

VERNON RUSKIN , PhD,MCom,BSc,Retired PEng (BC) ,PE(WA) Numbered Author

Dear Mr. Wruck and Ms. Erica Hamilton

I respectfully make this submission to answers terms of reference

item f) The commission may obtain expert advice on any subject related to inquiry and

item b iv) What .. other .. Generating projects ... could provide similar benefits. at...lower.. cost ..

To explain my submission I must give my background and History of Site C

Executive Summary

My earlier submission F 26-3 gave a list of feasible generating and Dam portfolios which can all provide the same benefits at far lower unit energy cost than the current Site C Dam.

However if BCUC is considering either a/ continuing or b/suspending and restarting the Dam I explain the exact reasons why BCUC immediately needs to get Site C Dam reviewed by top engineers and geologists outside of BC, to ensure :

#1 The SAFETY of people living downstream of the Dam and

#2 The BEST VALUE for ratepayer's money.

Background

Dal Grauer, President of BC Electric (the predecessor of BC Hydro) hired me in 1955, after Vancouver suffered a total blackout. I became Director, Planning Division with a 45 person staff.

It included Keith Kidd, ex Ontario Hydro engineer, for Peace River, and Bill Weymark, Gen McNaughton's staff engineer for Columbia. We planned designed, budgeted and contracted more than ten Dams in BC, including Site C. on the Peace River and 4 Dams on the Columbia River.

I next formed a company, built the first computer model of the Columbia River in Canada to check down stream benefits for Gen McNaughton and BC Hydro.

I next became Partner PS Ross Consulting arm of Touche Ross (which later became Deloitte Touche and then Deloitte)

I then formed my own engineering company and expanded into the US with offices in Vancouver, Bellingham, San Francisco, Los Angeles, Chicago, Atlanta and Cincinnati. We served 31 electric and gas utilities and pipelines in Canada and in US and over 100 other customers (names upon request)

I retired to Vancouver in 1992 and later did independent volunteer non-partisan energy research I gave that to NDP John Horgan, and to Liberal MLA Ralph Sultan and to BCUC.

History of Site C

1. Sixty years ago when I was Director or the Planning Division of BC Electric, Keith Kidd (ex Ontario Hydro) in my Division originally designed a standard (slightly curved) Site C Dam #1. (See picture X1)

2. BC Hydro tabled that standard Site C Dam #1 with BCUC in 1982, (and therefore must have checked that it complied with earthquake regulations).

BCUC turned Site C down at that time for lack of sufficient load to justify its construction.

3. Under Premier Gordon Campbell, BC Hydro re-proposed that standard Site C Dam #1. Vancouver Sun reported it cost around 3.3 billion in 2005. Picture X1

4. Under Premier Christie Clark in 2011, BC Hydro consulting engineers changed Site C Dam to an “upgraded” right angle design, Dam #2 – (see picture X2) which raised the cost to \$7.9 Billion .

The “upgrade” resulted in a \$4.6 billion surge in contractor cost, and about \$200 million more for engineer’s supervision of that construction:

The cheaper alternative to the “upgraded” Site C Dam #2 was the original Site C Dam #1 at much lower cost.

I believe BC Hydro managers knew it, but were afraid to admit they had spent a lot of time and money on Dam #2, so they tried to hide their error using media release spins claiming doubtful advantages for their “upgraded Dam design”.

Unfortunately they misled the government, MLAs and many BC citizens and wasted billions of dollars in direct and deferred charges or obligations now clearly stated by Deloitte.

Truth Will Out

Eventually truth will out: The so-called “Upgrade” Dam #2 is at best a serious error , or worse a boondoggle benefitting contractors and not ratepayers.

The truth is it Costs BC Ratepayers an unnecessary extra \$4 Billion plus it may compromise Safety of people downstream of the Dam #2.

Please look at Picture X1 Dam #1 vs. Picture X2 Dam #2



Picture X 1 Original Dam (Gordon Campbell)



Picture X 2 Upgraded Dam (Christy Clark)

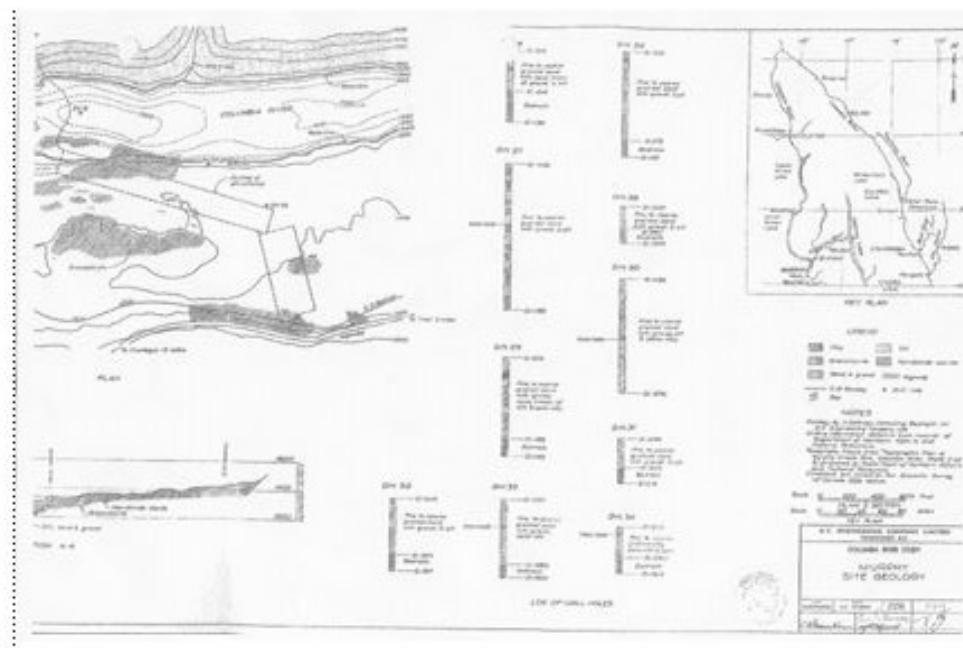
Many engineers will agree that the "upgraded" right angle design, Dam #2 is bigger and weaker, because every engineering student at university taking “Theory of Structures” and “Strength of Material” learns that a right angle structure like Dam #2 is weaker at the corner and needs more material to reinforce it, than the original BC Electric's standard (slightly curved) Dam #1 design.

Nobody can say BC Electric’s planned sites, like Site C Dam #1, were not well investigated, drilled, checked out and signed off by BC’s most famous geologist Dr. Vic Dolmage (who blew up the famous navigation hazard, namely; Ripple Rock in Seymour Narrows just north of Campbell River, BC. It was the biggest ever controlled non-nuclear explosion on earth).

All site geological maps (including Site C) were given to Dr. Dolmage for checkout.

An example map is shown on page 120 of my 2013 book entitled “Clean Energy Starvation in the Midst of Plenty”, ISBN 978-1492222552 on Amazon.

Exhibit XG -Example of Site Geology for Murphy Creek for Dr. Dolmage-



Cost of Dams

While I was Director of Planning at BC Electric, we designed Peace River Dams A, B, C, D and E of which A and B were built, and 12 Columbia River Dams, of which 4 were built. We also built 4 smaller Dams. Altogether the 10 Dams we designed have all stood a 50 year test of time, and every day produce most of BC Hydro's electricity at around \$7 per mwhr. IPP's produce electricity at around \$86 per mwhr and the current Site C was estimated to produce electricity at around \$132 per mwhr, if completed, including interest during construction and ALL "deferred" charges which are applied when it goes in service.

My experience with ten Dams is that the cost mainly depends on the quantity of material moved from source location to the Dam site.

Site C Dam #2 clearly physically requires a lot more material than the original Site C Dam #1, which I believe contributes to the much higher cost.

My planning Division at BC Electric was also responsible for checking contractors progress and authorizing payments, we found overruns on major Dams our biggest problem. We never saw a Dam overrun as low as 5%, plus as soon as any major Dam was "finished", contractors filed lawsuits for inevitably unforeseen unspecified extra work. In fact some contractors 'low-balled bids' so they would get the contract and could make millions in profit on all the inevitable quantum merit claims for extras.

Evidence of engineering and geotechnical problems

My earlier concerns increased because the media reported evidence of material failures that needed repairs eg July 2016, Feb 2017 etc)

Please See 4 pictures

1. Original Dam which Vancouver Sun reported cost 3.3 billion when Gordon Campbell was BC premier.
2. ‘Upgraded Dam #2 would cost 7.9 to 9.0 billion which Premier Christy Clark and CEO McDonald reportedly wanted to build ‘beyond the point of no return’.
3. July 2016 Example of Damage from Chris Pollon’s book “The Peace in Peril”
4. Jan 2017 Example of long 400 meter crack reported by CBC

Plus I believe “upgraded” Site C Dam #2 is geotechnically weaker than BC Electric's Dam #1 design, because it is not tied into the midstream island (see pictures X1 and X2)

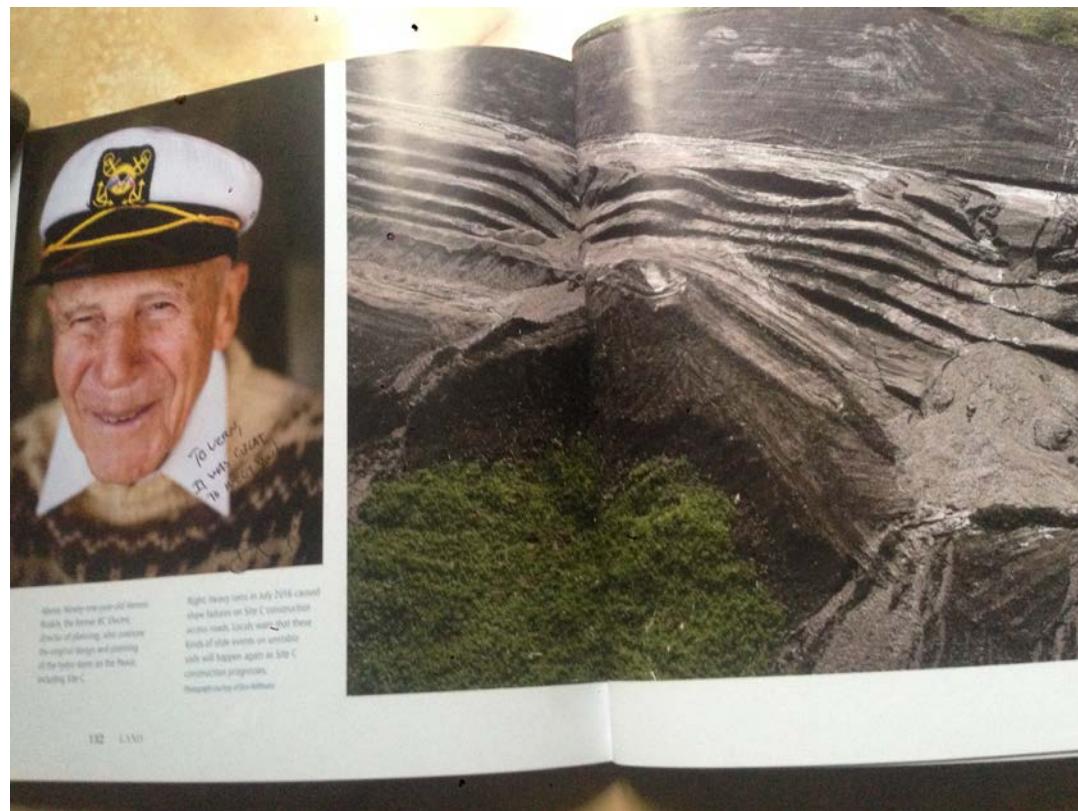
I believe that the so-called “Upgrade” change in 2011e in site C Dam #2 Design is Costing BC Ratepayers around \$4 Billion more – and may Compromise Safety.

Vancouver Sun reported, in 2005 that Site C cost had increased from \$3.3 billion when BC Hydro had earlier tabled BC Electric's standard design of Site C with the BC Utilities Commission

Engineering, Cost and Safety Questions

Though I'm retired as a registered BC professional engineer, I believe that Not only is the new "upgraded" design weaker, but it requires much more material and cost to build, and reinforce. (see pictures)

In July 2016 rains caused slides and slope failures see picture X3 and



Picture X 3 Example picture of Damage 2016 (Chris Pollen book Peace in Peril)



Picture X 4 CBC Feb 24, 2017 a 400 meter long crack appeared during construction activities.

These are factual evidence of material engineering or construction or geological problems that may endanger public safety and cannot reasonably be swept under the carpet By Deloitte saying BC Hydro has enough \$440 million reserve (5%) for contingencies. I note they wisely left a loophole by referring to overruns if there are delays in river diversion, which is the toughest work to come next year

But regardless let's never forget Public Safety overrides Money

No Additional energy and capacity is provided :

BC Hydros sheet also claimed upgraded Dam #2 produces 5,100 gwhrs energy vs 4,600 gwhrs from original Dam #1

Any junior engineer can tell you energy depends only on water head and flow and since both Dams have the same flow and head, the energy generated must be the same.

Similarly, the peak megawatt capacity is the same, depending on how much generating capacity you decide to install.

Any claim the upgraded Dam #2 has greater energy capacity is an error or media spin misleading the government, BCUC and the public.

Safety and Engineering Economics Issues

I taught "Engineering Economics" at UBC for 14 years and 2 years for the Association of BC Professional Engineers. I taught students that Vancouver's Second Narrows Bridge falling down showed BC professional engineers are:

- #1 Legally personally responsible for their work during and after construction, and
- #2 Are responsible to get an independent second opinion if there is the slightest doubt about public safety issues
- #3 Must recommend the most economical SAFEST alternative.

With all due respect, I believe serious failures now show there exists more than the slightest doubt about dam safety.

I don't joke when I say that slides, earthquakes, heavy rain and maybe terrorists will happen regardless of politics, counting the number of votes or BCUC submissions, or opinions by BC Hydro, or by anyone .

BCUC may obtain expert advice on any subject related to the inquiry per the terms of reference.

For example, BCUC hired Deloitte to advise on monetary matters, load forecasting and sources of supply.

In 1960 Dr Shrum as Chairman of the BC Energy Board set a precedent by getting advice from top engineers outside of BC (Sir Wm Halcrow and Partners) on Peace and Columbia Dams

Conclusion

With all due respect I believe BCUC, and inquiry chairman Mr Morton, would be ethically, morally and possibly legally, responsible for any damage to residents' life, health and property caused downstream of the current Site C Dam, whether through defects or negligence in, design, construction, or due to floods, rain, mudslides or earthquakes if the current Site C Dam a) continues or b) is suspended and restarted later.

I respectfully submit it is imperative and fully justified for BCUC and inquiry chairman M Morton to order immediately that both Dam designs #1 and #2 be reviewed by top engineers and geologists outside of BC, to ensure

- 1/ the Safety of people in communities living downstream of the Dam and
- 2/ the best value for public money of captive ratepayers, for whose fiduciary interest and energy supplies BCUC is the one and only public and ratepayer protector.

APPENDIX 'A'

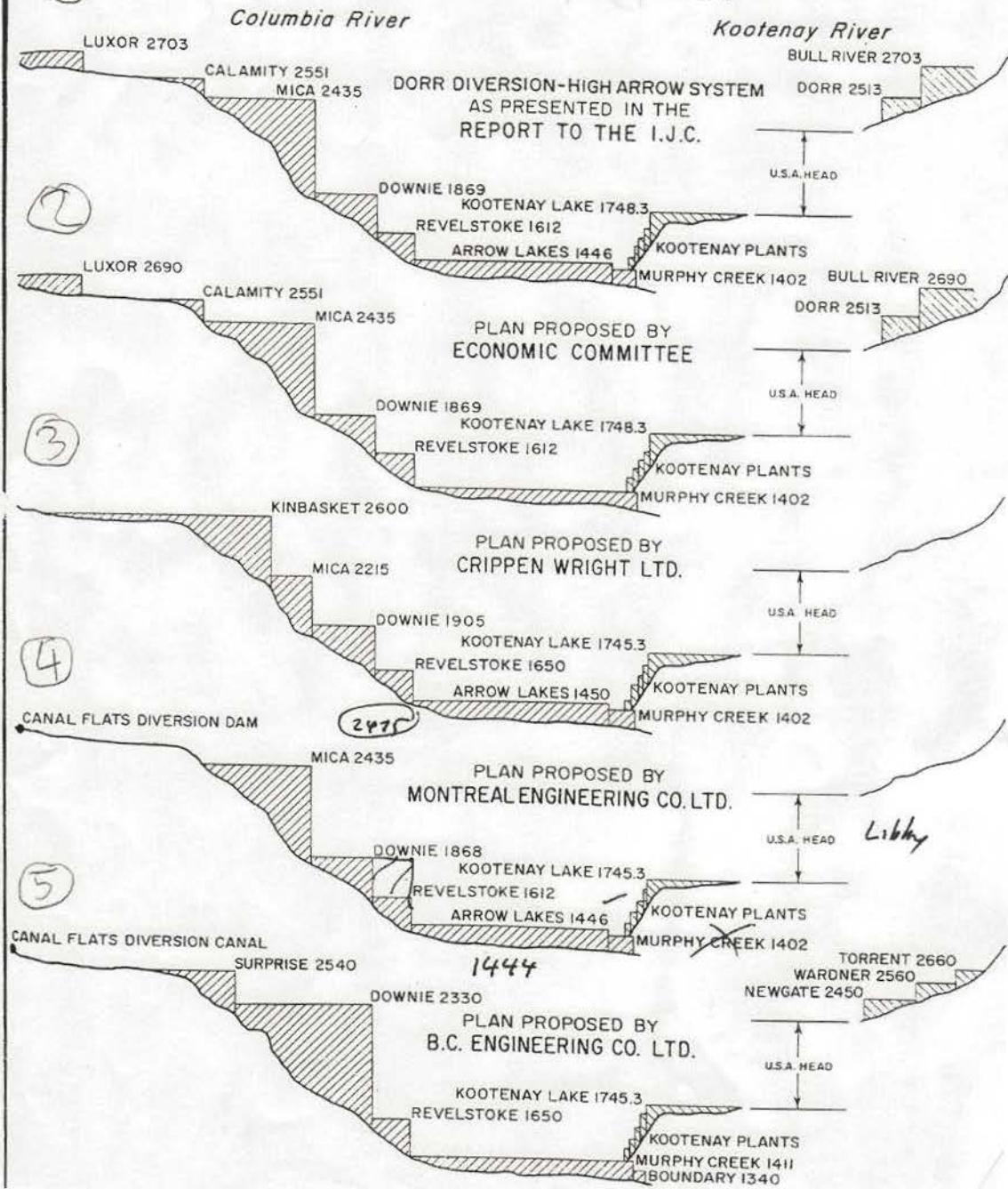
Sad Error/Boondoggle in the past:

Site C mirrors a sad error or Boondoggle which happened in 1957 in BC.

In 1957, Gen. McNaughton asked BC Electric to design all Columbia Dams, and specifically to avoid flooding the Arrow Lakes. See sketch #5 where Murphy Creek Dam is below Arrow Lakes which would not have flooded out 2,300 angry people. This Murphy Dam which would have avoided building Arrow Dam altogether. See sketch #4 BC Hydro consulting engineers “upgraded” BC Electric’s original design and built HIGH-Arrow Dam which flooded out 2,300 people and cost more than double, benefiting contractors. HIGH-Arrow Dam, which was later renamed “Keenleyside” Dam.

DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES
WATER RESOURCES BRANCH

COLUMBIA AND KOOTENAY RIVERS
SKETCH PROFILES SHOWING
CANADIAN STORAGE AND POWER PROJECTS
PROPOSED IN VARIOUS REPORTS



Sketch #4 BC Hydro's Upgraded Design by Keenlyside / McNabb floods out Arrow Lakes and people.
Sketch #5 BC Electric's/BC Engineering design would not have flooded out Arrow Lakes

But Years too late in 1974, BC Assistant Deputy Minister McNabb, admitted at SFU (ref 36 in my book) : Under the Treaty, BC Hydro could have built a Murrphy Creek Dam below the Arrow Lakes, (and avoided building HIGH-Arrow Dam altogether), which would have avoided flooding out 2,300 angry people (including First Nations), and saved ratepayer's money.

BC hydro

FOR GENERATIONS

Transcriptions of Columbia River Treaty Lectures

[Jan - Apr 1974, Simon Fraser University]

<u>Speaker and Date</u>	<u>Relevant (Former) Position</u>
✓ #1 Howard C. Green [Jan]	Canadian Secretary of State
✓ #2 Alvin Hamilton [1 Feb]	Chairman, Columbia River Liaison Committee
✓ #3 Arthur Laing [6 Feb]	Minister of Northern Affairs, Senator
✓ #4 Gordon Shrum [20 Feb]	President, BC Hydro
#5 Bob Strachan [22 Feb]	Leader, New Democratic Party
#6 Neil Swainson [27 Feb]	UVic Political Science Professor
#7 Larret Higgins [1 Mar]	Technical Advisor
#8 Jim Wilson [8 Mar]	Executive Director, BC Hydro
#9 Ian McDougal [13 Mar]	Environmental Lawyer
#10 Marion Marts [~15 Mar]	US Professor of Environmental Geography
✓ #11 Ray Williston [20 Mar]	Minister of Lands, Forests and Water Resources
#12 Charles Bourne [22 Mar]	UBC Law Professor
#13 Gordon McNabb [27 Mar]	Senior ADM, Energy Mines and Resources
✓ #14 Hugh Keenleyside [3 Apr]	Chairman, BC Hydro

1/1
TSH
Disclaimer: This material was transcribed by BC Hydro from 35 year old cassette tape that contained highly variable audio quality. While significant effort was expended to render these transcripts as accurate as reasonably practical, many comments and responses were unclear or inaudible. As a result, the enclosed transcripts are not a full disclosure of the Jan - April 1974 lectures. Readers that require the most accurate understanding of these lectures are advised to review the originating tapes and/or the digital conversions which were requested and funded by BC Hydro. These transcripts can be reviewed in the SFU Archives located at the Burnaby Mountain campus.

If and when significant transcription errors are identified which impact the accuracy of the transcripts, readers are asked to forward the correction to Doug Robinson, SFU Archives, 8140

Current Cost Recovery:

There may be a Potential Mechanism to recover current costs In accordance per terms of reference b (ii) (e) and(f)

It is possible BC hydro was misled by an error or a boondoggle (which has happened before). It may be recoverable through errors and omission insurance, and ratepayers are billed for the premiums.