential operating ranges. In addition they have assisted in desktop studies and on-ground geological studies of the area.

39. Although general geological investigations have been carried out by engineering geologists, at this stage no physical investigations have been carried out. For the purposes of considering options the geological characteristics of the area have been derived from aerial photography, surface mapping and rock outcrops.

40. The results of these initial investigations are that the geology of the lower Nevis Valley is dominated by schist formations including steep gorges. The gorge is dominated by landslides especially on the true right bank. The topography including general ground level profiles, and geology, limit the scope for storage and intake sites and the options for transporting water especially via surface routes.

41. In terms of possible dam sites, investigations so far have concentrated on possible intake dam sites downstream of the Nevisburn. It has been assumed that this structure would have a crest level at or about 640 metres above mean sea level. These investigations have indicated that a suitable site exists about halfway between the Nevisburn and Potters Creek. This area has been identified by me to Mr McKenzie and is shown by him. I note that an intake dam site is located in Mr Petries evidence downstream of our preferred site. Our investigations indicate that this site indicated by Mr Petrie is not suitable for a dam.

42. Although considered as one of the options, no geological investigations have been carried out on potential dam sites in the gorge downstream of Nevis Crossing. However for the purposes of investigation it has been assumed that a structure in this location would have a crest level at or about 663 metres above mean sea level.

43. At this early stage the final form of any structures has yet to be resolved but it is anticipated that any dams will be concrete gravity structures probably constructed of roller compacted concrete. The general form of these structures includes a stepped spillway over a large section of the downstream face.

44. Elements such as bypass conduits and provision for fish passage are still to be investigated.

45. The landslide characteristics of the lower Nevis gorge make the use of surface water conveyance via pipelines or races prohibitive. The option of a 6.5 km long, 3m diameter power tunnel is being investigated. It is anticipated that this tunnel would have a submerged intake just upstream of the intake dam and daylight on the slope approximately 320 metres above the proposed powerhouse site. Geological reports and investigations so far indicate tunnelling conditions in the schist are expected to be generally favourable, with no major fault zones evident. The surface geology and topography infers that occasional smaller faults up to 10m wide may be encountered. Conditions are likely to be similar to those in schist bedrock in the Cromwell Gorge.

46. Any tunnel could possibly be shortened by 1km, by constructing a pipeline from the intake dam to a portal at the mouth of Potters Creek. No active landslides are evident in that general location, but the steep face of a dormant landslide, and rugged schist bluffs, could make construction difficult.

47. The penstock route above the potential powerhouse area traverses dormant landslides and colluviums (or slip derived material). Before any engineering work can be undertaken this area will require careful investigation, and design, to reduce the risk of instability.

48. It is anticipated that the powerhouse would accommodate two generating sets and a small switchyard. Foundation conditions at the potential powerhouse site are likely to be poor due to a wide crushed/sheared zone. Design and construction details would require careful consideration to address this issue.

49. As part of the engineering studies a general literature review has looked at any potential project seismic hazards in the area. So far investigations have concluded that more physical investigations are required to quantify any issues but initial indications are that the risks are no different from the risks any hydro development in the South Island faces. It is anticipated that these factors will be taken into account and accommodated for during the detailed design process.

50. Preliminary investigation into access requirements for a potential scheme are ongoing. Extension of existing access routes will be

required in the Nevis Crossing and Nevisburn area. If a storage dam is created above Nevis Crossing an alternative access would be required across the river and around the margins of any reservoir. It is anticipated that the downstream end of the scheme would be accessed via Bannockburn through Long Gully and Slapjack Saddle. A rough access track to the potential powerhouse site already exists.

51. Studies of the potential effects of any scheme proposal on sediment transport in the river were carried out by NIWA. These studies concluded that sediment yield for the section of river above any potential reservoirs was approximately 111,000 tonnes/year of suspended load and 22,000 tonnes/ year of bedload. Further investigations into the effects of reservoir operations including drawdown, on issues such as possible dust generation, sediment re-suspension, bedload bypass and management of any lakeshore erosion, are required before a project is selected. Management options for addressing sediment issues are part of the ongoing investigations and it is anticipated any issues can be addressed during the design phase

52. Electromechanical investigations have currently focussed on likely turbine and generator configurations to develop an output model. By selecting turbines and generators with the most efficient characteristics to match the flow and head for a potential scheme the energy output can be derived from the river flow records. Because of potential access limitations to the proposed powerhouse site and transmission parameters the installation of two generating sets in the powerhouse seems to the preferred option at this stage.

53. Desktop studies of transmission options have been undertaken considering either feeding into the National Grid via the Cromwell-Queenstown 110 kV power line, or embedding the generation in the local Queenstown and Cromwell network.

54. Studies so far indicate that the transmission of the energy generated from the proposed Nevis station is a complex issue, due to the remote location and the size of the proposed station. Transmission will require detailed study once generating equipment sizes are determined. There are two main options for transmission from the station, which are:

(a) Connect to the Aurora Energy Ltd's local distribution network.

(b) Connect to Transpower 110kV Cromwell to Frankton line near Slapjack Saddle.

55. There are currently two Aurora lines within reach of the potential station site. One connects into the Frankton sub-station near Queenstown via the Gibston Valley and the other connects to the Cromwell substation via the Roaring Meg Power Station in the Kawarau Gorge.

56. The connection to the Transpower 110kV Cromwell to Frankton line is relatively straight forward with this line being in close proximity to the potential power station.

57. As all our existing stations are connected into the existing embedded network there is a preference at this stage to pursue this option. This option would result in the energy being transported into either the Wakatipu Basin or the Cromwell area or both. The option would involve upgrading, and possible extension, of the existing embedded network which in turn has environmental impacts that must be considered in any resource consent application. It is anticipated that construction of these lines would involve large single poles or twin pole structures. More work is required to establish the most appropriate transmission options.

58. Given that the project is still in the conceptual design phase limited work has been carried on construction methodologies and their impacts. Aspects such as access tracks and spoil disposal. have yet to be addressed. Given the relatively small quantities of spoil involved in the project it is anticipated that this material can be disposed of in close proximity to the source and landscaped to match the existing topography or removed. Many of these issues relating to construction impacts are most likely to be temporary in nature and addressed at a latter phase of any project development.

59. Desktop studies to assess various operational scenarios, estimate construction cost and economic evaluations have been undertaken as well. These are discussed later in my evidence.

Environmental Investigations

60. Some of the environmental investigations carried out so far have been targeted to assess the impacts of any potential hydro scheme. Others have been commissioned for tenure review with some areas of these studies having an overlap with assessments on the impacts of any potential hydro scheme.

61. Specific studies include:

    (a) A preliminary cultural impact assessment.

    (b) Aquatic studies focusing on trout and native fish. These studies are ongoing and are targeted at establishing the current features of the aquatic environment. Impacts of any future hydro option have also been considered with a focus on potential impacts on fish migration and spawning, native fish and impacts of reduced flows in the gorge section of the lower river and the impact of potential reservoirs.

    (c) botanical studies over a limited area above Nevis Crossing.

    (d) A comprehensives study of the archaeological values in the area has been completed.

    (e) Apart from the ongoing investigations associated with the studies outlined above further studies are required on the landscape, wilderness, recreational and kayaking values in the area of potential impact of any hydro scheme.

62. A major exercise that has yet to be undertaken is consultation with the community and stakeholder interest groups. Pioneer Generation considers this is essential to establish potential issues that have not already been raised and to establish design parameter to avoid, remedy or mitigate these issues. This information can be fed back into the conceptual design process and has the potential to influence the total viability of the project.

63. The detail regarding studies on environmental issues will be covered by others.

Potential Operating Scenarios

64. Calculation of potential energy output from the possible scheme is dependent on the hydrology of the catchment, storage profiles, size and capacity of the generating plant chosen and the requirements for environmental and recreational flows that bypass the intake structures.

65. The operating regime for any potential scheme is governed by the final design concept chosen, conditions of consent and the prevailing energy market. Several operating scenarios have been investigated during the current investigation process including the allowance for storage options and environmental and recreational flows.

66. As a result of various hydrological modelling by NIWA it has been established that any potential storage reservoir above Nevis Crossing has limited storage capacity compared to the catchment size.

67. As anticipated in the 1960's concept to maximise the value of storage above Nevis Crossing one option is to have a large operating range and an operating regime where the reservoir is kept well below spill level for significant periods. This operating regime is perceived by Pioneer Generation to have significant environmental impacts especially on landscape values and has been discounted during the investigation process. However, as discussed above, with a more sensitive operating regime during any period of significant inflow any storage reservoir will fill and overtop relatively quickly. Therefore it is considered that any value from a reservoir would be derived from matching demand peaks in the local embedded network feeding Cromwell- Wanaka and Queenstown areas.

68. Because of the bed profile of any potential storage above Nevis Crossing there is potential with say an 8 metre operating range for significant areas of lake bed to be exposed at certain times.

69. Being conscious of the impacts on landscape one further option investigated was maintaining a full storage lake with minimal operating range from the period of spring thaw to the end of May and using the storage range of this lake in the winter period. The amenity value of lake during this time of year is limited as weather conditions

make road access into the valley extremely difficult. In addition during this period any exposed lake bed would be frozen and less vulnerable to wind erosion. The outcome of this operating regime would be to again fill the lake during the spring thaw.

70. If the scheme proceeded without significant storage above Nevis Crossing being included, it would operate essentially as a run-of-river scheme. An intake reservoir in the Nevisburn area would be small but there may be some small peaking capability dependant on the limits on drawdown established by conditions of consent. As hydro is not an abstractive use the flows downstream of the power station would essentially mimic the current flow patterns in the river.

71. All operating scenarios have considered environmental releases into the gorge section of the river and recreational releases over weekends of the summer months.

72. Modelling of operating scenarios so far has considered residual flows in the gorge section of between 15 and 20% of the mean flow and up to 13 recreational releases over the summer months but those considerations may change as any project evolves. Modelling of the environmental flows has also allowed for flushing flows on a regular basis. There are times during the year that the storages will overtop due to large inflows especially during the spring.

73. Potential operating scenarios requires further work both from an ecological viewpoint as well as feedback from a stakeholder consultation process.

Scheme Viability

74. Based on a run of river option from the work carried out so far the realistic potential of any scheme is to produce a peak of up to 45 MW and energy of approximately 200 GWhrs per annum. This is equivalent to Pioneer Generation's current energy production.

75. Preliminary investigations into the economic viability of the project have also been completed. This investigation has included estimates of capital costs, forward electricity price paths and a range of options for a potential scheme model and operating scenarios. The outcome of this preliminary work indicate that:

(a) A small hydroelectric scheme on the river is viable.

(b) The value of inclusion of storage above Nevis Crossing is predominately to provide peaking capacity.

(c) The scheme is still economically viable without a storage above Nevis Crossing.

(d) Economic viability is sensitive to any final conditions of consent especially environmental flows by passing the intake.

Conclusions

76. Pioneer Generation and its predecessors have had a long association with the Nevis Valley and hydro potential in the area. The company has actively participated in the various planning processes that affect potential development in the valley including the formation of Water Conservation Order (Kawarau) 1997.

77. Since 2000 the company has been actively investigating the hydro potential of the lower Nevis River. This investigation work has involved both engineering and environmental studies.

78. While there are topographic features of the lower Nevis River that enable or define specific concept options for potential hydro development, Pioneer Generation has focused on a process rather than a final concept when investigating and defining options for potential future hydroelectric development.

79. The reason for this approach are that it has long been recognised that it is not only engineering parameters that govern the final form of any consentable scheme. Other factors such as the environmental, recreational and social aspects of such a development also play a significant part in defining a viable proposal in the future. All these factors impact on the economics and overall viability of a potential scheme.

80. Considering engineering aspects and ,environmental and recreational values Pioneer Generation has investigated a range of options for construction and operation of a potential scheme.

81. It should also be noted that a vital aspect of the development process is a suitable tenure over the land required to construct and operate a scheme. In the future a viable scheme is clearly dependant on the outcome of tenure review for properties associated with the scheme. While Pioneer Generation has initiated this process the final outcome is still unknown and appears to be some time away.

82. Pending the resolution of this tenure review process Pioneer Generation has not taken its planning beyond the stages I have mentioned, so it is not possible to give any indication as to whether or not the company will be in a position to consider proceeding with a scheme or for that matter when. Those decisions can only be made after the tenure review process is complete.

References

83. Hicks, D.M. 2005. Sedimentation effects associated with a proposed hydro-scheme on the Nevis River. Prepared for Pioneer Generation. NIWA Client Report CHC2005-009.

84. McKercher A, Wild M. 2005. Nevis River – Hydrology and Impact of Storage. Prepared for Pioneer Generation. NIWA Client Report CHC2005-001. And Addenda.

85. Otago Central Electric Power Board 1991, Submission to the Ministry for the Environment, Kawarau National Water Conservation Order Application.

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6 May 2009