Social and Economic Implications of the Construction of a Cold Water Release and Related Facilities at or near Kenney Dam

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by
Marvin Shaffer & Associates Ltd.

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Executive Summary

In its 2001 report pursuant to the 1997 B.C./Alcan agreement, the management committee for the Nechako Environmental Enhancement Fund concluded that a cold water release facility (CWRF) at or near Kenney Dam was the preferred option to provide greatest benefits for the Murray-Cheslatta and Nechako river systems. The total capital cost would be approximately $100 million. The province's share would be $50 million, likely more taking into account Alcan's contributions to date, inflation, and other factors. Installing generation and transmission facilities along with the CWRF would add $50 to $65 million to the capital costs.

The purpose of this report is to present an assessment of the social and economic implications of this investment, specifically an assessment of the benefits and opportunities that a CWRF would have for local communities and First Nations, recreational and commercial interests, Alcan and the province itself.

A CWRF would eliminate the large and volatile releases through the existing Skins Lake spillway and reduce the amount of cooling water needed to meet salmon temperature targets in the summer months. The reduction in cooling water requirements would enable a more natural flow regime to be established as well as free up flows that could be used to meet user needs or be retained in the reservoir to maintain reservoir levels and higher levels of power production at the existing Kemano generating station. A CWRF would also provide an opportunity to produce power at or near Kenney dam.

The principal benefits would derive from:

- the rehabilitation of the Murray-Cheslatta system made possible by reduced, more stable and natural flows through the Skins Lake spillway;
- more flexible and natural flows for the Nechako; and
- the maintenance of higher levels of power production at the existing Kemano station and new power production at or near Kenney dam should generating and transmission facilities be installed along with a CWRF.

The rehabilitation of the Murray-Cheslatta system is central to the social and economic development plans of the First Nations and other communities in the area. The flow regime with a CWRF, combined with revegetation and other restoration efforts, could generate and sustain a significant amount of angling and related economic activity. A study for the Cheslatta Carrier Nation and Southside Economic Development Association estimated that the increased angling activity could generate $500,000 to $1,000,000 per year or the equivalent of 10 to 20 full time jobs. Although the estimates may be optimistic, the impacts, whatever their precise magnitude, would contribute to increased incomes and opportunities in the region.

A major benefit of provincial significance would be realized if the rehabilitation of the Murray-Cheslatta facilitated the resolution of outstanding lawsuits that have been filed by the Skins Tyee and Cheslatta First Nations. A CWRF in itself won't necessarily resolve the disputes with these bands, but it is widely recognized that a CWRF is necessary for

the Murray-Cheslatta system to be rehabilitated and for the disputes to be resolved. If an agreement with the bands could be reached along with any government commitment to a CWRF, the costs of the CWRF would be offset to some degree by the costs the government would otherwise face. In their lawsuits, the bands are seeking the voiding of the 1950 agreement and water licences permitting the establishment of the Nechako reservoir and Skins Lake spillway, repair of damages that have been done to their lands, control over future releases, past and punitive damage awards and costs.

With respect to impacts on the Nechako, a CWRF would enable more immediate response to unanticipated flood events, though require careful management of forced spills in high water years. The more natural flow regime and flexibility offered by a CWRF would likely reduce the costs that implementation of a sturgeon recovery plan under the Species at Risk Act would otherwise entail. It would also facilitate the rehabilitation and enhancement of other resident fish resources, with potentially even greater impact on angling and related economic activity than on the Murray-Cheslatta. The more natural flow regime and freed-up cooling flows could help meet other user needs, but agreements would be required to address conflicts among users as well as to establish firm release requirements from the reservoir.

The impact on power production at Kemano and the amount that could be produced at Kenney dam would depend on the allocation of the freed-up cooling flows. Three scenarios are considered in this assessment: a 'maximum' Kemano power scenario (where up to 10 m^3/sec. is retained in the reservoir), an intermediate scenario (where up to 5 m^3/sec. is retained, and a no Kemano power scenario (where all of the freed-up flows are allocated to meet user needs on the Nechako).

Based on simulations of historic water conditions, Alcan estimated that it would have retained 3.9 m^3/sec. on average under the maximum Kemano power scenario, maintaining generation levels 122,600 MWh per year, on average, greater than otherwise. The value or opportunity cost of that power to Alcan is estimated at $4.9 million per year based on forecast market conditions net of transmission costs and water rentals. Under the intermediate scenario, the incremental power production would average 85,500 MWh per year, with an annual value of $3.4 million.

The benefit of the incremental power production at Kemano could pay for all or a significant share of Alcan's contribution to a CWRF. The present value benefit under the 'maximum' Kemano power scenario over a forty year period would be $74 million at a 6% real discount rate; $48 million at a 10% real discount rate. The present value benefit under the intermediate scenario over a forty year period would be $52 million at a 6% real discount rate; $34 million at a 10% real discount rate.

The water rental benefit that the provincial government would realize from incremental power production at Kemano would depend on how the power is used. If it were used to support smelter operations, as Alcan intends, the water rentals would be relatively small, averaging some $37,000 per year in the 'maximum' Kemano power scenario, $26,000 in the intermediate scenario. If Alcan were to sell the incremental power, the water rentals

would be much higher, averaging $593,000 per year in the 'maximum' Kemano power scenario and $413,000 per year in the intermediate scenario. The direct financial benefit for government would be much less if the power were used for smelter operations, but there would be more aluminum production than otherwise which would generate some tax benefits as well as employment and other spin-offs for Kitimat.

The more that the flows are retained in the reservoir, the less would be the generation at Kenney dam. Alcan estimated that under the 'maximum' Kemano power scenario, Kenney dam generation would average 215,000 MWh per year. In the intermediate scenario it would average 233,000 MWh per year and in the no Kemano power scenario it would average 240,000 per year.

Based on recent BC Hydro purchase prices in green and other power calls, the value of the production from Kenney dam would significantly exceed its costs, including the interest costs on the capital investment required. The net present value of the project at a 6% real (8% nominal) interest rate would be $60 million in the 'maximum' Kemano power, $70 million in the intermediate and $74 million in the no Kemano power scenarios. In addition there would be water rentals totaling in present value $8.6 million, $9.9 million and 10.4 million in the three scenarios respectively (at a 6% real discount rate).

If the government were willing and able to capture the net present value of Kenney dam generation, the net return, more so combined with the water rentals government would receive, would be more than sufficient to recover all of the government's contribution to a CWRF. That would require reaching agreements with Alcan on the water rights and development plan, and with BC Hydro on the price and other terms for a power sale. It would also require the government contracting with private parties or a crown agency like Columbia Power to undertake the development on its behalf.

In the table below, all of the benefits of a CWRF are summarized, along with the income and employment impacts that the construction of a CWRF and Kenney dam power facilities would generate. The water rentals indicate the direct government revenue benefits of the project; the water rentals plus Kenney dam benefits indicate the benefits that government could potentially use to offset its contribution to a CWRF.

Multiple Account Summary
($ in npv millions at 6% real discount rate)

	'Maximum' Power	Intermediate	No Kemano
Reg. Economic Dev	Increased fisheries-related recreation and tourism in Murray-Cheslatta and Nechako regions (income impact estimated at up to $500,000 to $1 million annually) Project construction labour income of $30-$50 million (300-500 PYs of employment over the construction period) Project O&M labour income of $200,000 to $300,000 per year		
First Nation	Ability to implement economic development plans Ability to restore culturally significant sites and activity Provides necessary component for resolution of outstanding lawsuits		
Water Flows (excl power)	Greater ability to react to unanticipated flood events Facilitate/lessen costs of sturgeon recovery Flexibility to meet additional user needs (with greatest amount of freed-up flows in No Kemano scenario)		
Kemano power	74.1	51.7	0
Kenney power	59.7	70.1	74.1
Water Rentals **-Kemano** **-Kenney**	 .55-8.9 8.6	 .39-6.2 9.9	 0 10.4

1.0 Introduction

Under the 1997 Alcan/B.C. Agreement addressing legal and other issues arising from the province's rejection of the Kemano Completion Project, Alcan and the province agreed to establish a fund (the Nechako Environmental Enhancement Fund) for the downstream enhancement of the Nechako watershed. A management committee was established to assess enhancement options including, but not limited to, the development of a cold water release facility (CWRF) at or near the Kenney Dam. Alcan agreed to match provincial government (or other party) contributions to the fund, up to a total contribution on its part of $50 million.[1]

The management committee, including a representative from the province, Alcan and the President of the University of Northern British Columbia completed its research and consultations in 2001. In its report it concluded that a CWRF at or near the Kenney dam was the preferred option to provide greatest benefits to the Nechako and Murray-Cheslatta river systems. A CWRF would provide an alternative to the Skins Lake spillway for the water Alcan has to release from the Kemano reservoir system for fish and reservoir management purposes. It would reduce the amount of water Alcan needs to release to meet the temperature targets for migrating sockeye in the Nechako River and better ensure the targets are consistently met. It would also result in the rewatering of the Nechako canyon and provide an opportunity to install hydro generation along with the CWRF at or near Kenney Dam.

The committee studied other options including support for conservation and stewardship activities, fish hatcheries, habitat improvement, and cattle fencing, but it determined that such measures could complement, but not substitute for a CWRF. The committee saw the CWRF as a prerequisite for other improvements to be successfully undertaken.

The committee estimated the total capital costs of a CWRF at $96 million in constant 2001 dollars (excluding GST, interest during construction, and permitting costs). An additional $600,000 would be needed for establishing a pilot channel in the Nechako Canyon[2], $3 million for a trust fund to help pay for ongoing activities and costs of the Nechako Watershed Council[3] and $150,000 for a scientific panel to advise on optimal

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[1] At this point, the maximum amount Alcan would have to contribute to a CWRF or other enhancement option under the 97 Agreement would be $50 million less the amount it has already contributed for the committee's work and an amount not exceeding $10 million as credit for any reduction in costs made possible by the use of design or engineering work which Alcan did as part of its planning for the Kemano Completion Project

[2] The Committee recommended establishing a pilot channel as opposed to an engineered structure for the rewatering of the Nechako Canyon, provided fish impacts from the resulting movement of sediment could be avoided or mitigated. It is a more natural and cost-effective option. If an engineered structure had to be constructed it would add an estimated $38 million to the total project cost.

[3] The Nechako Watershed Council was formed in 1998 to represent communities and user interests, and help identify and resolve water management issues. The Council estimated that $75,000 per year would be required to administer an adaptive water management regime, and up to $1 million per year would be required for data collection and evaluation. A much larger trust fund than the $3 million estimated by the Committee would be required to support that level of monitoring work.

flow regimes. The total capital cost would be approximately $100 million. Operating costs were estimated at $230,000-300,000 per year. Under the 97 Agreement they would be Alcan's responsibility.

Unless the province can find partners (e.g., the federal government) to participate in the funding of a CWRF, it will have to contribute $50 million, likely more, toward its construction. The exact amount will depend on the total capital cost of a CWRF (including permitting costs, inflation from 2001, interest during construction, and any non-recoverable GST); any provision made for major maintenance;[4] the size of the trust fund established for on-going research, monitoring and water management; and the credit Alcan receives for its previous CWRF design and engineering work and its contributions for the management committee. Additional costs would be incurred if the province (or one of its Crown corporations) were to invest in Kenney Dam generation and transmission facilities. The capital costs of that project have been estimated to total between $50 and $64 million in constant 2000 dollars, including $15 million for transmission.[5]

A CWRF would clearly entail a significant level of expenditure for the province. At the same time it would have beneficial environmental, social and economic effects. The purpose of this report is to provide an assessment of the social and economic implications, specifically an assessment of the magnitude or significance of the benefits and opportunities that the construction and operation of a CWRF would have for local communities and First Nations, recreational and commercial interests, Alcan and the province itself.

The assessment is based on reports and presentations made to the NEEF committee and the Nechako Watershed Council as well as data and other information provided by Alcan and provincial government officials.

2.0 Impacts on Water Releases

A CWRF would have three main impacts on the release of water from the Nechako reservoir.

1. **Relocation of releases:-** Fish requirement and forced spill water releases in excess of an agreed flow for the Murray-Cheslatta system would shift from the Skins Lake spillway (the Murray-Cheslatta system) to the CWRF (the Nechako canyon). This would eliminate the large and volatile releases through the Skins Lake spillway, and enable the Murray-Cheslatta system to be rehabilitated with a more natural flow regime.
2. **Reshaping of releases:-** Less cooling water would have to be released to meet temperature targets for migrating sockeye in the hot summer period. This would eliminate the abnormal peak flows in July and August, enabling a more natural

[4] Under the 97 Agreement, Alcan would solely be responsible for operating and managing the maintenance of a CWRF, but not the costs of the maintenance itself.
[5] Klohn Crippen, letter to the Nechako Watershed Council, October 10, 2000.

flow regime (with releases peaking in the spring freshet) to be established throughout the Nechako system.

3. **Potential reallocation of flows:-** The reduced requirement for cooling would free up flows for additional releases to meet user needs, or enable more water to be retained in the reservoir to maintain reservoir levels and higher levels of power production at the existing Kemano hydro generating station.

It is currently proposed that with a CWRF, releases through the Skins Lake spillway would be managed to provide flows averaging 15 m^3/sec. on an annualized basis, fluctuating seasonally in accordance with a natural flow regime. There would be no flood releases through the spillway in all years up to 1 in 200 year flood conditions.

The CWRF would handle the balance of the releases, with minimum monthly flows averaging 25 m^3/sec. Releases through the CWRF would average more than 25 m^3/sec. on an annualized basis with any forced spills from the reservoir. They would also be greater the more that the water no longer required to meet migrating sockeye temperature targets (the freed-up flow) is allocated to downstream users (as opposed to being retained in the reservoir). The freed-up flow is estimated to average 12.9 m^3/sec. to 13.8 m^3/sec. (annualized), depending on the design temperature of the CWRF.

For purposes of this study, three freed-up flow allocation scenarios are considered. The first, a no Kemano power scenario, assumes that all of the freed-up flows are released to meet downstream user needs. The second, a 'maximum' Kemano power scenario,[6] assumes that Alcan retains in the reservoir up to 10 m^3/sec. (annualized), the exact amount depending on reservoir conditions, with the balance being released for downstream user needs. The third, an intermediate scenario, assumes Alcan retains up to 5 m^3/sec. (annualized), depending on reservoir conditions, with the balance being released for downstream user needs.

3.0 Principal Benefits

The changes in the water releases from the Nechako reservoir made possible by a CWRF would have a wide range of social and economic benefits.

The less volatile, more natural flow regime for the Murray-Cheslatta system would benefit recreational and commercial interests and provide a basis for tourism and recreational-related economic development. It would also help address long standing grievances of the Cheslatta and Skins Tyee First Nations who were not only displaced by the original flooding caused by the Kemano project, but continue to be frustrated by the

[6] In a truly maximum Kemano power scenario, Alcan would retain all of the freed-up flow that would not cause extra forced spills. In the 'maximum' power scenario assumed here and modeled by Alcan, it would not retain any of the freed up flow if there was a significant risk of additional spill, it would retain up to 5 m^3/sec. only if the risk of extra spill in the following month was low and from 5 up to 10 m^3/sec. only under low reservoir and inflow conditions. The average amount they would retain in this scenario based on simulations under historic water conditions would be 3.9 m^3/sec. (annualized).

releases through the Skins Lake spillway in their attempts to restore culturally significant sites and engage in their traditional fishing and other activities.

For the Nechako system, the flexibility offered by a CWRF would provide some benefit in managing unanticipated flood events. The flexibility, more natural flow regime and freed-up flows would also assist in sturgeon recovery efforts and the enhancement of other fisheries and fisheries-related economic activity, as well as help meet a wide range of user needs.

The retention of some of the freed-up flows in the reservoir would increase average annual power production at the existing Kemano generating station, supporting smelter activity when there would otherwise be insufficient hydro-electric production to maintain full smelter operations and meet Alcan's long term supply contract with BC Hydro. It could also enable Alcan to sell additional power to BC Hydro or other markets. Retention of the freed-up flows in the reservoirs would serve to maintain higher summer reservoir levels, especially during low water years.

Releases through the CWRF would provide the opportunity for the economic production of electricity at or near Kenney dam. This emission-free power would likely be certifiable as green,[7] and could help meet the province's growing electricity requirements or be sold in export markets.

3.1 Rehabilitation of the Murray-Cheslatta System

In terms of social and local economic impacts, the rehabilitation of the Murray-Cheslatta system made possible by a more stable, natural flow regime is a very significant potential benefit of a CWRF.

The original flooding and establishment of the Skins Way spillway required the relocation of Cheslatta and Skins Tyee First Nation communities. Its on-going operation, with large and volatile flows, has caused periodic flooding and soil erosion which in turn has degraded fish habitat and productivity, [8] discouraged investment in recreational and tourism-related facilities, precluded the restoration of spiritually and culturally significant First Nation sites, and reduced quality and increased costs for domestic water use.

It is widely recognized that these problems cannot be effectively addressed without a CWRF. A more stable, natural flow regime is necessary for flood control, reduced soil

[7] The only reason it might not be certified green is because of its reliance on releases from a large reservoir. However, the power project would not cause any increase in reservoir capacity and would be associated with a CWRF specifically designed to improve water flow regimes.

[8] In a presentation to the Nechako Watershed Council (July 16, 1999), Don Cadden of the then Ministry of Environment, Lands and Parks, noted that the historical characteristics of the rivers and lakes was dramatically altered by the creation of the reservoir and spillway. Fish habitat has been degraded and productivity reduced as a result of extensive deposition of silt, suspended sediment, reduced light penetration, and debris in Murray and Cheslatta Lakes; barriers to fish passage at the mouths of tributaries; and substantial erosion, widened channels, unstable banks, and other impacts on the Cheslatta river. Angler activity and First Nation food harvests have been greatly reduced.

erosion, enhancement of fish and wildlife habitat and productivity, restoration of burial grounds, and better quality and lower cost domestic water supply. It is central to the social and economic development plans of the First Nation and other communities in the area.[9]

Tourism Development and Other Rehabilitation-Related Benefits:- There is the potential for a significant increase in recreation and tourist-related activity with the rehabilitation of the Murray-Cheslatta system. In a study undertaken for the Cheslatta Carrier Nation and Southside Economic Development Association, Holman and Schienbien reported that a more natural water flow regime, accompanied by revegetation and shoreline stabilization, debris removal and other restoration efforts, could generate and sustain an estimated 10,000 angler days per year in the Cheslatta watershed.[10] That estimate could be overly optimistic based on the experience of other high quality lakes in the area, but the impact still could be very significant.[11]

Based on government surveys, Holman and Schieban estimated that angling-related expenditures would average $53 per angler day; $120 including equipment purchases. Provincial input-output model runs indicate that each dollar of angler spending would directly and indirectly generate (including induced household respending impacts) some $.94 of income. An increase of 10,000 angler days would therefore generate some $500,000 to over $1 million per year in income, or the equivalent of 10 to 20 full time jobs. Even if the increase were only 5,000 angler days, the annual income impact would be $250,000 to $500,000 or the equivalent of 5 to 10 full time jobs.

Not all of this income would be realized locally—some of the indirect and induced impacts would be manifested elsewhere in the province. Also, not all of the spending and income impact would necessarily be incremental, particularly from a provincial perspective. However, the incremental local impact would be significant and would contribute to increased incomes and opportunities in the region.

In addition to the spending-related benefits, there would be benefits accruing to local residents with access to better fishing and river-related recreational opportunities—what economists term consumer surplus benefits—the amount they in principle would be willing to pay for the better quality fishing opportunities. These were estimated in the Holman and Schienbien study at some $170,000 per year, based on government survey estimates of anglers' willingness to pay for angling opportunities.

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[9] In his presentation to the Nechako Watershed Council (July 16, 1999), Mike Robertson, a resident in the Southside, Grassy Plains area and advisor to the Cheslatta Carrier Nation stated that the Carrier Sekani Tribal Council and Cheslatta Carrier Nation have put a lot of effort into developing a restoration plan and noted that a release facility at Kenney Dam is required before any restoration is possible.

[10] G. Holman and S. Schienbien, "Potential Economic Value of Tourism and Other Benefits Associated with Restoration of Natural Water Flow Patterns in the Cheslatta Watershed", prepared for the Cheslatta Carrier Nation and Southside Development Association, December 2000. The angler day estimate was based on D.Ableson and P.Slaney, "Revised Sport Fisheries Management Plan for the Nechako River and Murray/Cheslatta System", May 1990.

[11] In his 1999 presentation to the Nechako Watershed Council, Don Cadden estimated benefits assuming and impact of 5000 angler days.

There would as well be increased food harvests for First Nations, which not only have the economic value of the retail price of the fish, but also the important social value of supporting traditional activities.

Potential Dispute Resolution Benefits:- In terms of impacts of broader provincial significance, a major benefit would be realized if the rehabilitation of the Murray-Cheslatta system were to facilitate resolution of disputes and claims issues with the Skins Tyee and the Cheslatta Bands. Both of these Bands have filed lawsuits with regard to the original flooding and forced relocation of villages, on-going soil erosion, destruction of fish and wildlife habitat, and their inability to restore graveyards and other culturally significant sites.

In their lawsuits, both Bands are arguing that the original surrender of reserves was not valid, they were not consulted and their interests weren't taken into account in the 1987 agreement between Alcan, the Province and DFO establishing the current flow regime and in the more recent 97 agreement between Alcan and the Province settling issues arising from the province's rejection of the Kemano Completion project. They are seeking the voiding of B.C.'s Industrial Development Act and water licences permitting the establishment of the Nechako reservoir and operation of the Skins Lake spillway, arguing that they were inconsistent with their rights and title. Further, they are seeking repair of the damages that have been done to their lands, control over future discharges through the Skins Way spillway, past and punitive damage awards, and costs.

The Cheslatta lawsuit was filed in 1998 and will not proceed until the Cheslatta add Alcan as a defendant party, which they have not done to date. The Skins Tyee suit was filed in 2002. In January 2004 the province and the federal governments filed statements of defence, but the action has not proceeded further.

In both cases it is up to the Bands to take the next steps. If the lawsuits are pursued, it is unclear what the outcome would be. They would be vigorously defended, but they are complicated aboriginal title cases, with no case law for guidance. The potential exposure is consequently uncertain.[12]

It is clear that if a settlement of these claims is to be reached, it will require the restoration of a more natural flow regime through the Murray-Cheslatta system, which in turn requires a CWRF. A CWRF in itself may not resolve these claims, but it would be a necessary component.

While uncertain in magnitude, settlement of the outstanding lawsuits and the issues they raise would be a significant benefit. The CWRF offers the opportunity for that benefit to be realized. However, that would require the government to pursue a comprehensive

[12] Information related to potential exposure from other cases and settlement proposals is discussed in a separate confidential memo.

agreement with the Skins Tyee and Cheslatta bands along with any commitment to a CWRF.

If an agreement with the Skins Tyee and Cheslatta bands were reached, costs of the CWRF would be offset to some degree by the costs the government would otherwise face or have to incur to settle the current lawsuits. If agreement could be reached on broader Treaty issues, the benefit would be that much greater. The costs of the CWRF could then be credited in any larger Treaty settlement.

3.2 Nechako System Impacts

The Nechako River system will be affected both by the reshaping of water flows as well as the allocation of some or all of the freed-up cooling flows to meet different resource interests. Data are not available, nor is the management regime with a CWRF sufficiently defined to determine the specific impacts on the different resources and user groups. However, the nature of the potential impacts and benefits are discussed below.

Flood control:- The Nechako reservoir has provided flood control benefits for the Nechako system. However, flood events have continued, not only from heavy spring run-offs but also ice jams in the river in the spring and fall.

Provincial Water Management officials have commented that the long lag between the time that water is released at Skins Lake and the time this water affects flows in the Nechako River (as the water works through the Murray-Cheslatta system) can impede flood event management. The problem is that it is not possible with the Skins Lake release facility to react to flood conditions that arise suddenly. Once water is released into the Murray-Cheslatta system, the flows cannot be stopped, even if river conditions require less release from the reservoir to avoid or mitigate flood conditions.

Unlike the Murray-Cheslatta system, there would be no significant storage of water in the Nechako canyon resulting from releases through a CWRF. Consequently, a CWRF could allow officials to immediately curtail flows into the Nechako in response to current conditions. Water Management officials believe this is an important benefit and could reduce flooding conditions when for example, run-offs suddenly increase (temperatures rise more than anticipated) or ice jams suddenly occur (as in the fall of 1996 when there was an unanticipated marked and sustained reduction in temperature).

On the other hand, the storage capacity of the Murray-Cheslatta system can be beneficial when water must be released from the reservoir to avoid flooding there. With the release of forced spills through a CWRF, the reservoir would have to be managed carefully to avoid circumstances when releases cannot be curtailed despite high water levels on the Nechako River.

Irrigation:- There is a significant agricultural industry in the Nechako valley with some 250 reported beef and dairy farms and over 200 other farms producing grain and forage

crops, other livestock or engaged on other farming activity.[13] Because of limited rainfall during the May to August growing season, there has been a demand for irrigation to support this agricultural activity, and there is potential for increased demand in the future.

The provincial Water Management Branch undertook a study of existing and potential irrigation demand in relation to flows both with and without a CWRF.[14] A CWRF would cause a significant reduction in flows in the July and August period. However, the irrigation demands constitute a very small percentage of total flows even with a CWRF. Existing demands peak in July at approximately 1 m^3/sec. The potential irrigation demand (and there is some uncertainty whether that demand would ever materialize) was estimated at 6 m^3/sec. in July (3 m^3/sec. in August). These demands represent a small proportion of total flows, even in low flow years. The existing July demand represents an estimated 1.2% of 1 in 20 year low flows. The potential July demand represents an estimated 7.2% of 1 in 20 year low flows. (The existing and potential August demands represent .7% and 4.1% of 1 in 20 year low flows respectively).

In a model of water flows and water requirements prepared by Alcan, estimated irrigation requirements could be met with a CWRF under all water allocation scenarios[15].

Sturgeon and Other Fish Resources:- The impact of a CWRF on sturgeon and other fish resources is addressed in a separate report by Triton Environmental Consultants Ltd.. There is some uncertainty about the temperature and flows that may be required in support of sturgeon recovery efforts, as well as the optimal flows for the enhancement of resident and anadramous fish resources. However, it is generally agreed that the more natural regime and flexibility enabled by a CWRF would assist in sturgeon recovery and the rehabilitation and enhancement of other fish stocks.

A sturgeon recovery plan will be required under the Species at Risk Act. It is likely that DFO will want the restoration of a spring freshet and it could demand higher flows than provided for in the 1987 Agreement if needed for sturgeon. While the requirements and impacts with and without a CWRF are not known at this time, it is expected they would be significantly less problematic and costly with the reshaping of flows and greater ability to achieve temperature targets enabled by a CWRF. This has the potential to be a significant benefit of the CWRF.

The rehabilitation and enhancement of other resident fish resources would also generate benefits. Like the Murray-Cheslatta, the Nechako River could support more angling activity with improved habitat and increased productivity. Ministry officials have indicated that the impact on angling activity along the full length of the Nechako could in fact be greater than in the Murray-Cheslatta system. Again, whatever the precise impact on the number of angler days, there would be significant regional economic impacts due to angling-related expenditures averaging $50 to over $100 per angling day.

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[13] Nechako Valley Regional Agricultural Information Guide, 1999.

[14] Water Management Branch, "Nechako Hydrologic Analysis and Irrigation Demand: Nautley to the Stuart Confluence", December 1998.

[15] Alcan, "Nechako Downstream Allocation Model (N-Dam)", Draft Simulation Results April 23, 2003.

Other River Interests:- A wide range of other interests would be affected by a CWRF. Canoeists use the river both for white water and touring experiences. The reshaping of flows would potentially improve white water opportunities in the spring and touring throughout the summer months. Problems associated with the instability of flows would be mitigated.

Float plane operators have had problems landing in the river in low flow periods during the fall months. Ranchers have had concerns with low water conditions when the river does not provide natural fencing for their grazing cattle. A CWRF wouldn't necessarily resolve these issues,[16] particularly in low water years, but there would be some potential to allocate some of the freed-up cooling flows to address these concerns.

Overall, the advantage of a CWRF is that it can restore a more natural flow regime and provide some flexibility to meet specific interests needs. Agreements would be required to address conflicts among users as well as to establish firm release requirements for the reservoir. Such an agreement would have to incorporate the potential for adapting to monitoring results and new information or requirements. However, bounds on the adaptive management would need to be established for all parties to have some certainty over the potential effects of a CWRF.

3.3 Power Production Benefits

A CWRF would enable power production to be increased at the existing Kemano generating station as well as at a new generating station, should one be built at or near Kenney Dam along with the CWRF. While a CWRF is not being proposed or supported in the region for the incremental power potential it offers, in terms of measurable resource impacts, this power potential would be the largest benefit of a CWRF.

Incremental Power Production at Kemano:- The amount that power production would increase at the existing Kemano generating station depends on the allocation of the freed-up cooling flows due to the CWRF. If all of the freed up flows were allocated to Nechako River interests, then there would be no incremental power production at Kemano. However, if some of the freed-up flows were retained in the reservoir, there would be increased power production in those years when the reservoir would not otherwise be full. (There would also be higher reservoir water levels and less exposed shorelines during low water periods, an important benefit for residents in the area).

Alcan has modeled reservoir operations and estimated incremental power production at Kemano under the 'maximum' and intermediate power scenarios assumed for purposes of this study.

[16] Alcan's N-Dam model indicates that with a CWRF the water requirements for these interests would be met in all months but September and October, naturally low flow periods.

Under the 'maximum' Kemano power scenario, up to 10 m^3/sec. (annualized) would be retained in the reservoir. This maximum amount would only be retained in those years when the reservoir level and inflows were low. Based on simulation results using actual inflows over the 1955 to 2002 period, Alcan estimated that it would have retained the maximum amount in less than 10% of the years. It would have retained 5 m^3/sec. (annualized) or more in only 22% of the years. In over 40% of the years it would not have retained any of the freed-up flows because the reservoir levels were too high. Alcan estimated that on average over the 1955-2002 period it would have retained some 3.9 m^3/sec. (annualized) under this scenario.

The incremental power production from the retained flows would vary by year. In some years the incremental production would have exceeded 500,000 MWh. In other years there would have been no incremental power production. Over the entire 1955-2002 simulation period, the average increase in power production at Kemano would have been some 122,600 MWh per year.

In the intermediate scenario, up to 5 m^3/sec. (annualized) would be retained in the reservoir. Water would be retained provided it would not significantly increase the probability of additional forced spills. Alcan estimated that it would have retained 2.7 m^3/sec. (annualized) on average over the 1995-2002 period under this scenario. The incremental power production would have averaged 85,500 MWh per year.

Under either scenario—the 'maximum' power or intermediate—the impact of a CWRF on Kemano power production in the future would depend on water conditions and the precise manner in which the reservoir is managed. If water conditions are drier on average than they were over the 1955-2002 period (for example with a prolonged continuation of the experience of recent years), the incremental power production would be greater than the amounts estimated in Alcan's simulations. It would also be greater if Alcan were to manage the reservoir more aggressively than assumed in its simulations—in particular if Alcan were willing to draw down the reservoir to levels that increase the risk of not being able to meet power production targets in subsequent years due to persisting low inflow conditions.[17] Alcan would be able to use more of the freed-up flows more often.[18]

Alcan has indicated that incremental power production would be used to support smelter operations. The availability of freed-up flows in low water years would enable Alcan to maintain higher levels of power and aluminum production than otherwise. Currently two

[17] Alcan estimated that if it were willing to accept a 15% risk of not being able to meet a minimum 770 MW of production each year, then incremental power production would increase by an average of 5 MW (43,800 MWh per year) as compared to the incremental power production assuming a zero risk of not being able to meet the 770 MW target each year. The 770 MW target reflects the sum of Alcan's smelter load and contract volumes in a 140 MW power supply agreement with BC Hydro. The BC Hydro agreement expires in 2014 at which time Alcan presumably would have less concern about assuming some risk of not meeting a 770MW production target each year.

[18] For similar reasons, Alcan would be able to use more of the freed-up flows more often, and the average incremental power production would be greater, if it were to pursue and secure the necessary approvals for the dredging of Tahtsa Narrows.

of the eight pot lines at its Kitimat smelter have been shutdown because of low reservoir levels and limited hydro capability.

Whether the incremental power would in fact be used for smelter operations would ultimately depend on both aluminum and wholesale electricity market prices. Presumably Alcan would only use the incremental power for smelter operations if the resulting increase in aluminum production were sufficiently profitable to offset the opportunity cost of not selling the power at available electricity market prices.

Electricity market prices net of transmission charges and losses, marketing costs and water rentals effectively provide a measure of the value of any incremental power production to Alcan. They indicate either what Alcan would receive if it were to sell the power, or what the power would have to be worth in aluminum production for Alcan to use the power in smelter operations.

The future electricity market prices that Alcan could receive for any incremental power production are highly uncertain. It would depend on market conditions in the years when the incremental power is manifested and on Alcan's ability to shape production to heavy load hour periods and high-priced seasons of the year.

For purposes of this study, an average Kemano delivery point price of $45/MWh (2004$ Cdn) is assumed. This is less than the $50-$55/MWh that BC Hydro has been paying for new sources of power in the province, but the incremental power production at Kemano would not be a firm source of supply eligible for BC Hydro's calls. The $45/MWh Kemano price is reflective of current forecasts of mid-Columbia (U.S. northwest) market prices, which are in the $45-$50 range (US), adjusted for transmission costs in the U.S. and B.C. and a $.75 to $.80 exchange rate.

Because Alcan is already selling large volumes of power, any incremental sales would be at the second tier $4.835/MWh B.C. water rental rate.[19] Thus with a $45 price, the value or opportunity cost of incremental power to Alcan net of water rentals would be just over $40/MWh. At this value, the average incremental production of 122,600 MWh under the 'maximum' Kemano power scenario would be worth some $4.9 million per year. The average incremental production of 85,500 MWh under the intermediate scenario would be worth some $3.4 million per year.

In Table 1, the present values of the Kemano incremental power production benefits over a 40 year period are shown at 6% and 10% real discount rates. The 6% rate is reflective of the time value of money or cost of capital government would employ in project and policy evaluations. The 10% rate is more reflective of the cost of capital industry would employ.

[19] B.C. water rentals are currently $1.036/MWh up to 160,000 MWh and $4.835/MWh for sales in excess of 160,000 MWh. They will escalate with increases in BC Hydro's domestic power rates.

As shown in the table, the present value of the benefit to Alcan in the 'maximum' Kemano power scenario totals $74 million at a 6% real discount rate; $48 million at a 10% real discount rate. In the intermediate scenario it is $52 million at a 6% real discount rate; $34 million at a 10% real discount rate. Even at the 10% discount rate, the incremental power benefits to Alcan could pay for almost all or a large portion of its share of a CWRF.

Table 1
Kemano Incremental Power Production Benefits to Alcan
(millions 2004$Cdn)

	'Maximum' Power	Intermediate
Ave. incr. power (MWh)	122,600	85,500
Ave. annual benefit	4.9	3.4
NPV @6% rate	74.1	51.7
NPV @10% rate	48.2	33.6

Because of the water rentals that would be paid, the provincial government would also derive some benefit from the incremental power production at Kemano. However, the amount would depend on how the power was used. If Alcan did in fact use the power for smelter operations, the special rate established under the 1950 Alcan/B.C. agreement would apply. It varies with aluminum prices, but has been in the range of $.25-.30/MWh in recent years. At $.30/MWh the incremental water rentals would average approximately $37,000 per year in the 'maximum' power scenario; $26,000 in the intermediate scenario. The present values over 40 years at a 6% discount rate would be $550,000 and $390,000 in the two scenarios respectively.

If Alcan were to sell the power, the second tier water rental rate would generate on average some $593,000 per year in the 'maximum' Kemano power scenario; $413,000 in the intermediate scenario. The present value benefit to government at a 6% real discount rate would be $8.9 million and $6.2 million in the two scenarios respectively.

The direct financial benefit to the government would be much less if the incremental power is used for smelter operations than if it were sold. However, there would be greater aluminum production and employment than otherwise, which would generate some tax benefits for the government as well as employment and other spin-off benefits for Kitimat. [20]

Kenney Dam Generation:- The water releases through a CWRF at or near Kenney Dam could be used to generate hydro-electric power. The minimum monthly average 25 m^3/sec. that would be released through the CWRF would generate approximately 160,000 MWh per year of firm power. The additional releases with forced spills and with the

[20] Alcan indicated that it can restart ½ potline of capacity with a 50 MW increment of power. That is roughly the amount of power that would be produced from the retention of the 10 m^3/sec. (annualized) available in dry years under the 'maximum' power scenario. The restarting of ½ potline of capacity would support 16 full-time jobs.

allocation of some of the freed-up flows to the Nechako system would increase the generation potential. In the 'maximum' Kemano power scenario, Alcan estimated that Kenney dam generation would average 215,000 MWh per year. In the intermediate scenario it would average 233,000 MWh per year. In the scenario where all of the freed-up flows were allocated to the Nechako, Kenney dam generation would average 240,000 MWh per year.[21]

The net value of this generation potential depends on the price the power would receive and the incremental capital and operating and maintenance costs it would entail.

The highest value market for Kenney Dam power would be sales to BC Hydro under its green or other independent power calls. BC Hydro has been offering $55/MWh for such power, subject to adjustments for location and other factors. Given the GHG (greenhouse gas) and green credits this power would likely be eligible for, the price of Kenney Dam power sold to BC Hydro could average over $50/MWh, escalating annually as in BC Hydro's other recent contracts at 50% of the inflation rate.

The costs of installing generating facilities were estimated by Klohn Crippen at $35-$50 million (2000$), including interest during construction. The transmission facilities required to connect to the BC Hydro system would add another $15 million to the capital cost. Operating and maintenance costs would be in the order of $350,000 to $450,000 per year (approximately .7% of the capital costs).[22]

With a $50/MWh price, total capital costs of $65 million, and operating and maintenance costs of $400,000 per year, there would be a very large positive net value to Kenney Dam generation. The net present value, or net benefit over a 40 year life span for the facility would be $60 million in the 'maximum' (Kemano) power scenario, $70 million in the intermediate scenario and $74 million in the no Kemano power scenario at a 6% real discount rate.[23] There would in addition be a present value of water rentals totaling $8.6 in the 'maximum' (Kemano) power scenario, $9.9 million in the intermediate scenario and $10.4 million in the no Kemano power scenario at that discount rate.[24]

The net benefit from Kenney dam generation indicates the amount by which the revenues exceed all of its costs, including a 6% real interest rate applied to the capital costs. With inflation continuing at approximately 2% per year, a 6% real interest rate would be equivalent to a nominal rate of 8%, which is well above current long term borrowing rates. If government were willing and able to capture the net benefit from Kenney dam generation, for example by financing the project at a 6% real (8% nominal) rate in

[21] These estimates are based on the assumption that 41.6 MW of capacity would be installed.
[22] Klohn Crippen, letter to the Nechako Watershed Council, October 10, 2000.
[23] The assumptions used in the net present value calculations for Kenney Dam are listed in Appendix A.
[24] It is assumed in this calculation that Kenney dam would be subject to water rentals on a stand-alone basis—that is, subject to the first tier rate up to 160,000 MWh of production and the second tier rate thereafter. If Kenney dam generation were undertaken by Alcan (or BC Hydro) and all be subject to the second tier rate, the water rental payments would be more than double (and the project net present value correspondingly less).

exchange for the net revenues it would yield, the net return, more so combined with the water rentals, would be more than sufficient to recover all of the government's contribution to a CWRF.

For the government to capture the net benefit from Kenney dam generation, there would have to be a different approach taken for this project than an independent power project (IPP) development. Because of risks and taxes, an IPP would likely require a significantly higher rate of return than 6% real. As shown in Table 2, the higher the required rate of return, the markedly lower the net present value of the project. At 10% real, the net present value would only be $18 million under the 'maximum' Kemano power scenario.

Even if an IPP were willing to undertake the project for a 6% real return, there is no existing mechanism by which government could capture the net present value of an IPP development at Kenney dam. That would require a competitive auction for the development rights, something which Alcan would almost certainly object to (unless it were to share in the auction return) and which would be unprecedented in the way water rights have been allocated in the province. As a practical matter Alcan may not want an IPP involved in the power project. It could greatly complicate the arrangements under which the CWRF is built and operated. A different approach for Kenney dam generation would be justified on the basis of the unique circumstances in this development.

Table 2
Net Benefit of Kenney Dam Generation
(net present value, millions 2004$Cdn)

	'Maximum' Power	Intermediate	No Kemano Power
6% real disc. rate	59.7	70.1	74.1
8% real disc. rate	35.1	43.4	46.7
10% real disc. rate	17.7	24.6	27.3

Government would have to reach agreement with Alcan on the water rights and development plan to go forward with Kenney Dam generation. It would also have to reach an agreement with BC Hydro on the price and other terms for a power sale. It could then contract with private parties or a crown agency like Columbia Power Corporation to undertake the development on its behalf. Columbia Power has recent experience in developing hydro developments with special water management arrangements, and is familiar with the project.[25]

An agreement with Columbia Power could be modeled on its projects and revenue sharing arrangements in the Kootenays. Columbia Power could finance the project with non-recourse debt once a long term sale agreement is reached with BC Hydro. It would then retain the sale revenues it needs to cover its costs and debt service charges, and return to the government all revenues in excess of its costs. The revenues the government

[25] It made a presentation to the Nechako Watershed Council on Kenney dam generation in 1999.

receives could then be used to recover its CWRF contribution. Revenues that the government receives in excess of its CWRF costs could be distributed in whole or in part to a Murray-Cheslatta/Nechako watershed management or development fund. In this way the government would not only recover all of its costs, but also provide funding for on-going management costs as well as generate a positive local benefit and interest in the project.

Summary of Power Production Benefits:- In Tables 3 and 4, the power production benefits from increased production at Kemano and Kenney dam generation are summarized. Table 3 shows the present value benefits at a 6% real discount rate; Table 4 shows the present value benefits at an 8% real discount rate.

Table 3
Power Production Benefits
(NPV at 6% real discount rate, millions 2004$Cdn)

	'Maximum' Power	Intermediate	No Kemano Power
Alcan (Kemano)	74.1	51.7	0
Gov't Water Rentals -Kemano -Kenney Dam	 .55-8.9 8.6	 .39-6.2 9.9	 0 10.4
Kenney Dam	59.7	70.1	74.1

Table 4
Power Production Benefits
(NPV at 10% real discount rate, millions 2004$Cdn)

	'Maximum' Power	Intermediate	No Kemano Power
Alcan (Kemano)	48.2	33.6	0
Gov't Water Rentals -Kemano -Kenney Dam	 .36-5.8 5.5	 .25-4.0 6.4	 0 6.7
Kenney Dam	17.7	24.6	27.3

4.0 Economic Impacts

In addition to the economic impacts that would be generated by increased recreation and tourist related expenditures associated with improved fisheries opportunities in the Murray-Cheslatta and Nechako systems, there would be income and employment generated as a result of the construction and operation of the CWRF and, if built, the Kenney dam facilities.

A CWRF would cost an estimated $96 million to construct. Klohn Crippen estimated that the construction cost net of engineering services would be approximately $88 million. Over $15 million of that would be for labour and another $26 million would be sub-contract services. Assuming a similar labour content for subcontract services as direct contract work, employment on the project would generate $21-22 million in income. That would represent more than 200 person years of employment over the construction period.

There would in addition be employment associated with the construction of generation and transmission facilities should a Kenney Dam power project be built along with the CWRF. Detailed cost breakdowns are not available for a Kenney Dam power project. However, assuming a similar labour content to the CWRF itself, Kenney Dam would add over $10 million and 100 person years to the construction employment impact.

In total, construction of a CWRF and Kenney Dam power project could directly generate some $30 to $35 million in income and over 300 person years of employment. That is a conservative estimate. The total labour income on other power projects has amounted to over 30% of the total project cost.[26] On a pro-rata basis the $160 million construction cost here would directly generate some $50 million in income and almost 500 person years of employment.

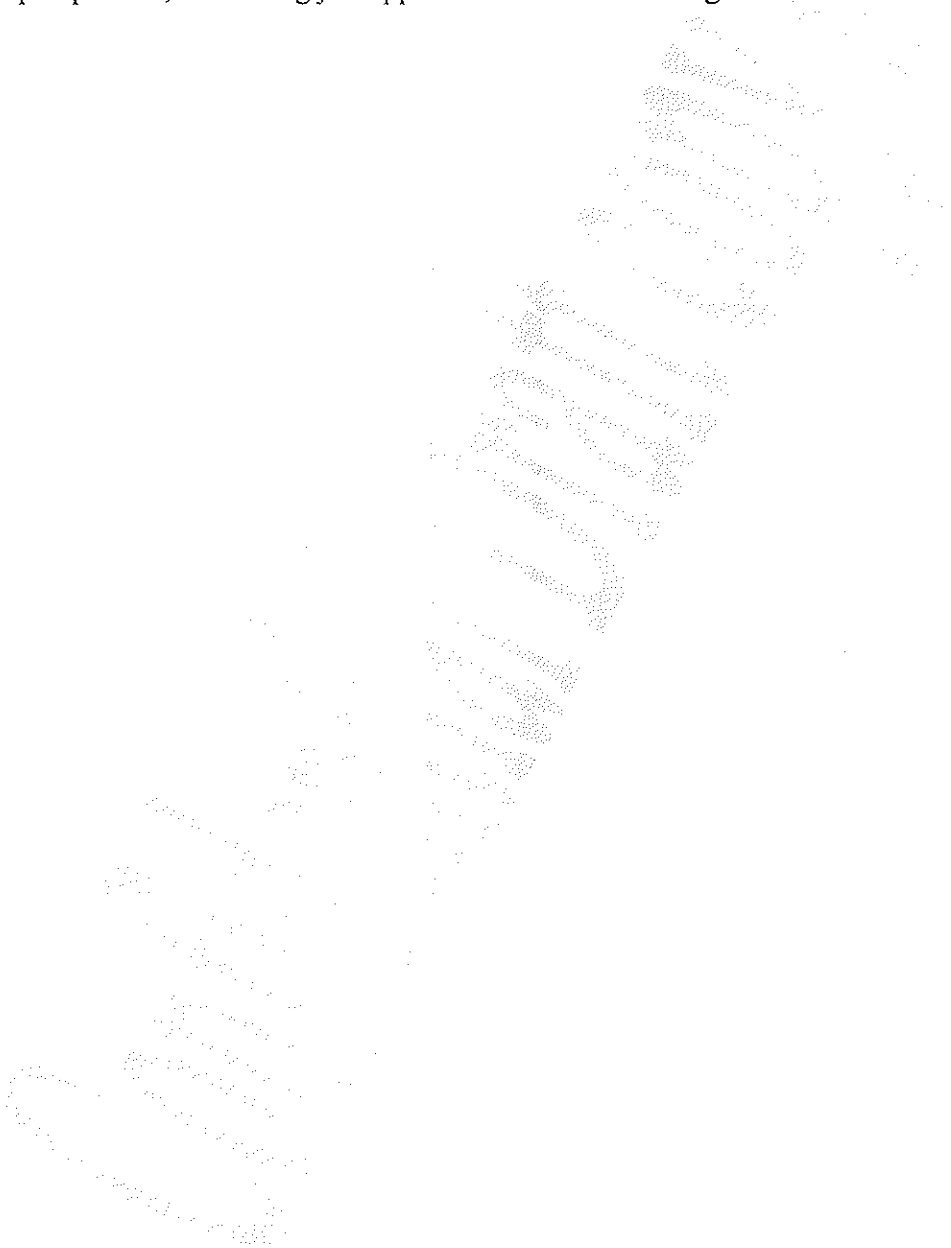
In addition to the direct impacts there would be indirect and induced impacts on income and employment in other sectors resulting from the purchase of input goods and services and the respending of increased household incomes. Input-output model runs have not been undertaken to estimate these indirect and induced effects, but typically total impacts throughout the province are double or more than the direct effects.

It is important to recognize that income and employment impacts indicate how much labour would be required as a result of a project, but they do not necessarily indicate the economic benefits that would be realized. There would be benefits to the extent the project results in the employment of persons who would otherwise be unemployed. But if there are alternative employment opportunities, as one could expect given the level of construction activity expected in the province in the short to medium term, the impacts would simply serve to attract workers from other jobs or from outside the province. There would no doubt be a local stimulus—increasing the amount of economic activity within

[26] For a recent study of the Wuskwatim hydro generating project in northern Manitoba, Manitoba Hydro estimated that construction labour income, including overheads, would amount to an estimated 38% of the total capital cost.

the immediate region—but not necessarily increased activity or significant net benefits for the province as a whole.

The operating and maintenance requirements for the CWRF and for any generation and transmission facilities would be relatively small. Klohn Crippen indicated there would be the need for a resident operator of the CWRF as well as a shift operator at certain times of the year. There would as well be the need for regular maintenance visits. A similar level of requirements would be required for the power facilities. In total the annual labour income could total some $200,000 -$300,000 per year. Again, the main benefit would be from a local perspective, increasing job opportunities within the region.



Appendix A
Net Present Value of Kenney Dam Generation
Input Assumptions

Capital cost	$65 million
O&M costs	$400,000/yr
Water rentals	$3,453/MW $1.036/MWh up to 160,000 MWh $4.835/MWh over 160,000 MWh
Selling price	$50/MWh escalating at 50% of infl
Inflation rate	2%/yr
Capacity	41.4 MW
Output	215,000 MWh in max Kemano 233,000 MWh in intermediate 240,000 MWh in no Kemano
First year output	50%
Project life	40 years