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**Framework for Assessing the Benefits of the
Proposed Nechako River Cold Water Release Facility**

Activity 5: Assessment of Benefits

EXECUTIVE SUMMARY.....1

1. INTRODUCTION.....1

2. BENEFITS ASSESSMENT FRAMEWORK.....3

APPENDIX A: MEASURING BENEFICIAL EFFECTS: A CONSIDERATION OF POTENTIAL INDICATORS.....8

APPENDIX B: SUGGESTED BASE CASE AND OTHER FUTURE WORK.....22

APPENDIX C: REGIONAL SOCIO ECONOMIC STATISTICS.....25

REFERENCES.....27

TABLE OF CONTENTS

Executive Summary

This report presents a framework to identify and evaluate the benefits from a Cold Water Release Facility that could be constructed near the Kenny Dam and discharge into the Nechako River. The potential beneficial effects of the project are very diverse, including improvements to the economy, the environmental, and enhancement of social, cultural and community opportunities. The Benefits Assessment framework captures this array of project outputs and assist in the decision making process.

The proposed framework contains five accounts. The accounts, the nature of the effects addressed, and the types of indicators to be used to characterize the magnitude of the change, are summarized in the following table.

Account	Nature of Effect	Type of Indicators
Economic Benefits	Increase in provincial income or economic activity.	Dollars, employment, qualitative descriptions of more difficult to quantify economic benefits
Environmental Benefits	Improvements in physical and biological productivity	Bio- physical measures (hectares, population level) and qualitative assessment
Community and Regional Social Benefits	Improvements in Community, First Nation social and cultural values	Mainly qualitative assessment
Community and Regional Economic Impact	Income and employment opportunities for regional population	Dollars and employment
Government Revenue	Financial gain to government	Dollars

For most of the accounts, the project's beneficial effects are identified by comparing the respective indicator values estimated for the project to the corresponding base case values. The base case indicator values are the conditions that would prevail if the project were not built. A prioritized list of base case indicators (hence project indicators) is offered for consideration in Appendix B.

1. Introduction

This report presents the initial specification of a Benefits Assessment framework for evaluating the proposed Nechako Cold Water Release Facility (CWRF). The framework can assist the Nechako Enhancement Society (NES) and the Nechako Watershed Council (NWC) assess the merits of constructing the facility as well as the range of alternative opportunities (e.g. flow regimes) the facility may support. Specifically, this report responds to Activity 5 "Assessment of Benefits" of the NWC's Work Plan:

"Identifying and evaluating the many social, economic and environmental benefits of a CWRF to the residents of the area, as well as the upstream benefits and benefits to the province as a whole, assists with making informed investment decisions throughout the planning process."

Planning for the CWRF is at an early stage. Construction may be ten years hence. For the consideration of project benefits, the first step is to identify the nature of the benefits and lay the necessary groundwork for estimating their potential magnitudes and/or significance. These are the elements of Activity 5 addressed in this report.

The Benefits Assessment framework incorporates many of the techniques of "multiple accounts analysis"¹. In particular, the Multiple Accounts Analysis (MAA) acknowledges that not all important project effects can be adequately measured by a single "yardstick," such as dollars. Different perspectives, reflecting different values and objectives are embodied in the various evaluation accounts. The following section defines the "accounts" (i.e., categories of benefits) appropriate to capture the diversity of beneficial effects the CWRF is expected to produce.

This Benefits Assessment framework does not include potentially negative features of the project (e.g. project costs, any potential negative environmental effects), because the NWC Work Plan direction is to concentrate on identifying beneficial effects. Potentially adverse socio-economic or environmental effects would be addressed under the federal and/or provincial environmental review processes.

Appendix A presents a menu of indicators that may be used to characterize the magnitude of change. Given the distinct natures of the 5 accounts, the list of potential indicators is both long and varied. An ideal indicator is one that can be objectively measured, the information is readily available, and the causal link to the project is unambiguous. However, few indicators satisfy the entire criterion. Much of the groundwork noted above relates to improving the current knowledge of indicator values, and improving our understanding of an indicator's linkage to the project. On a related point, the intended use of the proposed indicators is for investment phase planning. Project monitoring indicators, appropriate for measuring actual project performance, are not addressed here.

¹ Recommended to the NWC by G. Holman in his report *A Review of Methodologies for Evaluating the Benefits of a Cold Water Release Facility at Kenny Dam, 2002.*

Appendix B proposes base case indicators and identifies necessary work to obtain reliable values. Base case indicators are intended to portray the status of pertinent conditions if the CWRP is not built. This provides a benchmark for identifying the relative changes attributable to the CWRP.

2. Benefits Assessment Framework

Construction and operation of the CWRP will give rise to a diversity of beneficial effects. Many of these were identified by the NWC. Specifically, the NWC compiled an *Issues List*, consisting of 24 separate matters or potential project outcomes. This array of issues helped guide the definition of evaluation accounts. The five accounts that comprise the Benefits Assessment framework are

Economic Benefits: Economic benefits are improvements to the provincial economy. This includes the value of increased production of economic goods (e.g. electricity) as well as conservation of scarce economic resources (e.g. labour benefit, water). The good's "price" for valuing the beneficial effect is not necessarily a market transaction price, because market prices may not embody important social effects. Economic benefits that can not be quantified are addressed in qualitative terms.

Environmental Benefits: Beneficial changes in the physical environment, physical processes, flora and fauna are important project features. The account includes outcomes that may have regional and provincial significance.

Community and Regional Social Benefits: This account encompasses direct community, First Nation, cultural and social benefits. Its focus is at the regional level and is intended to reflect direct project effects on nearby communities and rural residents. Given the difficulty in measuring many of the beneficial effects addressed by this account, mostly descriptive indicators are used.

Community and Regional Economic Impacts: This account provides a perspective with regard to the associated (gross) economic activity that might be expected with the project. That is, the expenditure associated with the construction and operation of the CWRP will give rise to direct financial impacts, and spin-off or multiplier effects regionally and throughout the provincial economy. The magnitude and distribution of these effects in terms of income, employment, and tax revenue to government (property tax, income tax) are reported in this account.

Government Revenues: Project implications to local, provincial and federal government tax revenue is captured in this account. In general, government revenue collected as a fee for service is not included. On the assumption the project is an incremental investment, "new" revenue would be derived from sales taxes, water rental fees, and where the labour would be otherwise unemployed, income tax revenue.

The timing of project benefits and their linkage to the project are important considerations. The project features were organized under four headings corresponding to project phases or the nature of their relationship to the project. The headings are:

- i. **Construction Phase**: Benefits associated with the construction the CWRP and ancillary works, re-watering of the Nechako Canyon, and establishing a channel through the Cheslatta Fan. This phase ends with project commissioning.

- ii. **Operations:** Benefits associated with, and managing water discharges from the CWRP, Skins Spillway, and the Kemano penstock.
- iii. **Other Benefits:** These would include benefits associated with modifying the operating flow regime to obtain specific management objectives. These objectives have not been determined. The *Issues* document indicated several possible objectives, such as restoring natural flow profile to the Murray-Chesatta and Nechako systems, improved recreation opportunities, and increased electricity production at Kemano. Alternative management objectives could be specified (i.e. scenarios) and subject to analysis in support of the decision making process.
- iv. **Optional Investment Projects:** These projects are made possible by the construction of the CWRP, but additional funding is required to realize them. Two such projects identified at this time are electricity generating at Kenny Dam, and channel and bank rehabilitation of the Murray-Chesatta system.

Given this background, Table 2.1 presents potential beneficial effects in the assessment framework. The table's left hand column lists significant project features grouped in terms of the four project headings discussed above. Reading across a feature's row, the project benefit is described in the context of one or more of the five accounts. The table connects the matters identified in the NWC's *Issues* to particular project features and to the account(s) in which the effect shall be assessed². At this point in project planning, Table 2.1 provides a generalized evaluation framework. Table 2.2 provides a supplementary benefits assessment framework for optional projects linked to the CWRP.

Appendix A expands on methods for "measuring" the benefits identified in tables 2.1 and 2.2. Because of lack of data and uncertainties regarding the cause-and-effect linkages between the CWRP and key variables (e.g., fisheries stocks), it is often the case that beneficial effects cannot be quantified. In such circumstances, the nature and significance of the impacts are assessed qualitatively (i.e., descriptively).

² It is noted that the *Issues List* contains two issues concerning the Nechako Reservoir. Since the reservoir will continue to operate within the same historical operating range, it is not evident there would be beneficial effects associated with the CWRP. For this reason these issues were not addressed in this report. This position may be re-visited when the flow regime becomes better defined.

Table 2.1: Benefits Assessment Framework

Project Features	Accounts				
	Economic Benefits	Environmental Benefits	Community and Regional Social Benefits (including First Nations)	Community and Regional Economic Impacts	Government Revenues
Potential Project Benefits					
1. Construction Phase					
Facility Construction, Re-watering Nechako Canyon, Establishing Channel at Cheslatta Fan	Employment & Income benefits to those that would otherwise be unemployed	Benefits for fish habitat		Employment and income accruing to watershed residents	Income taxes, sales taxes,
2. Operations					
Facility Operations	Operational Changes that improve efficiencies or increase value. Employment & Income benefits to those that would otherwise be unemployed	Improvement/increase in fish habitat and populations Establish more natural flow pattern, and physical processes (flushing, erosion) Potential recovery of white Sturgeon Other potential environmental benefits associated with reducing large volume of July/August flows.	Potential benefits for recreation users safety, visual appearance of river, First Nations traditional uses and interests, flood protection	Employment and income accruing to watershed residents Change in income/employment associated with change in timing electricity generation	income taxes, sales taxes, property tax, expenditure Income taxes if labor income increased. Reduction in flood protection expenditures.
Change Flow Regime Murray Cheslatta system (benefits from investment in habitat	Improvement in recreation use	Establish more natural flow profile	Potential benefits for recreation users safety, visual appearance of river,	Increase in incomes/employment from expanded business	Corporate and personal income taxes

Activity 5: Assessment of Benefits (draft report)
04/17/03

Project Features		Accounts			
	Economic Benefits	Environmental Benefits	Community and Regional Social Benefits (including First Nations)	Community and Regional Economic Impacts	Government Revenues
<i>investment in habitat restoration identified in Table 2.2 below).</i>	Increase in tourism business	Benefits for fish habitat	First Nations traditional uses and interests, flood protection, etc.	activity.	from expanded business operations
3. Other Potential Benefits¹					
Incremental electricity production at Kemano	Economic value of electricity production			Potential for avoided/reduced shut downs in aluminum production.	Water rentals. Corporate and personal tax revenue
Canoeing/other recreation	Improved recreation opportunities for non-residents		Improved recreation opportunities for project area residents		
Confining cattle		Reduced habitat damage caused by cattle wandering (eroding banks)	Qualitative assessment of cost avoided with reduced cattle wandering		
Float Plane operations			Potential improvements re timing of use, safety, etc.		

1. Benefits whose significance are conditional on decisions made with respect to the allocation of water flows "freed-up" due to the existence of the CWRP.

Table 2.2: Benefits Assessment Framework of Optional Projects Linked to the CWRP

Incremental Investment Projects		Environmental Benefits	Community and Regional Social Benefits (including First Nations)	Community and Regional Economic Benefits	Government Revenues
<i>Electricity production at Kenny dam</i>					
<ul style="list-style-type: none"> ◆ Construction ◆ Operations 	<p>Employment & Income benefits</p> <p>Employment & Income benefits</p> <p>Economic value of electricity production</p>	None identified to date	None identified to date	<p>income and employment impacts</p> <p>income and employment impacts</p>	<p>Water rentals</p> <p>Income taxes and sales tax</p>
<i>Habitat Restoration of Murray Cheslatta System</i> (Incremental to restoring flow profile)					
<ul style="list-style-type: none"> ◆ Construction ◆ Operations 	<p>Employment benefit</p> <p>Gain in recreation user values</p> <p>Increase in tourism business</p> <p>Employment benefit</p>	<p>Potential benefits for fish and wildlife habitat</p> <p>Enhancement of shoreline habitat</p>	<p>Economic Development of Cheslatta First Nation</p> <p>Aesthetic improvement</p> <p>Change in native food fishery</p> <p>Economic Development of Cheslatta First Nation</p>	<p>Increased income/employment from rehabilitation projects and new/expanded tourism industry.</p>	<p>Income taxes and sales tax</p>

APPENDIX A: Measuring Beneficial Effects: A Consideration of Potential Indicators

For each of the potential beneficial outcomes (i.e. listed in Tables 2.1 and 2.2), the next step is to define an indicator whose role is to register the expected change in the project effect or outcome. The choice of indicator is influenced by the nature of the beneficial outcome. For example, the indicator for a project outcome that is financial or economic in nature may be expressed in physical units such as population numbers or area of habitat. Project effects that are not discrete and separable, for example a cultural attribute, may only support a qualitative indicator (e.g. plus or minus).

In addition to the nature of the effect, there are other factors influencing the choice of indicators. In general, a well understood cause and effect linkage between the project and project effects will support a quantitative indicator. For example, re-watering the Nechako Canyon will increase fish habitat in the canyon (a project output) which can be measured (i.e. hectares of new habitat, an indicator). However, where the cause-effect link is not well understood, subject to uncertain statistical variation, or realization of the effect is subject to other external forces, measuring the degree of change quantitatively may not be reliable. An example may be the extent to which the altered flow regime (project output) leads to higher fish population (an environmental project outcome) and possibly an increase in the quality and quantity of recreation fishing days (a socio-economic outcome). If the constraint is insufficient information (not lack of understanding of the cause/effect linkage), research and fieldwork can improve indicator reliability. A number of indicators identified will require future research effort if they are to be useful in the decision making process. Where the linkage is poorly understood (not lack of information), a qualitative indicator (i.e. plus or minus change) may be the most suitable choice.

Obviously, the different types of indicators cannot be summed in a formal sense to provide a single "bottom line answer". The utility of a multiple account framework is not the evaluation of a single project concept, but in comparing several project concepts in terms of their relative change in indicators across the five accounts. This evaluation can assist decision-makers identify the set of indicator values (or the corresponding project definition) that best meets their interests.

The five evaluation accounts group project outcomes of similar nature. It follows that similar types of indicators are used for the particular accounts. In the remainder of this appendix, indicators for each project outcome are considered for each of the evaluation accounts. The discussion includes a consideration of how the indicator is measured (quantitative or qualitative), where the effect is expected to occur, the status of information regarding the current indicator and other comments.

The actual application of the Benefits Assessment framework involves specifying expected future indicator values in the absence of the project, as well as alternative project scenarios. The point to note is that the estimation of indicator values (base case and project scenarios)

involves a forecast of future events, which is always uncertain. Nothing can be done to eliminate this uncertainty entirely, but the risk can be reduced by using the best available information in the decision making process.

Economic Benefits Account Indicators

This account registers improvements in the provincial economy. A reliable indicator is an increase in provincial income, broadly defined to include both monetary and non-monetary improvements. Non-monetary improvements that cannot be reliably quantified in dollar terms are expressed qualitatively. An increase in provincial income occurs with increased production of traded goods and services. Nevertheless, the economic value may not correspond to the financial transaction value, where the market price is influenced by subsidies, taxes, external effects and restrictive policies. In such circumstances the observed market price will be subject to adjustment.

An increase in provincial income also occurs when there is a reduction in consumption of economic resources (i.e. cost savings). This frees up resources to increase output in alternative uses. For instance, the CWRP is a different technology to satisfy downstream fishery requirements, which compared to current technology (Skins Lake Spillway) frees up water (volume and timing) that can be re-allocated to other beneficial uses.

The provincial economy is the frame of reference of this account. That is, a positive increase in local income that is offset by reduced income elsewhere in the province would not be registered here. The Community and Economic Impact account captures the local economic effects.

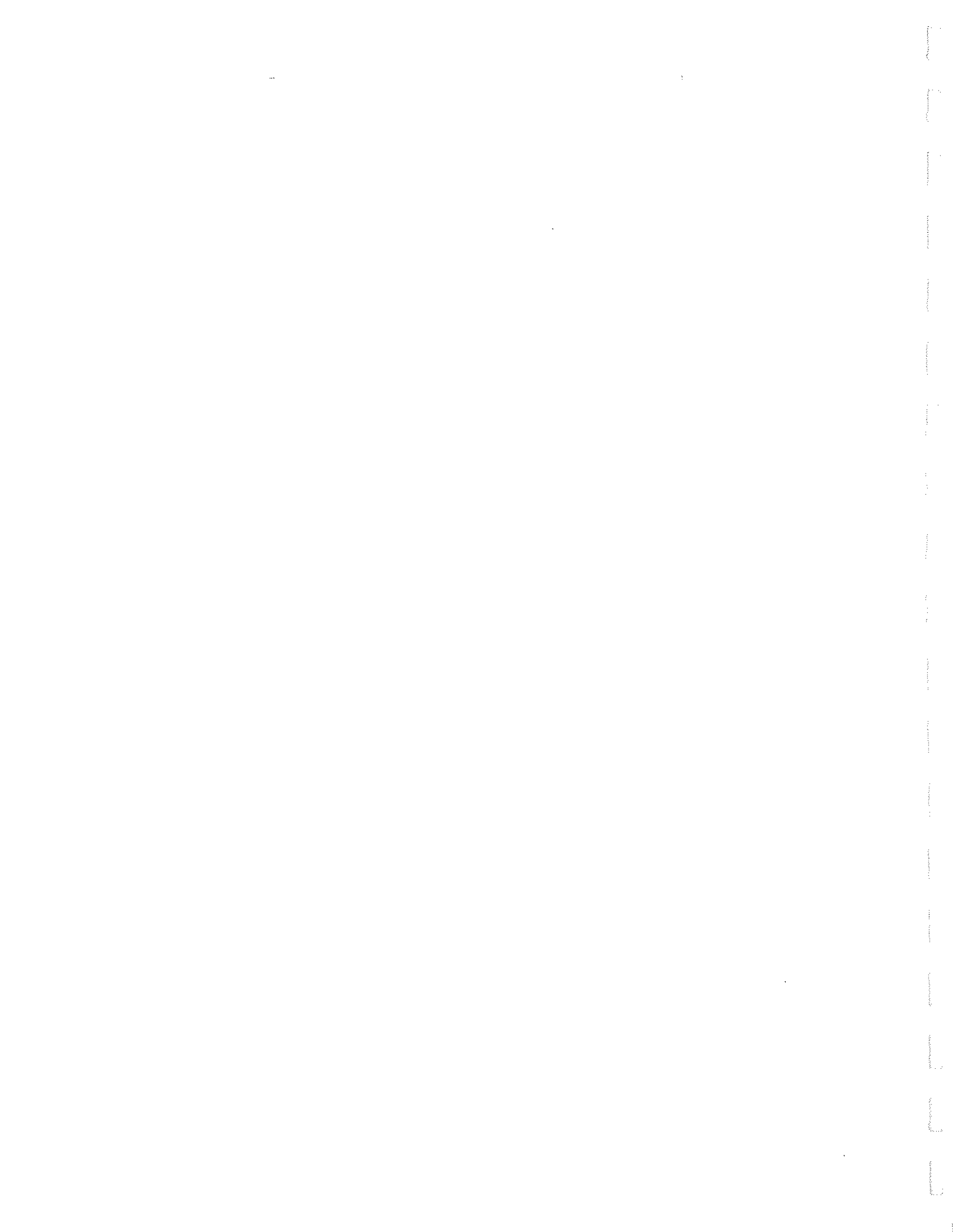
Table 1A lists the project outputs, recommended indicators, and the unit of measure.

Table 1A: Economic Benefits Account Indicators

Benefit Descriptions	Indicators	Unit Measure	of	Distribution	Data Sources	Comments
Employment and Income Benefits	Probability of hiring unemployed multiplied by the wage bill.	Person-Years of Employment and \$ Incomes		Nechako, Province	Project developer, HRDC regional office	Typically, unemployment rate for skilled trades is low. Will depend on regional economic conditions at the time of construction.
Increase in commercial salmon harvest	Increase in landed value of chinook and sockeye catch	Dollar value if data available, otherwise qualitative.		Nechako, Province	Fisheries and Oceans escapement and carcass recovery surveys.	Project will at least maintain current objectives. Impact quantifiable if forecast on salmon population is available.
Change in timing and volume of electricity production (Kemano)	Economic value of incremental energy production.	Value of energy reflective of social opportunity cost.		Province	may use reservoir simulation model with/without the project to show potential seasonal incremental gains. Maintains energy potential in low water episodes.	Dependent on outcome of flow regime discussions. Social value is price in highest valued market regardless of actual disposition. Value includes water rental.
Public Recreation (fishing, canoeing)	Recreation angler day, willingness to pay of non-watershed residents	Qualitative (+, -) , change in fishing days, change in value		Nechako	WLAP Prince George, Smithers; Need baseline survey of current use. DFO provincial estimate of average residents willingness to pay \$26/ fresh water fishing day.	User survey could provide baseline. Base for preparing forecast of "with" project use. Activity must be "new" fishing days, not displacement from other BC locations.
Non-resident Tourism (fishing, canoeing)	non-resident (net) spending on recreation activity	Qualitative (+, -) , change in fishing days, change in value		Nechako	Need baseline survey of current use. DFO provincial estimate of average spending is \$53/ fresh water fishing day.	Not expected to be large without investment in tourism facilities and effective advertising. Must be "new" tourism spending.

Table 1A(a): Economic Benefits Account Indicators for Optional Projects

Benefit Descriptions	Indicators	Unit of Measure	Distribution	Data Sources	Comments
Re-hab. Murray Cheslatta system Employment and Income Benefits	Probability of hiring unemployed multiplied by the wage bill.	Person-Years of Employment and \$ Income	Province	Proponent, HRDC regional office	Proponent to define and cost watershed restoration investment schedule.
Electricity Production: Incremental energy production (capacity to be determined)	Economic value of incremental energy production	Value of energy reflective of social opportunity cost.	Province	Klohn Crippen prefeasibility analysis. Columbia Power. Trade-off project costs, capacity and flow. 20 MW needs annualized flow of 36.8mcs. Engineering studies. Project developer, HRDC regional office	Would need to specify alternative flows at the CWRP to identify the incremental impact of facility on other values/users (Murray/Cheslatta system.).
Employment and Income Benefits	Probability of hiring unemployed multiplied by the wage bill.	Person-Years of Employment and \$ Incomes	Nechako, Province		Typically, unemployment rate for skilled trades is low. Will depend on regional economic conditions at the time of construction.



Environmental Account Indicators
The indicators for the environmental account are primarily measures of physical features or attributes associated with the project's expected physical and biophysical outcomes. Indicators of physical outcomes characterize water quantity and quality characteristics, and river system characteristics. Indicators of biophysical outcomes are quantity and productivity of affected habitat (primarily fish habitat) and the population levels of indicator species.

Where appropriate, it is helpful to describe the respective indicator with respect to the following factors:

- i. Identify where the change in indicator value occurs
- ii. Specify the duration of the effect (i.e. temporary verses permanent change)
- iii. Identify beneficial events that are external to the project, that would amplify the effects of the project, and the likelihood of the external event occurring (certain, possible, unlikely)

Table 2A generally characterizes the indicators in terms of the first two factors noted above. The duration of the effect is indicated if temporary. The third factor should be addressed as field research related to the project progresses.

The list of Environmental Account indicators is preliminary. It is anticipated that scientists and resource agencies may refine it. It is noted in the table where there is no base line information for the proposed indicator. Quantitative indicator values cannot be reliably made without this information, and fieldwork is required to provide a reasonable basis for predicting project outcomes.

Table 2A Environmental Benefits Account Indicators

Benefit Description	Indicator	Unit of Measure	Distribution	Data Source	Comment
Nechako River					
Establish more natural flow pattern and physical processes (flushing, erosion)	Indicators to be derived from Flow Principles (hydrograph sediment transport/accumulation temperature regime)	Various physical parameters	Nechako	White sturgeon Recovery Team formulating flow principles. Base line values required.	It would be useful to relate indicators to flow simulation model.
Improvement in fish habitat	Hectares of spawning, rearing habitat for sockeye, chinook, trout, sturgeon..	Hectares of habitat.	Nechako Canyon, Nechako River		Changes may be a permanent or temporary increase fish habitat
Change in Resident Fish populations	indicator species include: sockeye, chinook, mountain whitefish, white sturgeon, and rainbow trout	Average fish population levels	Nechako Canyon, Nechako River	Chinook spawning habitat could support 14,000 fish, but actual much less. Baseline information required.	Change in flow and temperature regime could impact species composition
White Sturgeon recovery	Increase in juvenile fish in target population Increased spawning activity	Research on-going	Nechako	White Sturgeon Recovery Team.	
Murray-Cheslatta System					
Establish more natural flow pattern, and physical processes		Unit of Measure			
Improvements to fish habitat	Hectares of spawning, rearing habitat for, trout, or other indicator species	Hectares of habitat		Project proponent, Requires base line inventory and rehabilitation targets	Requires base line inventory and rehabilitation targets
Stream and lake bank rehabilitation (Optional Investment)	Assessment of intact riparian areas	Width and condition of streambank condition, vegetation cover, stable banks		Requires base line inventory and rehabilitation targets and desired re-vegetation outcome. Cheslatta First Nation	A minimum average annual flow of 15cms is sought to rehabilitate. The rehabilitation program at roughly prefeasibility stage of planning. Watershed restoration with no investment could take >100 yr..
	Current target is to approximate flow profile of Stellaco River	River flow indicator values, variance analysis to Stellaco flow.		Cheslatta First Nation, WLAP for monitoring. No flow simulation model of system	System totally disrupted such that system's historic flow levels would be insufficient to adequately regenerate the watershed.

Community and Regional Social Benefits Account Indicators

The outputs of this account are important to people, or the community. The importance may be related to cultural, social, historical or other values and beliefs that are not easily captured in quantitative, objective indicators.

An improved quality of life is not an explicit project output, and is not included in Table 3A. It is however a desirable outcome and may be implicit in number of the project outcomes that enhance cultural, economic and social values. Indicators of quality of life at a regional level include the population level, the level and dispersion of area income, health indices and other social indicators. Appendix C contains the statistics related to several quality-of-life indicators. The relationship between the CWRP and enhancing quality-of-life is difficult to assess, and may occur only indirectly via project outputs that have identifiable indicators (e.g. increase in recreation opportunities).

Compared to indicators proposed for the other evaluation accounts, the indicators of societal values are surrogates that may not be reflective of the underlying value itself. For example, the value of improving user safety may not be related to the number of incidents. Nevertheless, there is likely a positive correlation between the underlying value and the indicator, and measurement of the indicator is relatively straightforward.

Incremental flood protection might typically be indicated as the value of flood damage avoided. If such an estimate can be developed, this output would move to the Economic Benefits Account. The current facility (Kenny Dam and Skins Spillway) presently confers significant flood benefits to downstream communities and flood plain residents. When managing for flood control objectives, the CWRP provides better management tool because water may be discharged directly into the Nechako with immediate effect. This reduces uncertainty and risk of incremental downstream damage. Simulation of flood events may provide an indication of how frequent and significant this enhanced management control may be.

For cattle wandering and floatplane use, consideration by the NWC may recommend minimum flow volumes that satisfy the concerns. These minimum flows are accepted here as an indicator of a threshold value, while a substantial deviation from that value would imply the concern is not addressed.

Table 3A: Community and Regional Social Benefits Account Indicators (includes First Nations)

Benefit Descriptions	Indicators	Unit of Measure	Distribution	Data Sources	Comments
Improvement for First Nations cultural areas and activities	Identify archeological sites and values,	# of accessible sites, change in condition,	Murray-Cheslatta, Nechako Canyon	First Nations	One specific area of interest is around the Nechako Canyon.
Improved Recreation User safety	Number of incidents related to rapid increase in river flow	# of incidents	Murray-Cheslatta River	Present recording of incidents appears to be anecdotal rather than formal process.	Relate to flow profile with/without project during the May-Sept period
Economic Development of Cheslatta Community (includes <i>Optional Projects</i>)	Band employment in Cheslatta watershed restoration Band Employment in eco-tourism operations	# of direct jobs, total income	Murray-Cheslatta Nechako River, Murray-Cheslatta	Will depend on level of investment in watershed restoration and eco-tourism facilities. Project developer not identified.	Cheslatta band hold community forest license for lands along the river. May integrate with eco-tourism activities.
Improvement in river's visual appearance	Degree of improvement in river's visual appearance related to project flow regime	Change in property values, Qualitative measures.	Nechako River, Murray-Cheslatta	No data, a baseline visual sensitive inventory is required.	Not clear the extent adjusting flow regime would address concerns, to the extent such concerns exist.
Native food Fishery in Cheslatta Lake	Change in lake trout population	Increased catch for food fish and ceremonial purposes.	Cheslatta First Nation	Baseline survey of existing food fishery required.	Lake trout historically important to Cheslatta food fishery.
Effect on drinking water	Enhancement in safety and water quality.	Qualitative measure of change	Murray-Cheslatta	About 55 households took drinking water directly from the river (1999). Will require local survey and monitoring (SSEID)	Stabilized flows may offer incremental improvement in user safety and reduced turbidity.

Activity 5: Assessment of Benefits (draft report)
04/17/03

Benefit Descriptions	Indicators	Unit of Measure	Distribution	Data Sources	Comments
Incremental Flood Protection	Reduction in the frequency of damaging floods on the Nechako and Fraser.	Qualitative (+,-) linked to simulation of river flows,	Downstream Nechako	Nechako River simulation with and without CWRP.	Water release from CWR more immediate contribution to Nechako River compared to via Skins Lake spillway.
Reduced erosion rate of privately held stream bank	Hectares of productive stream bank saved, stream sediment reduced, fish habitat protected	Qualitative (+,-) linked to simulation of river flows	Nechako, Murray-Chestlata	Field assessment to establish baseline.	Caused by high summer flows, and other releases
Cattle Wandering	Sufficient flow /depth to stop cattle from crossing river.	Qualitative (+,-) relative to prefer flow regime.	Nechako, upriver from Fort Fraser	Field work. Nechako Valley Regional Cattlemen's Association.	A minimum annualized flow of 50cms early May to late Sept would alleviate most problems along the Nechako.
Float Plane Operations	Adequate water depth, mark/maintain safe landing strip.	Qualitative (+,-) relative to prefer flow regime	Nechako	Field monitoring, Vanderhoof Float Plane Owners Association.	Difficulties arise from summer flow releases. Annualized flow of 31.7cms minimum flow, with 41cms preferred.

Community and Regional Economic Impact Account Indicators
This account highlights the project's beneficial economic impacts to the regional economy. Economic impacts refer to the income and employment that project expenditures and ancillary expenditures (e.g. higher tourist spending) may generate in the plan area.

An economic impact is initiated by the project expenditure on goods and services. This expenditure is received by supply industries and labour, and re-spent in the economy to satisfy their respective needs. This re-spending ripples through the economy augmenting income and employment in what is termed the "multiplier effect". The more self-contained the region and provincial economies, a greater proportion of this ripple effect is captured and this multiplier effect is larger. A computer model of the provincial economy maintained by the provincial BC STATS provides the basis for developing both provincial regional multiplier values. Multiplier values are available for the Vanderhoof area, reflective of its economy in 1996. It is likely that these multiplier values will not be reliable indicators in ten years time when the project is expected to commence. At that future date, more up to date multiplier values may be available.

Table 4A: Community and Regional Economic Impacts Account Indicators

Benefit Descriptions	Indicators	Unit of Measure	Distribution	Data Sources	Comments
Project construction economic impacts	Regional income and employment impacts. Use Vanderhoof multiplier values	Constant dollars, person years	Nechako watershed,	Project developer for breakdown purchases and proportion sourced locally.	Impacts will occur 10 years hence, will require local area multipliers appropriate to the economy at that time.
Project operations economic impacts	Regional income and employment impacts. Use Vanderhoof multiplier values	Constant dollars, person years	Nechako watershed,	Project developer	Same comments as above
Avoided/reduced shut down in aluminum production.	Short term regional employment, income impacts, other production benefits	Qualitative	Kitimat	Simulation model comparing power production potential with and without the CWRP	Presumption that energy shortfall would curtail aluminum production.
Optional projects					
Kenny Dam generation, Re-hab. Murray Cheslatta system, tourism investment					
Economic Impacts from incremental investments and expanded businesses	Regional income and employment impacts.	Person-Years of Employment and \$ Income, qualitative	Nechako watershed, Murray Cheslatta area	Project developer and survey of Murray Cheslatta tourism operators	Construction and operation of incremental investments will give rise to economic impacts. New/expanded tourism operations on Murray Cheslatta. Same multiplier for Kenny Hydro construction as CWRP. Different supply industry linkages for Murray-Cheslatta rehabilitation.

Government Revenue Account Indicators

The project will increase government revenue via various taxes levied by the federal, provincial and regional levels of government. This increase can be presented in dollar terms, or qualitatively is sufficient information is not available. The revenue effect may be described in terms of the magnitude and timing (one time or continuous). The current tax regulations should be used to estimate the respective tax revenue, unless impending changes to the system are known. The estimates are intended to be broadly indicative and not to meet government's budget forecasting needs.

The provincial input-output model (if available) will provide an estimate of increased provincial government revenue from the indirect and induced incomes attributable to the multiplier effects.

The project may require new government expenditure. Although no such expenditure has been identified at this time, it is acknowledged that this is a key information item for decision makers.

Table 5A: Government Revenue Account Indicators

Output Descriptions	Indicators	Unit of Measure	Distribution	Data Sources	Comments
Sales Taxes on installed project	Provincial sales tax and GST revenues from installed capacity and during operations	\$ or qualitative, depending on data availability	Provincial, federal	Capital and operating items subject to taxes from Project developer.	Projects include CWRE, and potentially Kenny dam hydro, Murray-Cheslatta rehab, increased tourism business
Water Rent revenue	change in water use/yr. multiplied by rental rate per unit	\$ or qualitative	provincial	Simulation model, allocation of flow to Kemano and Kenny Dam (if applicable)	Incremental to provincial revenue so also included in Economic Benefit Account as the economic value of electricity.
Personal Income Tax	Estimate of total income tax paid by direct, indirect /induced employment	\$ or qualitative	Provincial, federal	Average income multiplied by average tax rate.	
Corporate Income Tax	Tax paid by project developer/operator	\$ or qualitative	Provincial, federal	Estimate from project developer	Assumes income would not be earned in the absences of the project
Property tax	Increase in property tax directly related to project	\$ or qualitative	regional	Estimate increase in industrial property tax base, mill rates from BNRD	Under prior agreement the project may not be subject to property tax.

APPENDIX B: Suggested Base Case and Other Future Work

The indicator values introduced in Appendix A may be assessed for various project scenarios and a base case scenario. The base case is intended to reflect the most likely indicator values if the CWRP was not built. The respective base case indicator values provide the benchmark for assessing the significance of the project scenario indicator values. For example, if the base case trend in fish habitat (e.g. hectares of fish habitat) is declining, while the indicator value for a project scenario is to maintain the quantum of fish habitat at its current level, then the project results in a net gain for fish. Careful definition of the base case scenario and deriving the corresponding indicator values is critical to achieving a reliable Benefits Assessment. Over the next year or so work that will ultimately define project scenarios is expected to be an on-going task of the Nechako Watershed Council. Defining the base case scenario is not dependent on the project scenarios and work can begin to gather the necessary information/data for base case indicator values.

The reservoir flow simulation model could potentially play a central role by estimating the flow related indicator values for the base case and project scenarios. Future reservoir inflows are the same in the base case and project scenarios. The timing and volume of reservoir discharges for the base case is determined by specifying management objectives and managing the discharge through the Skins Spillway and Kemano penstock to achieve those objectives. With the project, the timing and volume of discharges through the existing facilities and the CWRP to achieve the specific management objectives defines the project flow scenario(s) indicator values. With respect to management objectives (e.g. flood control, electricity production, satisfying legal requirements, etc.), the priorities should be common for both the base case and project scenarios. It might be the case that limits to the existing facility's operating performance means that certain management objectives are not met, or not all the time. If the project should relax such limits, this can be attributed to the CWRP, not a change in management objectives. Otherwise, it might be the case that an objective could be satisfied by the existing facility.

The specification of most of the indicator values presented in Appendix A would broadly follow three steps:

- i. Establish current value or status of the indicator value, recent trends in value and casual factors affecting change,
- ii. Identify the nature and significance of the indicator's linkage to river flow regime or other project attributes,
- iii. Forecast future indicator values given the base case flow regime and other assumptions.

Table B identifies tasks to assess base case indicator values for each of the accounts. Indicators relevant to only to the project (e.g. jobs associated with the project, effects and outcomes related to the project flow regime) are not addressed in this table of base case indicators. Nevertheless, compilation of the base case indicator values and the respective relationship to the flow regime will likely contribute to a better understanding for predicting project indicator values.

It may be the case that budget or resource constraints will dictate the need to prioritize the base case indicator work. The table contains a preliminary assessment of priority for discussion purposes. That is, a high priority means the indicator (both base case and project scenario values) would be a relatively important consideration in the investment decision. This judgement was informed by the project's implicit objectives of enhancing the health of the Nechako River and sustaining the region's social and economic well being. An indicator that was judged to have a high correlation with these objectives is assigned a high priority, etc. There is subjectivity in this appraisal as it reflects the author's considerations only. If it is the case that budget constraint will impose limits with respect to project planning, the NES and the NWC should review this list and confirm priorities. After confirming priorities, the next step is to prepare a work plan and commence the work.

Table 1B: Base Case Indicator List			
Indicator	Tasks and comments		
	High	Medium	Low
Economic Benefits Account			
Employment & Income associated with existing reservoir operations	^		
Trends in contribution to chinook and sockeye commercial harvest			^
Forecast/Outlook of timing and volume of electricity production (Kemano)		^	
Public Recreation (Nechako, Murray Cheslatta)			
Establish current levels and trends in recreation use for fishing, canoeing, other river based recreation by non-Nechako Watershed residents,	^		
Non-resident Tourism (Nechako, Murray Cheslatta)			
Establish current levels and trends in recreation use for fishing, canoeing, other river based recreation			
Conduct field survey's to determine participation rate, willingness to pay, relation to flow level and other factors influencing use. Contributes to region's economic and social well being.			
Environmental Benefits Account			
Nechako River			
Base line flow indicators values			
define physical indicators of river health	^		
Baseline and trends in fish habitat (hectares and productivity measures)			
Change in spawning, rearing habitat for Sockeye, Chinook, trout, sturgeon. Requires field surveys and trends.	^		
Baseline and trends in resident fish populations			
Indicator species: sockeye, chinook, mountain whitefish, and rainbow trout. Requires field surveys and trends.	^		
Baseline and trends white sturgeon population			
Population under stress. White Sturgeon Recovery Team and Action Planning Group to provide indicator values.	^		

3 These broad project objectives were expressed by Dr. Jaki in announcing the NEBF's decision to recommend the project, "We have fulfilled our mandate with the knowledge that the health of the river and the sustainability of the region are of utmost importance to the peoples of the valley and to the species that depend on the flow of the Nechako."

Table 1B: Base Case Indicator List			
Indicator	Tasks and comments	Priority	
<i>Murray-Chesatta System</i>			
Base line flow indicators values	Current target is to approximate flow profile of Stellaco River. Need to define physical indicators of river health.	^	
Stream and lake bank conditions	Assessment of status and trends in riparian areas. Field survey and relationship to base case flow regime.	^	
Baseline and trends in fish habitat (hectares and productivity)	Hectares of spawning rearing habitat for: lake trout, kokanee, rainbow trout, burbot, ling cod and lake whitefish. Field survey and relationship to base case flow regime.	^	
Base line and trends in fish population	Field survey of indicator species identified above and relationship to base case flow regime.	^	
Community and Regional Social Benefits Account			
Identify First Nations cultural areas and activities to be protected	Identify archeological sites and values,	^	
Baseline Recreation User safety (# of incidents)	Establish present risk and future trends. Assess potential to address issue given base case.	^	
Outlook for Economic Development for the Chesatta Community	Identify economic drivers, income and employment. Trends. Relationship to flow regime or consequential effects.	^	
Change in property values, Qualitative measures.	Nechako River, Murray-Chesatta riverside property values.	^	
Current Status and trends in Native food Fishery in Chesatta Lake	Role and contribution of food fishery. Trends in harvest. Relationship to flow regime.	^	
Baseline and trend in reliance on Chesatta for drinking water	Establish current use, trends in use. Relationship to base case flow regime	^	
Forecast of potentially damaging flood events	Establish existing facility's capacity to manage specified flood events. Examine base case flow model to indicate frequency of occurrence.	^	
Loss of private land due to stream bank erosion.	Identify status and future stream bank that may be effected. Linkage to base case flows.	^	
Base line and trends in cattle wandering	Issues identifies current status. Link to base case flow profile and assess future trends.	^	
Base line and trends in float plane operations	Issues identifies current status. Link to base case flow profile and assess future trends.	^	
Community and Regional Economic Impacts Account			
Base line and projected economic impacts from current operations	Identify total income and employment impacts from current and trend facility operations. Use Vanderhoof multiplier values.	^	
Forecast of aluminum production, and employment.	Provides baseline for measuring project economic impacts.	^	
Government Revenue Account			
No base case impacts	Only project revenue implications will be examined		

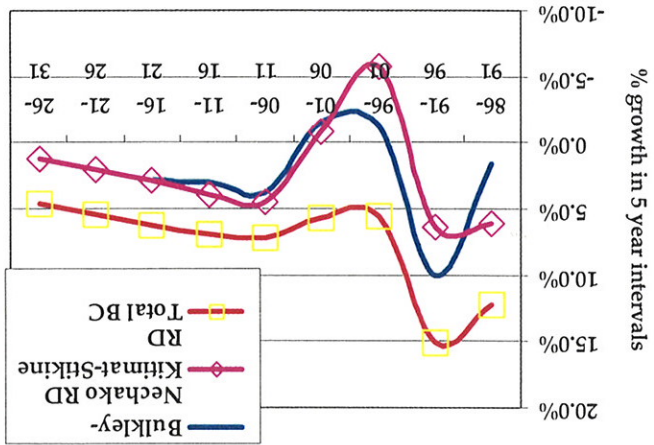
APPENDIX C: Regional Socio Economic Statistics

The base case will include an overview of the regional economy to provide a context for considering current conditions, and preparing the base case and project scenarios. This appendix summarizes statistics on several of the key socio-economic attributes. The base case would expand on this information.

Population

The population of the immediate project area is estimated to be in the order of 1,200 persons

in June 1999 (Southside Economic Development Corporation). The 2001 Census populations for the Bulkley-Nechako and Kitimat-Stikine Regional districts were equal, at 42,800 persons. In recent years the population growth of both regional districts has been negative. BC Stats population forecast for the regional district expects positive growth to resume after 2006, however at a pace below the expected provincial growth rate.



Historic and Forecast Population Growth

The distribution of the regional labour force among industries is one indicator of the make-up of the regional economy and its relative significance. This is summarized in the following table. In the period 1991-96 the labour force of the Bulkley-Nechako grew significantly faster than the Kitimat-Stikine labour force. The growth rates were relatively robust for primary industries (includes logging, agriculture, fishing), manufacturing, construction, and trade. This growth may be correlated to the relatively more rapid population growth with the Bulkley-Nechako RD experienced during that period. If so, this would suggest a contraction of the labour force after 1996 given the decline in the region's population. This circumstance will be clarified with the release of the 2001 Census labour force data later in 2003.

Bulkley-Nechako RD
Kitimat-Stikine RD

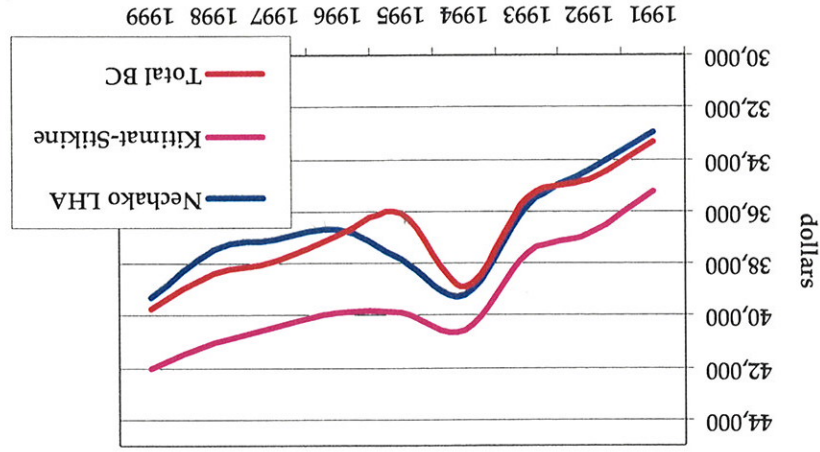
All industries	96 Census % of of 91 change		96 Census % of of 91 change	
	96 Census	91 change	96 Census	91 change
Primary Ind- Calc.	4,050	19%	2,255	10%
Manufacturing industries	3,560	17%	3,060	16%
Construction industries	1,100	5%	890	24%
Transportation & Communication	1,490	7%	1,545	-4%
Wholesale trade industries	640	3%	575	11%
Retail trade industries	2,465	11%	2,235	10%
Finance and insurance industries	395	2%	415	-5%
Real estate operator and insurance agent industries	215	1%	125	72%
Business service industries	555	3%	435	28%
Accommodation, food and beverage service industries	1,420	7%	1,225	16%
Other service industries	1,235	6%	990	25%
Government service industries	1,545	7%	1,400	10%
Educational service industries	1,445	7%	1,340	8%
Health and social service industries	1,400	7%	1,085	29%
	21,520		19,285	12%
	21,520		21,930	
			21,375	3%

Source: Statistics Canada

Average income (before tax)

Average income is an indicator of productivity and general economic wellbeing of the region. Average income in the Kitimat-Stikine RD is higher than the provincial average. Average income in the Bulkley Nechako RD dropped below the provincial average in the late 1990's but has recovered in recent years.

Average Incomes



Average income in the Kitimat-Stikine RD is higher than the provincial average. Average income in the Bulkley Nechako RD dropped below the provincial average in the late 1990's but has recovered in recent years.

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