Regulatory Impact Statement – Access to Water in an Electricity Supply Emergency: Report Back

AGENCY DISCLOSURE STATEMENT

This Regulatory Impact Statement (RIS) has been prepared by the Ministry of Economic Development, in consultation with the Ministry for the Environment.

The RIS examines a number of options for putting in place regulatory measures for access to water below minimum Resource Management Act 1991 (RMA) resource consent levels in Lakes Hawea and Pukaki, in advance of a dry year electricity emergency.

Options are evaluated relative to the status quo that there are no measures for access to this water in place, but that special legislation for access to water below minimum consent levels has been considered in the past and may be considered again in the future.

The main caveat on the analysis of issues is that many of the costs of using water are difficult to quantify robustly. Available information on the costs and benefits of using water, and on potential methods for setting access to water that could be used in development of regulatory measures, is included in appendices to this RIS.

Options for avoiding a dry year emergency other than using water below minimum consent levels are not included in the analysis. A number of different options for improved security of supply were considered as part of the 2009 Electricity Market Review, and measures from that review are in the process of being implemented. These measures are expected to incentivise industry participants to better manage supply risks, and should reduce the likelihood of requiring emergency conservation campaigns and dry year outages.

The RIS concludes that the options for regulatory measures to access water do not clearly provide an improvement on the status quo and therefore additional regulation or legislation is not required at this stage. The proposal therefore will not impose any additional costs on businesses, impair market competition or the incentives on businesses to innovate or invest, or override fundamental common law principles.

Signature Date: _____
Ministry of Economic Development

STATUS QUO AND PROBLEM DEFINITION

New Zealand has a high reliance on hydro generation. However, limited storage capacity creates a risk that in very dry years electricity supply may not meet demand. In this situation, the cost of rolling outages to consumers can be significant – one estimate is around $50 million a day[1]. In such circumstances, given the high costs of outages, it is inevitable that options to avoid or defer outages are explored.

One option that has been considered in previous dry years is using water in lakes below current RMA minimum consent levels. There is water in some lakes[2] between this minimum level and the absolute minimum level at which hydro plant can operate. As the cost of outages is high, the benefits of accessing this water may exceed the costs in some cases. However, analysis[3] shows that it is very hard to quantify these costs robustly, which risks them being under- or over-estimated.

In the past, Government has legislated for access to water below minimum consent levels in emergencies, despite costs being difficult to quantify. Special legislation in 1992 provided temporary powers for the Electricity Corporation New Zealand (ECNZ) to use water in Lake Pūkaki[4]. Legislation was also considered in 2003 and 2008. Preliminary results of hydro inflow modelling[5] indicates that emergency storage might be used once every 15 years, if it was available. However, the likelihood of a future dry year emergency is difficult to predict[6].

The status quo that special legislation to access water below minimum consent levels is likely to be considered in a dry year emergency raises two issues:

- Firstly, because legislation to access water has been considered previously, it is uncertain whether it would be implemented in future. This uncertainty could lead to poor risk management by electricity industry participants. In particular, if they expect legislation to provide access to water in a severe dry year, they may undervalue water and use it too quickly, meaning a greater risk of hydro shortages.
- Secondly, if previous approaches are taken in future, measures are only considered close to an emergency, leaving limited time to consult and to fully consider impacts of access to water. Without robust information on the costs of using water in an emergency, this could lead to adverse effects, particularly for local communities.

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[1] This cost is based on a value of lost load (the direct economic cost to a consumer of not receiving a unit of electricity) figure of $5,000/MWh, and curtailment of 10% of national demand per day. Appendices 1 and 2 contain further discussion and explanation on the costs of using water and of outages.

[2] Lake Hawea and Lake Pukaki both have significant amounts of additional water below minimum consent levels. Other hydro lakes also have smaller amounts of water between minimum consent and absolute minimum operational levels.

[3] Information showing available analysis of the costs of using water in included in Appendix 1 and Appendix 3. The costs result from the economic, environmental, recreational and cultural impacts of using water.

[4] In the event, access rights were not used as significant rain fell. Legislation was repealed by Order in Council late in 1992.

[5] Initial modelling was undertaken by the Electricity Commission in 2009, based on historic hydro inflow information.

[6] The likelihood of a future emergency will depend on future hydro inflows, which may be affected by a number of factors e.g. generators' risk management strategies, the effectiveness of conservation campaigns, the level of investment in new generation and transmission, climate and meteorological factors including the impacts of climate change on future inflows (likely to lead to increased inflows, but more seasonal variation in inflows). In addition, other measures to be undertaken as part of the 2009 Ministerial Review of the Electricity Market (see page 4 of this RIS) are expected to incentivise electricity industry participants to better manage supply risks, reducing the likelihood of requiring conservation campaigns and rolling outages.

The Electricity Market Review Technical Advisory Group considered that, given provisions to access water are likely to be considered in a dry year, there could be merit in examining terms and conditions for access to water below consent minimums ahead of time. In December 2009, Cabinet invited the Minister of Energy and Resources and the Minister for the Environment (CAB Min (09) 43/4 refers) to report back on whether, and if so how, terms and conditions should be set for access to water below current consent levels in Lake Pukaki and Lake Hawea[7] in a dry year emergency.

Cabinet also noted that any 'access terms and conditions should cap benefits to generators, provide for compensation to affected communities and mitigate or avoid environmental effects'.

What about using the RMA to consider emergency access?

RMA processes have already weighed up costs and benefits of accessing water and set minimum consent levels through plan or consent provisions. There is already some provision in resource consents held by generators for additional access to water in Lake Hawea and Lake Tekapo in situations where a shortage is more likely[8].

However, both Lake Hawea and Lake Pukaki have additional water that it would be possible to use in an emergency. For Lake Hawea, Contact Energy could apply to vary its consents to access water. For Lake Pukaki, Meridian Energy would first need to seek a change to the Waitaki Water Allocation Regional Plan to alter the minimum level of Lake Pukaki before seeking a new consent or consent variation, as this plan currently prohibits a consent application being made below the currently defined minimum lake level).

The generators have indicated, however, that they do not want to apply to vary consents for additional emergency access at this time and consider costs of seeking access may outweigh benefits. This is because:

- the consenting process is costly and time-consuming
- they are concerned that the process could lead to parts of their current consents being re-litigated
- the risk that an application would be declined
- they risk jeopardising relationships with local community stakeholders
- they have other projects requiring consent that are higher priority
- at very low lake levels, there are costs and risks to them (e.g. risks of breaching minimum flow consents, or being unable to meet their retail portfolio if lake is empty/refilling).

It is not feasible for the government to require generators to apply for consent (and in the case of Meridian, a plan change) for emergency water access. Further

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[7] Lakes Pukaki and Hawea were chosen as these are the South Island lakes with the largest amount of additional storage. Any measures identified may be generalisable to other lakes with lower amounts of storage. Information on the costs of accessing water in Lakes Pukaki and Hawea is included as Appendix 1.

[8] Access to a lower water level is allowed when 'the Electricity Commission…determines that reserve generation capacity…should generate electricity'. The EC has determined that this is currently a 4% hydro risk curve. With the abolition of the current reserve energy scheme, this condition is clarified through a provision in the Electricity Industry Act.

consideration under the RMA may not lead to any change or any increase in certainty (even if limited to considering emergency access) given processes have already weighed up the costs and benefits of accessing water.

What about access under the Civil Defence Emergency Management Act 2002?

The Civil Defence Emergency Management Act 1992 (CDEMA) and emergency powers in the RMA may allow government to effectively 'over-ride' resource consents in an emergency to generate electricity. However, it is likely that these powers would not be used until rolling outages were already underway and special legislation already considered, or passed. The criteria for an emergency in the CDEMA are very restrictive (failure or disruption to a lifeline utility that causes or may cause loss of life, or injury or illness, that cannot be dealt with by emergency services or requires a co-ordinated response).

Other relevant work

Current work under the RMA relating to water access and electricity generation

The New Start for Fresh Water Programme, led by MAF and MFE, is currently looking at policy options for improved management of freshwater in New Zealand. This work will examine all uses of freshwater, including hydro generation. A report back on this work is due early in 2011.

The RMA phase 2 review is looking at reconsenting issues and the level of information required when new consents are sought for an existing activity.

A National Policy Statement (NPS) to address issues relating to regional and district council provisions for renewable electricity generation in their statements, policies and rules, including recognising its benefits and national significance, is near finalisation.

Electricity Market Review recommendations on security of supply

As a part of the Electricity Market Review, Cabinet agreed to a number of measures to improve security of supply [CAB Min (09) 43/4 refers], as well as to look at the option of using water below minimum consent levels. These include:

- abolishing the reserve energy scheme and selling Whirinaki power station to Meridian Energy;
- requiring retailers to make payments to consumers in the event of a conservation campaign or dry year power cuts;
- putting a floor on spot prices during a conservation campaign or dry year power cuts; and
- requiring generators to disclose information (such as hydro reserves, fuel stockpiles and availability, planned outages and net hedge positions) which informs the market on supply risks and management of risks.

These measures were analysed against alternatives in the Regulatory Impact Statement for the Electricity Market Review. The Electricity Authority will be consulting on and developing these measures over the next year. These measures aim to incentivise industry participants to better manage supply risks, and their

overall effect should be to reduce the risk of getting to the point where rolling outages are required. This paper examines arrangements for access to water in this context.

OBJECTIVE

The objective is to provide certainty in advance (particularly for electricity generators) on whether and how water in Lakes Pukaki and Hawea below minimum consent levels would be used in a dry year emergency.

REGULATORY IMPACT ANALYSIS

Option 1: National Policy Statement	An NPS under the RMA would provide additional guidance to consenting authorities on access to water in a dry year. It could, for example, provide guidance on assessing the national benefits of accessing hydro storage in an emergency.
Option 2: Specify no access to water in an emergency	Government would state that it will not legislate to allow water below minimum consent levels to be accessed in an emergency, and if additional access is sought, this must be through existing RMA processes ahead of an emergency.
Option 3: Outline a process for making legislation in an emergency ahead of time	Government acknowledges that in an emergency, special legislation that overrides RMA consent levels would be considered and outlines a process that would be used in that situation.
Option 4: Legislation put in place in advance	Legislative provisions are put in place in advance that set terms and conditions for access to water in a dry year emergency.

Analysis of options

Option 1: National Policy Statement

NPSs can be prepared under the RMA that state objectives and policies for matters of national significance. Consenting authorities must incorporate their provisions into planning documents, and have regard to them when considering consent applications.

An NPS could set out policies and principles for use of resources in an electricity emergency. It could provide additional guidance to consenting authorities on assessing national benefits against local costs, and may improve certainty relative to the status quo, if additional terms and conditions for access to water for emergencies are set in future consenting processes.

However, this option is not preferred at this stage:

- An NPS would need to be generic in scope, and given the characteristics of each situation and each lake are different, might not be sufficiently specific to address

the policy objective. It would be inappropriate to limit an NPS to specific lakes or specific forms of electricity generation, or to use it to set out particular recommendations for terms and conditions in an emergency.

- It would be costly. Developing an NPS requires public consultation or a board of inquiry process, and may cost up to $2 million. Experience to date is that NPSs take a long time and significant resources to develop.

- Implementing NPS policies relies on generators applying for a consent variation and they might still be reluctant to vary consents for the reasons noted earlier, meaning no improvement on the status quo (although future consents may be able to incorporate changes).

Option 2: Specify no access to water in advance

Government could indicate that water below minimum consent levels would not be available for use under any circumstances.

This option would aim to improve certainty and reduce incentives on generators to use storage too quickly. However, this option is not preferred as it would be difficult to make this believable to stakeholders. It would be easy for a future government to ignore a Government statement and pass special legislation in a dry year. A legislated 'no access' provision cannot bind future Parliaments not to repeal or change legislation.

Although this option would make it more difficult to enact special legislation at an early stage in a dry year, it still risks special legislation being passed in a severe dry year. It could perversely increase the likelihood of legislation being passed quickly without informed consideration, relative to the status quo.

Option 3: Outline of processes for an emergency before special legislation

Guidance ahead of time could acknowledge that, in a dry year emergency, access below minimum consent levels would be considered, and outline processes for that situation. For example:

- an advisory group could be set up once the risk of a shortage reached a certain point to consider emergency legislation, with representation from affected stakeholders e.g. consenting authorities, generators, iwi and community groups.
- guidelines could specify what will be considered in emergency legislation (e.g. conditions that should be met before water can be used, compensation and mitigation arrangements, and how arrangements should be administered).

This option is not preferred. It explicitly indicates that issues will not be considered through the RMA process and that electricity supply is the most important use of water in a dry year. Setting out measures through legislation does not allow the value of alternative uses of water to be weighed up before a decision is made to use water and removes stakeholders' and the consent authorities' usual rights and roles under the RMA.

It is not likely to reduce uncertainty relative to the status quo by much as although it explicitly states that special legislation is likely and should be planned for ahead of time, there is still sufficient uncertainty around when legislation would be considered

that it leads to the same difficulties in risk management that are outlined in the first bullet of the status quo.

It is not likely to improve outcomes and planning in a dry year very much relative to the status quo. There is usually only 2-3 months warning of a potential hydro shortage, which is still a very tight timeframe in which to complete activities such as gather information, consult and pass legislation.

Option 4: Legislate in advance for emergency access

Legislative provisions put in place in advance could set terms and conditions for access to water in a dry year, and address issues identified by Cabinet around 'capping benefits to generators and providing for compensation to affected communities and mitigating or avoiding environmental effects'.

There are a few different ways that this option could be implemented[9]. One approach would be to specify draft terms and conditions which would then be considered through a board of inquiry process to allow for comprehensive stakeholder consultation. Once a board had reported to government, results could be used as the basis of legislation specifying, in advance, terms and conditions for access to water in a dry year.

Any legislative provisions should not preclude generators from applying for access to water below current minimum consent levels through the usual RMA processes.

Legislation would also need to over-ride the minimum lake level specified in Rule 3 of the Waitaki Water Allocation Regional Plan[10] to allow use of water in Lake Pukaki below the current consented minimum (518m).

This option is the one that best addresses the two issues with the status quo outlined above. However, it is not the preferred option, as it has a number of disadvantages and costs that outweigh the benefits:

- As with option 3, it explicitly provides an exception to existing resource consents to make water available in a dry year (though terms and conditions may be stringent), without going through the RMA process. The same issues identified under option 3 (lack of flexibility to consider alternative uses of water, over-riding usual RMA rights and roles) arise with this option.
- Affected parties may be unwilling to participate in the board of inquiry process because the costs to them outweigh benefits. Generators may be unwilling to participate in a process that would impair their relationships with local communities and set a cap on benefits (relative to the status quo), and other stakeholders unwilling to participate in a process that effectively re-litigates contentious matters previously considered under the RMA. In practice, this means that Government would need to take the lead in advocating for change to existing consent conditions, without willing participation and buy-in from other affected

[9] E.g. one or all of a policy process, or advisory group, or a board of inquiry process could be used to assess costs and benefits of using water. Results could feed into the development of regulations or legislation to be brought in by Order in Council in an emergency, or legislation brought into force now.

[10] Legislation could either amend the Plan to make a general change to the minimum lake level, or make a change only for emergencies. A blanket change would allow other applications for water use down to whatever new minimum was decided. This would be outside the scope of legislation for emergency access to water. We suggest that a general plan change should follow the normal plan change process, and legislation should only amend the Plan for emergency access.

parties. With no-one other than Government advocating for the proposal, it will be more difficult to get information enabling satisfactory terms and conditions to be set in legislation.

- Even if legislation enables access to water below minimum levels in a dry year, there is no guarantee that generators would use the water in an emergency without being compelled to via further legislation, particularly if terms and conditions of access are onerous.
- It is difficult to set terms and conditions ahead of an emergency, as each situation and each lake is different. Compensation and mitigation arrangements will depend on how much water is used, how quickly it is drawn down, the duration of an emergency and the time of year.
- The time and cost required for a board of inquiry to consider issues fully is significant. The direct cost of a board of inquiry process is estimated at $500,000. Other parties will also incur significant costs, e.g. for evidence gathering and expert opinions.
- Conditions in special legislation could be inconsistent with the RMA and lead to changes in the way the RMA is interpreted in future, particularly in relation to setting provisions around compensation and capping benefits to generators. It may also make future consent processes more difficult if it creates a perception that stakeholders and decision-makers cannot rely on limits imposed on the exercise of consents to maintain appropriate environmental bottom lines.

CONSULTATION

Government departments

The paper was prepared by the Ministry of Economic Development in consultation with the Ministry for the Environment.

The Department of Conservation, Te Puni Kokiri, Treasury, Electricity Commission and the Ministry of Agriculture and Forestry were consulted on the paper.

The Department of Prime Minister and Cabinet were informed.

Other affected stakeholders

Electricity generators

Contact Energy operates Lake Hawea. Contact does not wish to seek access to water below 336m in Lake Hawea, and is unsure whether it would support measures to access this water. It considers that access to water below 336m should only be available in an extreme emergency, if at all. It noted that there are significant commercial and resource consent risks during the refilling period that would need to be addressed. It also considers that 330m may be too low and if a proposal proceeds, that any absolute minimum level should be set subject to detailed analysis of likely environmental effects. If legislation was to be considered, Contact would support the principle of graduated access to different lake ranges based on the severity of the electricity supply situation facing New Zealand.

Meridian Energy operates Lake Pukaki. Meridian has examined the possibility of access to water in Lake Pukaki below 518m, but is not currently seeking access as

this project is lower priority when compared with other consenting projects and a consent application is currently prohibited under the Waitaki Catchment Water Allocation Regional Plan[11]. Meridian considers on the basis of current knowledge that consent may be possible to use water below 518m, subject to a satisfactory plan change outcome, but also notes that from its investigations to date environmental effects increase and may become significant the lower a new limit is set. Meridian notes that any legislation used to access emergency water should not preclude generators from applying for access to water below their current minimum consent levels under the usual RMA process, where matters may be able to be more appropriately worked through with stakeholders.

Local Government

Environment Canterbury and the Otago Regional Council are the consenting authorities for use of water in Lakes Pukaki and Hawea respectively. The two councils have been informed that an investigation into options to lower the two lakes in an electricity supply emergency is being undertaken, and will be informed of the results of this Cabinet report-back.

The Guardians of Lake Hawea are a group of residents that have a strong interest in Lake Hawea. They will be informed of the result of this Cabinet report back.

Ngai Tahu

Ngai Tahu has statutory acknowledgments over Lake Pukaki and Lake Hawea, and must be consulted over resource consent applications. In the spirit of the Ngai Tahu Claims Settlement Act, if any legislative provision that over-rides the RMA were proposed, it should be developed in consultation with Ngai Tahu. Some initial discussions were held with Te Runanga o Ngai Tahu and Ngai Tahu will be informed of the result this Cabinet report back.

CONCLUSIONS AND RECOMMENDATIONS

None of the options clearly provide an improvement on the status quo and it is recommended that no action is undertaken.

Options other than legislation will not effectively address the policy objective. An NPS may not provide additional certainty as it will be broad in scope. It will also be expensive to develop. Permanently ruling out access to water (other than what is provided through the RMA process) is difficult to make believable to stakeholders.

Options to set terms and conditions beforehand would increase certainty, but are not recommended for other reasons, including difficulties in assessing costs and benefits in advance outside of the RMA, the costs of doing so, and difficulty in getting stakeholder buy-in.

Other electricity market reforms to improve security of supply may help to address the objective in the first instance. Additionally, RMA work streams including the new start for fresh water programme are examining fresh water issues, and an NPS for renewable electricity generation has been prepared and is to be gazetted later this year.

[11] Meridian is currently seeking consent to use water and build a power station in the Lake Pukaki control gates.

IMPLEMENTATION

Not required as the preferred option is the status quo.

MONITORING, EVALUATION AND REVIEW

Not required as the preferred option is the status quo.

APPENDIX 1: COSTS OF ACCESSING WATER IN LAKES HAWEA AND PUKAKI[12]

Impacts of lowering Lake Hawea

Lake Hawea is operated by Contact Energy. The lake has a minimum consent level of 338 m, or 336 m when certain conditions are met[13]. A further 6m of storage may be available in Lake Hawea between 336m and an operational minimum of 330m. This storage could provide up to 250GWh[14] of energy.

Costs/Risks	Size and nature of impact	Costs and possible mitigation
Dust	Lower lake levels expose sediment on the lakebed. In dry windy weather, dust storms can occur. Dust storms have reportedly been a major nuisance to Hawea residents, and reduced the value of the wool clip. Increased dust may also pose a health hazard, and a driving hazard on roads around the lake.	Vegetation may be able to be introduced to areas around the shoreline to prevent some of the dust. Another mitigation possibility is use of water as a stabilising agent, using a sprinkler system. Costs estimated ~$20,000 per hectare capital cost (around $10 million for ~450 hectares).
Lake Access / Recreation	The distance from shore to water increases. Sedimentation on the shoreline can be soft, muddy and unstable, creating a pedestrian hazard	Costs are graduated – depends on level of drawdown. Warning signs would be required.
Tourism	Road between Central Otago and West Coast follows the lake edge at one point. Erosion and exposed lakebed may detract from landscape values.	Difficult to quantify
Navigation	Exposed rocks and trees can be hazardous. High outflows and low lake levels create a vortex above the Hawea intake pipes which may also be a safety hazard.	Signage could reduce risk. Removal of obstacles would need to be considered if low lake levels were ongoing. Booms and warning signs for vortex would be needed.
Boating	Current boat ramp access would become more difficult.	Ramps and jetties would need to be extended or rebuilt.
Ground Water / Irrigation	A siphon in the lake to extract water to irrigate farmland is only effective for lake levels above 341m. Below this a pump is used to pump water. However, accessing water becomes difficult at levels below 336m as pump facilities cannot deliver maximum flows. Lower	Hard to quantify. Additional pumps/pumping facilities may be required. Pumps from nearby streams have been provided in the past where domestic bores have

[12] Information from this section is from 'Scoping report on access to additional hydro storage in electricity emergencies', Concept Consulting, September 2010.
[13] See footnote 5.
[14] Equivalent to an expected avoided cost of outages of between $625 million and $1875 million – see Appendix 2 for details.

	lake levels may reduce groundwater, which can affect bores in the surrounding areas.	dried up.
Fish	Long periods at low lake levels can reduce fish condition. Fish passage into streams can be reduced.	Hard to quantify – it may be possible to maintain fish passage by physical works.
Aquatic Vegetation	Draw down of the lake for a sustained period may affect shallow plant communities, invertebrates that dwell in them and any fish/birds that use them as food or protection.	Difficult to quantify – draw down rate could be restricted to allow eco-systems to re-establish.
Cultural	Lake is of importance to Ngai Tahu iwi, who hold a statutory acknowledgement over it. Altering lake levels may affect availability of food and access to lake and downstream resources	Difficult to quantify
Downstream impacts	Lake may require 18 months – 2 years to refill, during which time downstream flows may be reduced, affecting fisheries, wildlife and downstream water use e.g. for irrigation. Downstream consent levels may need to be amended / suspended.	Difficult to quantify – depends on the depth and duration of drawdown and weather patterns during the inflow season.

Impacts of lowering Lake Pukaki

Lake Pukaki is operated by Meridian Energy. It has a minimum consent level of 518m, specified both in Meridian's current resource consent and in Rule 3 of the Waitaki Water Allocation Regional Plan. Meridian cannot apply to go below this level without first applying to change the Plan, as rule 12 of the Waitaki Plan prohibits an application being made. 4.5m of extra storage may be available in the lake between 518m and 513.5m. Meridian indicates that on the basis of its current knowledge there are increasing and potentially significant costs for using water at lower levels (below 516.4m). Lowering the lake to 516.4 m could provide an additional 200 GWh of energy, and lowering to 513.5 m an additional 515GWh[15] of energy in total.

Costs/Risks	**Size and nature of impact**	**Possible mitigation and costs**
Dust	Lowering the lake beyond the current minimum could increase the chance of dust storms in spring. There is less habitation around Pukaki, so impacts are less severe than for Hawea. Dust may cause a driving hazard on roads around the lake and on the scenic road to Aoraki/Mt Cook.	Difficult to quantify. Not considered severe.
Erosion /	Exposed lake shelf may erode into the lake,	Repair and maintenance

[15] Equivalent to an expected avoided cost of outages of between $1300 million and $3850 million – see Appendix 2 for details.

Slumping	cutting away at the delta, and eroding the sides of the lake where roads or protective barriers exist. Further damage may be caused from waves as the lake returns to higher levels. Delta slumping may create waves that damage roads and bridge abutments, and pose a safety hazard. This event is low risk, but possible and will depend on a range of factors.	of roads required. Meridian estimates a cost between $0.3 to $3.2 million to address erosion impacts for lowering lake between 1 to 4.5m.
Lake Access / Recreation	The distance from shore to water increases. The shoreline can be unstable, creating a pedestrian hazard.	Costs are graduated – depends on level of drawdown. Warning signs would be required.
Tourism / Landscape	Road to Aoraki/Mt Cook follows lake edge. Lowering the lake may lead to subsidence of the road. There is also a popular view point for Aoraki/Mt Cook at the southern end of the lake. Erosion and exposed lakebed may detract from landscape values.	Difficult to quantify
Navigation	Exposed rocks and trees due to low lake levels can create hazards.	Signage could reduce risk. Removal of obstacles needed if ongoing low lake levels.
Boating	Current boating entry points could become unserviceable.	Ramps/jetties may need to be extended/rebuilt.
Wading birds	Lowering the lake may affect the aquatic invertebrates on which black stilts and other listed braided river and wading birds depend for food. Breeding success may be reduced if nests are flooded when the lake rises back to its earlier level. Black Stilts are critically endangered.	Difficult to quantify – Additional protection measures for affected populations or relocation may be possible.
Fish	Prolonged periods at low lake levels can reduce fish condition. Fish passage into streams can be reduced by lower lake levels.	It may be possible to maintain fish passage by physical works.
Aquatic vegetation	Draw down of the lake for a sustained period may affect shallower plant communities, invertebrates that dwell in them and any fish/birds that use them as food or protection.	Difficult to quantify – draw down rate could be restricted to allow eco-systems to re-establish.
Terrestrial vegetation	Rare turf vegetation is found on the shoreline. Altering the lake range may affect the population.	Difficult to quantify
Cultural	Lake is of significant importance to Ngai Tahu iwi, who hold a statutory acknowledgement over it. Altering lake levels may affect availability of food, access to the lake at a lakeside noahanga site and downstream resources, together with broader cultural	Difficult to quantify

	impacts associated with Lake Pukaki's connection with Aoraki/Mt Cook.	
Downstream Impacts	Lake may require 18 months – 2 years to refill, during which time downstream flows may be affected, affecting fisheries, wildlife and downstream water use e.g. for irrigation. There is potential for increased sediments in the outflow from the dam due to slumping of the delta bed. Downstream consent levels may need to be amended / suspended.	Difficult to quantify – depends on the depth and duration of drawdown and weather patterns during the inflow season.

APPENDIX 2: ELECTRICITY MARKET COSTS AND BENEFITS[16]

Value of lost load due to outages

The key benefit from using water in an emergency is avoiding outages. The direct economic costs to consumers is the value of lost load (VoLL). This cost can vary depending on the amount of notice before an outage (predicted outages are less costly, as planning can reduce effects), who is affected (for example, costs to commercial consumers are on average higher than to industrial consumers), the time of day it occurs, and how long it lasts. The Electricity Commission uses an estimate of $23,185/MWh for transmission planning[17]. This number reflects the cost of an unplanned outage to an average customer. The cost of dry year outages is likely to be lower, as outages can be anticipated and managed to a greater degree. Industry sources typically use a figure of around $5,000/MWh for dry year outages. (For comparative purposes, long-run average wholesale market prices are around $80 - 100/MWh.)

Up to 765GWh of additional storage may be available in Lakes Pukaki and Hawea. A much smaller amount is likely to be needed in a dry year, as any change in weather would allow increased hydro generation.

The total avoided cost from using additional storage is VoLL multiplied by the volume of power cuts avoided. To calculate this, it is assumed that:

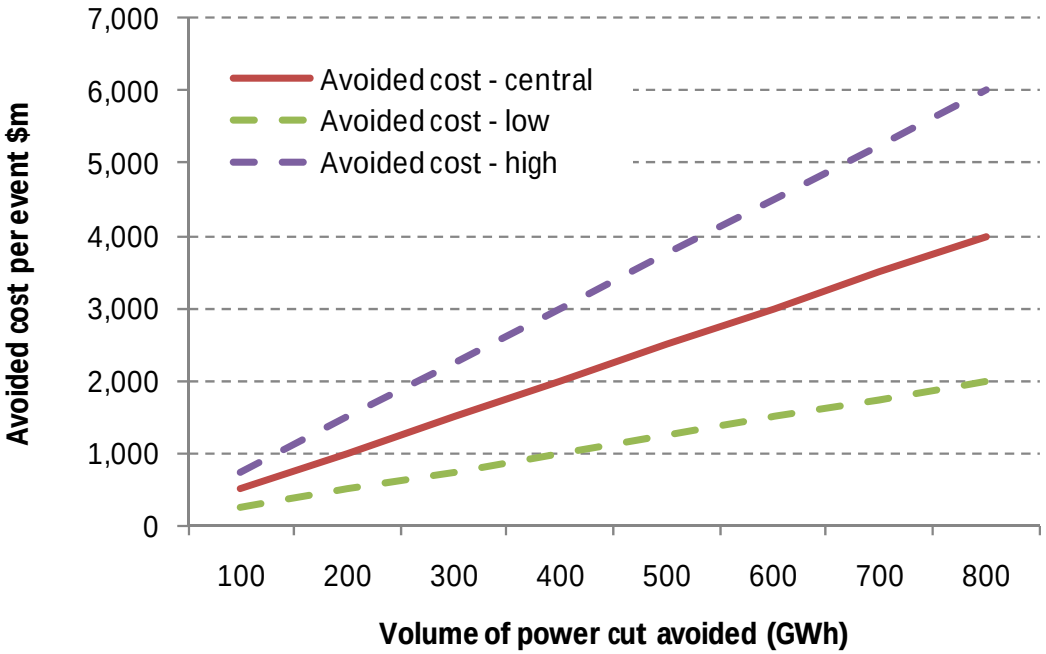
- Additional hydro storage is used just before outages. Storage may be used earlier or later. If used earlier, this may reduce the expected benefit figure.
- Other than the direct cost to consumers, there are no other costs of power cuts. However, there may be costs such as reduced confidence in New Zealand's electricity system, leading to reduced business investment.

The graph shows the range of avoided costs. Expected avoided costs are extremely large. For example, if avoided power cuts were 200GWh, this equates to an expected avoided cost of between $500 million to $1,500 million. In the absence of rain in May/June 2008, lakes were drawn down by the equivalent of 75GWh per week. This

[16] Information from this section is from 'Scoping report on access to additional hydro storage in electricity emergencies', Concept Consulting, September 2010.
[17] This figure is used in Part F of the Rules for the Grid Investment Test, and as a mid-point estimate for the cost of load shedding in the Generation Adequacy Criteria. It is current being reviewed.

is about 10% of national demand. Using the estimate for VoLL above, outages curtailing 10% of demand could cost around $378 million per week.

Figure 1: Estimate of avoided cost of outages



Preliminary work by the Electricity Commission suggested that emergency storage could be used once every 15 years, if it were available. However, the likelihood of a future emergency will depend on future hydro inflows, which may be affected by a number of factors e.g. generators' risk management strategies, the effectiveness of conservation campaigns, the level of investment in new generation and transmission and the impacts of climate change on future inflows (likely to lead to increased inflows, but more seasonal variation in inflows). In addition, other measures to be undertaken as part of the 2009 Ministerial Review of the Electricity Market are expected to incentivise electricity industry participants to better manage supply risks, reducing the likelihood of requiring conservation campaigns and rolling outages.

Other electricity market risks and costs:

Costs/Risk	Size and nature of impact	Possible mitigation and level of cost
Re-fill	Lakes can take a long time to refill after being drawn down, depending on inflows. This could reduce supply until the lake is restored, with the following effects. • Increased risk of an electricity shortage in the next year • Impacts on NZ's emissions profile if additional thermal electricity needs to	Costs are difficult to quantify – depends on the level of drawdown.

	be used • Exposure to risk of failure in other parts of the electricity system, such as the interisland link, or thermal generation. • Higher wholesale prices while lakes refill. The Electricity Commission has indicated that prices could be at or above $200/MWh.	
On-flow	Lake Pukaki: Lower lake levels lead to less water flowing to Ohau A power station. This would lead to decreased generation at Ohau A power station and the other 5 power stations below this in the Waitaki generation chain. Lake Hawea: Reduced generation at Clyde and Roxburgh, assuming releases from Hawea were restricted to rebuild lake storage. There are risks for generators in managing their generation portfolio and meeting retail obligations while lakes are refilling.	Difficult to quantify – depends on depth of draw down and restrictions on flow. Changing the flow control system to function differently at lower lake levels would be possible but may introduce secondary effects such as damaging the canal linings.
Damage to hydro structures	There is potential for waves at lower lake levels to damage the unprotected upstream face of the dam at Lake Pukaki, where blanket and riprap materials would otherwise protect this area. Tekapo B power station which sits in Lake Pukaki and may also face cavitation and vibration problems at low lake levels.	Protective materials may need to be extended and lake level restrictions may exist because of this problem. An estimate from Meridian suggests around $11 million costs for 3-4.5 m lake decrease.

APPENDIX 3: COSTS AND BENEFITS FROM USING WATER AND POSSIBLE APPROACHES TO SETTING ACCESS TO EMERGENCY WATER

The benefits of using water to generate electricity are high, as shown in Appendix 2. The costs of using water include the local economic, social and environmental costs identified in Appendix 1, and the electricity market costs identified in Appendix 2.

Evidence from consenting processes and other sources shows that estimating costs is difficult. Quantitative estimates for some costs can be derived, e.g. the costs of physical works such as rebuilding or reinforcing a road. However, some costs, such as the value of ecological impacts on plant and animal species, cultural values, amenity and landscape values are very difficult to quantify.

Costs will also vary in each electricity emergency, depending on:

- how much water is used – costs of using water get larger at progressively lower lake levels
- the rate at which water is used and overall duration of lake levels below the consented minimum – a long period of time at low lake levels may exacerbate some effects
- the time of year the lake is low – this can affect downstream uses such as for irrigation, with the irrigation season typically starting when the lake may be low, and how quickly the lake may refill.

It would be important to ensure that water is not used before it is needed – other lower cost sources of generation or emergency measures should be used before water below minimum consent levels.

It would therefore be difficult to set robust terms and conditions for access to water prior to an emergency. However, the factors discussed in the following sections could be considered for setting terms and conditions.

Physical triggers

Part of the uncertainty around whether water would be used is due to the nature of RMA consents. Consent is granted for use without restrictions for the part of the lake available to generators, and after this point use of the water is not allowed at all. Because of these steep discontinuities, the credibility of consent durability in an emergency is reduced.

More graduated consents – similar to the step consents used for Lake Hawea and Lake Tekapo[18] could help to address these issues. Access could be based on a 'physical trigger' to approximate the need for water and degree of dry year risk. A physical trigger would also provide a clear point ahead of which access to water could not be contemplated. Some suggested options are:

- Security of supply risk – at present hydro storage is compared to hydro risk curves that reflect the degree of risk of shortage (taking into account potential future inflows). Access to certain ranges in lakes could be based on more or less conservative risk curves.

- Other criteria – For example, 1992 special legislation outlined criteria that had to be met before using water in Lake Pukaki, including that:

    - Electricity was transmitted south on the inter-island link as much as possible

    - ECNZ had achieved all reasonable voluntary power saving possible

    - ECNZ had used all other permitted hydro storage in the South Island

The main challenge will be setting rules to cover all situations. For example, water may be needed for a local shortage, rather than a national shortage, or as a result of

[18] Lake Tekapo and Hawea have consents effectively allowing access to additional water when a 4% hydro risk curve is breached. See footnote 10

transmission constraints rather than a lack of generation capacity. A trigger may also need to vary seasonally, depending on other requirements for water use.

Compensation and mitigation provisions if water is used

Section 17 of the RMA specifies a duty for persons to "avoid, remedy or mitigate any adverse effect on the environment arising from an activity carried out by or on behalf of the person". Requirements in consents can include, for example, flood management, dam safety requirements, minimum lake levels, erosion management, and foreshore and lake margins management and monitoring.

Special legislation might include additional provisions for compensation and mitigation of effects below the minimum consent level, given these would not be specified in consents. However, specific compensation and mitigation arrangements will be difficult to set ahead of time. As noted above, costs vary in each dry year emergency and some costs are difficult to quantify.

1992 legislation for access to Lake Pukaki specifies a model for compensation. Access was based on an RMA framework. A bond of $1 million[19] was required to be paid to Canterbury Regional Council, and ECNZ was required to comply with conditions, including avoiding, remedying or mitigating adverse effects on the environment from using the lake.

Setting compensation and mitigation provisions through legislation may affect future consenting or reconsenting processes, as noted under option 4.

Capping benefits to generators

Cabinet noted that access terms and conditions should "cap benefits to generators and provide for compensation to affected communities, and mitigate or avoid environmental effects". This provision was noted to ensure that costs of using water are fully addressed and to address the incentives on generators to mismanage storage.

The benefit to generators of using water in a dry year (providing they are not using generation to match their retail portfolio) is likely to be high and therefore incentives to use water will be significant. The spot price of electricity in a dry year emergency will be high, depending on arrangements put in place by the EA for scarcity pricing[20].

On the other hand, the costs and disincentives for using water include the following:

a Environmental costs, including the costs of compensation and mitigation of effects.

b The cost of refilling lakes to minimum consented levels – once water below the consent minimum is used, lakes cannot be used until they refill, exposing generators to portfolio risks.

[19] 1992 dollars. In 2010 dollars, this bond would be approximately $1.5 million

[20] The Electricity Commission is currently consulting on options. It is expected proposals will be developed by the end of 2010 for implementation in 2011. Options at present include a price floor for pre-shortage situations and/or a value of lost load (VoLL) price floor for actual emergencies.

c Existing generation portfolio and retail obligations – Generators note they would use other options in preference to emergency water to meet their retail obligations. The extent to which this is a disincentive is unclear – given a choice between using generation with a price cap and buying outright from the spot market, they are likely to choose to generate.

It is very difficult to set a 'correct' price signal to manage incentives on generators. The value of water will vary in different dry years, and will be hard to calculate as it depends on a range of factors, such as future inflows and future demands, and the time of year the lake is low. Financial incentives to use or preserve water will therefore vary, and would be hard to set appropriately by capping benefits on generators.

Getting incentives correct for provisions to cap benefits to generators is likely to be less crucial if there are arrangements in place specifying a physical trigger mechanism and/or compensation and mitigation, as these instruments would already restrict when water could be accessed.