Kemano Completion Project Review

Summary Report

December, 1994

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1.0 Background

Debate and controversy with respect to Alcan's Kemano projects have been ongoing for many years. The legal rights provided to Alcan stem from the Industrial Development Act of 1949 and an agreement between Alcan and the Province of B.C. (the "1950 Agreement") which, among other things, provided Alcan with water diversion rights to the Nechako River and the Nanika River, and favourable water rental rates. These water rights were granted to Alcan to develop a hydro-electric facility to power an aluminum smelter in northwestern British Columbia. Water rights granted to Alcan under the 1950 Agreement are to be exercised prior to December 31, 1999. At that time, Alcan will receive a water licence in perpetuity for the water required to operate facilities constructed for hydro-electric generation prior to the deadline. Construction of the first phase of development began in 1951 and was completed in 1954 with a total installed capacity of 896 MW.

The Kemano Completion Project ("KCP") involves the installation of four new generators at the Kemano power plant with a nameplate rating of 540 MW. This will bring the total installed capacity at the plant to 1436 MW. KCP also involves the construction of a new power tunnel and associated intake, the dredging of Tahtsa Narrows and the addition of 1.1 metres to the gates at the Skins Lake Spillway. KCP also requires the construction of 82 km of 300 kV transmission line to transmit the KCP output to Kitimat, where it connects to the B.C. Hydro system.

B.C. Hydro has contracted to purchase an average annual 285 MW of KCP output for a period of at least 20 years. B.C. Hydro has also executed a Coordination Agreement with Alcan to capture efficiency gains realized from the coordinated operation of the Nechako Reservoir with the B.C. Hydro system.

To fulfill fish protection obligations the Project requires the building of a cold water release facility at the existing Kenney Dam and the construction of the Cheslatta fan channel. The Kenney Dam Release Facility ("KDRF") would draw cold water from deep in the reservoir to release into the Nechako River so that cool water conditions will prevail for the migration of adult salmon.

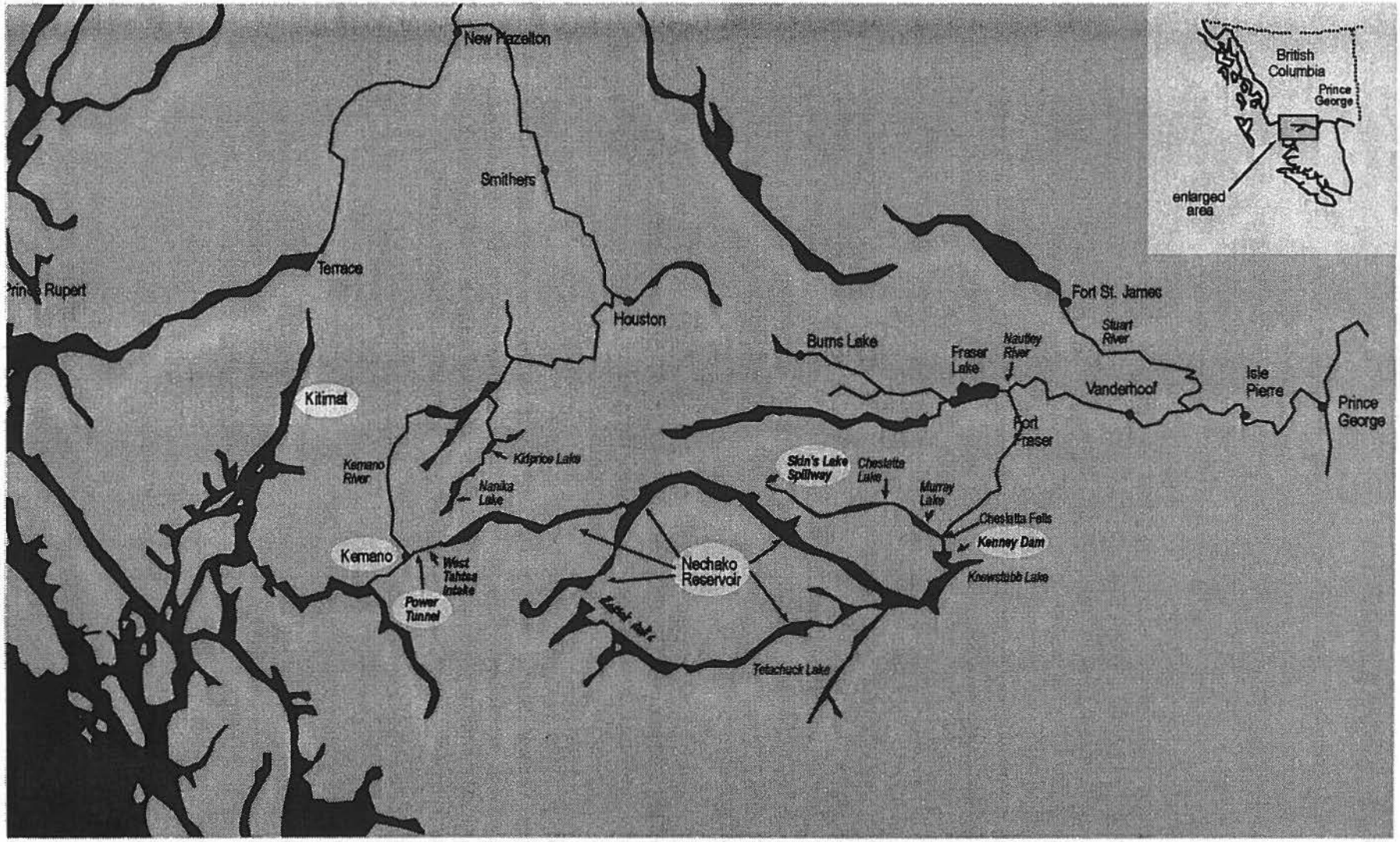
Figure 1-1 shows the location of the key features related to the KCP.

The Settlement Agreement

Prior to 1980, Alcan and the federal Fisheries Department ("DFO") reached an impasse in discussions on the amount of water to be released into the Nechako River to satisfy the DFO's mandate to protect the salmon fisheries. In 1980 the DFO obtained an injunction from the B.C. Supreme Court requiring Alcan to release additional flows which the DFO considered necessary for the protection of the salmon fisheries.

In 1985, Alcan petitioned the courts for a permanent resolution of the flow requirements. Prior to the court case, the federal government, provincial government and Alcan agreed to enter private negotiations to find technically accept-

Figure 1-1. **The Kemano Hydroelectric Development**



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able solutions to the conflict between Alcan's rights to the water in the Nechako and Nanika Rivers and the federal responsibility to protect the salmon fishery.

The 1987 Settlement Agreement between Alcan and the governments of British Columbia and Canada achieved an accord that all three parties deemed to be a satisfactory resolution, including a combination of flows and remedial measures for the Nechako River. This resulted in the development of the current KCP.

Under the Settlement Agreement Alcan gave up its rights under the 1950 Water Licence to divert the Nanika River and also agreed to construct a cold water release facility at Kenney Dam, as well as to construct and pay for other remedial measures required to maintain set numbers of chinook salmon. Alcan is to pay one half the costs of the monitoring and conservation measures and to share in the administration costs of a program to maintain the Nechako River fishery. The Nechako Fisheries Conservation Program (NFCP), was established with representation from the three parties and an independent expert.

The DFO agreed to forego any legal challenges to the 1950 Agreement, to pay for half the NFCP's costs of monitoring, and all the costs of applied research. The Province agreed to implement a fresh water fishery management strategy, and to amend Alcan's Water Licence and the 1950 Agreement to reflect the abandonment of Alcan's rights to the diversion of the Nanika River.

Alcan initiated construction of the KCP in 1988, but halted construction in 1991 following a successful challenge to the federal court trial division that KCP required a federal Energy Assessment Review Process Certificate prior to construction. That ruling was reversed by the Federal Court of Appeal and an appeal to the Supreme Court of Canada was dismissed in February, 1993. Approximately $500 million had been spent by Alcan on the KCP to that point.

Commission Review

On January 19, 1993, the Province of British Columbia issued the Terms of Reference for this Review under Order in Council No. 0033. The Terms of Reference specifically direct the Commission to "assess the nature and extent of the effects of the Project on the physical, biological, social and economic environments in the Kemano and Nechako River watersheds and the Nechako Reservoir." Issues to be addressed relate to river hydrology, fisheries, cost/benefit analysis, aboriginal concerns, and any other issues identified by the Commission. The Terms of Reference also direct the Commission to recommend options for addressing impacts of the project, inclusive of appropriate mitigation measures.

Initially, Alcan declined to participate in the Review process, but changed its position on July 9, 1993. The DFO had initially offered only limited participation, but that position also changed to full participation on January 27, 1994.

Representatives of the major First Nations' communities within the geographic region of the Review indicated that their participation in the Review would depend on certain concerns being addressed. Among the concerns, the First Nations' communities requested a full examination of the Fraser River, Kemano I,

and the justification for the project. The Commission's Terms of Reference did not satisfy First Nations' concerns regarding the scope of the Review, and First Nations groups declined to participate. The Technical Report provides additional background on the positions taken by First Nations. The recommendations from this Review will have a direct impact on First Nations.

The Terms of Reference direct the Commission to consult with interested parties on the form and content of the Review. The Pre-Hearing Activities commenced in April 1993 with a series of scoping meetings in Prince George, Fort Fraser and Kitimat. These meetings served to initiate consultation with interested parties about the Review and to scope the issues of concern to them, within the context of the Terms of Reference. As a precursor to the Public Hearings, the Commission staff held several workshops and pre-hearing meetings to provide a forum where interested parties could be informed about the Review and obtain clarification about the issues to be addressed.

Prior to the start of the public hearing, the Commission conducted two site visits of the study area. On September 10, 1993, the Commission was guided on a helicopter reconnaissance of the Nechako River, the Kenney Dam, the Nechako Reservoir, the Skins Lake Spillway, the Murray-Cheslatta system and the Cheslatta Fan. This was followed on October 20, 1993 with a tour of the Kemano River, the Kemano Community, the Kemano I powerhouse and the KCP facilities under construction. These tours served to provide the Commission with familiarity as to the character of the region, as well as an appreciation of some of the concerns articulated at the scoping meetings. During July and August, 1994, boat and canoe tours of the Nechako River, a float plane tour of the Nechako Reservoir and bus tours of local communities provided additional insights.

To focus discussion at the Community and Technical Hearing, the Commission developed a preliminary list of issues from the sentiments expressed at the scoping meetings and from comments submitted to the Commission by interested parties. The Commission kept the public apprised of these issues, Panel determinations, and the evolution of the Review process by the issuance of regular newsletters.

The Community Hearings were designed for information gathering, where participants would inform the Commission about the impacts of the KCP on the communities within the geographic region of the Review.

Community Hearings were held over 8 days in November and December 1993 and took place in Prince George, Fort Fraser, Vanderhoof and Kitimat. The Community Hearings were relatively informal and there was no cross-examination other than questions from the Review Panel. At these hearings the Commission also received suggestions from participants on mitigation and compensation for the negative impacts of the KCP, and how the positive impacts of the project could be maximized. The Commission heard submissions from 170 individuals and groups. In total over 1,500 people attended.

The Technical Hearing on the other hand, focused on collecting, analyzing and critiquing the technical and scientific evidence related to the KCP. Unlike the Community Hearings, the Technical Hearing was considerably more structured and formal and was divided into phases by key issues. Witnesses presented their evidence under affirmation, and were subject to direct examination and cross-examination.

The Technical Hearing was held mainly in the regions affected by the Project - Prince George, Vanderhoof and Terrace. This was to ensure that the people within the geographic region defined by the Terms of Reference had local access to the Review proceedings. Several weeks of hearings were also held in Vancouver to accommodate the significant interest in the project expressed by residents in the Lower Mainland and coastal communities.

The Technical Hearing spanned 79 days - December 8, 1993 to August 10, 1994. In total, 810 Exhibits were filed and 16,489 pages of transcript were recorded. The full public record totalled more than 200,000 pages. The hearings provided an exhaustive review of the KCP under the Terms of Reference. The Commission heard from all interested parties and the Commission issued subpoenas to ensure full participation by DFO scientists, along with representations from the federal and provincial Ministers responsible for negotiation of the Settlement Agreement in 1987.

2.0 Reservoir Operations

Under the existing Kemano I operations, the volume of water in the Nechako Reservoir cycles annually in response to seasonal variation in inflows. An approximate annual water balance is maintained by releases through the existing Kemano powerhouse and at Skins Lake Spillway. Kemano I resulted in significant reductions in flooding along the Nechako River and downstream on the Fraser River. However, the reduced water releases also resulted in high river temperature conditions in warm, dry years which created unfavourable conditions for migrating adult salmon. Releases through the Skins Lake Spillway meant dewatering of the Nechako canyon and significant impacts to Cheslatta lands and the Murray-Cheslatta system.

Plans to coordinate operation of the reservoir, after the KCP, balance the need for power production for the aluminum smelter, the sale of power to B.C. Hydro and the agreement to coordinate reservoir operations of the Nechako Reservoir with the B.C. Hydro system. During sustained periods of small inflow and/or relatively low Nechako Reservoir levels, Kemano power generation would be reduced provided other reservoirs in the B.C. Hydro system were in a superior storage position. Conversely, during sustained periods of large inflow and/or relatively high Nechako Reservoir levels, power generation would be increased at Kemano to avoid spilling, provided other B.C. Hydro reservoirs had the capacity to store water. During periods of system-wide drought, all reservoirs would be drawn down together to ensure sufficient capacity would be available to meet Alcan and B.C. Hydro firm loads at the end of the dry period. The maximum fluctuation in reservoir levels would increase from approximately five meters at present to nine meters under the KCP and reservoir coordination.

The KCP as now designed has several notable features. The Nanika River is no longer a component of the project. The Kemano River would receive a 30 percent increase in flow. The Nechako River flow would be reduced to less than half the levels of recent years.

The most notable feature of the project is the Kenney Dam Release Facility which would provide a more effective and efficient source of cooling water for salmon migration, enable rehabilitation of the Murray-Cheslatta system, restore the Nechako Canyon as a recreational resource, reduce erosion and sedimentation and improve water quality in the upper Nechako River. The facility would also improve management of flood releases from the reservoir, accommodating whatever releases are necessary except those at least as infrequent as once in 200 years.

For these several reasons the Commission recommends that the Kenney Dam Release Facility should be used for water releases regardless of the future of the KCP. The Commission recognizes that if the KCP is not undertaken the facility and the Cheslatta fan channel would have to be redesigned to accommodate substantially larger flows in order to restore the Murray Cheslatta system to its natural state.

The various impacts from the KCP operations are summarized in the following sections and are discussed in detail throughout the Technical Report. The Technical Report provides detailed discussion and specific recommendations.

3.0 Nechako Reservoir

The Commission recognizes that the Great Circle Chain of Lakes was once considered, and still has the potential, to be one of the most spectacular recreational assets of the Province. The Reservoir still provides the most ready access to Tweedsmuir Park. Safe public access to the site must remain a priority.

When the Nechako Reservoir was created in the 1950s, the Province granted Alcan the timber rights to the submerged trees. The Province did not require that Alcan remove the trees from the areas to be flooded, but did require Alcan to restore public road and water trail access, and to re-establish wharves and public approaches to pre-flooding conditions, up to a maximum total cost of $250,000 (1950$).

The resulting submerged timber created both significant navigational hazards and degraded the appearance of the Reservoir. A large number of partially submerged trees still protrude above the water. Debris and fallen logs have also accumulated along the shoreline.

Alcan has met its clearing requirements specified in the 1950 Agreement. Since 1979, Alcan has contributed approximately $500,000 annually to a timber clearing program which serves to increase boater safety, to provide refuge from wind and storm, and to improve the Reservoir appearance. Despite continued efforts, Alcan has only cleared approximately 10 percent of the timber in the Reservoir.

The KCP would further exacerbate the danger and public nuisance of the submerged timber in the Reservoir. With the KCP and coordination by B.C. Hydro, it is possible that the reservoir elevations could vary by up to nine meters. The annual reservoir fluctuations with the KCP would expose more standing timber creating even more hazardous navigation conditions. From an aesthetic perspective, the additional drawdown would worsen an already unattractive scene. Additionally, the decreased reservoir levels would impede access routes, water trails, boat launches and the rail portage.

The enhancement of the recreational potential of the Reservoir requires an aggressive program of timber removal and Alcan's continued commitment to maintain safe public access routes. The Commission recognizes that Alcan's program of timber clearing has improved recreational opportunities. However, the Commission finds that an aggressive clearing program must continue in the post-KCP Reservoir to ensure the safety of boaters and public access to recreational sites.

The Commission recommends that the Province should be prepared to provide incentives for Alcan to develop and implement a mutually acceptable plan for completing the clearing of the Reservoir by the year 2005. Such a plan should give priority to routes of access to Tweedsmuir Park such as Whitesail Reach of Ootsa Lake, Whitesail Lake to Chikamin Bay, Intata Reach and the south shore of Ootsa Lake. Such a plan should also include local community input.

If Alcan does not meet the targets developed in the plan, the Commission recommends that the timber rights should revert to the Province. The province could re-issue the rights to other interested parties granting the new bearer similar incentives for expedient removal.

Alcan has agreed to extend the rail portage system between Whitesail Lake and Eutsuk Lake at Chikamin Bay to ensure that it will remain operational under the greater drawdown of the KCP. Alcan has also agreed to extend or re-design private wharves and boat launching facilities where necessary. Alcan should confirm its responsibility to restore public access to the parks in the region affected by the lower minimum Reservoir levels.

4.0 The Nechako River

The most significant impacts of the Kemano Completion Project would occur on the Nechako River as the water releases from the reservoir would be substantially reduced. The effect would be most pronounced in the upper river above Fort Fraser, and most noticeable in the winter months from December to March, and in the summer months in years of low run off. These changes in river flows would have effects not only on fish, but on many other plants and animals of the river environment as well as on the communities near the banks of the river.

4.1 Fishery Impacts

Sockeye Salmon

The sockeye salmon of the Stuart and Nautley rivers are by far the major fishery resource of the Nechako River basin. The average annual commercial value of the sockeye for 1981 to 1992 was $26 million, which is 100 or more times the value of all other fish resources of the Nechako River. In 1993 the value of the sockeye catch was $77 million.

The importance of the sockeye resource was recognized for many years prior to the Settlement Agreement. The critical need for the sockeye is cool water conditions in July and August as they migrate up the Nechako, enroute to their spawning grounds in the tributaries to the large lakes of the Stuart and Nautley watersheds where their young reside before going to sea.

At present, cooling water must be provided from July 20 to August 20 by releases of reservoir surface water from the Skins Lake Spillway. Large volumes of water are needed in hot summers and even this may not always be sufficient to keep river water temperatures below levels that are highly stressful for sockeye. With the KCP, cold water released from the Kenney Dam Release Facility would enable better maintenance of lower river temperatures than can be achieved at present.

The Commission recognizes that the provisions of the Settlement Agreement provide the opportunity for greater protection for sockeye with the KCP. However, the Commission has concluded that the negotiated provisions should be augmented to protect the potential future value of the sockeye resource. The Commission recommends that cooling water releases from the Kenney Dam Release Facility be increased to provide a target temperature of 18.4°C at the confluence of the Nechako and Stuart Rivers. The Commission estimates that accommodation of this recommendation would require additional water releases of 6.5 m^3/s during the cooling period, or 1.1 m^3/s on an annual basis. Sustaining this target temperature through the season of migration and providing for ramping of flows to avoid stranding of young chinook would require an estimated 0.1 m^3/s on an annual basis. With these releases there will be the opportunity to undertake additional enhancements in the Stuart and Nautley systems which could very significantly increase the annual value of this fishery.

The possibility that reductions in the flow of the Nechako might cause difficulties for sockeye migration at Hell's Gate and at other points of passage on the Fraser was examined by the Commission. The recent installation of new, low level fishways at Hell's Gate together with other works designed to facilitate migration should ensure that any minor effect of the KCP on Fraser River flows would not affect salmon migration. With or without the KCP, the Fraser River should be monitored on a continuing basis for possible sites of obstruction.

Chinook Salmon and Trout

Chinook salmon are a second fishery resource of importance in the Nechako River. The value of the annual catch of chinook is not readily assessed, but for the period 1981 to 1992 the commercial value of the Nechako mainstem stocks was placed at $56,725 and that of the Stuart system at $95,806. Both of these stocks would also benefit from the recommended changes in cooling flow releases during migration.

The Settlement Agreement provides for a target escapement to the mainstem Nechako of 3,100 adult chinook with a range of 1,700 to 4,000. The Commission recognizes that the achievement of the target escapement is confounded by many factors beyond what happens on the Nechako. Low escapements, such as have occurred in recent years may in part be the result of increased exploitation rates, decreased ocean survival related to warm ocean conditions or perhaps the effect of undetected pollution as the juveniles journey to sea. Adult escapement is a poor yardstick for measuring the effectiveness of mitigation measures.

The Commission acknowledges the value of the considerable body of information that has been assembled by the NFCP in developing monitoring methods, in pilot testing remedial measures, in applied research and in developing strategies for assessment of the status of the chinook stock. Nevertheless, the Commission does not have confidence that the proposed program will be successful in achieving the conservation goal of maintaining the chinook at a population level of 3,100, and has accordingly recommended increases in flow. The Commission has accepted the target level of 3,100 chinook as a requirement to be met. A cost effectiveness study in a regional or provincial context might determine the optimal level of chinook and trout preservation efforts. However, the context of this Review focused on the Settlement Agreement and the Commission reviewed mitigation measures in relation to the target of 3,100 chinook.

The Commission has concluded that flows during the winter months, from December through March, must be increased from 14.2 m^3/s to 25.5 m^3/s to provide greater assurance that survival rates of incubating eggs and over-wintering juveniles would be acceptable. Increased winter flows are also a basic requirement of the provincial plan for mitigation of effects of the KCP on trout. The NFCP has acknowledged that if more water was available an increase in winter flows would have first priority.

Proposed KCP releases of water for the spring and summer period have also been considered as inadequate for the provision of rearing habitat for chinook and resident trout. The Commission has considered the effect of increasing the base flow from April through August at three different levels above the proposed base of 31.1 m^3/s in the Settlement Agreement.

Flow Scenario I

Increasing the base summer flows to 35 m^3/s would be a bare minimum provision and would still place the chinook and trout population at considerable risk. To ensure achievement of the conservation goal at this level of flow, a full scale hatchery operation should be undertaken immediately. It had been speculated at

one time by federal government employees that a hatchery on the Nechako could produce 50,000 adult chinook. While this may be optimistic, the Commission is confident that a hatchery operation could at least maintain the stocks to the level of the conservation goal, albeit artificially.

Flow Scenario II

A second option, increasing the base summer flows to 40 m^3/s, would give greater assurance that the wild stocks of chinook and trout would be maintained, but a pilot hatchery operation should be initiated at once to provide additional information on the biology of Nechako chinook and to prepare the way for a full scale hatchery if the need should emerge. The substantial decline in numbers of fry over the past four years and declines in the numbers of adults particularly in the past two years suggest that the need for a hatchery may emerge within five years.

Flow Scenario III

The third regime of flow for April through August would provide 45 m^3/s and give reasonable confidence that the natural stocks of chinook and trout could be maintained with only modest intervention and enhancement activities.

None of these levels of flow would be sufficient to guard against excessive sedimentation of the river bed. Accordingly the Commission recommends that high priority be given to erosion control and to encouraging riverbank vegetation in the Nechako mainstream and the tributaries between Cheslatta Falls and Fort Fraser. If these measures are not sufficient to forestall sedimentation problems, flushing flows to clean riverbed gravel may be necessary.

Of the various remedial measures described in the Settlement Agreement other than those concerned with erosion control and riverbank vegetation, the Commission would recommend that trials be continued with stream fertilization. The applied research and monitoring programs should be continued as a means of gaining greater understanding of the Nechako chinook stocks. The province should develop a parallel program for trout. However, as discussed in the Technical Report, the Commission recommends that the program of habitat complexes be discontinued.

The implications of these various flow provisions on seasonal and annual equivalent water releases are given in Table 1.1. It is to be noted that with increases of base flows the requirement for cooling flows would be reduced. The amount of the reduction could only be estimated with a computer simulation, and would vary both within the cooling flow period and from year to year. As is indicated in later sections, changes in the flows as outlined would have many beneficial effects for other uses of water of the river.

Determining the cost effectiveness between flow scenarios requires analysis of the cost of water not used for electricity generation, to be compared with the regional and provincial benefits of increasing flow. This analysis is beyond the Terms of Reference of the Review and requires simulations by B.C. Hydro of

Table 1. Possible Schedule of Flows for Fish Protection

Month	Short Term Observed 1980-1992	Settlement Agreement Below Cheslatta Falls		Rationale for Additional	Proposed Flows		
		Short Term	Long Term		35 m3/s April - August	40 m3/s April - August	45 m3/s April - August
January	31.1	31.1	14.2	Protection incubating salmon, overwintering juvenile salmon & trout	25.5	25.5	25.5
February	30.9	31.1	14.2	As for January	25.5	25.5	25.5
March	32.5	31.1	14.2	As for January	25.5	25.5	25.5
April	55.8	56.6	31.1	Rearing for salmon and trout	35	40	45
May	62.5	56.6	31.1	Base as for April. Flushing flows, 2 days @ 170 m^3/s plus ramping, once every three years	35.0 + 4.1	40.0 + 4.1	45.0 + 4.1
June	55.5	56.6	31.1	As for April	35	40	45
July	138.7	56.6 + 82.1	31.1 + 10.9	Base as for April Cooling water* 6.5 for 18.4 °C target 0.6 for extending season 0.6 for ramping	35.0 + 18.6	40.0 + 18.6	45.0 + 18.6
August					35.0 + 18.6	40 + 18.6	45.0 + 18.6
September	39.5	31.1	28.3	-	28.3	28.3	28.3
October	35.3	31.1	28.3	-	28.3	28.3	28.3
November	33.3	31.1	25.5	-	25.5	25.5	25.5
December	32.9	31.1	14.2	As for January	25.5	25.5	25.5
Mean Annual	**59.8**	**41.9 + 16.20**	**24.53 + 1.85**		**29.90 + 3.51**	**32.01 + 3.51**	**34.10 + 3.51**

water available for electricity after accommodation of the releases into the Nechako River.

4.2 Agriculture and Ranching

The reduced flows with the KCP will impact various consumptive uses of water along the Nechako River. Currently, irrigation is by far the most significant use of water from the river after power production and fisheries and, therefore, the most serious effects of water restrictions will be on this activity. The reduced flows may also have other impacts on agricultural activities such as a loss of sub-irrigation, the stranding of water intakes and problems with cattle containment due to the narrowing and shallowing of the river. Access to the river for watering cattle may be constrained by the need to ensure cattle do not wander and to protect water quality.

Alcan has agreed to mitigate or compensate for effects on agriculture caused by reduced sub-irrigation, stranding of water intakes, and cattle containment problems. The Commission is of the view that Alcan's commitments will resolve these concerns.

There is considerable debate about the amount of water which would be required for irrigation in the future and the amount of water which will be available under the 1987 Settlement Agreement long-term flows. As a result of this uncertainty, and at the request of the DFO, the Province has placed a freeze on new water licences upstream of the Stuart River.

The quantity of additional water required for future irrigation depends on how much land may be economically irrigated. The amount of land that would benefit from irrigation could vary from 5,040 hectares (present acreage under licence) to 54,000 hectares (maximum irrigable land) depending on economic conditions, particularly the price for agricultural products. The Commission is of the view that 18,000 hectares represents a reasonable approximation of the total acreage likely to be irrigated well into the foreseeable future. This represents about 13,000 additional hectares. The Province estimates that about 90 percent of future agricultural development will occur downstream of the Nautley.

An additional 13,000 hectares of irrigated land would require approximately 1.2 m^3/s of water on a mean annual basis. Of this amount, 0.1 m^3/s would be required upstream of the Nautley, and 1.1 m^3/s downstream of the Nautley.

As stated in the fisheries section, the Commission is of the view that the long-term flows in the Settlement Agreement are not sufficient to protect the fisheries resource and, therefore, they will not satisfy the needs of additional water withdrawals for irrigation. The Commission recommends that a survey of the availability of water from ground water, tributaries and the mainstem Nechako be conducted. The Commission further recommends that under the Settlement Agreement flows an additional 1.5 m^3/s on a mean annual basis be set aside for future irrigation and other consumptive water needs. Water could be added to the long-term flows on an incremental basis when it is needed. If the studies of alternative water sources determine that there is additional water which could be

accessed for irrigation needs, then the 1.5 m^3/s could be reduced. Allocations and distribution of this water throughout the year should be determined by the proposed Watershed Management Agency.

Commission Flow Scenario I would reduce the amount of water that should be set aside for future consumptive uses to less than 1.0 m^3/s. Under Commission Flow Scenarios II and III, the Commission believes there would be adequate water available downstream of the Nautley to meet the needs of agriculture in the foreseeable future. In the event that one of Commission Flow Scenarios I, II or III is chosen, the current moratorium on water licences downstream of the Nautley could be removed. There still may be some concerns upstream of the Nautley, however, water withdrawals are very small in this part of the river in the context of the mean monthly flow for fisheries protection during May to August.

4.3 Community Impacts

The reduced flows in the Nechako River after the commissioning of the KCP are anticipated to have impacts on community life along the river in several ways. Domestic water use, effluent discharge, future industrial development, and float plane operation would all be affected.

Municipal and Domestic Water Supply

The community of Fort Fraser has a water licence to extract its domestic water supply from the Nechako River. Currently, this is not a very good source of drinking water. However, the Province has made the commitment to absorb the total cost of any remedial measures deemed necessary to rectify the domestic water problem in this community after the installation of the KCP. This is anticipated to improve the overall water quality problem in Fort Fraser.

Vanderhoof also has a water licence to withdraw drinking water from the Nechako River, but has yet to exercise its rights under the licence. Rather, this community currently obtains its drinking water from wells.

Most individuals in the Nechako Valley obtain their domestic water from wells, with a small number withdrawing domestic water directly from the River. The water study recommended for agriculture and ranching will include ground water and should provide valuable information on how wells will be affected by the lower KCP flows. Alcan has committed to modify wells and any existing intakes in the river that are affected by the lower KCP flows. The Commission is satisfied that these measures are adequate.

Sewage Treatment

Currently, some communities utilize the Nechako River for discharging municipal effluents, particularly sewage after processing. Other pollutants may enter the river from surface run-off, leaching and tributary inflows. Sewage treatment at Vanderhoof and Fort Fraser is currently inadequate and the KCP will make

this problem worse. The Province is committed to upgrade the treatment facilities at Fort Fraser and Vanderhoof after the KCP, which will take care of the current problem and the problems caused by the KCP.

The Commission recommends that with the KCP, regular water quality monitoring should be conducted by the Province, especially in the Fort Fraser and Vanderhoof areas. The Fort Fraser area is particularly critical until the water and sewerage facilities in this community have been upgraded.

Industrial Use of Water

Industrial development upstream of the Nechako and Stuart confluence is sparse. The residents in the communities along the Nechako River have expressed fears that future industrial development in their communities would be hampered with the KCP as costs for effluent treatment and discharge would probably be very high. Additionally, the Ministry of Environment, Lands and Parks has stated that industrial proposals for the region would be closely scrutinized, especially with respect to effluent discharge, because of the reduced capacity of the river to absorb pollutants under the KCP.

Float Planes

Float plane operators use the river, especially at Vanderhoof. The Vanderhoof operation can currently be problematic during periods of low flows. This situation could be exacerbated with the KCP flows. The Commission is of the view that safety must be the paramount criterion in determining appropriate mitigation measures. Alcan has committed to provide safe float plane landing and take-off conditions at Vanderhoof after the KCP, or, if this is not feasible, to construct new facilities at a nearby lake.

4.4 Social Impacts

The Project will have various impacts on lifestyle and social considerations for the public using the Nechako River. The Project will affect the use and perceived value of the river to the local residents related to matters such as aesthetics, heritage sites, water based recreation, boating, angling, flooding and wildlife. It is difficult to determine the impact that each of the proposed Commission Flow Scenarios would have on these issues, except to recognize that each incremental increase in flow could reduce the magnitude of the negative social impacts.

Aesthetics

The rewatering of the Nechako Canyon under the KCP would have a positive impact. The most significant negative changes to the appearance of the Nechako River would occur between Cheslatta falls and Fort Fraser as a result of the substantially lower flows under the KCP, especially during the winter months. Although the stretch of the river from Fort Fraser to the Stuart confluence will not experience the same magnitude of flow reduction as the upper reaches, the

reduced KCP flows will cause some negative visual impacts. Downstream of the Stuart, the visual impacts will probably be noticeable but not significant.

The presence of artificial structures for fish habitat would reduce aesthetic values. The Commission has recommended that these structures not be used for fish habitat enhancement.

Heritage Sites

There was little evidence presented regarding heritage sites and the implications of the KCP. Since many of the heritage sites had been constructed to avoid flooding under natural flow conditions, reduced flows should not affect the physical sites.

Water-Based Recreation

At present, certain sections of the Nechako River are not particularly well-suited to water-based recreational activities because of poor water quality, high cooling flows, or the presence of substantial beds of aquatic weeds.

Improvements in the sewage treatment facilities would correct many of the current and future water quality problems, particularly near Vanderhoof. Additionally, the lower flows in July and August should improve safety conditions. However, increased weed growth at Fort Fraser and Vanderhoof after the KCP might decrease the desirability of the river for swimming. Furthermore, reduced flow might affect the safety of other water-based activities in parts of the river.

The Commission concludes that the impacts of the KCP on water-based recreation activities are uncertain. Although the proposed additional Commission flows should reduce weed growth relative to Settlement Agreement flows and improve conditions for small craft recreation, parts of the river might still remain unsuitable for swimming.

Recreational Boating

Under the present conditions, navigation during the fall flows is difficult. The Commission is of the view that the KCP would have a detrimental effect on boating and canoeing. The effects would be most severe upstream of the Nautley. The Commission concludes that it is not possible to mitigate the effects on boating without additional flows.

The Commission notes that Alcan has placed on record its commitment to undertake the costs of any necessary facility modifications to private docks and boat launching facilities that have been adversely impacted by the KCP. Likewise, the Commission believes that the Province should undertake similar work required to rectify public docking and boat launching facilities.

Angling

The rewatering of the Nechako Canyon offers an excellent opportunity to improve angling in the upper Nechako River. Lower and less variable flows should improve angling conditions upstream of the Nautley. The Commission has found that the flows under the Settlement Agreement would provide inadequate habitat for trout. The Commission Flow Scenarios would improve future angling by increasing habitat for resident fish.

The Commission is concerned about the lack of baseline data on angling in the Nechako River, particularly downstream of the Nautley. Without this information, it is difficult to see how the Province can properly fulfill its commitment under the Settlement Agreement to "maintain present recreational fisheries values."

Flooding

The KCP will reduce the likelihood of flooding in the Nechako Valley. Under existing conditions this has been a problem at Vanderhoof and Prince George. Flood benefits will occur in lesser increments down the Fraser River.

Wildlife

There was little evidence presented about the effects on wildlife to suggest that there would be any significant effects to which the wildlife would not adapt. A wildlife surveillance program could be used to identify any serious concerns. Specific effects that may merit monitoring include moose and deer calving and fawning sites on the in-channel islands, and the Vanderhoof Bird Sanctuary.

5.0 The Murray/Cheslatta System

Water from the Nechako Reservoir currently reaches the Nechako River by way of the Skins Lake Spillway and the Murray-Cheslatta system. Since the 1950's, the variable and sometimes heavy flows in the Cheslatta River between Skins Lake and Cheslatta Lake have resulted in significant environmental alterations.

With the KCP, the KDRF has been designed so that the Skins Lake Spillway will not release flows more frequently than once every 200 years, apart from routine maintenance spills. Reducing the flows to natural levels will benefit the lake system, by eliminating the surcharges which have killed shoreline trees and the near shore fish food organisms. In addition, lake flushing rates will slow considerably, leading to greater productivity for freshwater fish.

Once natural flows are restored, most of the tributaries to the Murray-Cheslatta system may provide promising spawning and rearing habitat for trout, although some restorative measures may be necessary. Mitigation work on the lakes themselves will include clearing shoreline debris and replanting shoreline vegetation. Such measures are intended to slow erosion and siltation of lake trout spawning habitats, thereby allowing the fisheries and recreational potential of the Murray-Cheslatta system to be realized.

The Cheslatta Nation have developed a Cheslatta Redevelopment Project ("CRP") in parallel with the provincial Fisheries Management Plan. The CRP envisages the restoration of the lakes, the identification and establishment of historic sites, the creation of recreational opportunities and a significant element of training for band members.

In the view of the Commission, the potential for rehabilitation of the Murray-Cheslatta system is a major benefit arising from the KDRF component of the KCP. Allowing the system to revert to natural flows will allow it to stabilize. The Commission recommends that the rehabilitation of the Murray-Cheslatta system should be undertaken with a community approach. First Nations and other local interests should be represented in both the design and implementation phases.

The KCP design makes provision for flood releases down the Skins Lake Spillway no more frequently than once in 200 years. However, the data supporting this estimate do not allow for precise estimates so that the actual likelihood of flood releases could be substantially less than 200 years. The Commission recommends that flood releases through the Skins Lake Spillway should be avoided, if possible. This may be done through a combination of measures including prespills, greater release capacity at the KDRF, or the effect of the Commission flow scenarios on flood control.

6.0 Kemano Watershed

Powerhouse flows at Kemano would increase 30 percent with the KCP creating slow changes in the river channel with possible effects on salmon, trout and eulachon populations. The Commission flow scenarios would only modestly reduce the expected discharges after the KCP. The commercial value of salmon originating in the Kemano is approximately $300,000 per year and there is the potential for increasing stocks. The hatchery proposal once considered by the DFO should be reassessed for its potential to enhance the salmon runs.

The Kemano River Working Group, made up of representatives of Alcan, the DFO and the provincial environment ministry guided the program of environmental protection during construction prior to the halt in the Project. The Coordination Agreement with B.C. Hydro implies a regime of powerhouse releases that could pose problems for fish protection. Operational guidelines should be established for the Kemano generating station under the KCP and should include the commissioning procedure, ramping rates, minimum discharge and flood control procedures and protocols for flow maintenance.

The Kemano River Working Group should be formally constituted to oversee environmental protection and mitigation measures for the remainder of the construction period and subsequently during operation. The membership should include local and regional community interests. This expanded Group should oversee the studies recommended by the Commission in the Technical Report.

Mitigation techniques that may be necessary for salmon have been demonstrated to a limited extent in the Kemano watershed or in other coastal areas. There is insufficient knowledge on which to base an assessment of impacts on eulachon and a study is recommended so that mitigation measures could be implemented if necessary.

7.0 Mitigation and Compensation

7.1 Commitments by Alcan and the Province

The terms of the Settlement Agreement provide for certain undertakings by Alcan and the Federal and Provincial governments to mitigate and/or compensate for anticipated negative impacts of the KCP. Additionally, Alcan and the Province have made commitments over and above those stipulated in the Settlement Agreement. Those latter commitments are described below.

Alcan's Commitments

Information presented at the hearing indicated that Alcan has committed to rectify or compensate for any KCP related impacts on the following existing facilities:

- private water intakes for domestic water or irrigation;
- cattle fencing;
- crop production losses caused by a reduction in sub-irrigation;
- private wells;
- trapping;
- private wharves and boat launching facilities; and
- float plane landing site at Vanderhoof.

The lowering of the minimum water level of the Nechako Reservoir will be mitigated by:

- clearing of standing timber and marking of hazards in specific areas of the reservoir to facilitate and improve boating;
- maintenance of Alcan's boat launch and campsite at Skins Lake; and
- extension of the Chikamin Bay rail portage.

Management of Alcan's commitments is being coordinated through a committee called the River and Reservoir Residents Committee ("RRRC"). This committee, established by Alcan in 1988, is comprised of Alcan personnel, consultants and a community liaison representative from the area appointed by Alcan. The terms of reference of the RRRC include reviewing and assessing requests for mitigation or compensation. The RRRC plans to establish objective standards to

ensure consistency between mitigation claimants. However, skepticism still persists among potential claimants about the effectiveness and impartiality of this body.

Notwithstanding the existence and intent of the RRRC, the Commission believes that a formal mitigation and compensation agreement or policy should be developed between Alcan and the stakeholders who may be affected by the KCP and to whom Alcan has expressed an intent to assist. The agreement or policy should state the precise nature of the commitments made by Alcan, including a time frame, and how effects will be evaluated. Such an arrangement would accomplish two goals. First, it would precisely describe the nature of Alcan's commitment to mitigate or compensate, thereby providing some certainty to parties that may be affected by the KCP. Second, it would ensure that the same standards are applied to all affected parties.

Integral to any arrangement is a fair and effective process for the resolution of disputes. Although Alcan indicated that there was a preference by residents to negotiate individually, there were parties at the Hearing who felt disadvantaged by the lack of formality to that approach. The details of any such process should be determined between Alcan, governments, and key stakeholders. However, it is critical that any process should include an independent decision-maker. The Watershed Management Agency proposed in Section 7.2 could undertake such a function.

Provincial Commitments

The Province has undertaken to mitigate or compensate for impacts of the KCP on some of the public facilities in the region. Specifically, the Province has made commitments to:

- pay the full capital cost of any sewer or water supply upgrades required at Fort Fraser; and
- pay the full capital costs for upgrades to Vanderhoof's sewage treatment facilities.

Provincial commitments in respect of the rehabilitation of the Murray-Cheslatta system are described in Section 8 of the Technical Report.

7.2 Watershed Management Agency

The concept of a Watershed Management Agency received widespread support in the Nechako region. Opinions differed over the type of structure and the degree of authority the Agency should have.

In the Nechako reservoir and watershed, the complexity of the KCP issues compound the difficulties of managing a scarce resource. Already there are conflicts between the consumptive uses of water, such as irrigation, and the protection of the resource for fisheries in the Nechako River. At present there is a freeze on the licensing of water for consumptive purposes in the reaches of the river above the Stuart confluence. Alternatives such as tributary storage and ground water

have been suggested, but require further study. In addition, there could be conflicts between the Nechako Fisheries Conservation Program of remedial measures and canoeing or boating activities on the river. There is little apparent communication between the agencies responsible for planning and managing the resources in the region and stakeholder groups. There was general consensus that a more comprehensive and integrated approach to management of the watershed involving community participation is required to address existing, as well as future, issues. A watershed management approach is broader in scope than site specific management and reflects the interdependencies in the watershed, for example between upstream uses and downstream effects. It provides sensitivity to regional resource issues and encourages cooperation in the resolution of conflicts.

A Watershed Management Agency would provide a framework for ensuring that studies of resources, such as the salmon and trout fishery are integrated. A coordinated approach to data collection monitoring and the development of evaluation criteria is required.

Structure

The Commission recommends the immediate establishment of a Watershed Management Agency for the Nechako Reservoir and Watershed. The Commission notes that Hearing participants supported an approach that is flexible, involves stakeholder participation and is based on consensus-based decision making. The proposal of the Fraser River Management Board to facilitate the establishment of the Watershed Management Agency has merit in the absence of another alternative. However, this may not be necessary if the Province wants interested parties in the region to be directly involved with the setting up of the Watershed Management Agency. The Commission believes that the stakeholders in the region should determine the structure and mandate of the Agency and how they want the process of establishing the Agency to be conducted. It is expected that agencies such as the NFCP and the Water Comptroller will continue to undertake their existing responsibilities until such time as specific responsibilities are formally transferred to the Agency.

Existing agencies and planning programs will provide a core of stakeholders in the region for developing a new structure with a broader interest base.

The Commission recommends that the initial cost of establishing the Watershed Management Agency should be funded by the three levels of Government. The ongoing administrative costs of the Agency including the costs of participation by stakeholders, should be cost shared.

Responsibilities

There is a need for a comprehensive water management plan to be undertaken in the Nechako watershed to examine the water source options available for meeting the existing and future demands for surface and groundwater. The Watershed Management Agency should be responsible for conducting and implementing a comprehensive water management plan. The freeze on licensing should

remain in effect under Settlement Agreement flows until it can be demonstrated that there is sufficient water available to protect the fishery and allow for further withdrawals.

Baseline Studies, Monitoring and Evaluation

Studies which should be undertaken for the reservoir and watershed include a physical limnology study of the reservoir, a survey of groundwater wells and the collection of baseline data on resident fish in the Nechako.

Monitoring and evaluating the impacts of the KCP and implementing an adaptive management program will be an ongoing requirement post construction. Monitoring and surveillance studies identified include wildlife, particularly calving and fawning sites on in-channel islands and the Vanderhoof Bird Sanctuary, and water quality monitoring.

The Commission recommends that the program of baseline studies should be initiated as soon as possible. The Commission also recommends that the Watershed Management Agency should be responsible for overseeing the conduct of the baseline, monitoring and surveillance studies and for overseeing the implementation of recommendations or remedial measures.

7.3 Local Benefits Fund

The Terms of Reference instructed the Commission to consider whether a local benefits fund would be an appropriate mechanism for addressing impacts of the KCP. A local benefits fund is designed to provide funds to groups, communities or regions that are adversely affected by a large project development. Typically, a local benefits fund is established in situations where most of the long term benefits from the development accrue over a much wider region than the one that experiences the direct impacts. A fund is intended to provide some compensation, to the extent possible, to the region that experiences the negative project impacts. It is designed to address negative impacts that are unmitigated or unavoidable.

In these circumstances, the purpose of a Local Benefits Fund would be to address the residual negative impacts of the KCP, and not the impacts where commitments for mitigation or compensation already exist. Commitments made under the Settlement Agreement and since the Settlement Agreement would be funded separately.

Experience with local benefits funds within B.C. and across Canada indicates that there are a number of different ways in which the funds are structured and implemented. Residents of the Nechako valley supported the establishment of a local benefits fund with a structure for managing the fund located in the region with local and provincial representation. Funding sources suggested were a water consumption tax, funding by Alcan, the water rental fees, or an equivalent contribution from B.C. Hydro.

The Commission recommends that a Local Benefits Fund be established to provide some compensation for the residual impacts of the KCP in the Nechako reservoir and watershed and the Kemano watershed. In the Nechako reservoir and watershed the Local Benefits Fund should support some of the administrative costs of the Watershed Management Agency and other responsibilities and activities directly related to the KCP.

In each watershed, funds should be provided in the initial years for baseline studies that are required to enable the impacts from the KCP to be evaluated post construction. Funding for monitoring and evaluation will be required on an ongoing basis for many years after the KCP is completed. In addition the Local Benefits Fund should have sufficient funds for remedial measures that may be required.

The fund should be allocated and managed separately in each watershed. The Local Benefits Fund could be managed either by government with local representation or by a local committee. The Commission believes that the fund should be structured in such a way to provide funds in perpetuity.

While it is difficult to determine an appropriate amount of money for the fund the Commission estimates that the capital of the fund under Settlement Agreement flows should be in the order of $15 - $20 million. This amount could be lowered to reflect reduced negative impacts under the Commission Flow Scenarios. The Commission has recognized that some of the initial funding is required to conduct baseline studies. However, a residual amount of money should remain in the fund and earn interest to provide an annual amount of money in perpetuity. It is suggested that the residual amount be not less than $10 million. The funds could be provided by the project proponent, B.C. Hydro, government or some combination of these sources.

8.0 Financial Benefits and Regional Economic Impacts

Financial Benefits

From the analysis of the impacts on the provincial economy that Alcan claimed would accrue from its expenditures on the KCP, it is not possible for the Commission to determine whether the KCP would benefit the province any more or less than an alternative project that met the same domestic energy demand. Nonetheless, there would undoubtedly be positive employment and economic activity impacts in the region during the construction period.

The Commission finds that B.C. Hydro's projected benefits from the Coordination Agreement and Long-Term Electricity Purchase Agreement, exhibit variability depending on the value of other new energy supplies, the timing of the KCP and the quantity of available water in the Nechako Reservoir for electricity generation and coordination. The Commission cautions, however, that the ben-

efits from these agreements represent the benefits to B.C. Hydro and its customers, but do not necessarily represent the net benefits of the KCP to the Province, since there are unmitigated resource costs and benefits that have not been included in the evaluation.

The Commission Flow Scenarios presented in this report will affect the benefits to B.C. Hydro from the agreements with Alcan. There was insufficient evidence presented during the hearing for the Commission to determine the specific effect of alternative flow regimes on the benefits from Coordination. To determine this, it is necessary for B.C. Hydro to recalculate the quantities of energy and capacity available—under each recommended flow scenario—from coordination of the Nechako Reservoir with the rest of its system. The Commission Flow Scenarios would affect the benefit to B.C. Hydro from the Long-Term Purchase Agreement if the reduced generation capability would impair Alcan's ability to deliver the energy and capacity under the terms of the Purchase Agreement.

Regional Economic Impacts

Previous sections of this Summary Report have detailed the positive and negative impacts of the KCP under the Settlement Agreement flows and the Commission Flow Scenarios.

The following matrix (Table 2) provides a recap of the various impacts of the KCP under the Settlement Agreement flows (inclusive of more recent commitments by Alcan and the Province) and the impacts under the Commission's recommendations for mitigation.

A major feature of the Commission's analysis is the recognition of the substantial benefits that would accrue from the installation of the Kenney Dam Release Facility. In addition to the restoration of the Murray-Cheslatta system, the Facility would ensure better protection of sockeye salmon than now exists, especially with the implementation of the lower target temperature. The Commission views these benefits as so significant that it recommends that the Facility should be built whether or not the KCP proceeds.

The Commission's recommendation of a plan for clearing the Reservoir of flooded timber by the year 2005 has important implications for recreational interests and possibly for the forest industry of the region.

For the chinook and trout of the Nechako River, the Commission was not satisfied that the provisions of the Settlement Agreement were adequate, but was unable to set a precise estimate on the single level of flow that would be best. Rather, as flow levels are increased the degree of risk is decreased. Hence, the Commission provides three scenarios of flow, each associated with different additional measures of mitigation. Each of these scenarios has implications for the mitigation of effects, other than those on fish, which are important for the maintenance of the quality of life and the environment of the Nechako Valley.

The Commission recognizes that its various recommendations have major implications for the viability of the Project as it is presently designed. Detailed analysis would be required to assess both engineering feasibility and financial consequences. With those assessments, it would then be possible to weigh the potential benefits and costs in a provincial context.

This Summary Report deals only with the major findings of the Commission. Many of the potential impacts of the KCP are interrelated and in some cases highly technical. The Technical Report provides full details on the positions taken by participants in the Review along with the rationale leading to each of the Commission's conclusions and recommendations.

Table 2. Comparison of the Settlement Agreement Mitigation with the Commission's Proposed Measures

	Effect of Settlement Agreement	Mitigation Commitments	*Additional proposed mitigation compared to Settlement Agreement*		
			Scenario I 35 m^3/s plus chinook hatchery	**Scenario II 40 m^3/s**	**Scenario III 45 m^3/s**
Nechako Reservoir	Increase drawdown might impact safety, access and aesthetics of the reservoir	Alcan-wharves, boat launch, etc.	Improved by tree clearing program		
Nechako Watershed					
Sockeye	Improved temperature conditions but still less than optimal	Kenney Dam Release Facility	Temperature control to 18.4°C provides significant improvement		
Chinook and Trout	Flows insufficient to achieve conservation targets for Chinook	Alcan-remedial measures under Settlement Agr.	Minimum mitigation	Adequate mitigation	Natural mitigation
Agriculture & Ranching	Insufficient water for present and future irrigation, etc.	Alcan-modified intakes & cattle fencing, etc.	Irrigation water required	Irrigation water available	
Groundwater	Potential drop in water table uncertain	Alcan-modified private wells	Potentially small improvement		
Municipal & Domestic Water Supply	Problems currently exist at Fort Fraser & Vanderhoof; exacerbated by the KCP	Province	No change		
Sewage Treatment	Problems currently exist at Fort Fraser & Vanderhoof; exacerbated by the KCP	Province	No change		
Industrial Use of Water	Uncertain whether it would decrease future industrial investments	None	Potential improvement		
Float Planes	Currently problematic during low flows, exacerbated under Settlement Agreement flows	Alcan	No change	Remaining problems in September and October	
Aesthetics	Positive impacts on Nechako Canyon; mostly negative between Nautley & Cheslatta Falls	None	Improvement with increased flow		
Water-Based Recreation Activities	Some positive, some negative; weed problems	None	Modest improvement upstream of Nautley		Improvement
Recreational Boating	Detrimental effect on boating and canoeing, most severe upstream of the Nautley	None	Modest improvement upstream of Nautley		Improvement
Angling	Provincial commitment to "maintain present recreational fisheries values"	Province	Improvement	Further improvement	
Flooding	Reduced flooding in the Nechako Valley	None	Slight improvement		
Wildlife	Uncertain, but not likely significant	None	Some improvement		
Murray/Cheslatta	Improvement by decreased flooding; Return of Cheslatta Nation lands conditions for rehabilitation	Kenney Dam Release Facility	Avoid flood releases		
Kemano Watershed	Small negative impact on salmon, trout and eulachon	Alcan	Potentially small improvement		

Note: Shaded areas represent resources and activities most significantly impacted by proposed mitigation measures and flows

Kemano Completion Project Review

Summary Report

December, 1994

Contents

1.0 Background

Debate and controversy with respect to Alcan's Kemano projects have been ongoing for many years. The legal rights provided to Alcan stem from the Industrial Development Act of 1949 and an agreement between Alcan and the Province of B.C. (the "1950 Agreement") which, among other things, provided Alcan with water diversion rights to the Nechako River and the Nanika River, and favourable water rental rates. These water rights were granted to Alcan to develop a hydro-electric facility to power an aluminum smelter in northwestern British Columbia. Water rights granted to Alcan under the 1950 Agreement are to be exercised prior to December 31, 1999. At that time, Alcan will receive a water licence in perpetuity for the water required to operate facilities constructed for hydro-electric generation prior to the deadline. Construction of the first phase of development began in 1951 and was completed in 1954 with a total installed capacity of 896 MW.

The Kemano Completion Project ("KCP") involves the installation of four new generators at the Kemano power plant with a nameplate rating of 540 MW. This will bring the total installed capacity at the plant to 1436 MW. KCP also involves the construction of a new power tunnel and associated intake, the dredging of Tahtsa Narrows and the addition of 1.1 metres to the gates at the Skins Lake Spillway. KCP also requires the construction of 82 km of 300 kV transmission line to transmit the KCP output to Kitimat, where it connects to the B.C. Hydro system.

B.C. Hydro has contracted to purchase an average annual 285 MW of KCP output for a period of at least 20 years. B.C. Hydro has also executed a Coordination Agreement with Alcan to capture efficiency gains realized from the coordinated operation of the Nechako Reservoir with the B.C. Hydro system.

To fulfill fish protection obligations the Project requires the building of a cold water release facility at the existing Kenney Dam and the construction of the Cheslatta fan channel. The Kenney Dam Release Facility ("KDRF") would draw cold water from deep in the reservoir to release into the Nechako River so that cool water conditions will prevail for the migration of adult salmon.

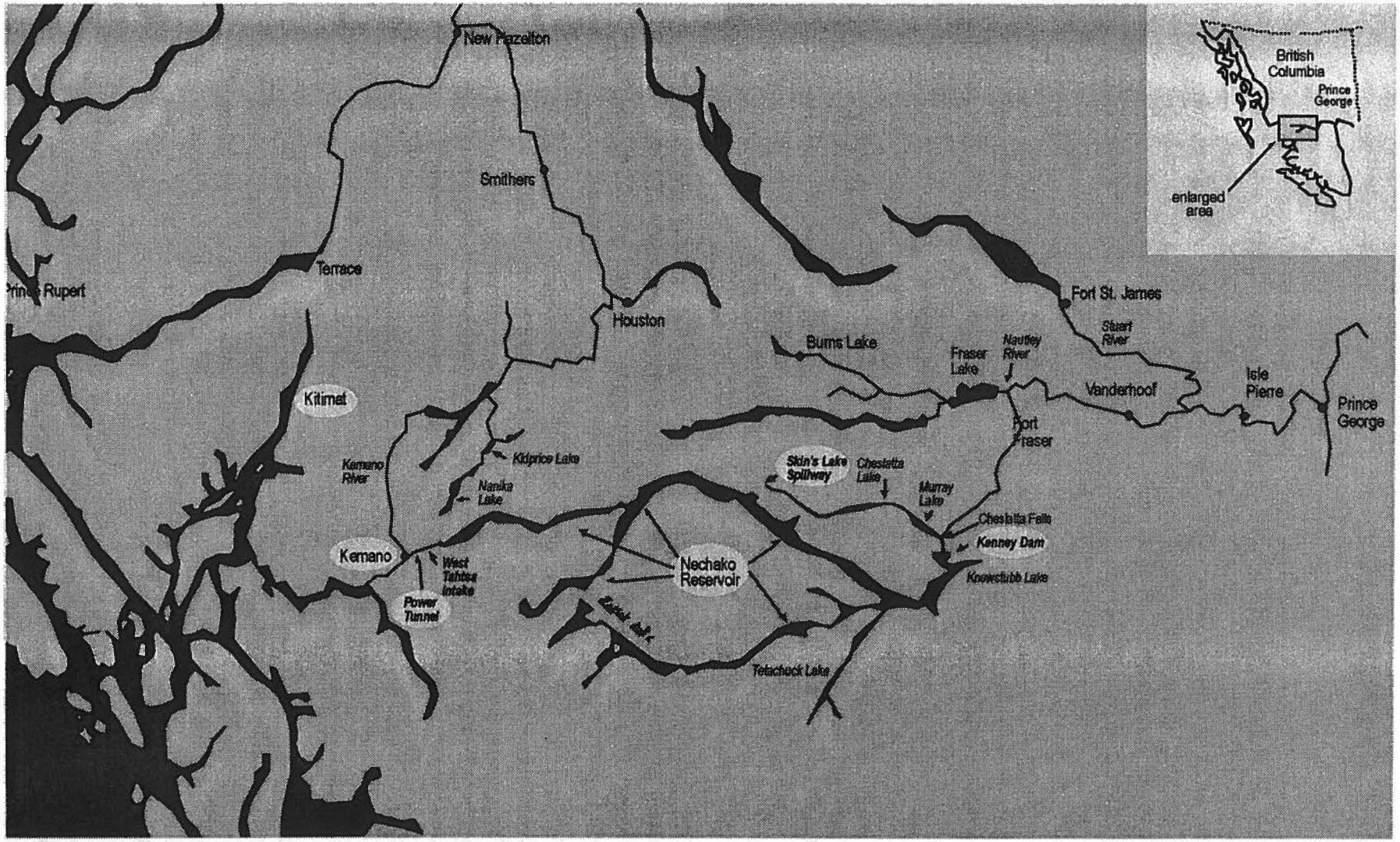
Figure 1-1 shows the location of the key features related to the KCP.

The Settlement Agreement

Prior to 1980, Alcan and the federal Fisheries Department ("DFO") reached an impasse in discussions on the amount of water to be released into the Nechako River to satisfy the DFO's mandate to protect the salmon fisheries. In 1980 the DFO obtained an injunction from the B.C. Supreme Court requiring Alcan to release additional flows which the DFO considered necessary for the protection of the salmon fisheries.

In 1985, Alcan petitioned the courts for a permanent resolution of the flow requirements. Prior to the court case, the federal government, provincial government and Alcan agreed to enter private negotiations to find technically accept-

Figure 1-1. **The Kemano Hydroelectric Development**



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able solutions to the conflict between Alcan's rights to the water in the Nechako and Nanika Rivers and the federal responsibility to protect the salmon fishery.

The 1987 Settlement Agreement between Alcan and the governments of British Columbia and Canada achieved an accord that all three parties deemed to be a satisfactory resolution, including a combination of flows and remedial measures for the Nechako River. This resulted in the development of the current KCP.

Under the Settlement Agreement Alcan gave up its rights under the 1950 Water Licence to divert the Nanika River and also agreed to construct a cold water release facility at Kenney Dam, as well as to construct and pay for other remedial measures required to maintain set numbers of chinook salmon. Alcan is to pay one half the costs of the monitoring and conservation measures and to share in the administration costs of a program to maintain the Nechako River fishery. The Nechako Fisheries Conservation Program (NFCP), was established with representation from the three parties and an independent expert.

The DFO agreed to forego any legal challenges to the 1950 Agreement, to pay for half the NFCP's costs of monitoring, and all the costs of applied research. The Province agreed to implement a fresh water fishery management strategy, and to amend Alcan's Water Licence and the 1950 Agreement to reflect the abandonment of Alcan's rights to the diversion of the Nanika River.

Alcan initiated construction of the KCP in 1988, but halted construction in 1991 following a successful challenge to the federal court trial division that KCP required a federal Energy Assessment Review Process Certificate prior to construction. That ruling was reversed by the Federal Court of Appeal and an appeal to the Supreme Court of Canada was dismissed in February, 1993. Approximately $500 million had been spent by Alcan on the KCP to that point.

Commission Review

On January 19, 1993, the Province of British Columbia issued the Terms of Reference for this Review under Order in Council No. 0033. The Terms of Reference specifically direct the Commission to "assess the nature and extent of the effects of the Project on the physical, biological, social and economic environments in the Kemano and Nechako River watersheds and the Nechako Reservoir." Issues to be addressed relate to river hydrology, fisheries, cost/benefit analysis, aboriginal concerns, and any other issues identified by the Commission. The Terms of Reference also direct the Commission to recommend options for addressing impacts of the project, inclusive of appropriate mitigation measures.

Initially, Alcan declined to participate in the Review process, but changed its position on July 9, 1993. The DFO had initially offered only limited participation, but that position also changed to full participation on January 27, 1994.

Representatives of the major First Nations' communities within the geographic region of the Review indicated that their participation in the Review would depend on certain concerns being addressed. Among the concerns, the First Nations' communities requested a full examination of the Fraser River, Kemano I,

and the justification for the project. The Commission's Terms of Reference did not satisfy First Nations' concerns regarding the scope of the Review, and First Nations groups declined to participate. The Technical Report provides additional background on the positions taken by First Nations. The recommendations from this Review will have a direct impact on First Nations.

The Terms of Reference direct the Commission to consult with interested parties on the form and content of the Review. The Pre-Hearing Activities commenced in April 1993 with a series of scoping meetings in Prince George, Fort Fraser and Kitimat. These meetings served to initiate consultation with interested parties about the Review and to scope the issues of concern to them, within the context of the Terms of Reference. As a precursor to the Public Hearings, the Commission staff held several workshops and pre-hearing meetings to provide a forum where interested parties could be informed about the Review and obtain clarification about the issues to be addressed.

Prior to the start of the public hearing, the Commission conducted two site visits of the study area. On September 10, 1993, the Commission was guided on a helicopter reconnaissance of the Nechako River, the Kenney Dam, the Nechako Reservoir, the Skins Lake Spillway, the Murray-Cheslatta system and the Cheslatta Fan. This was followed on October 20, 1993 with a tour of the Kemano River, the Kemano Community, the Kemano I powerhouse and the KCP facilities under construction. These tours served to provide the Commission with familiarity as to the character of the region, as well as an appreciation of some of the concerns articulated at the scoping meetings. During July and August, 1994, boat and canoe tours of the Nechako River, a float plane tour of the Nechako Reservoir and bus tours of local communities provided additional insights.

To focus discussion at the Community and Technical Hearing, the Commission developed a preliminary list of issues from the sentiments expressed at the scoping meetings and from comments submitted to the Commission by interested parties. The Commission kept the public apprised of these issues, Panel determinations, and the evolution of the Review process by the issuance of regular newsletters.

The Community Hearings were designed for information gathering, where participants would inform the Commission about the impacts of the KCP on the communities within the geographic region of the Review.

Community Hearings were held over 8 days in November and December 1993 and took place in Prince George, Fort Fraser, Vanderhoof and Kitimat. The Community Hearings were relatively informal and there was no cross-examination other than questions from the Review Panel. At these hearings the Commission also received suggestions from participants on mitigation and compensation for the negative impacts of the KCP, and how the positive impacts of the project could be maximized. The Commission heard submissions from 170 individuals and groups. In total over 1,500 people attended.

The Technical Hearing on the other hand, focused on collecting, analyzing and critiquing the technical and scientific evidence related to the KCP. Unlike the Community Hearings, the Technical Hearing was considerably more structured and formal and was divided into phases by key issues. Witnesses presented their evidence under affirmation, and were subject to direct examination and cross-examination.

The Technical Hearing was held mainly in the regions affected by the Project - Prince George, Vanderhoof and Terrace. This was to ensure that the people within the geographic region defined by the Terms of Reference had local access to the Review proceedings. Several weeks of hearings were also held in Vancouver to accommodate the significant interest in the project expressed by residents in the Lower Mainland and coastal communities.

The Technical Hearing spanned 79 days - December 8, 1993 to August 10, 1994. In total, 810 Exhibits were filed and 16,489 pages of transcript were recorded. The full public record totalled more than 200,000 pages. The hearings provided an exhaustive review of the KCP under the Terms of Reference. The Commission heard from all interested parties and the Commission issued subpoenas to ensure full participation by DFO scientists, along with representations from the federal and provincial Ministers responsible for negotiation of the Settlement Agreement in 1987.

2.0 Reservoir Operations

Under the existing Kemano I operations, the volume of water in the Nechako Reservoir cycles annually in response to seasonal variation in inflows. An approximate annual water balance is maintained by releases through the existing Kemano powerhouse and at Skins Lake Spillway. Kemano I resulted in significant reductions in flooding along the Nechako River and downstream on the Fraser River. However, the reduced water releases also resulted in high river temperature conditions in warm, dry years which created unfavourable conditions for migrating adult salmon. Releases through the Skins Lake Spillway meant dewatering of the Nechako canyon and significant impacts to Cheslatta lands and the Murray-Cheslatta system.

Plans to coordinate operation of the reservoir, after the KCP, balance the need for power production for the aluminum smelter, the sale of power to B.C. Hydro and the agreement to coordinate reservoir operations of the Nechako Reservoir with the B.C. Hydro system. During sustained periods of small inflow and/or relatively low Nechako Reservoir levels, Kemano power generation would be reduced provided other reservoirs in the B.C. Hydro system were in a superior storage position. Conversely, during sustained periods of large inflow and/or relatively high Nechako Reservoir levels, power generation would be increased at Kemano to avoid spilling, provided other B.C. Hydro reservoirs had the capacity to store water. During periods of system-wide drought, all reservoirs would be drawn down together to ensure sufficient capacity would be available to meet Alcan and B.C. Hydro firm loads at the end of the dry period. The maximum fluctuation in reservoir levels would increase from approximately five meters at present to nine meters under the KCP and reservoir coordination.

The KCP as now designed has several notable features. The Nanika River is no longer a component of the project. The Kemano River would receive a 30 percent increase in flow. The Nechako River flow would be reduced to less than half the levels of recent years.

The most notable feature of the project is the Kenney Dam Release Facility which would provide a more effective and efficient source of cooling water for salmon migration, enable rehabilitation of the Murray-Cheslatta system, restore the Nechako Canyon as a recreational resource, reduce erosion and sedimentation and improve water quality in the upper Nechako River. The facility would also improve management of flood releases from the reservoir, accommodating whatever releases are necessary except those at least as infrequent as once in 200 years.

For these several reasons the Commission recommends that the Kenney Dam Release Facility should be used for water releases regardless of the future of the KCP. The Commission recognizes that if the KCP is not undertaken the facility and the Cheslatta fan channel would have to be redesigned to accommodate substantially larger flows in order to restore the Murray Cheslatta system to its natural state.

The various impacts from the KCP operations are summarized in the following sections and are discussed in detail throughout the Technical Report. The Technical Report provides detailed discussion and specific recommendations.

3.0 Nechako Reservoir

The Commission recognizes that the Great Circle Chain of Lakes was once considered, and still has the potential, to be one of the most spectacular recreational assets of the Province. The Reservoir still provides the most ready access to Tweedsmuir Park. Safe public access to the site must remain a priority.

When the Nechako Reservoir was created in the 1950s, the Province granted Alcan the timber rights to the submerged trees. The Province did not require that Alcan remove the trees from the areas to be flooded, but did require Alcan to restore public road and water trail access, and to re-establish wharves and public approaches to pre-flooding conditions, up to a maximum total cost of $250,000 (1950$).

The resulting submerged timber created both significant navigational hazards and degraded the appearance of the Reservoir. A large number of partially submerged trees still protrude above the water. Debris and fallen logs have also accumulated along the shoreline.

Alcan has met its clearing requirements specified in the 1950 Agreement. Since 1979, Alcan has contributed approximately $500,000 annually to a timber clearing program which serves to increase boater safety, to provide refuge from wind and storm, and to improve the Reservoir appearance. Despite continued efforts, Alcan has only cleared approximately 10 percent of the timber in the Reservoir.

The KCP would further exacerbate the danger and public nuisance of the submerged timber in the Reservoir. With the KCP and coordination by B.C. Hydro, it is possible that the reservoir elevations could vary by up to nine meters. The annual reservoir fluctuations with the KCP would expose more standing timber creating even more hazardous navigation conditions. From an aesthetic perspective, the additional drawdown would worsen an already unattractive scene. Additionally, the decreased reservoir levels would impede access routes, water trails, boat launches and the rail portage.

The enhancement of the recreational potential of the Reservoir requires an aggressive program of timber removal and Alcan's continued commitment to maintain safe public access routes. The Commission recognizes that Alcan's program of timber clearing has improved recreational opportunities. However, the Commission finds that an aggressive clearing program must continue in the post-KCP Reservoir to ensure the safety of boaters and public access to recreational sites.

The Commission recommends that the Province should be prepared to provide incentives for Alcan to develop and implement a mutually acceptable plan for completing the clearing of the Reservoir by the year 2005. Such a plan should give priority to routes of access to Tweedsmuir Park such as Whitesail Reach of Ootsa Lake, Whitesail Lake to Chikamin Bay, Intata Reach and the south shore of Ootsa Lake. Such a plan should also include local community input.

If Alcan does not meet the targets developed in the plan, the Commission recommends that the timber rights should revert to the Province. The province could re-issue the rights to other interested parties granting the new bearer similar incentives for expedient removal.

Alcan has agreed to extend the rail portage system between Whitesail Lake and Eutsuk Lake at Chikamin Bay to ensure that it will remain operational under the greater drawdown of the KCP. Alcan has also agreed to extend or re-design private wharves and boat launching facilities where necessary. Alcan should confirm its responsibility to restore public access to the parks in the region affected by the lower minimum Reservoir levels.

4.0 The Nechako River

The most significant impacts of the Kemano Completion Project would occur on the Nechako River as the water releases from the reservoir would be substantially reduced. The effect would be most pronounced in the upper river above Fort Fraser, and most noticeable in the winter months from December to March, and in the summer months in years of low run off. These changes in river flows would have effects not only on fish, but on many other plants and animals of the river environment as well as on the communities near the banks of the river.

4.1 Fishery Impacts

Sockeye Salmon

The sockeye salmon of the Stuart and Nautley rivers are by far the major fishery resource of the Nechako River basin. The average annual commercial value of the sockeye for 1981 to 1992 was $26 million, which is 100 or more times the value of all other fish resources of the Nechako River. In 1993 the value of the sockeye catch was $77 million.

The importance of the sockeye resource was recognized for many years prior to the Settlement Agreement. The critical need for the sockeye is cool water conditions in July and August as they migrate up the Nechako, enroute to their spawning grounds in the tributaries to the large lakes of the Stuart and Nautley watersheds where their young reside before going to sea.

At present, cooling water must be provided from July 20 to August 20 by releases of reservoir surface water from the Skins Lake Spillway. Large volumes of water are needed in hot summers and even this may not always be sufficient to keep river water temperatures below levels that are highly stressful for sockeye. With the KCP, cold water released from the Kenney Dam Release Facility would enable better maintenance of lower river temperatures than can be achieved at present.

The Commission recognizes that the provisions of the Settlement Agreement provide the opportunity for greater protection for sockeye with the KCP. However, the Commission has concluded that the negotiated provisions should be augmented to protect the potential future value of the sockeye resource. The Commission recommends that cooling water releases from the Kenney Dam Release Facility be increased to provide a target temperature of 18.4°C at the confluence of the Nechako and Stuart Rivers. The Commission estimates that accommodation of this recommendation would require additional water releases of 6.5 m^3/s during the cooling period, or 1.1 m^3/s on an annual basis. Sustaining this target temperature through the season of migration and providing for ramping of flows to avoid stranding of young chinook would require an estimated 0.1 m^3/s on an annual basis. With these releases there will be the opportunity to undertake additional enhancements in the Stuart and Nautley systems which could very significantly increase the annual value of this fishery.

The possibility that reductions in the flow of the Nechako might cause difficulties for sockeye migration at Hell's Gate and at other points of passage on the Fraser was examined by the Commission. The recent installation of new, low level fishways at Hell's Gate together with other works designed to facilitate migration should ensure that any minor effect of the KCP on Fraser River flows would not affect salmon migration. With or without the KCP, the Fraser River should be monitored on a continuing basis for possible sites of obstruction.

Chinook Salmon and Trout

Chinook salmon are a second fishery resource of importance in the Nechako River. The value of the annual catch of chinook is not readily assessed, but for the period 1981 to 1992 the commercial value of the Nechako mainstem stocks was placed at $56,725 and that of the Stuart system at $95,806. Both of these stocks would also benefit from the recommended changes in cooling flow releases during migration.

The Settlement Agreement provides for a target escapement to the mainstem Nechako of 3,100 adult chinook with a range of 1,700 to 4,000. The Commission recognizes that the achievement of the target escapement is confounded by many factors beyond what happens on the Nechako. Low escapements, such as have occurred in recent years may in part be the result of increased exploitation rates, decreased ocean survival related to warm ocean conditions or perhaps the effect of undetected pollution as the juveniles journey to sea. Adult escapement is a poor yardstick for measuring the effectiveness of mitigation measures.

The Commission acknowledges the value of the considerable body of information that has been assembled by the NFCP in developing monitoring methods, in pilot testing remedial measures, in applied research and in developing strategies for assessment of the status of the chinook stock. Nevertheless, the Commission does not have confidence that the proposed program will be successful in achieving the conservation goal of maintaining the chinook at a population level of 3,100, and has accordingly recommended increases in flow. The Commission has accepted the target level of 3,100 chinook as a requirement to be met. A cost effectiveness study in a regional or provincial context might determine the optimal level of chinook and trout preservation efforts. However, the context of this Review focused on the Settlement Agreement and the Commission reviewed mitigation measures in relation to the target of 3,100 chinook.

The Commission has concluded that flows during the winter months, from December through March, must be increased from 14.2 m^3/s to 25.5 m^3/s to provide greater assurance that survival rates of incubating eggs and over-wintering juveniles would be acceptable. Increased winter flows are also a basic requirement of the provincial plan for mitigation of effects of the KCP on trout. The NFCP has acknowledged that if more water was available an increase in winter flows would have first priority.

Proposed KCP releases of water for the spring and summer period have also been considered as inadequate for the provision of rearing habitat for chinook and resident trout. The Commission has considered the effect of increasing the base flow from April through August at three different levels above the proposed base of 31.1 m^3/s in the Settlement Agreement.

Flow Scenario I

Increasing the base summer flows to 35 m^3/s would be a bare minimum provision and would still place the chinook and trout population at considerable risk. To ensure achievement of the conservation goal at this level of flow, a full scale hatchery operation should be undertaken immediately. It had been speculated at

one time by federal government employees that a hatchery on the Nechako could produce 50,000 adult chinook. While this may be optimistic, the Commission is confident that a hatchery operation could at least maintain the stocks to the level of the conservation goal, albeit artificially.

Flow Scenario II

A second option, increasing the base summer flows to 40 m^3/s, would give greater assurance that the wild stocks of chinook and trout would be maintained, but a pilot hatchery operation should be initiated at once to provide additional information on the biology of Nechako chinook and to prepare the way for a full scale hatchery if the need should emerge. The substantial decline in numbers of fry over the past four years and declines in the numbers of adults particularly in the past two years suggest that the need for a hatchery may emerge within five years.

Flow Scenario III

The third regime of flow for April through August would provide 45 m^3/s and give reasonable confidence that the natural stocks of chinook and trout could be maintained with only modest intervention and enhancement activities.

None of these levels of flow would be sufficient to guard against excessive sedimentation of the river bed. Accordingly the Commission recommends that high priority be given to erosion control and to encouraging riverbank vegetation in the Nechako mainstream and the tributaries between Cheslatta Falls and Fort Fraser. If these measures are not sufficient to forestall sedimentation problems, flushing flows to clean riverbed gravel may be necessary.

Of the various remedial measures described in the Settlement Agreement other than those concerned with erosion control and riverbank vegetation, the Commission would recommend that trials be continued with stream fertilization. The applied research and monitoring programs should be continued as a means of gaining greater understanding of the Nechako chinook stocks. The province should develop a parallel program for trout. However, as discussed in the Technical Report, the Commission recommends that the program of habitat complexes be discontinued.

The implications of these various flow provisions on seasonal and annual equivalent water releases are given in Table 1.1. It is to be noted that with increases of base flows the requirement for cooling flows would be reduced. The amount of the reduction could only be estimated with a computer simulation, and would vary both within the cooling flow period and from year to year. As is indicated in later sections, changes in the flows as outlined would have many beneficial effects for other uses of water of the river.

Determining the cost effectiveness between flow scenarios requires analysis of the cost of water not used for electricity generation, to be compared with the regional and provincial benefits of increasing flow. This analysis is beyond the Terms of Reference of the Review and requires simulations by B.C. Hydro of

accessed for irrigation needs, then the 1.5 m^3/s could be reduced. Allocations and distribution of this water throughout the year should be determined by the proposed Watershed Management Agency.

Commission Flow Scenario I would reduce the amount of water that should be set aside for future consumptive uses to less than 1.0 m^3/s. Under Commission Flow Scenarios II and III, the Commission believes there would be adequate water available downstream of the Nautley to meet the needs of agriculture in the foreseeable future. In the event that one of Commission Flow Scenarios I, II or III is chosen, the current moratorium on water licences downstream of the Nautley could be removed. There still may be some concerns upstream of the Nautley, however, water withdrawals are very small in this part of the river in the context of the mean monthly flow for fisheries protection during May to August.

4.3 Community Impacts

The reduced flows in the Nechako River after the commissioning of the KCP are anticipated to have impacts on community life along the river in several ways. Domestic water use, effluent discharge, future industrial development, and float plane operation would all be affected.

Municipal and Domestic Water Supply

The community of Fort Fraser has a water licence to extract its domestic water supply from the Nechako River. Currently, this is not a very good source of drinking water. However, the Province has made the commitment to absorb the total cost of any remedial measures deemed necessary to rectify the domestic water problem in this community after the installation of the KCP. This is anticipated to improve the overall water quality problem in Fort Fraser.

Vanderhoof also has a water licence to withdraw drinking water from the Nechako River, but has yet to exercise its rights under the licence. Rather, this community currently obtains its drinking water from wells.

Most individuals in the Nechako Valley obtain their domestic water from wells, with a small number withdrawing domestic water directly from the River. The water study recommended for agriculture and ranching will include ground water and should provide valuable information on how wells will be affected by the lower KCP flows. Alcan has committed to modify wells and any existing intakes in the river that are affected by the lower KCP flows. The Commission is satisfied that these measures are adequate.

Sewage Treatment

Currently, some communities utilize the Nechako River for discharging municipal effluents, particularly sewage after processing. Other pollutants may enter the river from surface run-off, leaching and tributary inflows. Sewage treatment at Vanderhoof and Fort Fraser is currently inadequate and the KCP will make

this problem worse. The Province is committed to upgrade the treatment facilities at Fort Fraser and Vanderhoof after the KCP, which will take care of the current problem and the problems caused by the KCP.

The Commission recommends that with the KCP, regular water quality monitoring should be conducted by the Province, especially in the Fort Fraser and Vanderhoof areas. The Fort Fraser area is particularly critical until the water and sewerage facilities in this community have been upgraded.

Industrial Use of Water

Industrial development upstream of the Nechako and Stuart confluence is sparse. The residents in the communities along the Nechako River have expressed fears that future industrial development in their communities would be hampered with the KCP as costs for effluent treatment and discharge would probably be very high. Additionally, the Ministry of Environment, Lands and Parks has stated that industrial proposals for the region would be closely scrutinized, especially with respect to effluent discharge, because of the reduced capacity of the river to absorb pollutants under the KCP.

Float Planes

Float plane operators use the river, especially at Vanderhoof. The Vanderhoof operation can currently be problematic during periods of low flows. This situation could be exacerbated with the KCP flows. The Commission is of the view that safety must be the paramount criterion in determining appropriate mitigation measures. Alcan has committed to provide safe float plane landing and take-off conditions at Vanderhoof after the KCP, or, if this is not feasible, to construct new facilities at a nearby lake.

4.4 Social Impacts

The Project will have various impacts on lifestyle and social considerations for the public using the Nechako River. The Project will affect the use and perceived value of the river to the local residents related to matters such as aesthetics, heritage sites, water based recreation, boating, angling, flooding and wildlife. It is difficult to determine the impact that each of the proposed Commission Flow Scenarios would have on these issues, except to recognize that each incremental increase in flow could reduce the magnitude of the negative social impacts.

Aesthetics

The rewatering of the Nechako Canyon under the KCP would have a positive impact. The most significant negative changes to the appearance of the Nechako River would occur between Cheslatta falls and Fort Fraser as a result of the substantially lower flows under the KCP, especially during the winter months. Although the stretch of the river from Fort Fraser to the Stuart confluence will not experience the same magnitude of flow reduction as the upper reaches, the

reduced KCP flows will cause some negative visual impacts. Downstream of the Stuart, the visual impacts will probably be noticeable but not significant.

The presence of artificial structures for fish habitat would reduce aesthetic values. The Commission has recommended that these structures not be used for fish habitat enhancement.

Heritage Sites

There was little evidence presented regarding heritage sites and the implications of the KCP. Since many of the heritage sites had been constructed to avoid flooding under natural flow conditions, reduced flows should not affect the physical sites.

Water-Based Recreation

At present, certain sections of the Nechako River are not particularly well-suited to water-based recreational activities because of poor water quality, high cooling flows, or the presence of substantial beds of aquatic weeds.

Improvements in the sewage treatment facilities would correct many of the current and future water quality problems, particularly near Vanderhoof. Additionally, the lower flows in July and August should improve safety conditions. However, increased weed growth at Fort Fraser and Vanderhoof after the KCP might decrease the desirability of the river for swimming. Furthermore, reduced flow might affect the safety of other water-based activities in parts of the river.

The Commission concludes that the impacts of the KCP on water-based recreation activities are uncertain. Although the proposed additional Commission flows should reduce weed growth relative to Settlement Agreement flows and improve conditions for small craft recreation, parts of the river might still remain unsuitable for swimming.

Recreational Boating

Under the present conditions, navigation during the fall flows is difficult. The Commission is of the view that the KCP would have a detrimental effect on boating and canoeing. The effects would be most severe upstream of the Nautley. The Commission concludes that it is not possible to mitigate the effects on boating without additional flows.

The Commission notes that Alcan has placed on record its commitment to undertake the costs of any necessary facility modifications to private docks and boat launching facilities that have been adversely impacted by the KCP. Likewise, the Commission believes that the Province should undertake similar work required to rectify public docking and boat launching facilities.

Angling

The rewatering of the Nechako Canyon offers an excellent opportunity to improve angling in the upper Nechako River. Lower and less variable flows should improve angling conditions upstream of the Nautley. The Commission has found that the flows under the Settlement Agreement would provide inadequate habitat for trout. The Commission Flow Scenarios would improve future angling by increasing habitat for resident fish.

The Commission is concerned about the lack of baseline data on angling in the Nechako River, particularly downstream of the Nautley. Without this information, it is difficult to see how the Province can properly fulfill its commitment under the Settlement Agreement to "maintain present recreational fisheries values."

Flooding

The KCP will reduce the likelihood of flooding in the Nechako Valley. Under existing conditions this has been a problem at Vanderhoof and Prince George. Flood benefits will occur in lesser increments down the Fraser River.

Wildlife

There was little evidence presented about the effects on wildlife to suggest that there would be any significant effects to which the wildlife would not adapt. A wildlife surveillance program could be used to identify any serious concerns. Specific effects that may merit monitoring include moose and deer calving and fawning sites on the in-channel islands, and the Vanderhoof Bird Sanctuary.

5.0 The Murray/Cheslatta System

Water from the Nechako Reservoir currently reaches the Nechako River by way of the Skins Lake Spillway and the Murray-Cheslatta system. Since the 1950's, the variable and sometimes heavy flows in the Cheslatta River between Skins Lake and Cheslatta Lake have resulted in significant environmental alterations.

With the KCP, the KDRF has been designed so that the Skins Lake Spillway will not release flows more frequently than once every 200 years, apart from routine maintenance spills. Reducing the flows to natural levels will benefit the lake system, by eliminating the surcharges which have killed shoreline trees and the near shore fish food organisms. In addition, lake flushing rates will slow considerably, leading to greater productivity for freshwater fish.

Once natural flows are restored, most of the tributaries to the Murray-Cheslatta system may provide promising spawning and rearing habitat for trout, although some restorative measures may be necessary. Mitigation work on the lakes themselves will include clearing shoreline debris and replanting shoreline vegetation. Such measures are intended to slow erosion and siltation of lake trout spawning habitats, thereby allowing the fisheries and recreational potential of the Murray-Cheslatta system to be realized.

The Cheslatta Nation have developed a Cheslatta Redevelopment Project ("CRP") in parallel with the provincial Fisheries Management Plan. The CRP envisages the restoration of the lakes, the identification and establishment of historic sites, the creation of recreational opportunities and a significant element of training for band members.

In the view of the Commission, the potential for rehabilitation of the Murray-Cheslatta system is a major benefit arising from the KDRF component of the KCP. Allowing the system to revert to natural flows will allow it to stabilize. The Commission recommends that the rehabilitation of the Murray-Cheslatta system should be undertaken with a community approach. First Nations and other local interests should be represented in both the design and implementation phases.

The KCP design makes provision for flood releases down the Skins Lake Spillway no more frequently than once in 200 years. However, the data supporting this estimate do not allow for precise estimates so that the actual likelihood of flood releases could be substantially less than 200 years. The Commission recommends that flood releases through the Skins Lake Spillway should be avoided, if possible. This may be done through a combination of measures including pre-spills, greater release capacity at the KDRF, or the effect of the Commission flow scenarios on flood control.

6.0 Kemano Watershed

Powerhouse flows at Kemano would increase 30 percent with the KCP creating slow changes in the river channel with possible effects on salmon, trout and eulachon populations. The Commission flow scenarios would only modestly reduce the expected discharges after the KCP. The commercial value of salmon originating in the Kemano is approximately $300,000 per year and there is the potential for increasing stocks. The hatchery proposal once considered by the DFO should be reassessed for its potential to enhance the salmon runs.

The Kemano River Working Group, made up of representatives of Alcan, the DFO and the provincial environment ministry guided the program of environmental protection during construction prior to the halt in the Project. The Coordination Agreement with B.C. Hydro implies a regime of powerhouse releases that could pose problems for fish protection. Operational guidelines should be established for the Kemano generating station under the KCP and should include the commissioning procedure, ramping rates, minimum discharge and flood control procedures and protocols for flow maintenance.

The Kemano River Working Group should be formally constituted to oversee environmental protection and mitigation measures for the remainder of the construction period and subsequently during operation. The membership should include local and regional community interests. This expanded Group should oversee the studies recommended by the Commission in the Technical Report.

Mitigation techniques that may be necessary for salmon have been demonstrated to a limited extent in the Kemano watershed or in other coastal areas. There is insufficient knowledge on which to base an assessment of impacts on eulachon and a study is recommended so that mitigation measures could be implemented if necessary.

7.0 Mitigation and Compensation

7.1 Commitments by Alcan and the Province

The terms of the Settlement Agreement provide for certain undertakings by Alcan and the Federal and Provincial governments to mitigate and/or compensate for anticipated negative impacts of the KCP. Additionally, Alcan and the Province have made commitments over and above those stipulated in the Settlement Agreement. Those latter commitments are described below.

Alcan's Commitments

Information presented at the hearing indicated that Alcan has committed to rectify or compensate for any KCP related impacts on the following existing facilities:

- private water intakes for domestic water or irrigation;
- cattle fencing;
- crop production losses caused by a reduction in sub-irrigation;
- private wells;
- trapping;
- private wharves and boat launching facilities; and
- float plane landing site at Vanderhoof.

The lowering of the minimum water level of the Nechako Reservoir will be mitigated by:

- clearing of standing timber and marking of hazards in specific areas of the reservoir to facilitate and improve boating;
- maintenance of Alcan's boat launch and campsite at Skins Lake; and
- extension of the Chikamin Bay rail portage.

Management of Alcan's commitments is being coordinated through a committee called the River and Reservoir Residents Committee ("RRRC"). This committee, established by Alcan in 1988, is comprised of Alcan personnel, consultants and a community liaison representative from the area appointed by Alcan. The terms of reference of the RRRC include reviewing and assessing requests for mitigation or compensation. The RRRC plans to establish objective standards to

ensure consistency between mitigation claimants. However, skepticism still persists among potential claimants about the effectiveness and impartiality of this body.

Notwithstanding the existence and intent of the RRRC, the Commission believes that a formal mitigation and compensation agreement or policy should be developed between Alcan and the stakeholders who may be affected by the KCP and to whom Alcan has expressed an intent to assist. The agreement or policy should state the precise nature of the commitments made by Alcan, including a time frame, and how effects will be evaluated. Such an arrangement would accomplish two goals. First, it would precisely describe the nature of Alcan's commitment to mitigate or compensate, thereby providing some certainty to parties that may be affected by the KCP. Second, it would ensure that the same standards are applied to all affected parties.

Integral to any arrangement is a fair and effective process for the resolution of disputes. Although Alcan indicated that there was a preference by residents to negotiate individually, there were parties at the Hearing who felt disadvantaged by the lack of formality to that approach. The details of any such process should be determined between Alcan, governments, and key stakeholders. However, it is critical that any process should include an independent decision-maker. The Watershed Management Agency proposed in Section 7.2 could undertake such a function.

Provincial Commitments

The Province has undertaken to mitigate or compensate for impacts of the KCP on some of the public facilities in the region. Specifically, the Province has made commitments to:

- pay the full capital cost of any sewer or water supply upgrades required at Fort Fraser; and
- pay the full capital costs for upgrades to Vanderhoof's sewage treatment facilities.

Provincial commitments in respect of the rehabilitation of the Murray-Cheslatta system are described in Section 8 of the Technical Report.

7.2 Watershed Management Agency

The concept of a Watershed Management Agency received widespread support in the Nechako region. Opinions differed over the type of structure and the degree of authority the Agency should have.

In the Nechako reservoir and watershed, the complexity of the KCP issues compound the difficulties of managing a scarce resource. Already there are conflicts between the consumptive uses of water, such as irrigation, and the protection of the resource for fisheries in the Nechako River. At present there is a freeze on the licensing of water for consumptive purposes in the reaches of the river above the Stuart confluence. Alternatives such as tributary storage and ground water

have been suggested, but require further study. In addition, there could be conflicts between the Nechako Fisheries Conservation Program of remedial measures and canoeing or boating activities on the river. There is little apparent communication between the agencies responsible for planning and managing the resources in the region and stakeholder groups. There was general consensus that a more comprehensive and integrated approach to management of the watershed involving community participation is required to address existing, as well as future, issues. A watershed management approach is broader in scope than site specific management and reflects the interdependencies in the watershed, for example between upstream uses and downstream effects. It provides sensitivity to regional resource issues and encourages cooperation in the resolution of conflicts.

A Watershed Management Agency would provide a framework for ensuring that studies of resources, such as the salmon and trout fishery are integrated. A coordinated approach to data collection monitoring and the development of evaluation criteria is required.

Structure

The Commission recommends the immediate establishment of a Watershed Management Agency for the Nechako Reservoir and Watershed. The Commission notes that Hearing participants supported an approach that is flexible, involves stakeholder participation and is based on consensus-based decision making. The proposal of the Fraser River Management Board to facilitate the establishment of the Watershed Management Agency has merit in the absence of another alternative. However, this may not be necessary if the Province wants interested parties in the region to be directly involved with the setting up of the Watershed Management Agency. The Commission believes that the stakeholders in the region should determine the structure and mandate of the Agency and how they want the process of establishing the Agency to be conducted. It is expected that agencies such as the NFCP and the Water Comptroller will continue to undertake their existing responsibilities until such time as specific responsibilities are formally transferred to the Agency.

Existing agencies and planning programs will provide a core of stakeholders in the region for developing a new structure with a broader interest base.

The Commission recommends that the initial cost of establishing the Watershed Management Agency should be funded by the three levels of Government. The ongoing administrative costs of the Agency including the costs of participation by stakeholders, should be cost shared.

Responsibilities

There is a need for a comprehensive water management plan to be undertaken in the Nechako watershed to examine the water source options available for meeting the existing and future demands for surface and groundwater. The Watershed Management Agency should be responsible for conducting and implementing a comprehensive water management plan. The freeze on licensing should

remain in effect under Settlement Agreement flows until it can be demonstrated that there is sufficient water available to protect the fishery and allow for further withdrawals.

Baseline Studies, Monitoring and Evaluation

Studies which should be undertaken for the reservoir and watershed include a physical limnology study of the reservoir, a survey of groundwater wells and the collection of baseline data on resident fish in the Nechako.

Monitoring and evaluating the impacts of the KCP and implementing an adaptive management program will be an ongoing requirement post construction. Monitoring and surveillance studies identified include wildlife, particularly calving and fawning sites on in-channel islands and the Vanderhoof Bird Sanctuary, and water quality monitoring.

The Commission recommends that the program of baseline studies should be initiated as soon as possible. The Commission also recommends that the Watershed Management Agency should be responsible for overseeing the conduct of the baseline, monitoring and surveillance studies and for overseeing the implementation of recommendations or remedial measures.

7.3 Local Benefits Fund

The Terms of Reference instructed the Commission to consider whether a local benefits fund would be an appropriate mechanism for addressing impacts of the KCP. A local benefits fund is designed to provide funds to groups, communities or regions that are adversely affected by a large project development. Typically, a local benefits fund is established in situations where most of the long term benefits from the development accrue over a much wider region than the one that experiences the direct impacts. A fund is intended to provide some compensation, to the extent possible, to the region that experiences the negative project impacts. It is designed to address negative impacts that are unmitigated or unavoidable.

In these circumstances, the purpose of a Local Benefits Fund would be to address the residual negative impacts of the KCP, and not the impacts where commitments for mitigation or compensation already exist. Commitments made under the Settlement Agreement and since the Settlement Agreement would be funded separately.

Experience with local benefits funds within B.C. and across Canada indicates that there are a number of different ways in which the funds are structured and implemented. Residents of the Nechako valley supported the establishment of a local benefits fund with a structure for managing the fund located in the region with local and provincial representation. Funding sources suggested were a water consumption tax, funding by Alcan, the water rental fees, or an equivalent contribution from B.C. Hydro.

The Commission recommends that a Local Benefits Fund be established to provide some compensation for the residual impacts of the KCP in the Nechako reservoir and watershed and the Kemano watershed. In the Nechako reservoir and watershed the Local Benefits Fund should support some of the administrative costs of the Watershed Management Agency and other responsibilities and activities directly related to the KCP.

In each watershed, funds should be provided in the initial years for baseline studies that are required to enable the impacts from the KCP to be evaluated post construction. Funding for monitoring and evaluation will be required on an ongoing basis for many years after the KCP is completed. In addition the Local Benefits Fund should have sufficient funds for remedial measures that may be required.

The fund should be allocated and managed separately in each watershed. The Local Benefits Fund could be managed either by government with local representation or by a local committee. The Commission believes that the fund should be structured in such a way to provide funds in perpetuity.

While it is difficult to determine an appropriate amount of money for the fund the Commission estimates that the capital of the fund under Settlement Agreement flows should be in the order of $15 - $20 million. This amount could be lowered to reflect reduced negative impacts under the Commission Flow Scenarios. The Commission has recognized that some of the initial funding is required to conduct baseline studies. However, a residual amount of money should remain in the fund and earn interest to provide an annual amount of money in perpetuity. It is suggested that the residual amount be not less than $10 million. The funds could be provided by the project proponent, B.C. Hydro, government or some combination of these sources.

8.0 Financial Benefits and Regional Economic Impacts

Financial Benefits

From the analysis of the impacts on the provincial economy that Alcan claimed would accrue from its expenditures on the KCP, it is not possible for the Commission to determine whether the KCP would benefit the province any more or less than an alternative project that met the same domestic energy demand. Nonetheless, there would undoubtedly be positive employment and economic activity impacts in the region during the construction period.

The Commission finds that B.C. Hydro's projected benefits from the Coordination Agreement and Long-Term Electricity Purchase Agreement, exhibit variability depending on the value of other new energy supplies, the timing of the KCP and the quantity of available water in the Nechako Reservoir for electricity generation and coordination. The Commission cautions, however, that the ben-

efits from these agreements represent the benefits to B.C. Hydro and its customers, but do not necessarily represent the net benefits of the KCP to the Province, since there are unmitigated resource costs and benefits that have not been included in the evaluation.

The Commission Flow Scenarios presented in this report will affect the benefits to B.C. Hydro from the agreements with Alcan. There was insufficient evidence presented during the hearing for the Commission to determine the specific effect of alternative flow regimes on the benefits from Coordination. To determine this, it is necessary for B.C. Hydro to recalculate the quantities of energy and capacity available—under each recommended flow scenario—from coordination of the Nechako Reservoir with the rest of its system. The Commission Flow Scenarios would affect the benefit to B.C. Hydro from the Long-Term Purchase Agreement if the reduced generation capability would impair Alcan's ability to deliver the energy and capacity under the terms of the Purchase Agreement.

Regional Economic Impacts

Previous sections of this Summary Report have detailed the positive and negative impacts of the KCP under the Settlement Agreement flows and the Commission Flow Scenarios.

The following matrix (Table 2) provides a recap of the various impacts of the KCP under the Settlement Agreement flows (inclusive of more recent commitments by Alcan and the Province) and the impacts under the Commission's recommendations for mitigation.

A major feature of the Commission's analysis is the recognition of the substantial benefits that would accrue from the installation of the Kenney Dam Release Facility. In addition to the restoration of the Murray-Cheslatta system, the Facility would ensure better protection of sockeye salmon than now exists, especially with the implementation of the lower target temperature. The Commission views these benefits as so significant that it recommends that the Facility should be built whether or not the KCP proceeds.

The Commission's recommendation of a plan for clearing the Reservoir of flooded timber by the year 2005 has important implications for recreational interests and possibly for the forest industry of the region.

For the chinook and trout of the Nechako River, the Commission was not satisfied that the provisions of the Settlement Agreement were adequate, but was unable to set a precise estimate on the single level of flow that would be best. Rather, as flow levels are increased the degree of risk is decreased. Hence, the Commission provides three scenarios of flow, each associated with different additional measures of mitigation. Each of these scenarios has implications for the mitigation of effects, other than those on fish, which are important for the maintenance of the quality of life and the environment of the Nechako Valley.

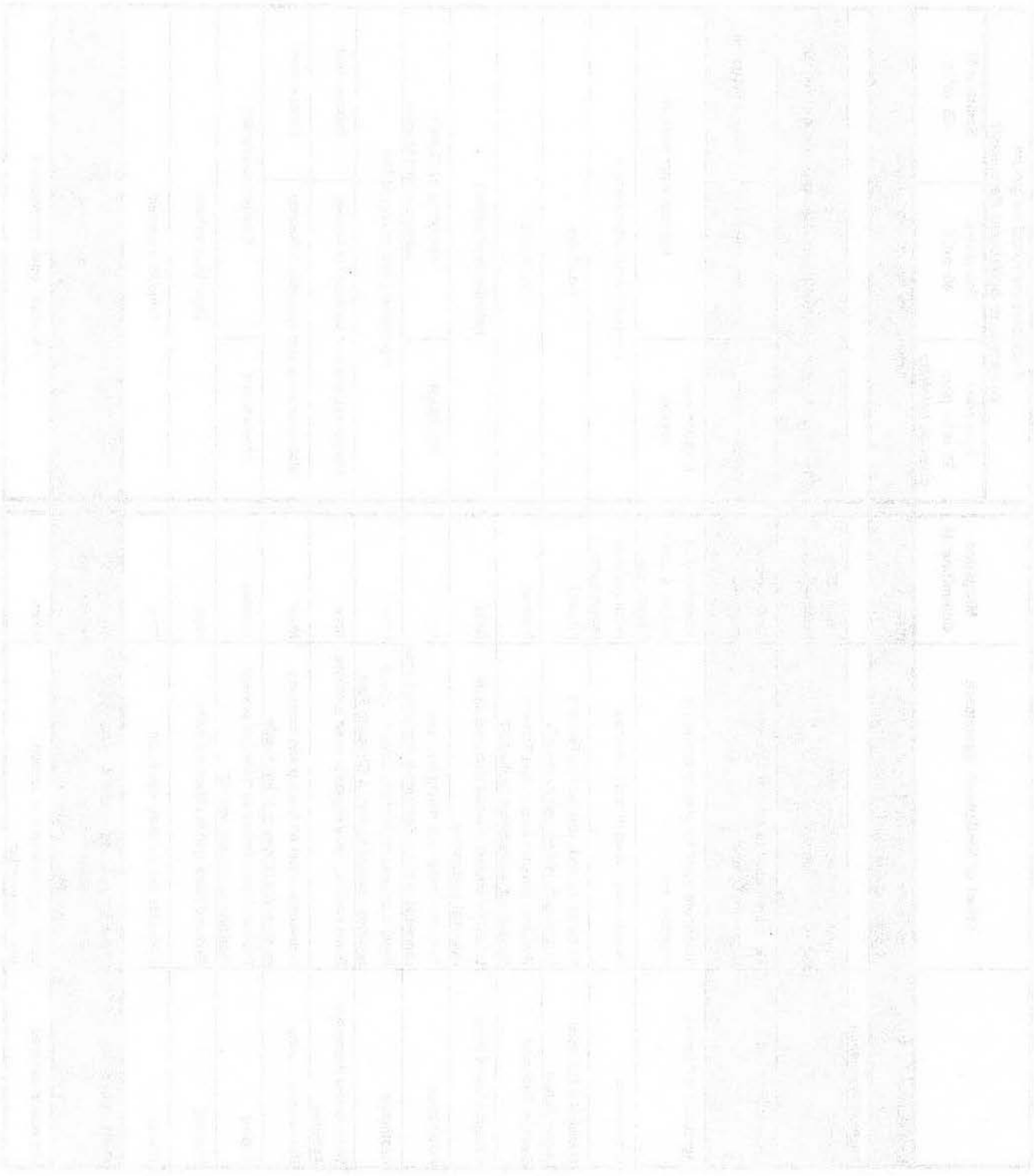
The Commission recognizes that its various recommendations have major implications for the viability of the Project as it is presently designed. Detailed analysis would be required to assess both engineering feasibility and financial consequences. With those assessments, it would then be possible to weigh the potential benefits and costs in a provincial context.

This Summary Report deals only with the major findings of the Commission. Many of the potential impacts of the KCP are interrelated and in some cases highly technical. The Technical Report provides full details on the positions taken by participants in the Review along with the rationale leading to each of the Commission's conclusions and recommendations.

Table 2. Comparison of the Settlement Agreement Mitigation with the Commission's Proposed Measures

	Effect of Settlement Agreement	Mitigation Commitments	*Additional proposed mitigation compared to Settlement Agreement*		
			Scenario I 35 m^3/s plus chinook hatchery	**Scenario II 40 m^3/s**	**Scenario III 45 m^3/s**
Nechako Reservoir	Increase drawdown might impact safety, access and aesthetics of the reservoir	Alcan-wharves, boat launch, etc.	Improved by tree clearing program		
Nechako Watershed					
Sockeye	Improved temperature conditions but still less than optimal	Kenney Dam Release Facility	Temperature control to 18.4°C provides significant improvement		
Chinook and Trout	Flows insufficient to achieve conservation targets for Chinook	Alcan-remedial measures under Settlement Agr.	Minimum mitigation	Adequate mitigation	Natural mitigation
Agriculture & Ranching	Insufficient water for present and future irrigation, etc.	Alcan-modified intakes & cattle fencing, etc.	Irrigation water required	Irrigation water available	
Groundwater	Potential drop in water table uncertain	Alcan-modified private wells	Potentially small improvement		
Municipal & Domestic Water Supply	Problems currently exist at Fort Fraser & Vanderhoof; exacerbated by the KCP	Province	No change		
Sewage Treatment	Problems currently exist at Fort Fraser & Vanderhoof; exacerbated by the KCP	Province	No change		
Industrial Use of Water	Uncertain whether it would decrease future industrial investments	None	Potential improvement		
Float Planes	Currently problematic during low flows, exacerbated under Settlement Agreement flows	Alcan	No change	Remaining problems in September and October	
Aesthetics	Positive impacts on Nechako Canyon; mostly negative between Nautley & Cheslatta Falls	None	Improvement with increased flow		
Water-Based Recreation Activities	Some positive, some negative; weed problems	None	Modest improvement upstream of Nautley		Improvement
Recreational Boating	Detrimental effect on boating and canoeing, most severe upstream of the Nautley	None	Modest improvement upstream of Nautley		Improvement
Angling	Provincial commitment to "maintain present recreational fisheries values"	Province	Improvement	Further improvement	
Flooding	Reduced flooding in the Nechako Valley	None	Slight improvement		
Wildlife	Uncertain, but not likely significant	None	Some improvement		
Murray/Cheslatta	Improvement by decreased flooding; Return of Cheslatta Nation lands conditions for rehabilitation	Kenney Dam Release Facility	Avoid flood releases		
Kemano Watershed	Small negative impact on salmon, trout and eulachon	Alcan	Potentially small improvement		

Note: Shaded areas represent resources and activities most significantly impacted by proposed mitigation measures and flows



Kemano Completion Project Review

Summary Report

December, 1994

Contents

1.0 Background

Debate and controversy with respect to Alcan's Kemano projects have been ongoing for many years. The legal rights provided to Alcan stem from the Industrial Development Act of 1949 and an agreement between Alcan and the Province of B.C. (the "1950 Agreement") which, among other things, provided Alcan with water diversion rights to the Nechako River and the Nanika River, and favourable water rental rates. These water rights were granted to Alcan to develop a hydro-electric facility to power an aluminum smelter in northwestern British Columbia. Water rights granted to Alcan under the 1950 Agreement are to be exercised prior to December 31, 1999. At that time, Alcan will receive a water licence in perpetuity for the water required to operate facilities constructed for hydro-electric generation prior to the deadline. Construction of the first phase of development began in 1951 and was completed in 1954 with a total installed capacity of 896 MW.

The Kemano Completion Project ("KCP") involves the installation of four new generators at the Kemano power plant with a nameplate rating of 540 MW. This will bring the total installed capacity at the plant to 1436 MW. KCP also involves the construction of a new power tunnel and associated intake, the dredging of Tahtsa Narrows and the addition of 1.1 metres to the gates at the Skins Lake Spillway. KCP also requires the construction of 82 km of 300 kV transmission line to transmit the KCP output to Kitimat, where it connects to the B.C. Hydro system.

B.C. Hydro has contracted to purchase an average annual 285 MW of KCP output for a period of at least 20 years. B.C. Hydro has also executed a Coordination Agreement with Alcan to capture efficiency gains realized from the coordinated operation of the Nechako Reservoir with the B.C. Hydro system.

To fulfill fish protection obligations the Project requires the building of a cold water release facility at the existing Kenney Dam and the construction of the Cheslatta fan channel. The Kenney Dam Release Facility ("KDRF") would draw cold water from deep in the reservoir to release into the Nechako River so that cool water conditions will prevail for the migration of adult salmon.

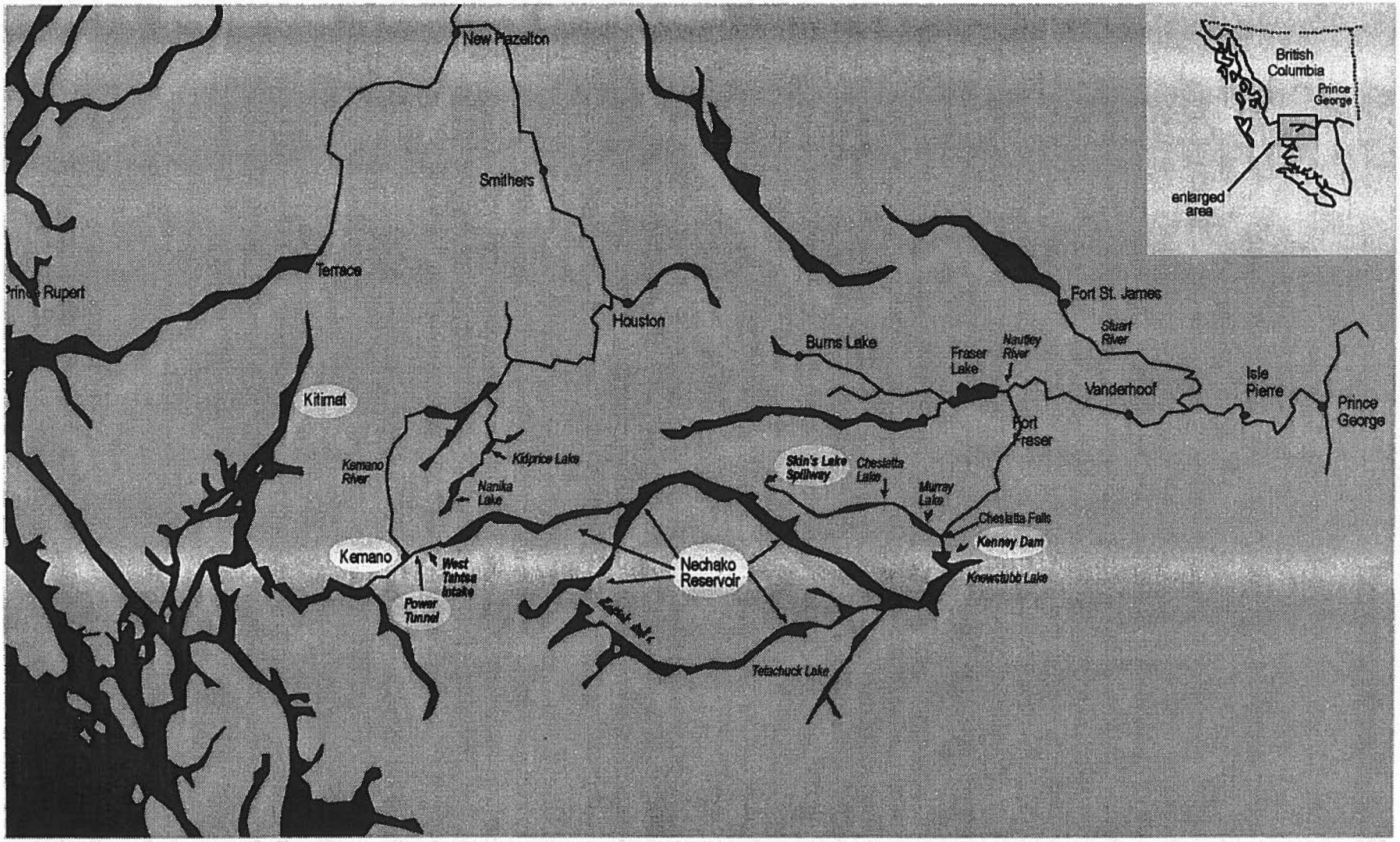
Figure 1-1 shows the location of the key features related to the KCP.

The Settlement Agreement

Prior to 1980, Alcan and the federal Fisheries Department ("DFO") reached an impasse in discussions on the amount of water to be released into the Nechako River to satisfy the DFO's mandate to protect the salmon fisheries. In 1980 the DFO obtained an injunction from the B.C. Supreme Court requiring Alcan to release additional flows which the DFO considered necessary for the protection of the salmon fisheries.

In 1985, Alcan petitioned the courts for a permanent resolution of the flow requirements. Prior to the court case, the federal government, provincial government and Alcan agreed to enter private negotiations to find technically accept-

Figure 1-1. **The Kemano Hydroelectric Development**



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able solutions to the conflict between Alcan's rights to the water in the Nechako and Nanika Rivers and the federal responsibility to protect the salmon fishery.

The 1987 Settlement Agreement between Alcan and the governments of British Columbia and Canada achieved an accord that all three parties deemed to be a satisfactory resolution, including a combination of flows and remedial measures for the Nechako River. This resulted in the development of the current KCP.

Under the Settlement Agreement Alcan gave up its rights under the 1950 Water Licence to divert the Nanika River and also agreed to construct a cold water release facility at Kenney Dam, as well as to construct and pay for other remedial measures required to maintain set numbers of chinook salmon. Alcan is to pay one half the costs of the monitoring and conservation measures and to share in the administration costs of a program to maintain the Nechako River fishery. The Nechako Fisheries Conservation Program (NFCP), was established with representation from the three parties and an independent expert.

The DFO agreed to forego any legal challenges to the 1950 Agreement, to pay for half the NFCP's costs of monitoring, and all the costs of applied research. The Province agreed to implement a fresh water fishery management strategy, and to amend Alcan's Water Licence and the 1950 Agreement to reflect the abandonment of Alcan's rights to the diversion of the Nanika River.

Alcan initiated construction of the KCP in 1988, but halted construction in 1991 following a successful challenge to the federal court trial division that KCP required a federal Energy Assessment Review Process Certificate prior to construction. That ruling was reversed by the Federal Court of Appeal and an appeal to the Supreme Court of Canada was dismissed in February, 1993. Approximately $500 million had been spent by Alcan on the KCP to that point.

Commission Review

On January 19, 1993, the Province of British Columbia issued the Terms of Reference for this Review under Order in Council No. 0033. The Terms of Reference specifically direct the Commission to "assess the nature and extent of the effects of the Project on the physical, biological, social and economic environments in the Kemano and Nechako River watersheds and the Nechako Reservoir." Issues to be addressed relate to river hydrology, fisheries, cost/benefit analysis, aboriginal concerns, and any other issues identified by the Commission. The Terms of Reference also direct the Commission to recommend options for addressing impacts of the project, inclusive of appropriate mitigation measures.

Initially, Alcan declined to participate in the Review process, but changed its position on July 9, 1993. The DFO had initially offered only limited participation, but that position also changed to full participation on January 27, 1994.

Representatives of the major First Nations' communities within the geographic region of the Review indicated that their participation in the Review would depend on certain concerns being addressed. Among the concerns, the First Nations' communities requested a full examination of the Fraser River, Kemano I,

and the justification for the project. The Commission's Terms of Reference did not satisfy First Nations' concerns regarding the scope of the Review, and First Nations groups declined to participate. The Technical Report provides additional background on the positions taken by First Nations. The recommendations from this Review will have a direct impact on First Nations.

The Terms of Reference direct the Commission to consult with interested parties on the form and content of the Review. The Pre-Hearing Activities commenced in April 1993 with a series of scoping meetings in Prince George, Fort Fraser and Kitimat. These meetings served to initiate consultation with interested parties about the Review and to scope the issues of concern to them, within the context of the Terms of Reference. As a precursor to the Public Hearings, the Commission staff held several workshops and pre-hearing meetings to provide a forum where interested parties could be informed about the Review and obtain clarification about the issues to be addressed.

Prior to the start of the public hearing, the Commission conducted two site visits of the study area. On September 10, 1993, the Commission was guided on a helicopter reconnaissance of the Nechako River, the Kenney Dam, the Nechako Reservoir, the Skins Lake Spillway, the Murray-Cheslatta system and the Cheslatta Fan. This was followed on October 20, 1993 with a tour of the Kemano River, the Kemano Community, the Kemano I powerhouse and the KCP facilities under construction. These tours served to provide the Commission with familiarity as to the character of the region, as well as an appreciation of some of the concerns articulated at the scoping meetings. During July and August, 1994, boat and canoe tours of the Nechako River, a float plane tour of the Nechako Reservoir and bus tours of local communities provided additional insights.

To focus discussion at the Community and Technical Hearing, the Commission developed a preliminary list of issues from the sentiments expressed at the scoping meetings and from comments submitted to the Commission by interested parties. The Commission kept the public apprised of these issues, Panel determinations, and the evolution of the Review process by the issuance of regular newsletters.

The Community Hearings were designed for information gathering, where participants would inform the Commission about the impacts of the KCP on the communities within the geographic region of the Review.

Community Hearings were held over 8 days in November and December 1993 and took place in Prince George, Fort Fraser, Vanderhoof and Kitimat. The Community Hearings were relatively informal and there was no cross-examination other than questions from the Review Panel. At these hearings the Commission also received suggestions from participants on mitigation and compensation for the negative impacts of the KCP, and how the positive impacts of the project could be maximized. The Commission heard submissions from 170 individuals and groups. In total over 1,500 people attended.

The Technical Hearing on the other hand, focused on collecting, analyzing and critiquing the technical and scientific evidence related to the KCP. Unlike the Community Hearings, the Technical Hearing was considerably more structured and formal and was divided into phases by key issues. Witnesses presented their evidence under affirmation, and were subject to direct examination and cross-examination.

The Technical Hearing was held mainly in the regions affected by the Project - Prince George, Vanderhoof and Terrace. This was to ensure that the people within the geographic region defined by the Terms of Reference had local access to the Review proceedings. Several weeks of hearings were also held in Vancouver to accommodate the significant interest in the project expressed by residents in the Lower Mainland and coastal communities.

The Technical Hearing spanned 79 days - December 8, 1993 to August 10, 1994. In total, 810 Exhibits were filed and 16,489 pages of transcript were recorded. The full public record totalled more than 200,000 pages. The hearings provided an exhaustive review of the KCP under the Terms of Reference. The Commission heard from all interested parties and the Commission issued subpoenas to ensure full participation by DFO scientists, along with representations from the federal and provincial Ministers responsible for negotiation of the Settlement Agreement in 1987.

2.0 Reservoir Operations

Under the existing Kemano I operations, the volume of water in the Nechako Reservoir cycles annually in response to seasonal variation in inflows. An approximate annual water balance is maintained by releases through the existing Kemano powerhouse and at Skins Lake Spillway. Kemano I resulted in significant reductions in flooding along the Nechako River and downstream on the Fraser River. However, the reduced water releases also resulted in high river temperature conditions in warm, dry years which created unfavourable conditions for migrating adult salmon. Releases through the Skins Lake Spillway meant dewatering of the Nechako canyon and significant impacts to Cheslatta lands and the Murray-Cheslatta system.

Plans to coordinate operation of the reservoir, after the KCP, balance the need for power production for the aluminum smelter, the sale of power to B.C. Hydro and the agreement to coordinate reservoir operations of the Nechako Reservoir with the B.C. Hydro system. During sustained periods of small inflow and/or relatively low Nechako Reservoir levels, Kemano power generation would be reduced provided other reservoirs in the B.C. Hydro system were in a superior storage position. Conversely, during sustained periods of large inflow and/or relatively high Nechako Reservoir levels, power generation would be increased at Kemano to avoid spilling, provided other B.C. Hydro reservoirs had the capacity to store water. During periods of system-wide drought, all reservoirs would be drawn down together to ensure sufficient capacity would be available to meet Alcan and B.C. Hydro firm loads at the end of the dry period. The maximum fluctuation in reservoir levels would increase from approximately five meters at present to nine meters under the KCP and reservoir coordination.

The KCP as now designed has several notable features. The Nanika River is no longer a component of the project. The Kemano River would receive a 30 percent increase in flow. The Nechako River flow would be reduced to less than half the levels of recent years.

The most notable feature of the project is the Kenney Dam Release Facility which would provide a more effective and efficient source of cooling water for salmon migration, enable rehabilitation of the Murray-Cheslatta system, restore the Nechako Canyon as a recreational resource, reduce erosion and sedimentation and improve water quality in the upper Nechako River. The facility would also improve management of flood releases from the reservoir, accommodating whatever releases are necessary except those at least as infrequent as once in 200 years.

For these several reasons the Commission recommends that the Kenney Dam Release Facility should be used for water releases regardless of the future of the KCP. The Commission recognizes that if the KCP is not undertaken the facility and the Cheslatta fan channel would have to be redesigned to accommodate substantially larger flows in order to restore the Murray Cheslatta system to its natural state.

The various impacts from the KCP operations are summarized in the following sections and are discussed in detail throughout the Technical Report. The Technical Report provides detailed discussion and specific recommendations.

3.0 Nechako Reservoir

The Commission recognizes that the Great Circle Chain of Lakes was once considered, and still has the potential, to be one of the most spectacular recreational assets of the Province. The Reservoir still provides the most ready access to Tweedsmuir Park. Safe public access to the site must remain a priority.

When the Nechako Reservoir was created in the 1950s, the Province granted Alcan the timber rights to the submerged trees. The Province did not require that Alcan remove the trees from the areas to be flooded, but did require Alcan to restore public road and water trail access, and to re-establish wharves and public approaches to pre-flooding conditions, up to a maximum total cost of $250,000 (1950$).

The resulting submerged timber created both significant navigational hazards and degraded the appearance of the Reservoir. A large number of partially submerged trees still protrude above the water. Debris and fallen logs have also accumulated along the shoreline.

Alcan has met its clearing requirements specified in the 1950 Agreement. Since 1979, Alcan has contributed approximately $500,000 annually to a timber clearing program which serves to increase boater safety, to provide refuge from wind and storm, and to improve the Reservoir appearance. Despite continued efforts, Alcan has only cleared approximately 10 percent of the timber in the Reservoir.

The KCP would further exacerbate the danger and public nuisance of the submerged timber in the Reservoir. With the KCP and coordination by B.C. Hydro, it is possible that the reservoir elevations could vary by up to nine meters. The annual reservoir fluctuations with the KCP would expose more standing timber creating even more hazardous navigation conditions. From an aesthetic perspective, the additional drawdown would worsen an already unattractive scene. Additionally, the decreased reservoir levels would impede access routes, water trails, boat launches and the rail portage.

The enhancement of the recreational potential of the Reservoir requires an aggressive program of timber removal and Alcan's continued commitment to maintain safe public access routes. The Commission recognizes that Alcan's program of timber clearing has improved recreational opportunities. However, the Commission finds that an aggressive clearing program must continue in the post-KCP Reservoir to ensure the safety of boaters and public access to recreational sites.

The Commission recommends that the Province should be prepared to provide incentives for Alcan to develop and implement a mutually acceptable plan for completing the clearing of the Reservoir by the year 2005. Such a plan should give priority to routes of access to Tweedsmuir Park such as Whitesail Reach of Ootsa Lake, Whitesail Lake to Chikamin Bay, Intata Reach and the south shore of Ootsa Lake. Such a plan should also include local community input.

If Alcan does not meet the targets developed in the plan, the Commission recommends that the timber rights should revert to the Province. The province could re-issue the rights to other interested parties granting the new bearer similar incentives for expedient removal.

Alcan has agreed to extend the rail portage system between Whitesail Lake and Eutsuk Lake at Chikamin Bay to ensure that it will remain operational under the greater drawdown of the KCP. Alcan has also agreed to extend or re-design private wharves and boat launching facilities where necessary. Alcan should confirm its responsibility to restore public access to the parks in the region affected by the lower minimum Reservoir levels.

4.0 The Nechako River

The most significant impacts of the Kemano Completion Project would occur on the Nechako River as the water releases from the reservoir would be substantially reduced. The effect would be most pronounced in the upper river above Fort Fraser, and most noticeable in the winter months from December to March, and in the summer months in years of low run off. These changes in river flows would have effects not only on fish, but on many other plants and animals of the river environment as well as on the communities near the banks of the river.

4.1 Fishery Impacts

Sockeye Salmon

The sockeye salmon of the Stuart and Nautley rivers are by far the major fishery resource of the Nechako River basin. The average annual commercial value of the sockeye for 1981 to 1992 was $26 million, which is 100 or more times the value of all other fish resources of the Nechako River. In 1993 the value of the sockeye catch was $77 million.

The importance of the sockeye resource was recognized for many years prior to the Settlement Agreement. The critical need for the sockeye is cool water conditions in July and August as they migrate up the Nechako, enroute to their spawning grounds in the tributaries to the large lakes of the Stuart and Nautley watersheds where their young reside before going to sea.

At present, cooling water must be provided from July 20 to August 20 by releases of reservoir surface water from the Skins Lake Spillway. Large volumes of water are needed in hot summers and even this may not always be sufficient to keep river water temperatures below levels that are highly stressful for sockeye. With the KCP, cold water released from the Kenney Dam Release Facility would enable better maintenance of lower river temperatures than can be achieved at present.

The Commission recognizes that the provisions of the Settlement Agreement provide the opportunity for greater protection for sockeye with the KCP. However, the Commission has concluded that the negotiated provisions should be augmented to protect the potential future value of the sockeye resource. The Commission recommends that cooling water releases from the Kenney Dam Release Facility be increased to provide a target temperature of 18.4°C at the confluence of the Nechako and Stuart Rivers. The Commission estimates that accommodation of this recommendation would require additional water releases of 6.5 m^3/s during the cooling period, or 1.1 m^3/s on an annual basis. Sustaining this target temperature through the season of migration and providing for ramping of flows to avoid stranding of young chinook would require an estimated 0.1 m^3/s on an annual basis. With these releases there will be the opportunity to undertake additional enhancements in the Stuart and Nautley systems which could very significantly increase the annual value of this fishery.

The possibility that reductions in the flow of the Nechako might cause difficulties for sockeye migration at Hell's Gate and at other points of passage on the Fraser was examined by the Commission. The recent installation of new, low level fishways at Hell's Gate together with other works designed to facilitate migration should ensure that any minor effect of the KCP on Fraser River flows would not affect salmon migration. With or without the KCP, the Fraser River should be monitored on a continuing basis for possible sites of obstruction.

Chinook Salmon and Trout

Chinook salmon are a second fishery resource of importance in the Nechako River. The value of the annual catch of chinook is not readily assessed, but for the period 1981 to 1992 the commercial value of the Nechako mainstem stocks was placed at $56,725 and that of the Stuart system at $95,806. Both of these stocks would also benefit from the recommended changes in cooling flow releases during migration.

The Settlement Agreement provides for a target escapement to the mainstem Nechako of 3,100 adult chinook with a range of 1,700 to 4,000. The Commission recognizes that the achievement of the target escapement is confounded by many factors beyond what happens on the Nechako. Low escapements, such as have occurred in recent years may in part be the result of increased exploitation rates, decreased ocean survival related to warm ocean conditions or perhaps the effect of undetected pollution as the juveniles journey to sea. Adult escapement is a poor yardstick for measuring the effectiveness of mitigation measures.

The Commission acknowledges the value of the considerable body of information that has been assembled by the NFCP in developing monitoring methods, in pilot testing remedial measures, in applied research and in developing strategies for assessment of the status of the chinook stock. Nevertheless, the Commission does not have confidence that the proposed program will be successful in achieving the conservation goal of maintaining the chinook at a population level of 3,100, and has accordingly recommended increases in flow. The Commission has accepted the target level of 3,100 chinook as a requirement to be met. A cost effectiveness study in a regional or provincial context might determine the optimal level of chinook and trout preservation efforts. However, the context of this Review focused on the Settlement Agreement and the Commission reviewed mitigation measures in relation to the target of 3,100 chinook.

The Commission has concluded that flows during the winter months, from December through March, must be increased from 14.2 m^3/s to 25.5 m^3/s to provide greater assurance that survival rates of incubating eggs and over-wintering juveniles would be acceptable. Increased winter flows are also a basic requirement of the provincial plan for mitigation of effects of the KCP on trout. The NFCP has acknowledged that if more water was available an increase in winter flows would have first priority.

Proposed KCP releases of water for the spring and summer period have also been considered as inadequate for the provision of rearing habitat for chinook and resident trout. The Commission has considered the effect of increasing the base flow from April through August at three different levels above the proposed base of 31.1 m^3/s in the Settlement Agreement.

Flow Scenario I

Increasing the base summer flows to 35 m^3/s would be a bare minimum provision and would still place the chinook and trout population at considerable risk. To ensure achievement of the conservation goal at this level of flow, a full scale hatchery operation should be undertaken immediately. It had been speculated at

one time by federal government employees that a hatchery on the Nechako could produce 50,000 adult chinook. While this may be optimistic, the Commission is confident that a hatchery operation could at least maintain the stocks to the level of the conservation goal, albeit artificially.

Flow Scenario II

A second option, increasing the base summer flows to 40 m^3/s, would give greater assurance that the wild stocks of chinook and trout would be maintained, but a pilot hatchery operation should be initiated at once to provide additional information on the biology of Nechako chinook and to prepare the way for a full scale hatchery if the need should emerge. The substantial decline in numbers of fry over the past four years and declines in the numbers of adults particularly in the past two years suggest that the need for a hatchery may emerge within five years.

Flow Scenario III

The third regime of flow for April through August would provide 45 m^3/s and give reasonable confidence that the natural stocks of chinook and trout could be maintained with only modest intervention and enhancement activities.

None of these levels of flow would be sufficient to guard against excessive sedimentation of the river bed. Accordingly the Commission recommends that high priority be given to erosion control and to encouraging riverbank vegetation in the Nechako mainstream and the tributaries between Cheslatta Falls and Fort Fraser. If these measures are not sufficient to forestall sedimentation problems, flushing flows to clean riverbed gravel may be necessary.

Of the various remedial measures described in the Settlement Agreement other than those concerned with erosion control and riverbank vegetation, the Commission would recommend that trials be continued with stream fertilization. The applied research and monitoring programs should be continued as a means of gaining greater understanding of the Nechako chinook stocks. The province should develop a parallel program for trout. However, as discussed in the Technical Report, the Commission recommends that the program of habitat complexes be discontinued.

The implications of these various flow provisions on seasonal and annual equivalent water releases are given in Table 1.1. It is to be noted that with increases of base flows the requirement for cooling flows would be reduced. The amount of the reduction could only be estimated with a computer simulation, and would vary both within the cooling flow period and from year to year. As is indicated in later sections, changes in the flows as outlined would have many beneficial effects for other uses of water of the river.

Determining the cost effectiveness between flow scenarios requires analysis of the cost of water not used for electricity generation, to be compared with the regional and provincial benefits of increasing flow. This analysis is beyond the Terms of Reference of the Review and requires simulations by B.C. Hydro of

Table 1. Possible Schedule of Flows for Fish Protection

Month	Short Term Observed 1980-1992	Settlement Agreement Below Cheslatta Falls		Rationale for Additional	Proposed Flows		
		Short Term	Long Term		35 m3/s April - August	40 m3/s April - August	45 m3/s April - August
January	31.1	31.1	14.2	Protection incubating salmon, overwintering juvenile salmon & trout	25.5	25.5	25.5
February	30.9	31.1	14.2	As for January	25.5	25.5	25.5
March	32.5	31.1	14.2	As for January	25.5	25.5	25.5
April	55.8	56.6	31.1	Rearing for salmon and trout	35	40	45
May	62.5	56.6	31.1	Base as for April. Flushing flows, 2 days @ 170 m^3/s plus ramping, once every three years	35.0 + 4.1	40.0 + 4.1	45.0 + 4.1
June	55.5	56.6	31.1	As for April	35	40	45
July	138.7	56.6 + 82.1	31.1 + 10.9	Base as for April Cooling water* 6.5 for 18.4 °C target 0.6 for extending season 0.6 for ramping	35.0 + 18.6	40.0 + 18.6	45.0 + 18.6
August					35.0 + 18.6	40 + 18.6	45.0 + 18.6
September	39.5	31.1	28.3	-	28.3	28.3	28.3
October	35.3	31.1	28.3	-	28.3	28.3	28.3
November	33.3	31.1	25.5	-	25.5	25.5	25.5
December	32.9	31.1	14.2	As for January	25.5	25.5	25.5
Mean Annual	**59.8**	**41.9 + 16.20**	**24.53 + 1.85**		**29.90 + 3.51**	**32.01 + 3.51**	**34.10 + 3.51**

water available for electricity after accommodation of the releases into the Nechako River.

4.2 Agriculture and Ranching

The reduced flows with the KCP will impact various consumptive uses of water along the Nechako River. Currently, irrigation is by far the most significant use of water from the river after power production and fisheries and, therefore, the most serious effects of water restrictions will be on this activity. The reduced flows may also have other impacts on agricultural activities such as a loss of sub-irrigation, the stranding of water intakes and problems with cattle containment due to the narrowing and shallowing of the river. Access to the river for watering cattle may be constrained by the need to ensure cattle do not wander and to protect water quality.

Alcan has agreed to mitigate or compensate for effects on agriculture caused by reduced sub-irrigation, stranding of water intakes, and cattle containment problems. The Commission is of the view that Alcan's commitments will resolve these concerns.

There is considerable debate about the amount of water which would be required for irrigation in the future and the amount of water which will be available under the 1987 Settlement Agreement long-term flows. As a result of this uncertainty, and at the request of the DFO, the Province has placed a freeze on new water licences upstream of the Stuart River.

The quantity of additional water required for future irrigation depends on how much land may be economically irrigated. The amount of land that would benefit from irrigation could vary from 5,040 hectares (present acreage under licence) to 54,000 hectares (maximum irrigable land) depending on economic conditions, particularly the price for agricultural products. The Commission is of the view that 18,000 hectares represents a reasonable approximation of the total acreage likely to be irrigated well into the foreseeable future. This represents about 13,000 additional hectares. The Province estimates that about 90 percent of future agricultural development will occur downstream of the Nautley.

An additional 13,000 hectares of irrigated land would require approximately 1.2 m^3/s of water on a mean annual basis. Of this amount, 0.1 m^3/s would be required upstream of the Nautley, and 1.1 m^3/s downstream of the Nautley.

As stated in the fisheries section, the Commission is of the view that the long-term flows in the Settlement Agreement are not sufficient to protect the fisheries resource and, therefore, they will not satisfy the needs of additional water withdrawals for irrigation. The Commission recommends that a survey of the availability of water from ground water, tributaries and the mainstem Nechako be conducted. The Commission further recommends that under the Settlement Agreement flows an additional 1.5 m^3/s on a mean annual basis be set aside for future irrigation and other consumptive water needs. Water could be added to the long-term flows on an incremental basis when it is needed. If the studies of alternative water sources determine that there is additional water which could be

accessed for irrigation needs, then the 1.5 m^3/s could be reduced. Allocations and distribution of this water throughout the year should be determined by the proposed Watershed Management Agency.

Commission Flow Scenario I would reduce the amount of water that should be set aside for future consumptive uses to less than 1.0 m^3/s. Under Commission Flow Scenarios II and III, the Commission believes there would be adequate water available downstream of the Nautley to meet the needs of agriculture in the foreseeable future. In the event that one of Commission Flow Scenarios I, II or III is chosen, the current moratorium on water licences downstream of the Nautley could be removed. There still may be some concerns upstream of the Nautley, however, water withdrawals are very small in this part of the river in the context of the mean monthly flow for fisheries protection during May to August.

4.3 Community Impacts

The reduced flows in the Nechako River after the commissioning of the KCP are anticipated to have impacts on community life along the river in several ways. Domestic water use, effluent discharge, future industrial development, and float plane operation would all be affected.

Municipal and Domestic Water Supply

The community of Fort Fraser has a water licence to extract its domestic water supply from the Nechako River. Currently, this is not a very good source of drinking water. However, the Province has made the commitment to absorb the total cost of any remedial measures deemed necessary to rectify the domestic water problem in this community after the installation of the KCP. This is anticipated to improve the overall water quality problem in Fort Fraser.

Vanderhoof also has a water licence to withdraw drinking water from the Nechako River, but has yet to exercise its rights under the licence. Rather, this community currently obtains its drinking water from wells.

Most individuals in the Nechako Valley obtain their domestic water from wells, with a small number withdrawing domestic water directly from the River. The water study recommended for agriculture and ranching will include ground water and should provide valuable information on how wells will be affected by the lower KCP flows. Alcan has committed to modify wells and any existing intakes in the river that are affected by the lower KCP flows. The Commission is satisfied that these measures are adequate.

Sewage Treatment

Currently, some communities utilize the Nechako River for discharging municipal effluents, particularly sewage after processing. Other pollutants may enter the river from surface run-off, leaching and tributary inflows. Sewage treatment at Vanderhoof and Fort Fraser is currently inadequate and the KCP will make

this problem worse. The Province is committed to upgrade the treatment facilities at Fort Fraser and Vanderhoof after the KCP, which will take care of the current problem and the problems caused by the KCP.

The Commission recommends that with the KCP, regular water quality monitoring should be conducted by the Province, especially in the Fort Fraser and Vanderhoof areas. The Fort Fraser area is particularly critical until the water and sewerage facilities in this community have been upgraded.

Industrial Use of Water

Industrial development upstream of the Nechako and Stuart confluence is sparse. The residents in the communities along the Nechako River have expressed fears that future industrial development in their communities would be hampered with the KCP as costs for effluent treatment and discharge would probably be very high. Additionally, the Ministry of Environment, Lands and Parks has stated that industrial proposals for the region would be closely scrutinized, especially with respect to effluent discharge, because of the reduced capacity of the river to absorb pollutants under the KCP.

Float Planes

Float plane operators use the river, especially at Vanderhoof. The Vanderhoof operation can currently be problematic during periods of low flows. This situation could be exacerbated with the KCP flows. The Commission is of the view that safety must be the paramount criterion in determining appropriate mitigation measures. Alcan has committed to provide safe float plane landing and take-off conditions at Vanderhoof after the KCP, or, if this is not feasible, to construct new facilities at a nearby lake.

4.4 Social Impacts

The Project will have various impacts on lifestyle and social considerations for the public using the Nechako River. The Project will affect the use and perceived value of the river to the local residents related to matters such as aesthetics, heritage sites, water based recreation, boating, angling, flooding and wildlife. It is difficult to determine the impact that each of the proposed Commission Flow Scenarios would have on these issues, except to recognize that each incremental increase in flow could reduce the magnitude of the negative social impacts.

Aesthetics

The rewatering of the Nechako Canyon under the KCP would have a positive impact. The most significant negative changes to the appearance of the Nechako River would occur between Cheslatta falls and Fort Fraser as a result of the substantially lower flows under the KCP, especially during the winter months. Although the stretch of the river from Fort Fraser to the Stuart confluence will not experience the same magnitude of flow reduction as the upper reaches, the

reduced KCP flows will cause some negative visual impacts. Downstream of the Stuart, the visual impacts will probably be noticeable but not significant.

The presence of artificial structures for fish habitat would reduce aesthetic values. The Commission has recommended that these structures not be used for fish habitat enhancement.

Heritage Sites

There was little evidence presented regarding heritage sites and the implications of the KCP. Since many of the heritage sites had been constructed to avoid flooding under natural flow conditions, reduced flows should not affect the physical sites.

Water-Based Recreation

At present, certain sections of the Nechako River are not particularly well-suited to water-based recreational activities because of poor water quality, high cooling flows, or the presence of substantial beds of aquatic weeds.

Improvements in the sewage treatment facilities would correct many of the current and future water quality problems, particularly near Vanderhoof. Additionally, the lower flows in July and August should improve safety conditions. However, increased weed growth at Fort Fraser and Vanderhoof after the KCP might decrease the desirability of the river for swimming. Furthermore, reduced flow might affect the safety of other water-based activities in parts of the river.

The Commission concludes that the impacts of the KCP on water-based recreation activities are uncertain. Although the proposed additional Commission flows should reduce weed growth relative to Settlement Agreement flows and improve conditions for small craft recreation, parts of the river might still remain unsuitable for swimming.

Recreational Boating

Under the present conditions, navigation during the fall flows is difficult. The Commission is of the view that the KCP would have a detrimental effect on boating and canoeing. The effects would be most severe upstream of the Nautley. The Commission concludes that it is not possible to mitigate the effects on boating without additional flows.

The Commission notes that Alcan has placed on record its commitment to undertake the costs of any necessary facility modifications to private docks and boat launching facilities that have been adversely impacted by the KCP. Likewise, the Commission believes that the Province should undertake similar work required to rectify public docking and boat launching facilities.

Angling

The rewatering of the Nechako Canyon offers an excellent opportunity to improve angling in the upper Nechako River. Lower and less variable flows should improve angling conditions upstream of the Nautley. The Commission has found that the flows under the Settlement Agreement would provide inadequate habitat for trout. The Commission Flow Scenarios would improve future angling by increasing habitat for resident fish.

The Commission is concerned about the lack of baseline data on angling in the Nechako River, particularly downstream of the Nautley. Without this information, it is difficult to see how the Province can properly fulfill its commitment under the Settlement Agreement to "maintain present recreational fisheries values."

Flooding

The KCP will reduce the likelihood of flooding in the Nechako Valley. Under existing conditions this has been a problem at Vanderhoof and Prince George. Flood benefits will occur in lesser increments down the Fraser River.

Wildlife

There was little evidence presented about the effects on wildlife to suggest that there would be any significant effects to which the wildlife would not adapt. A wildlife surveillance program could be used to identify any serious concerns. Specific effects that may merit monitoring include moose and deer calving and fawning sites on the in-channel islands, and the Vanderhoof Bird Sanctuary.

5.0 The Murray/Cheslatta System

Water from the Nechako Reservoir currently reaches the Nechako River by way of the Skins Lake Spillway and the Murray-Cheslatta system. Since the 1950's, the variable and sometimes heavy flows in the Cheslatta River between Skins Lake and Cheslatta Lake have resulted in significant environmental alterations.

With the KCP, the KDRF has been designed so that the Skins Lake Spillway will not release flows more frequently than once every 200 years, apart from routine maintenance spills. Reducing the flows to natural levels will benefit the lake system, by eliminating the surcharges which have killed shoreline trees and the near shore fish food organisms. In addition, lake flushing rates will slow considerably, leading to greater productivity for freshwater fish.

Once natural flows are restored, most of the tributaries to the Murray-Cheslatta system may provide promising spawning and rearing habitat for trout, although some restorative measures may be necessary. Mitigation work on the lakes themselves will include clearing shoreline debris and replanting shoreline vegetation. Such measures are intended to slow erosion and siltation of lake trout spawning habitats, thereby allowing the fisheries and recreational potential of the Murray-Cheslatta system to be realized.

The Cheslatta Nation have developed a Cheslatta Redevelopment Project ("CRP") in parallel with the provincial Fisheries Management Plan. The CRP envisages the restoration of the lakes, the identification and establishment of historic sites, the creation of recreational opportunities and a significant element of training for band members.

In the view of the Commission, the potential for rehabilitation of the Murray-Cheslatta system is a major benefit arising from the KDRF component of the KCP. Allowing the system to revert to natural flows will allow it to stabilize. The Commission recommends that the rehabilitation of the Murray-Cheslatta system should be undertaken with a community approach. First Nations and other local interests should be represented in both the design and implementation phases.

The KCP design makes provision for flood releases down the Skins Lake Spillway no more frequently than once in 200 years. However, the data supporting this estimate do not allow for precise estimates so that the actual likelihood of flood releases could be substantially less than 200 years. The Commission recommends that flood releases through the Skins Lake Spillway should be avoided, if possible. This may be done through a combination of measures including pre-spills, greater release capacity at the KDRF, or the effect of the Commission flow scenarios on flood control.

6.0 Kemano Watershed

Powerhouse flows at Kemano would increase 30 percent with the KCP creating slow changes in the river channel with possible effects on salmon, trout and eulachon populations. The Commission flow scenarios would only modestly reduce the expected discharges after the KCP. The commercial value of salmon originating in the Kemano is approximately $300,000 per year and there is the potential for increasing stocks. The hatchery proposal once considered by the DFO should be reassessed for its potential to enhance the salmon runs.

The Kemano River Working Group, made up of representatives of Alcan, the DFO and the provincial environment ministry guided the program of environmental protection during construction prior to the halt in the Project. The Coordination Agreement with B.C. Hydro implies a regime of powerhouse releases that could pose problems for fish protection. Operational guidelines should be established for the Kemano generating station under the KCP and should include the commissioning procedure, ramping rates, minimum discharge and flood control procedures and protocols for flow maintenance.

The Kemano River Working Group should be formally constituted to oversee environmental protection and mitigation measures for the remainder of the construction period and subsequently during operation. The membership should include local and regional community interests. This expanded Group should oversee the studies recommended by the Commission in the Technical Report.

Mitigation techniques that may be necessary for salmon have been demonstrated to a limited extent in the Kemano watershed or in other coastal areas. There is insufficient knowledge on which to base an assessment of impacts on eulachon and a study is recommended so that mitigation measures could be implemented if necessary.

7.0 Mitigation and Compensation

7.1 Commitments by Alcan and the Province

The terms of the Settlement Agreement provide for certain undertakings by Alcan and the Federal and Provincial governments to mitigate and/or compensate for anticipated negative impacts of the KCP. Additionally, Alcan and the Province have made commitments over and above those stipulated in the Settlement Agreement. Those latter commitments are described below.

Alcan's Commitments

Information presented at the hearing indicated that Alcan has committed to rectify or compensate for any KCP related impacts on the following existing facilities:

- private water intakes for domestic water or irrigation;
- cattle fencing;
- crop production losses caused by a reduction in sub-irrigation;
- private wells;
- trapping;
- private wharves and boat launching facilities; and
- float plane landing site at Vanderhoof.

The lowering of the minimum water level of the Nechako Reservoir will be mitigated by:

- clearing of standing timber and marking of hazards in specific areas of the reservoir to facilitate and improve boating;
- maintenance of Alcan's boat launch and campsite at Skins Lake; and
- extension of the Chikamin Bay rail portage.

Management of Alcan's commitments is being coordinated through a committee called the River and Reservoir Residents Committee ("RRRC"). This committee, established by Alcan in 1988, is comprised of Alcan personnel, consultants and a community liaison representative from the area appointed by Alcan. The terms of reference of the RRRC include reviewing and assessing requests for mitigation or compensation. The RRRC plans to establish objective standards to

ensure consistency between mitigation claimants. However, skepticism still persists among potential claimants about the effectiveness and impartiality of this body.

Notwithstanding the existence and intent of the RRRC, the Commission believes that a formal mitigation and compensation agreement or policy should be developed between Alcan and the stakeholders who may be affected by the KCP and to whom Alcan has expressed an intent to assist. The agreement or policy should state the precise nature of the commitments made by Alcan, including a time frame, and how effects will be evaluated. Such an arrangement would accomplish two goals. First, it would precisely describe the nature of Alcan's commitment to mitigate or compensate, thereby providing some certainty to parties that may be affected by the KCP. Second, it would ensure that the same standards are applied to all affected parties.

Integral to any arrangement is a fair and effective process for the resolution of disputes. Although Alcan indicated that there was a preference by residents to negotiate individually, there were parties at the Hearing who felt disadvantaged by the lack of formality to that approach. The details of any such process should be determined between Alcan, governments, and key stakeholders. However, it is critical that any process should include an independent decision-maker. The Watershed Management Agency proposed in Section 7.2 could undertake such a function.

Provincial Commitments

The Province has undertaken to mitigate or compensate for impacts of the KCP on some of the public facilities in the region. Specifically, the Province has made commitments to:

- pay the full capital cost of any sewer or water supply upgrades required at Fort Fraser; and
- pay the full capital costs for upgrades to Vanderhoof's sewage treatment facilities.

Provincial commitments in respect of the rehabilitation of the Murray-Cheslatta system are described in Section 8 of the Technical Report.

7.2 Watershed Management Agency

The concept of a Watershed Management Agency received widespread support in the Nechako region. Opinions differed over the type of structure and the degree of authority the Agency should have.

In the Nechako reservoir and watershed, the complexity of the KCP issues compound the difficulties of managing a scarce resource. Already there are conflicts between the consumptive uses of water, such as irrigation, and the protection of the resource for fisheries in the Nechako River. At present there is a freeze on the licensing of water for consumptive purposes in the reaches of the river above the Stuart confluence. Alternatives such as tributary storage and ground water

have been suggested, but require further study. In addition, there could be conflicts between the Nechako Fisheries Conservation Program of remedial measures and canoeing or boating activities on the river. There is little apparent communication between the agencies responsible for planning and managing the resources in the region and stakeholder groups. There was general consensus that a more comprehensive and integrated approach to management of the watershed involving community participation is required to address existing, as well as future, issues. A watershed management approach is broader in scope than site specific management and reflects the interdependencies in the watershed, for example between upstream uses and downstream effects. It provides sensitivity to regional resource issues and encourages cooperation in the resolution of conflicts.

A Watershed Management Agency would provide a framework for ensuring that studies of resources, such as the salmon and trout fishery are integrated. A coordinated approach to data collection monitoring and the development of evaluation criteria is required.

Structure

The Commission recommends the immediate establishment of a Watershed Management Agency for the Nechako Reservoir and Watershed. The Commission notes that Hearing participants supported an approach that is flexible, involves stakeholder participation and is based on consensus-based decision making. The proposal of the Fraser River Management Board to facilitate the establishment of the Watershed Management Agency has merit in the absence of another alternative. However, this may not be necessary if the Province wants interested parties in the region to be directly involved with the setting up of the Watershed Management Agency. The Commission believes that the stakeholders in the region should determine the structure and mandate of the Agency and how they want the process of establishing the Agency to be conducted. It is expected that agencies such as the NFCP and the Water Comptroller will continue to undertake their existing responsibilities until such time as specific responsibilities are formally transferred to the Agency.

Existing agencies and planning programs will provide a core of stakeholders in the region for developing a new structure with a broader interest base.

The Commission recommends that the initial cost of establishing the Watershed Management Agency should be funded by the three levels of Government. The ongoing administrative costs of the Agency including the costs of participation by stakeholders, should be cost shared.

Responsibilities

There is a need for a comprehensive water management plan to be undertaken in the Nechako watershed to examine the water source options available for meeting the existing and future demands for surface and groundwater. The Watershed Management Agency should be responsible for conducting and implementing a comprehensive water management plan. The freeze on licensing should

remain in effect under Settlement Agreement flows until it can be demonstrated that there is sufficient water available to protect the fishery and allow for further withdrawals.

Baseline Studies, Monitoring and Evaluation

Studies which should be undertaken for the reservoir and watershed include a physical limnology study of the reservoir, a survey of groundwater wells and the collection of baseline data on resident fish in the Nechako.

Monitoring and evaluating the impacts of the KCP and implementing an adaptive management program will be an ongoing requirement post construction. Monitoring and surveillance studies identified include wildlife, particularly calving and fawning sites on in-channel islands and the Vanderhoof Bird Sanctuary, and water quality monitoring.

The Commission recommends that the program of baseline studies should be initiated as soon as possible. The Commission also recommends that the Watershed Management Agency should be responsible for overseeing the conduct of the baseline, monitoring and surveillance studies and for overseeing the implementation of recommendations or remedial measures.

7.3 Local Benefits Fund

The Terms of Reference instructed the Commission to consider whether a local benefits fund would be an appropriate mechanism for addressing impacts of the KCP. A local benefits fund is designed to provide funds to groups, communities or regions that are adversely affected by a large project development. Typically, a local benefits fund is established in situations where most of the long term benefits from the development accrue over a much wider region than the one that experiences the direct impacts. A fund is intended to provide some compensation, to the extent possible, to the region that experiences the negative project impacts. It is designed to address negative impacts that are unmitigated or unavoidable.

In these circumstances, the purpose of a Local Benefits Fund would be to address the residual negative impacts of the KCP, and not the impacts where commitments for mitigation or compensation already exist. Commitments made under the Settlement Agreement and since the Settlement Agreement would be funded separately.

Experience with local benefits funds within B.C. and across Canada indicates that there are a number of different ways in which the funds are structured and implemented. Residents of the Nechako valley supported the establishment of a local benefits fund with a structure for managing the fund located in the region with local and provincial representation. Funding sources suggested were a water consumption tax, funding by Alcan, the water rental fees, or an equivalent contribution from B.C. Hydro.

The Commission recommends that a Local Benefits Fund be established to provide some compensation for the residual impacts of the KCP in the Nechako reservoir and watershed and the Kemano watershed. In the Nechako reservoir and watershed the Local Benefits Fund should support some of the administrative costs of the Watershed Management Agency and other responsibilities and activities directly related to the KCP.

In each watershed, funds should be provided in the initial years for baseline studies that are required to enable the impacts from the KCP to be evaluated post construction. Funding for monitoring and evaluation will be required on an ongoing basis for many years after the KCP is completed. In addition the Local Benefits Fund should have sufficient funds for remedial measures that may be required.

The fund should be allocated and managed separately in each watershed. The Local Benefits Fund could be managed either by government with local representation or by a local committee. The Commission believes that the fund should be structured in such a way to provide funds in perpetuity.

While it is difficult to determine an appropriate amount of money for the fund the Commission estimates that the capital of the fund under Settlement Agreement flows should be in the order of $15 - $20 million. This amount could be lowered to reflect reduced negative impacts under the Commission Flow Scenarios. The Commission has recognized that some of the initial funding is required to conduct baseline studies. However, a residual amount of money should remain in the fund and earn interest to provide an annual amount of money in perpetuity. It is suggested that the residual amount be not less than $10 million. The funds could be provided by the project proponent, B.C. Hydro, government or some combination of these sources.

8.0 Financial Benefits and Regional Economic Impacts

Financial Benefits

From the analysis of the impacts on the provincial economy that Alcan claimed would accrue from its expenditures on the KCP, it is not possible for the Commission to determine whether the KCP would benefit the province any more or less than an alternative project that met the same domestic energy demand. Nonetheless, there would undoubtedly be positive employment and economic activity impacts in the region during the construction period.

The Commission finds that B.C. Hydro's projected benefits from the Coordination Agreement and Long-Term Electricity Purchase Agreement, exhibit variability depending on the value of other new energy supplies, the timing of the KCP and the quantity of available water in the Nechako Reservoir for electricity generation and coordination. The Commission cautions, however, that the ben-

efits from these agreements represent the benefits to B.C. Hydro and its customers, but do not necessarily represent the net benefits of the KCP to the Province, since there are unmitigated resource costs and benefits that have not been included in the evaluation.

The Commission Flow Scenarios presented in this report will affect the benefits to B.C. Hydro from the agreements with Alcan. There was insufficient evidence presented during the hearing for the Commission to determine the specific effect of alternative flow regimes on the benefits from Coordination. To determine this, it is necessary for B.C. Hydro to recalculate the quantities of energy and capacity available—under each recommended flow scenario—from coordination of the Nechako Reservoir with the rest of its system. The Commission Flow Scenarios would affect the benefit to B.C. Hydro from the Long-Term Purchase Agreement if the reduced generation capability would impair Alcan's ability to deliver the energy and capacity under the terms of the Purchase Agreement.

Regional Economic Impacts

Previous sections of this Summary Report have detailed the positive and negative impacts of the KCP under the Settlement Agreement flows and the Commission Flow Scenarios.

The following matrix (Table 2) provides a recap of the various impacts of the KCP under the Settlement Agreement flows (inclusive of more recent commitments by Alcan and the Province) and the impacts under the Commission's recommendations for mitigation.

A major feature of the Commission's analysis is the recognition of the substantial benefits that would accrue from the installation of the Kenney Dam Release Facility. In addition to the restoration of the Murray-Cheslatta system, the Facility would ensure better protection of sockeye salmon than now exists, especially with the implementation of the lower target temperature. The Commission views these benefits as so significant that it recommends that the Facility should be built whether or not the KCP proceeds.

The Commission's recommendation of a plan for clearing the Reservoir of flooded timber by the year 2005 has important implications for recreational interests and possibly for the forest industry of the region.

For the chinook and trout of the Nechako River, the Commission was not satisfied that the provisions of the Settlement Agreement were adequate, but was unable to set a precise estimate on the single level of flow that would be best. Rather, as flow levels are increased the degree of risk is decreased. Hence, the Commission provides three scenarios of flow, each associated with different additional measures of mitigation. Each of these scenarios has implications for the mitigation of effects, other than those on fish, which are important for the maintenance of the quality of life and the environment of the Nechako Valley.

The Commission recognizes that its various recommendations have major implications for the viability of the Project as it is presently designed. Detailed analysis would be required to assess both engineering feasibility and financial consequences. With those assessments, it would then be possible to weigh the potential benefits and costs in a provincial context.

This Summary Report deals only with the major findings of the Commission. Many of the potential impacts of the KCP are interrelated and in some cases highly technical. The Technical Report provides full details on the positions taken by participants in the Review along with the rationale leading to each of the Commission's conclusions and recommendations.

Table 2. Comparison of the Settlement Agreement Mitigation with the Commission's Proposed Measures

	Effect of Settlement Agreement	Mitigation Commitments	*Additional proposed mitigation compared to Settlement Agreement*		
			Scenario I 35 m^3/s plus chinook hatchery	**Scenario II 40 m^3/s**	**Scenario III 45 m^3/s**
Nechako Reservoir	Increase drawdown might impact safety, access and aesthetics of the reservoir	Alcan-wharves, boat launch, etc.	Improved by tree clearing program		
Nechako Watershed					
Sockeye	Improved temperature conditions but still less than optimal	Kenney Dam Release Facility	Temperature control to 18.4°C provides significant improvement		
Chinook and Trout	Flows insufficient to achieve conservation targets for Chinook	Alcan-remedial measures under Settlement Agr.	Minimum mitigation	Adequate mitigation	Natural mitigation
Agriculture & Ranching	Insufficient water for present and future irrigation, etc.	Alcan-modified intakes & cattle fencing, etc.	Irrigation water required	Irrigation water available	
Groundwater	Potential drop in water table uncertain	Alcan-modified private wells	Potentially small improvement		
Municipal & Domestic Water Supply	Problems currently exist at Fort Fraser & Vanderhoof; exacerbated by the KCP	Province	No change		
Sewage Treatment	Problems currently exist at Fort Fraser & Vanderhoof; exacerbated by the KCP	Province	No change		
Industrial Use of Water	Uncertain whether it would decrease future industrial investments	None	Potential improvement		
Float Planes	Currently problematic during low flows, exacerbated under Settlement Agreement flows	Alcan	No change	Remaining problems in September and October	
Aesthetics	Positive impacts on Nechako Canyon; mostly negative between Nautley & Cheslatta Falls	None	Improvement with increased flow		
Water-Based Recreation Activities	Some positive, some negative; weed problems	None	Modest improvement upstream of Nautley		Improvement
Recreational Boating	Detrimental effect on boating and canoeing, most severe upstream of the Nautley	None	Modest improvement upstream of Nautley		Improvement
Angling	Provincial commitment to "maintain present recreational fisheries values"	Province	Improvement	Further improvement	
Flooding	Reduced flooding in the Nechako Valley	None	Slight improvement		
Wildlife	Uncertain, but not likely significant	None	Some improvement		
Murray/Cheslatta	Improvement by decreased flooding; Return of Cheslatta Nation lands conditions for rehabilitation	Kenney Dam Release Facility	Avoid flood releases		
Kemano Watershed	Small negative impact on salmon, trout and eulachon	Alcan	Potentially small improvement		

Note: Shaded areas represent resources and activities most significantly impacted by proposed mitigation measures and flows

Table 1. Possible Schedule of Flows for Fish Protection

Month	Short Term Observed 1980-1992	Settlement Agreement Below Cheslatta Falls		Rationale for Additional	Proposed Flows		
		Short Term	Long Term		35 m3/s April - August	40 m3/s April - August	45 m3/s April - August
January	31.1	31.1	14.2	Protection incubating salmon, overwintering juvenile salmon & trout	25.5	25.5	25.5
February	30.9	31.1	14.2	As for January	25.5	25.5	25.5
March	32.5	31.1	14.2	As for January	25.5	25.5	25.5
April	55.8	56.6	31.1	Rearing for salmon and trout	35	40	45
May	62.5	56.6	31.1	Base as for April. Flushing flows, 2 days @ 170 m^3/s plus ramping, once every three years	35.0 + 4.1	40.0 + 4.1	45.0 + 4.1
June	55.5	56.6	31.1	As for April	35	40	45
July	138.7	56.6 + 82.1	31.1 + 10.9	Base as for April Cooling water* 6.5 for 18.4 °C target 0.6 for extending season 0.6 for ramping	35.0 + 18.6	40.0 + 18.6	45.0 + 18.6
August					35.0 + 18.6	40 + 18.6	45.0 + 18.6
September	39.5	31.1	28.3	-	28.3	28.3	28.3
October	35.3	31.1	28.3	-	28.3	28.3	28.3
November	33.3	31.1	25.5	-	25.5	25.5	25.5
December	32.9	31.1	14.2	As for January	25.5	25.5	25.5
Mean Annual	**59.8**	**41.9 + 16.20**	**24.53 + 1.85**		**29.90 + 3.51**	**32.01 + 3.51**	**34.10 + 3.51**

water available for electricity after accommodation of the releases into the Nechako River.

4.2 Agriculture and Ranching

The reduced flows with the KCP will impact various consumptive uses of water along the Nechako River. Currently, irrigation is by far the most significant use of water from the river after power production and fisheries and, therefore, the most serious effects of water restrictions will be on this activity. The reduced flows may also have other impacts on agricultural activities such as a loss of sub-irrigation, the stranding of water intakes and problems with cattle containment due to the narrowing and shallowing of the river. Access to the river for watering cattle may be constrained by the need to ensure cattle do not wander and to protect water quality.

Alcan has agreed to mitigate or compensate for effects on agriculture caused by reduced sub-irrigation, stranding of water intakes, and cattle containment problems. The Commission is of the view that Alcan's commitments will resolve these concerns.

There is considerable debate about the amount of water which would be required for irrigation in the future and the amount of water which will be available under the 1987 Settlement Agreement long-term flows. As a result of this uncertainty, and at the request of the DFO, the Province has placed a freeze on new water licences upstream of the Stuart River.

The quantity of additional water required for future irrigation depends on how much land may be economically irrigated. The amount of land that would benefit from irrigation could vary from 5,040 hectares (present acreage under licence) to 54,000 hectares (maximum irrigable land) depending on economic conditions, particularly the price for agricultural products. The Commission is of the view that 18,000 hectares represents a reasonable approximation of the total acreage likely to be irrigated well into the foreseeable future. This represents about 13,000 additional hectares. The Province estimates that about 90 percent of future agricultural development will occur downstream of the Nautley.

An additional 13,000 hectares of irrigated land would require approximately 1.2 m^3/s of water on a mean annual basis. Of this amount, 0.1 m^3/s would be required upstream of the Nautley, and 1.1 m^3/s downstream of the Nautley.

As stated in the fisheries section, the Commission is of the view that the long-term flows in the Settlement Agreement are not sufficient to protect the fisheries resource and, therefore, they will not satisfy the needs of additional water withdrawals for irrigation. The Commission recommends that a survey of the availability of water from ground water, tributaries and the mainstem Nechako be conducted. The Commission further recommends that under the Settlement Agreement flows an additional 1.5 m^3/s on a mean annual basis be set aside for future irrigation and other consumptive water needs. Water could be added to the long-term flows on an incremental basis when it is needed. If the studies of alternative water sources determine that there is additional water which could be