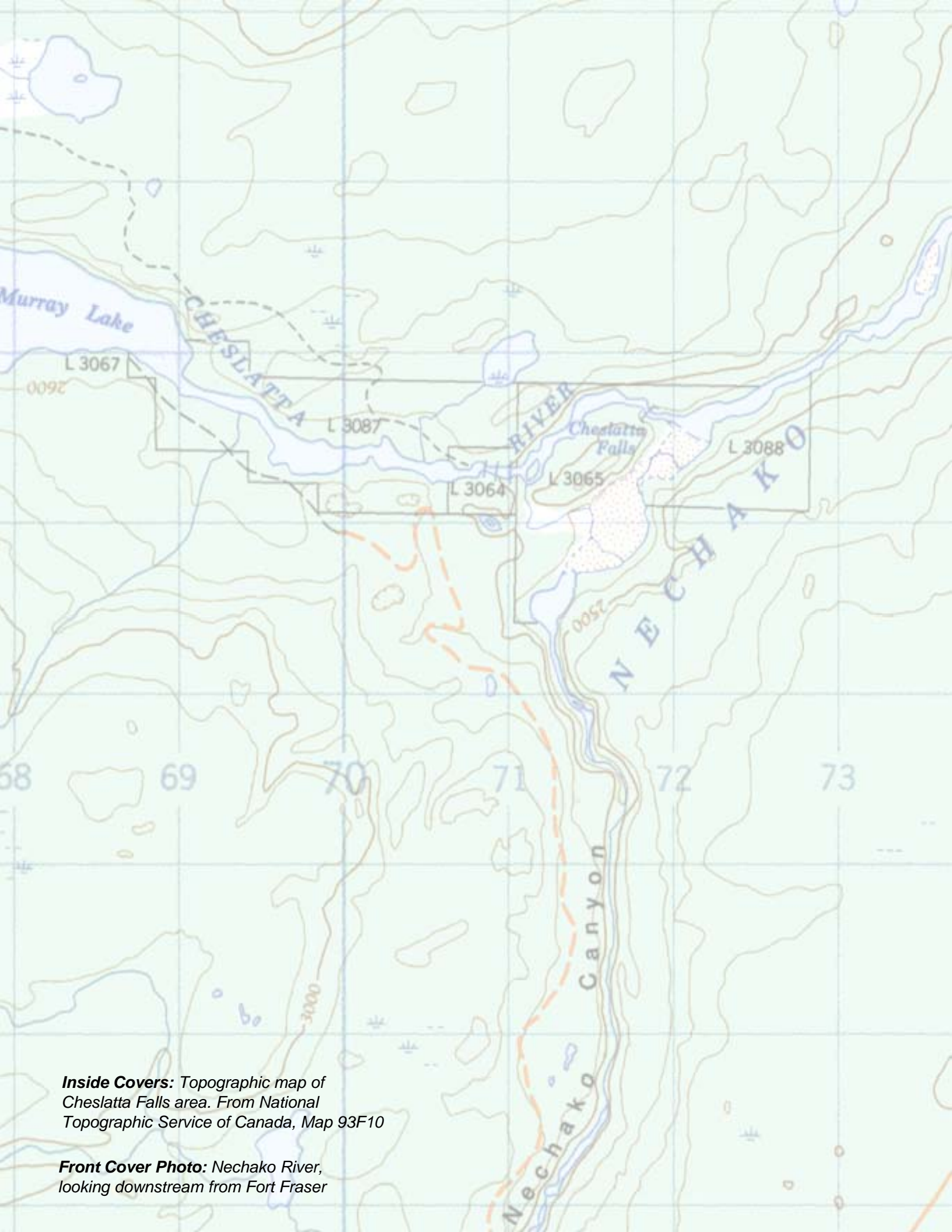


Kenney Dam Cold Water Release Facility

Addendum to April 2008 Interim Report (2008-2009)

**Nechako Enhancement
Society**

November 2009



Inside Covers: Topographic map of Cheslatta Falls area. From National Topographic Service of Canada, Map 93F10

Front Cover Photo: Nechako River, looking downstream from Fort Fraser

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Photo: Nechako Canyon and Scour Hole Lake

1 INTRODUCTION

In April of 2008 the Nechako Enhancement Society (NES), on behalf of the Nechako Watershed Council (NWC), prepared an Interim Report¹ which summarized in one document the work completed during the first six years of the NWC work plan, the gaps identified and progress made to date in addressing the technical issues that must be considered in relation to the design, construction and commissioning of a CWRF at Kenney Dam.

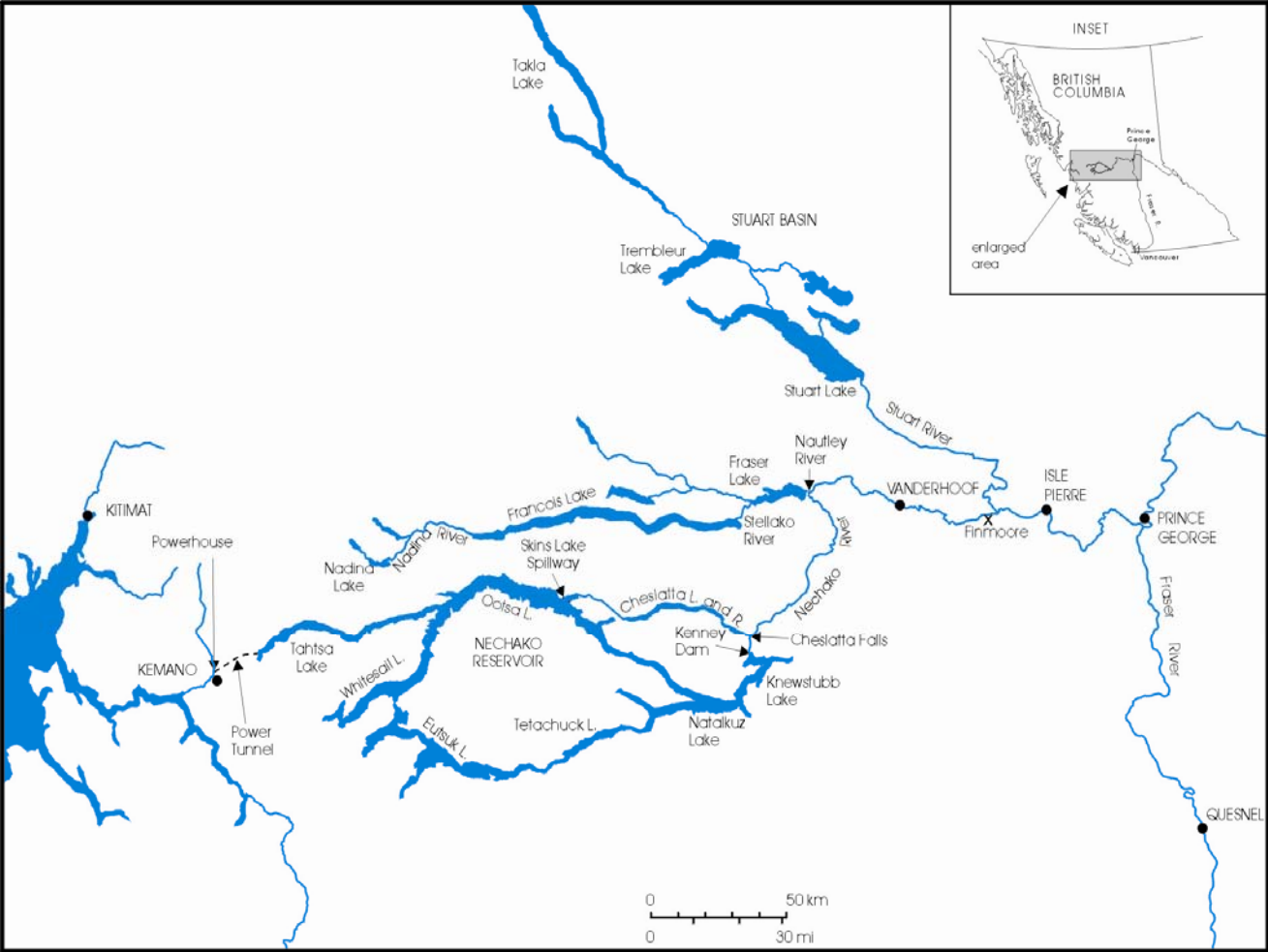
Included in the Interim Report was a discussion of the fact that ongoing work by DFO suggests that there may be a requirement to define new temperature criteria for that portion of the Nechako

¹ Kenney Dam CWRF Interim Report 2002-2007, April 2008

River downstream of the Stuart River confluence and that this in turn may result in little or no freed up water being available for downstream enhancement. Also discussed were the results of an updated cost estimate which showed that the costs of construction had almost doubled compared to the 2001 NEEF Management Committee estimate.

At a subsequent, June 2008 NWC meeting, the NWC concluded that because of the engineering risks, lack of “freed-up” flows and escalating cost, a CWRF was no longer the preferred option. A surface WRF would result in similar flow releases, fewer engineering risks and lower costs and would still allow the primary benefit of rehabilitation of the Cheslatta River and Lake System, but “freed-up” flows for downstream environmental enhancement of the Nechako River would be minimal, if any. Therefore, the NWC directed the NES to obtain a detailed cost estimate for a simplified surface Water Release Facility (WRF) at Kenny Dam.

Figure 1-1: Map of Nechako River Watershed





*Photo: Kenney Dam.
Photo provided by Alcan.*

2 WATER RELEASE FACILITY

In January 2009 the NES issued a contract to SNC Lavalin to prepare a report and cost estimate for a surface water release facility (WRF) at Kenney Dam. The NES requested that the design of the WRF be based on the work previously commissioned by the Management Committee of the Nechako Environmental Enhancement Fund (NEEF) as well as Rio Tinto Alcan (RTA) information that was used to design the cold water release facility at Kenney Dam.

The scope of work included a cost estimate, construction schedule, construction strategy, and facility description including conceptual design drawings for each of the following items:

- a surface water release facility (WRF) at Kenney Dam;

- modification to Skins Lake Spillway (SLS), (once completed this will be the subject of a separate report.)

Once the contract was underway the scope of work was expanded to include:

- The digitization of the topographic and geological information based on previous surveys and geotechnical studies in order to establish ground and rock surfaces at the location of the proposed WRF at Kenney Dam; and
- Development of an alternate design of WRF at Kenney Dam.

The cost estimate was requested to be accurate to 30% and based on an EPCM (Engineering, Procurement and Construction Management) type of contract. During development of most infrastructure projects, the facilities are designed and defined in more detail with the result that costs are more likely to increase than decrease. Such estimates therefore probably have a range of accuracy of 0% to +30%.

SNC Lavalin was provided with the following design criteria:

- the WRF at Kenney Dam must be capable of operating all year around, releasing flow of 5 m³/s to 45 m³/s through the low-level outlet during the winter, and flows of 45 m³/s to 450 m³/s through a surface spillway in summer.

Operational parameters were specified as follows:

Reservoir Elevations:

- Probable Maximum Flood Level (PMF)
857.11 m

- Maximum Normal Operation Reservoir Level 853.44 m
- Minimum Operation Reservoir Level (MOL) 844.30 m
- Controlled Reservoir Level at 450 m³/s discharge 851.00 m

Surface Spillway Discharge:

- Maximum spillway discharge 450 m³/s
- Maximum spillway discharge at MOL (el.844.30) 283 m³/s

Low Level Outlet Discharge:

- Maximum discharge 45 m³/s
- Minimum discharge 5 m³/s
- Maximum invert elevation of intake channel, or lower 832.00 m
- Top of WRF spillway control structure, or higher 859.50 m

Tailwater Elevations:

- Maximum Tailwater Level at 450 m³/s discharge 769.90 m
- Maximum Winter Tailwater Level at 45 m³/s discharge 766.74 m
- Tailwater under no-flow condition 764.50 m

2.1 INFORMATION STATUS

In their May 2009 report SNC Lavalin provided an alternative concept layout, construction planning details and a cost estimate for a WRF at Kenny Dam.²

The SNC Report describes a facility as shown in Figure 2-1.

² SNC, 2009

The facility shown in Figure 2-1 consists of the following:

- A surface water intake channel in the left abutment of Kenney Dam;
- A release structure equipped with regulating gates and maintenance bulkheads, incorporating a bridge to maintain road access across the dam;
- A chute spillway with flip bucket energy dissipater;
- A pre-excavated plunge pool;
- Downstream left bank protection;
- A low-level outlet;
- Diesel generator power supply;
- Electrical distribution system, lighting, HVAC equipment, local and remote controls and instrumentation, and security monitoring system; and
- Accommodation for a permanent operator, with facilities for temporary accommodation of maintenance personnel situated on the left abutment, above the facility.

Using a proposed basic configuration developed in 2001 but excluding both the deep-water intakes and pipeline components, SNC Lavalin developed an alternative layout for the WRF. The alternative layout comprises three (3) surface water outlets and a low-level water outlet releasing water through a combined penstock and spillway chute. The chute will discharge via a flip bucket and the penstock via an energy-dissipating valve house, designed for future conversion into a power generating facility.

The layout, described more fully in their report includes the following components:

- An intake channel conveying water from the reservoir to the regulating structure;
- A high level outlet regulating structure with the capacity to pass 450 m³/s;

- A low- level outlet with the capacity to pass 45 m³/s via a 3 m-diameter penstock embedded below the spillway chute and leading to the valve house;
- A flip-bucket spillway designed to discharge flows greater than 45 m³/sec;
- A valve house designed to accommodate 4 energy-dissipating valves with provision to replace two valves with two horizontal axis turbine-generator units, if required in the future.

For the purposes of construction planning, the project was divided into five major areas of activity:

- Surface Water Intake Channel
- Regulating Structure
- Spillway, Flip Bucket, Plunge Pool
- Low Level Outlet
- Valve House

Construction was planned and scheduled in stages designed to maintain uninterrupted traffic to and from the dam crest as this “restriction” and the “freshet fisheries window” were both found to create the critical path for the Project.

A number of construction methodology assumptions were identified and should any of these assumptions not be accurate there could be significant implications to both the schedule and costs for the Project.

A schedule showing it would take a total of 52 months to build and commission the WRF was developed. Preliminary design (including Computational Fluid Dynamics Studies and Physical Modelling) and Regulatory approvals are shown to precede the tender and award process. The duration

of the actual construction job is 37 months from the date of award of the construction contract shown at month 15 on the overall schedule.

An estimate of costs was prepared using Heavybid (HCSS) Estimating and Bidding Software. This cost estimate did not include PST or GST, escalation costs for material and wages during the Project or annual operating and maintenance costs.

The estimated cost for construction of the WRF was determined to be \$150,583,955. This cost estimate included a 5% contingency and was reported to be accurate only to +30% due to the preliminary (pre-feasibility) level of design.

At a July 2009 NWC meeting the NES tabled and discussed the results of the completed SNC Lavalin Report. In preparation for that meeting the NES developed a Table wherein the costs estimated by SNC Lavalin were broken out by year and assigned to the activities detailed in the construction schedule. Estimates for additional items such as additional works associated with commissioning, preliminary engineering and costing, contingencies and the environmental assessment process and permitting were included. Since July, the costs associated with modifications required to the Skins Lake Spillway to accommodate the lower flows into the Cheslatta River and Lake system have been completed and the work plan and budget have been updated (Table 2.1).

The October 2009 SNC Skins Lake Spillway Water Release Facility Report presents a conceptual design and cost estimate for a Water Release Facility (WRF) at Skins Lake Spillway. The design of the WRF was based on the work previously completed and in accordance

with RTA design criteria. The layout developed relied heavily upon sparse contour information and assumptions about bathymetry. For the next stage of engineering, a number of additional studies will be required.

An estimate of costs was prepared using Heavybid (HCSS) Estimating and Bidding Software. The estimated cost for construction of the WRF was determined to be \$22,066,059. This cost estimate was reported to be accurate only to +30% and excludes escalation, GST and owners costs. Annual operating and maintenance costs of the facility were excluded from this estimate.

To proceed with further engineering, the environmental assessment and construction of a WRF, the total estimated cost is \$255.7M. This estimate does not include the unknown costs for: water for commissioning the WRF, commissioning and post-commissioning environmental monitoring and Cheslatta River and Lake System rehabilitation costs.

Table 2-1 Kenney Dam Release Facility Work Plan and Budget

Kenney Dam Water Release Facility and Associated Works

	Activity	Revised Budget Estimate (\$M)
Year 9 (SNC Year 1) - WRF Preliminary Engineering and Costing		
	NEEF Management Committee Operating Fund	\$0.250
	Complete joint venture agreement between Province and RTA	\$0.250
	Develop a Nechako Environmental Conservation Program management structure	\$0.250
SNC	Preliminary Engineering of WRF & costing & construction plan including verification of flip bucket spillway design for TGP criteria (20 months)	\$3.400
SNC(p 1-1)	Contingency (30%)	\$1.020
	Geotechnical Drilling in the Cheslatta Fan	\$0.076
	Re-run sediment model with geotech data	\$0.060
	Cheslatta Fan Preliminary Engineering and Costing	\$0.250
	Cheslatta Lake & River System Flow Regimes	\$0.150
	Develop consultation plan for EA process	\$0.500
	Complete temperature and flow modelling for WRF releases - DFO and Triton	\$0.010
	Complete package in preparation for entry to EA process	\$0.040
	Project Manager	\$0.125
	Sub-Total (Cash)	\$6.381
	Provincial and RTA in-kind contributions (1 FTE each)	\$0.300
Total Year - WRF Preliminary Engineering & Costing & in-kind staff support		\$6.681
Year 10 (SNC Year 2) - Environmental Assessment Process & Permitting		
	Enter EA Process including consultation (18 months)	\$2.500
	Project Manager	\$0.250
	Project Office	\$0.150
	Office Operating Expenses	\$0.020
SNC	Start-up (camp establishment & start-up)	\$16.600
SNC	Contingency (30%)	\$4.980
SNC memo	Detailed Engineering	\$6.000
	Sub-Total (Cash)	\$30.500
	Provincial and RTA in-kind contributions (equivalent to 1FTE each)	\$0.300
Total Year 10 - WRF Environmental Assessment Process & Permitting & in-kind staff contribution		\$30.800
Year 11 (SNC Year 3) - Complete EA Process & Permitting		
	Complete EA process including consultation	\$1.000
	Project Manager	\$0.250
SNC	Civil works	\$55.000
SNC	Contingency (30%)	\$16.500
	Sub-Total (Cash)	\$72.750
	Provincial and RTA in-kind contributions (equivalent to 1FTE each)	\$0.300
Total Year 11 - WRF Complete Environmental Assessment process & in-kind staff contribution		\$73.050
Year 12 (SNC Year 4) - WRF Construction		
SNC	Structures (bridge, spillway, flipbucket, powerhouse shell, liner, valves etc)	\$65.000
SNC	Contingency (30%)	\$19.500
	Sub-Total (Cash)	\$84.500
	Provincial and RTA in-kind contributions (equivalent to 1FTE each)	\$0.300
Total Year 12 - WRF Construction		\$84.800
Year 13 (SNC Year 5) - WRF Mechanical & Electrical, SLS Modifications, Cheslatta Fan Channel		
SNC	Mechanical & electrical	\$10.000
SNC	Contingency (30%)	\$3.000
SNC	Skins Lake Spillway Modification	\$22.067
	Cheslatta Fan - armoured channel	\$10.000
RTA	Owners Costs; Commissioning/Start-up (5% of \$150M)	\$7.500
	Sub-Total (Cash)	\$52.567
	Provincial and RTA in-kind contributions (equivalent to 1FTE each)	\$0.300
Total Year 13 - Mechanical & Electrical, SLS Modifications, Cheslatta Fan Channel		\$52.867
WRF Total Cash		\$246.698
WRF Total In-Kind support (RTA and BC Government)		\$1.500
Total Year 9 - 13 (Cash + In-Kind)		\$248.198
WRF Scope Change Contingency		
SNC	Scope Change (5% contingency on \$150M)	\$7.500
Total - Scope Change Contingency		\$7.500
TOTAL (WRF & ASSOCIATED WORKS)		\$255.698
Reference:		
SNC Lavalin, May 2009. Water Release Facility At Kenney Dam: Alternative Concept Layout, Construction Planning and Cost. Prepared For: Nechako Enhancement Society.		
SNC		

Table 2-1 Kenney Dam Release Facility Work Plan and Budget (con't)

Kenney Dam Water Release Facility and Associated Works

SUMMARY:

Year	Activities	Budget Estimate (\$M)
1	WRF Preliminary Engineering and Costing, Complete Preparation for Environmental Assessment Review	\$6.681
2	Environmental Assessment and Permitting	\$30.800
3	Complete Environmental Assessment and Permitting	\$73.050
4	Water Release Facility Construction	\$84.800
5	Water Release Facility Mechanical and Electrical, SLS Modifications, Cheslatta Fan Channel	\$52.867
	Scope Change Contingency	\$7.500
TOTAL		\$255.698

2.2 INFORMATION GAPS

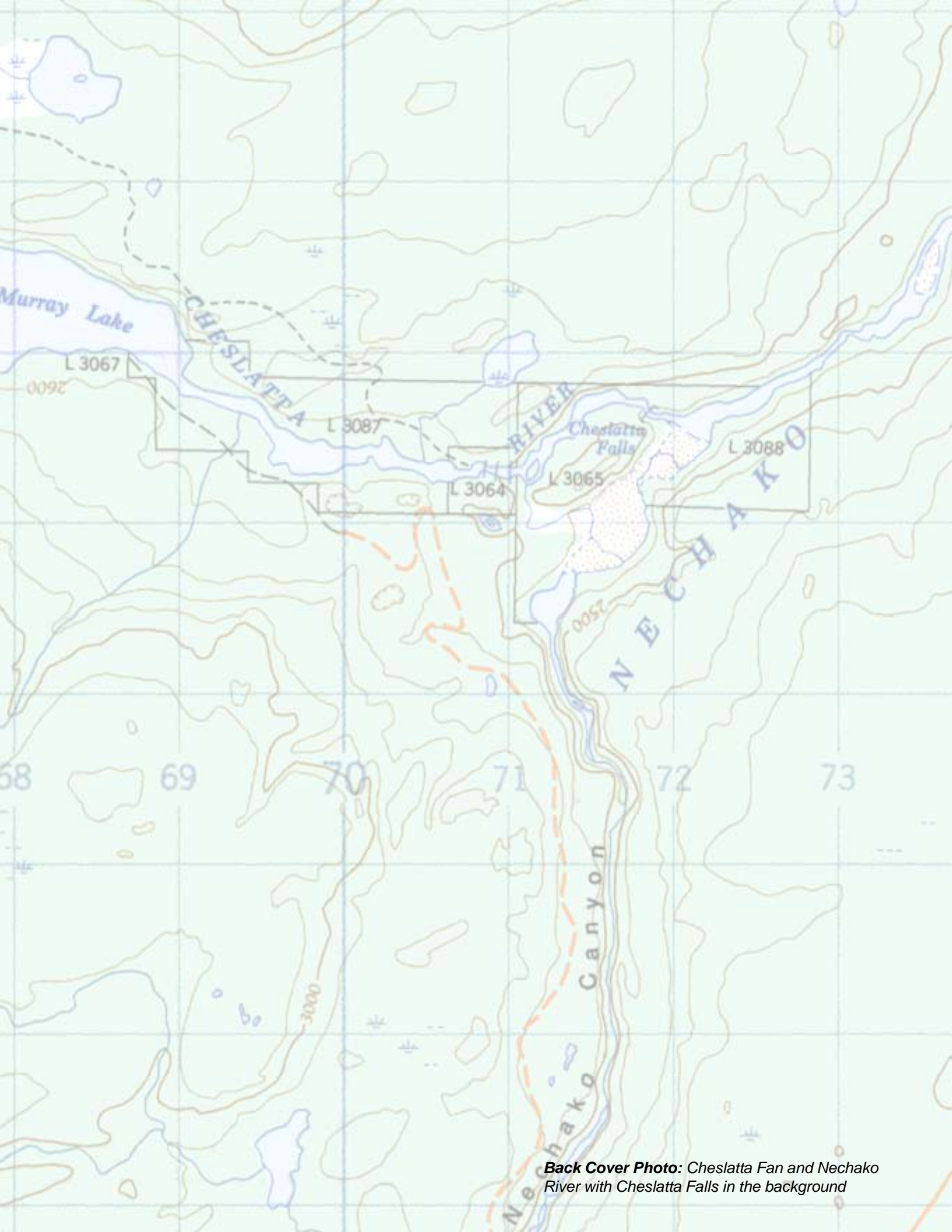
The May 2009 SNC Lavalin Report on the Kenney Dam WRF identified that hydraulic model studies will be required to evaluate the proposed geometry and alignment of WRF structures for Kenney Dam WRF. These studies will comprise both, Computational Fluid Dynamic (CFD) and subsequent Physical Modelling. The computational modelling will provide valuable insight and allow improvements to be made and tested at low cost. The physical hydraulic model will provide a valuable performance check of the proposed layout.

The October 2009 SNC Lavalin Report on the Skins Lake Spillway WRF identified that topographic and bathymetric field surveys will be required. Hydraulic model studies to evaluate the proposed geometry and alignment may also be required. All of these studies will need to be completed before construction can proceed.

3 REFERENCES

Nechako Enhancement Society (NES). April 2008. Kenny Dam Cold Water Release Facility Interim Report (2002 – 2007).

SNC Lavalin (SNC). May 2009. Water Release Facility at Kenny Dam. Alternative Concept Layout, Construction Planning and Cost, prepared for Nechako Enhancement Society.



Back Cover Photo: Cheslatta Fan and Nechako River with Cheslatta Falls in the background

