ARTHUR HADLAND

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CA-7

March 2, 2013

Linda Jones
Panel Manager/Gestionnaire des Commissions
Review Panels/Commissions d'examens
Canadian Environmental Assessment Agency/
Agence canadienne d'évaluation environnementale
22nd Floor, 160 Elgin Street / 22e étage, 160 Rue Elgin
Ottawa, Ontario
K1A 0H3
Tel: 613 946-8709
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linda.jones@ceaa-acee.gc.ca

Dear Linda
Please find additional information regarding proposed Site C reservoir stability and safety in the enclosed hard copies.

I would like to add the comments that the following keys points are being glossed over or marginalized by the proponent {BC Hydro):

1. Provincial energy needs assessment
2. Economic (business case) for energy growth
3. Alternative energy sources
4. Reservoir stability and public safety *please see below
5. A 100 year agricultural needs evaluation
6. Historical significance of valley for all communities
7. Future wildlife sustainability
8. Cumulative effects back to 1957

Would the committee also please refer to and consider the details surrounding the failure of the Teton in Idaho (1976: 11 fatalities + 13,000 head of cattle) and the 1963 failure of Vajont Dam in Italy (estimates of the dead range from 1,900 to 2,500). The 1975 failure of the Banqiao Reservoir Dam and other dams in Henan Province, China caused more casualties than any other dam failure in history: an estimated 171,000 people. The potential for failure of proposed Site C is in all probability is just as likely as these examples.

To date the investigation process by the proponents has lacked balance and stewardship. It is faulty.

In the interest of ensuring **public safety** and **protecting the environment**, I do hope and trust that there will be honesty and integrity in the Assessment Review Process

Arthur A Hadland
Director of Area C, PRRD

*Please see Mineral Resources Report commissioned by Jack Weisgerber, Minister
March 14, 2013

PUBLIC SAFETY

CA-7

January 30, 2013

Public safety is an issue surrounding the proposed Site C reservoir.

The need to address and ensure public safety has become a priority at all levels of Canadian government. A September 2009 Klohn Crippen Berger and SNC Lavelin report produced for BC Hydro draws this factor to the fore within the pondage of the proposed Site C project.
Quote...
"***The uncertainties in predicting both the extent and rate of the shoreline impacts lead to the proposal to adopt an observational approach for periodically reviewing and updating the reservoir impact lines after the reservoir has been filled.***"
http://www.bchydro.com/energy_in_bc/projects/site_c/document_centre/stage_2_reports.html

This professional opinion needs to be examined in detail regarding the safety of human activities surrounding and within the proposed reservoir. It has not been addressed as of the writing of this commentary.
This outstanding safety concern is further reinforced by the report commissioned by the Honorable Jack Weisgerber, Minister of Energy, Mines and Petroleum Resources in 1991. This report prepared by the Geological Survey Branch of British Columbia (Quaternary Geology and Landforms of Eastern Peace River Region, British Columbia, by N.R. Catto 1991). This report was made without reference to the proposed flooding of the Lower Peace River Valley; rather it was commissioned to examine aggregate exploitation within the lower Peace River region. This report is brought to the attention of the reader regarding reservoir safety concerns. These concerns are highlighted in this 1991 report by the following excerpted observations.

1. "Mass movements, including rotational and translation glacial slides and a variety of sediment gravity flows, commonly occur along all the major streams."....Page 2

2. "The high concentrations of montmorillonite and bentonite in the strata, however, together with their poorly consolidated nature, greatly increases susceptibility of these rocks to slope failure following fluvial (or arthropogenic) undercutting or overloading."....Page 2

3. "The clays are generally plastic, susceptible to sediment gravity flow if disturbed, and contain a high proportion of material derived from the local Cretaceous bedrock."....Page 5

4. "Mass movements in the region can be induced by the fluvial undercutting, natural overloading of the slopes (e.g. by debris flow from above), loss of internal cohesion due to sudden saturation (as was common during June, 1990), or by human activity. Evidence of past colluviation in the region is extensive (Bobrowsky et al. 1991), and extreme caution is required in any effort to exploit or utilize river valley slopes."....Page 10

5. "Thus, all of the major terrain slopes present in the eastern Peace River Region are subject to slope failure. Extreme caution should therefore be observed in any effort to exploit or utilize river valley slopes."....Page 15

6. "Valley slopes throughout the region are subject to slope failure and colluviation, and the development of these sites should be minimized."....Page 17 summary excerpt

PUBLIC SAFETY

CA-7

These six cautionary quotes were made researching the potential for exploration or exploitation of aggregate sites in the eastern Peace River area.

These same quotes are directly pertinent to the public safety within and surrounding the proposed Site C reservoir. To date this major issue has been ignored, minimized and/or marginalized by the proponent (BC Hydro and Power Authority) and their contractors.

As ministers responsible for public safety it is your role to investigate, report, and form your respective opinions on the measures that will be taken to ensure public safety or to recommend that the proposed project is too risky in terms of ensuring public safety to be undertaken.

For your reference:
Quaternary Geology and Landforms of Eastern Peace River Region, British Columbia. commissioned by the Hon. J Weisgerber, Minister of Energy, Mines and Mineral Resources. 1991. Geological Service Branch www.empr.gov.bc.ca/Mining/Geoscience/.../1991/.../OF1991-11.pdf

Opinion from the Peace authored by Arthur A. Hadland:
Mar 12 **peace opinion**
keepingthe**peace**.files.wordpress.com/2012/.../mar-12-**peace-opinion**....

Yours truly,

Arthur A. Hadland

March 14, 2013

"...for as long as the sun shines, the grass grows and the rivers flow..."

Treaty No.8

DECLARATION on this 17th day of September 2010

of the
Doig River First Nation
Halfway River First Nation
Prophet River First Nation
West Moberly First Nations

Concerning the Proposed Site C Dam on the Peace River, British Columbia

Wǫchiigíi Yededzę? Dane Gǫdineh Yą t'a dǫh ááh? kaa

WHEREAS we, the Dunne Zaa/Dane z̲aa people of the Doig River First Nation, Halfway River First Nation, Prophet River First Nation and West Moberly First Nations are the original indigenous Nations of northern British Columbia who have a unique historical, spiritual and cultural link to the land:

- We have occupied the Peace River Valley and its tributaries, the Athabasca and Mackenzie watershed region since time immemorial ; and continue to occupy this land;
- Our ancient, sacred sites and graves of our ancestors are found throughout the Peace River Valley and its tributaries;

AND WHEREAS we have inherent, constitutional rights to continue our way of life in the Peace River region:

- We are signatories to Treaty No. 8, a peace and friendship Treaty between the Crown and each of the signatory First Nations.
- We are stewards of the land, who face industrial devastation to the land; and
- In Treaty No. 8, the Crown and First Nations agreed that the First Nation signatories "have the right to continue with our way of life for as long as the sun shines, the grass grows and the rivers flow" without forced interference as though never entered the treaty; and

The rights provided for in Treaty 8 are constitutionally recognized and affirmed by section 35 of the *Constitution Act*, 1982;

AND WHEREAS the Province of British Columbia proposes to construct and operate a major hydroelectric dam project (the "Site C Dam") on the Peace River that eliminates our ability to continue our way of life and exercise our Treaty-protected constitutional rights to hunt, trap, fish, harvesting and carry out traditional practices on the land. Construction and operation of the proposed Site C dam will, among other things, have direct and cumulative impacts that (but not limited to):

- Disrespect and destroy the graves of our ancestors
- Eliminate critical warm lowlands where both predators and prey survive harsh northern winters;
- Demolishes habitat and disrupts migration routes for bull trout and other fish species at the top of the Peace River aquatic food chain and cause them to become contaminated with mercury that poisons the traditional foods of First Nations, as happened already behind the Bennett Dam already impacting our homeland;
- Annihilate the islands in the Peace where cow moose deliver their calves Submerge key ungulate calving grounds for moose, mule deer, and elk;
- Eliminate regionally rare and important ecosystems, including old growth deciduous and mixed wood forest of the Peace, Halfway, and Moberly Rivers, riparian forests important to furbearers, habitat for red and blue listed neo-tropical migrant birds, and traditional and medicinal rare plant communities;
- Destroy more than 7000 acres of class one and class two farmland and along with it the opportunity for food security in northeast BC and other lands eliminated by erosion;
- Together with the reservoirs created by the two existing dams, create a cumulative barrier to fish and wildlife, especially grizzly bear, movement at the narrowest waist of the continentally important Yellowstone to Yukon wildlife corridor;
- Exacerbate the negative environmental impacts caused by the first two upstream Peace River dams to the Peace-Athabasca delta and other wetlands down the Peace, Athabasca and Mackenzie river watersheds through Alberta and the Northwest Territory all the way to the Arctic Ocean;
- Add 147,000 tons of carbon dioxide to the atmosphere as a result of this dam project which this government has dared call green and clean; and
- Eliminates the very land upon which our people hold annual cultural camps to maintain the heritage of our relationship between our Elders, our youth and the land that is our duty to pass on to future generations in a healthy vibrant state.

AND WHEREAS the proposed Site C Dam will have harmful environmental effects that will impact on First Nations, and all residents in the Peace River region or downstream;

AND WHEREAS it is in the interests of all British Columbians that the Peace River and its tributaries be preserved for future generations;

AND WHEREAS We, the Chiefs of the four First Nations, gathered with affected First Nations located downstream of the proposed Site C Dam, along with several environmental organizations and concerned residents of the Peace Region, at a Summit on September 16 and 17 in Fort St John, British Columbia;

WE, THE UNDERSIGNED CHIEFS AND SUPPORTERS, ON BEHALF OF OUR RESPECTIVE FIRST NATIONS, CALL UPON THE FEDERAL GOVERNMENT WHO HAS A FIDUCIARY OBLIGATION TO ALL THE FIRST NATIONS POTENTIALLY AFFECTED BY THE PROPOSED SITE C DAM TO PROTECT AND SAFEGUARD THEIR INHERENT INDIGENOUS RIGHTS AND WAY OF LIFE;

WE, THE UNDERSIGNED CHIEFS AND SUPPORTERS, ON BEHALF OF OUR RESPECTIVE FIRST NATIONS, CALL UPON THE PREMIER AND THE GOVERNMENT OF BRITISH COLUMBIA TO:

- Support and adequately fund a full, independent comprehensive cumulative assessment with a pre-industrial baseline of the proposed Site C Dam on the Peace River region and the Athabasca and MacKenzie Delta, including a full environmental and cultural assessment of the impacts of the two previously constructed upstream dams, and how and will continue to impact and affect will affect the Treaty rights and interests of the First Nations;

- Support and adequately fund a full, independent study of all viable alternative options for the production of electricity for the Province's needs;

- Halt any and all efforts of the proposed project until the completion of these full, independent studies;

- Re-instate the authority of the BC Utilities Commission to examine the true economic impacts to the people of British Columbia of constructing the Site C Dam; and

- To allow formal participation by First Nations in the decision making process concerning the proposed Site C Dam and to agree that where no agreement can be reached on the proposed Site C Dam to agree to appoint together with First Nations an impartial decision maker.

AND, FURTHERMORE, IN RECOGNITION OF THE IMPACT THAT THE PROPOSED SITE C DAM WILL HAVE ON THE LOCAL ENVIRONMENT, OUR WAY OF LIFE AND OUR ABILITY TO EXERCISE OUR TREATY RIGHTS,

WE, THE UNDERSIGNED CHIEFS AND SUPPORTERS, ON BEHALF OF OUR RESPECTIVE FIRST NATIONS, DECLARE THAT:

- We are opposed to the proposed Site C Dam;

- We vow to use all lawful means to stop the Site C Dam from proceeding; and

- We assert that the proposed Site C Dam is not "green or clean."

"...for as long as the sun shines, the grass grows and the rivers flow..."

Treaty No.8

SIGNATORIES:

Chief Norman Davis, Doig River First Nation

Chief Ed Whitford, Halfway River First Nation

Chief Lynette Tsakoza, Prophet River First Nation

Chief Roland Willson, West Moberly First Nations

FIRST NATIONS JOINED IN OPPOSING SITE C.

OTHER B.C. FIRST NATION CHIEFS:

Treaty 8

Chief Derek Orr, CHIEF
McLeod Lake Indian Band

TREATY 8 CHIEFS FROM ALBERTA:

VERBAL ASSENT
Danny Bellerose, PROXY
Driftpile First Nation

VERBAL ASSENT
Matthew Willier, PROXY
Sucker Creek First Nation

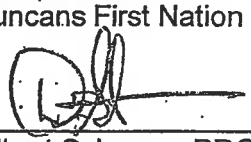
Leon Chalifoux, CHIEF
Swan River First Nation

VERBAL ASSENT
Gus Loonskin, Chief
Little Red River Cree Nation

"...for as long as the sun shines, the grass grows and the rivers flow..."

Treaty No.8

VERBAL ASSENT
Don Testawich, CHIEF
Duncans First Nation



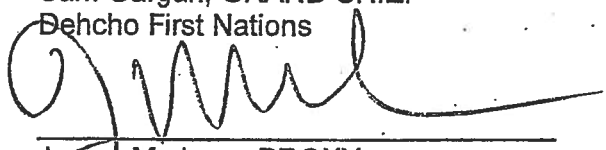
Dilbert Salopree, PROXY
Dene Tha' First Nation

VERBAL ASSENT
Rupert Meneen, CHIEF
Tall Cree First Nation

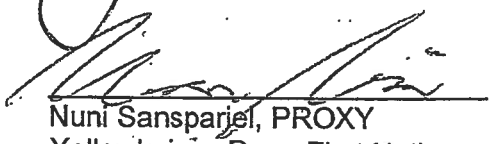
VERBAL ASSENT
Vyola Goodswimmer, PROXY
Sturgeon Lake Cree First Nation

THE FOLLOWING FIRST NATIONS ARE IN SUPPORT OF THIS DECLARATION:

VERBAL ASSENT
Sam Gargan, GRAND CHIEF
Dehcho First Nations



James Marlowe, PROXY
Lutselk'e Dene First Nation



Nuni Sansparjel, PROXY
Yellowknives Dene First Nation

PEACE RIVER REGIONAL DISTRICT

Office of: Director, Electoral Area 'C'

Revised

December 5, 2011

Honourable James Moore
Minister of Canadian Heritage and Official Languages
15 Eddy Street
Gatineau, Quebec K1A 0M5

Dear Mr. Moore:

Re: Rocky Mountain Fort and Rocky Mountain Portage House

I was pleased to hear your address to UBCM at Vancouver, BC on September 29, 2011. Your stated commitment to preserving Canadian Heritage has compelled me to draw your attention to unrecognized heritage lying within the BC Peace River.

There are two unrecognized early trading forts on the North East British Columbia section of the Peace River which warrant direct attention from your Ministry. The Peace River was designated as a BC Heritage river in the 1990's.

The Rocky Mountain Fort was established by John Finlay in 1794, as the first permanent Caucasian settlement on British Columbia's Mainland. The Rocky Mountain Portage House was constructed in 1805 by John Finlay and Simon Fraser, and was situated opposite of present day Hudson's Hope.

The Peace River was the gateway to mainland British Columbia during the 17th and 18th centuries, and was used by early explorers including Alexander MacKenzie (1793), John Finlay (1794/95), Simon Fraser (1805), John Stuart, A.R. MacLeod, David Thompson (1804) and William McIntosh, to name some.

I personally visited the Rocky Mountain Fort at the Moberly River on October 8, 2011 and question if there has been any attention given to this site since the last archaeological work in 1986/1987. Please refer to my photographs showing the palisade and the plots of the buildings.

Canadian Archives must have records showing the Rocky Mountain Fort as the first trading post established in what is now British Columbia. This information should merit it as a Federal Park status, and the Rocky Mountain Portage House should merit a Provincial Park status. The Peace Region does not have a Federal Park. This site does pre-date Fort Saint James (1806) which has a Federal Park designation.

PLEASE REPLY TO:
☐ BOX 810, DAWSON CREEK, BC V1G 4H8 TELEPHONE: (250) 784-3200 or (800) 670-7773 FAX: (250) 784-3201 EMAIL: prrd.dc@prrd.bc.ca
☒ 9505 100 STREET, FORT ST. JOHN, BC V1J 4N4 TELEPHONE: (250) 785-8084 Fax: (250) 785-1125 EMAIL: prrd.fsj@prrd.bc.ca

This historic route and the * two identified forts (reference "Prophecy of the Swan") are now threatened by B.C. Hydro and Power Authority's (BCHPA) proposed Site C dam site. The valley to be flooded by Site C also contains many pre-historic indigenous sites (traditional wintering grounds) and lies in the pathway of the Beringia Corridor which contains the 11,000 year old Charlie Lake Cave, lying 7 miles north of the proposed dam site. This last feature would probably merit an UNESCO designation.

A Stage II assessment by BCHPA does not refer to or identify these forts, nor are they identified on any provincial mapping. The only communication is that BCHPA is prepared to mitigate the permanent destruction of these valuable heritage sites. I feel it is impossible for BCHPA to mitigate these significant heritage treasures.

As Federal Minister responsible for the preservation of Canadian heritage sites would you please investigate these sites. The provincial government of British Columbia is not taking any action as they are proponents of the proposed Site C.

Your attention to this request is greatly appreciated.

Sincerely yours,

Arthur A. Hadland
Director Area 'C'
Peace River Regional District

AH/clk

NOTE: There are suggestions that there are two other unidentified trading forts lying in the BC portion of the Peace River which have not been investigated. These possibilities also need to be addressed.

cc:

Honourable Christy Clark - Premier, Province of British Columbia
Honourable Terry Lake – Minister, Ministry of Environment, Province of British Columbia
Honourable Peter Kent – Minister of the Environment
Chris Warkentin, MP – Peace River
Bob Zimmer, MP – Prince George – Peace River
Pat Pimm, MLA – Peace River North
Blair Lekstrom, MLA – Peace River South
Karen Goodings – Chair - Peace River Regional District
Dr. Harold Kalman, Historic Sites and Monuments Board of Canada
Dr. Knute Fladmark, Department of Archaeology, Simon Fraser University

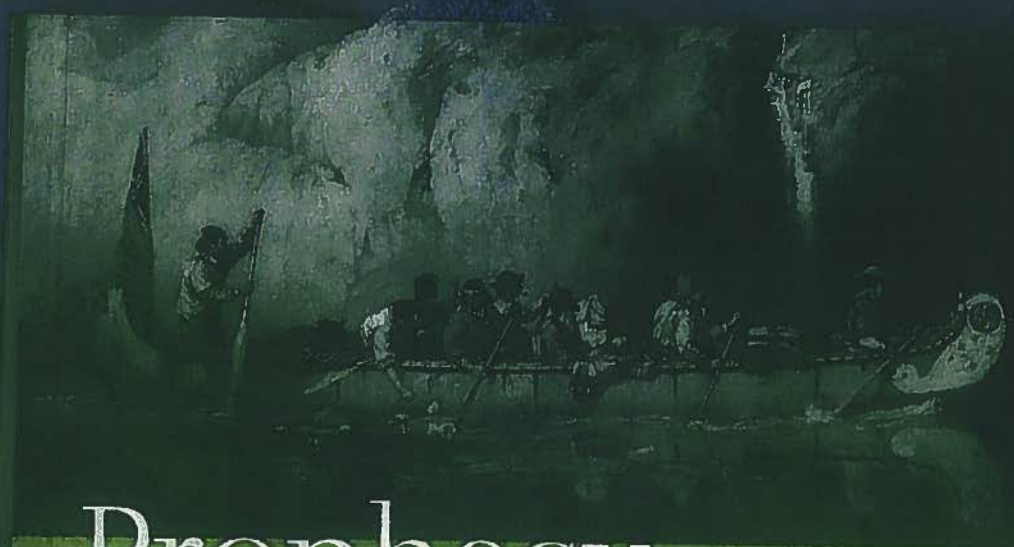
1986 PHOTOGRAPHS OF ROCKY MOUNTAIN FORT (1794)

Eastern wall trench of Rocky Mountain Fort

Western wall trench of Rocky Mountain Fort

Layout of building structures plot of Rocky Mountain Fort

March 14, 2013



Prophecy of the Swan

The Upper Peace River Fur Trade of 1794–1823

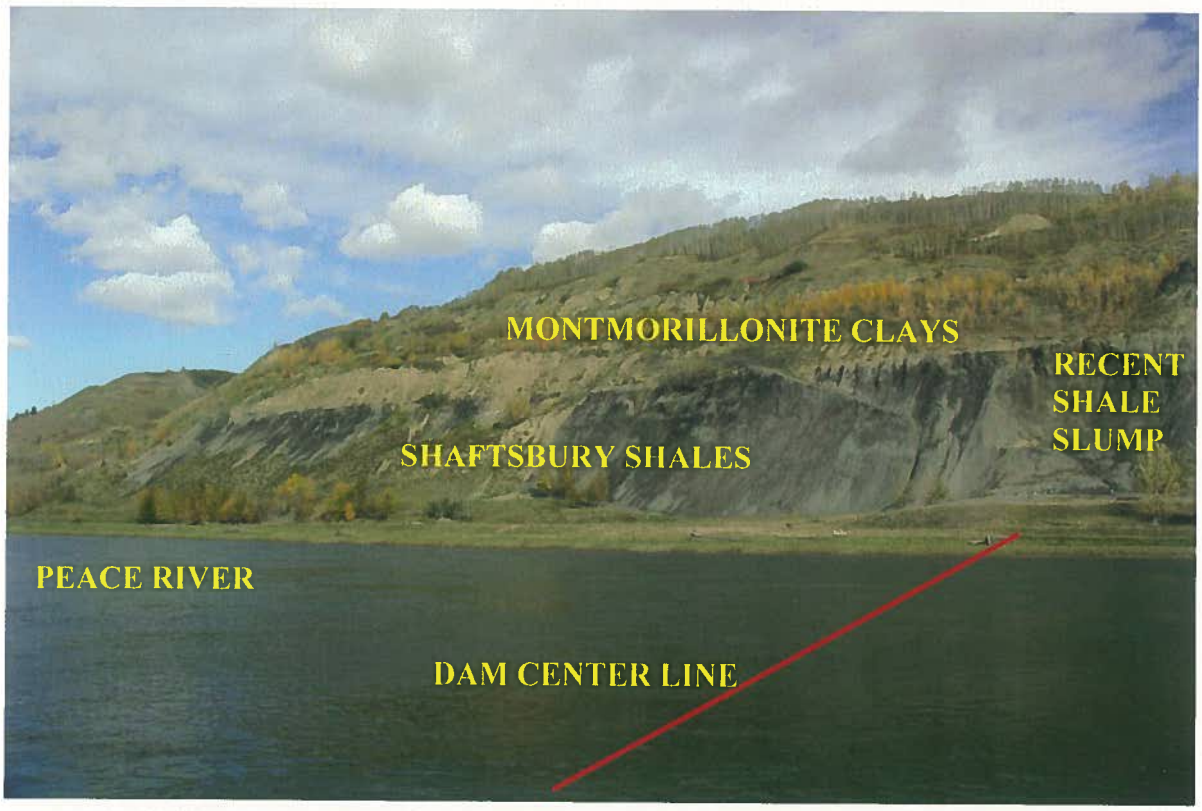
David V. Burley,
J. Scott Hamilton, and
Knut R. Fladmark

Opinion from the Peace

Proposed Site C would destroy a productive river valley equal to the distance from Vancouver to Chilliwack. Would you like this project in your back yard? Do you think this flooding could be considered green and clean!!!

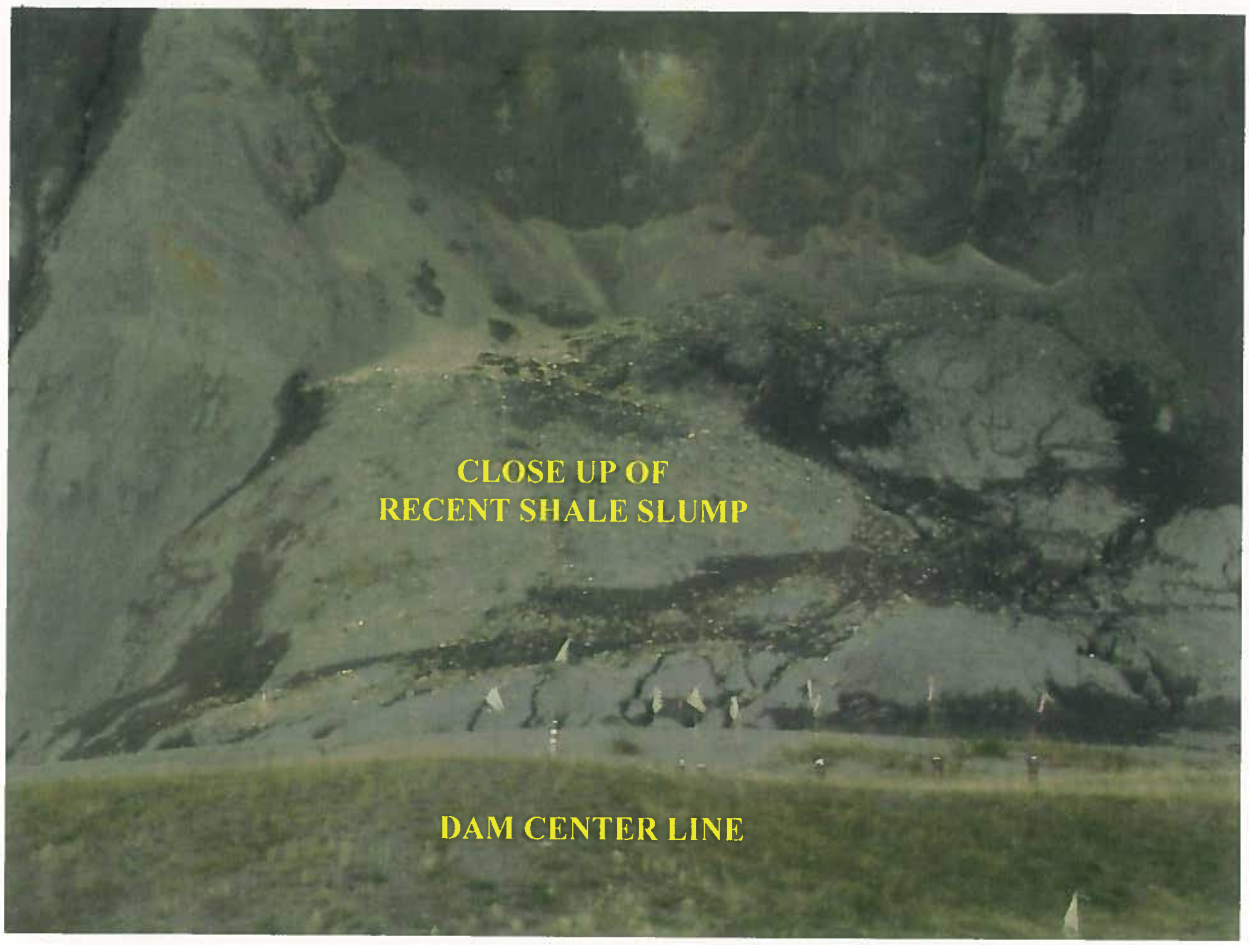
The lack of transparency by the Provincial government regarding the proposed flooding of the Peace River will commit BC citizens to participating in British Columbia's Environmental Disaster of the 21st Century. In order to emphasize this statement please refer to the following information.

The reader should note that the first two dams on the Peace (WAC Bennett and Peace Canyon) are imbedded in bedrock and not in sedimentary material such as exists at proposed Site C.



This photo shows an overview of the proposed Site C dam axis with the very unstable Montmorillonite clays perched on top of the Shaftesbury shales. As long as these shales and clays are dry they remain stable. However, there is no way of guaranteeing they will remain dry. Man does not have control over the periods of heavy rain that can occur.

March 14, 2013

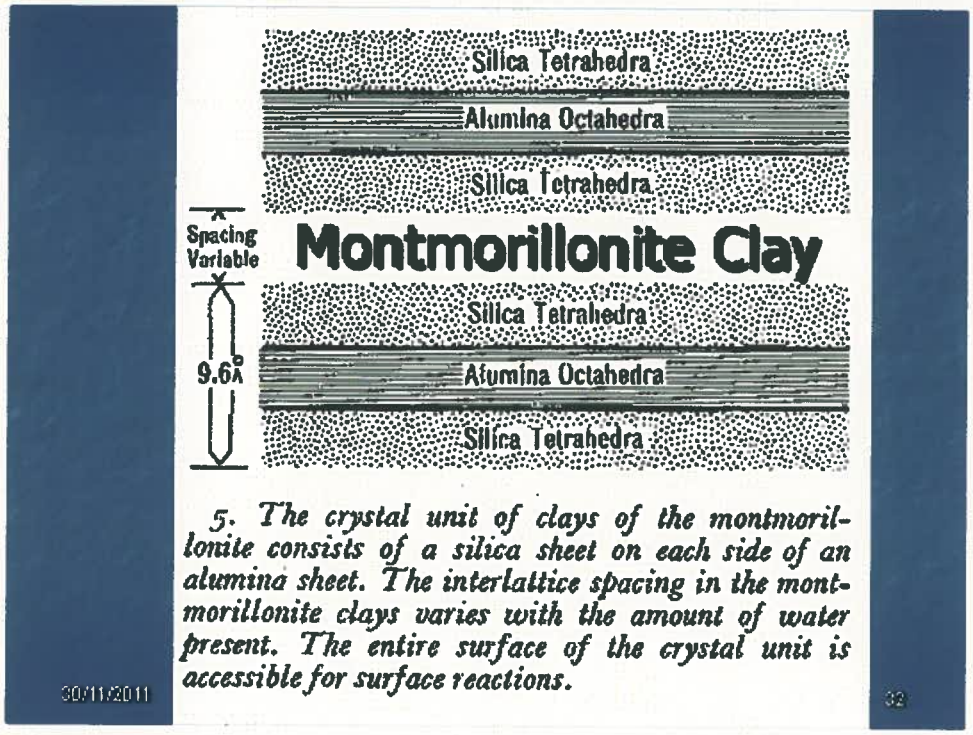


This 2011 photo shows the recent slide of the sedimentary rock (Shaftsbury shales) lying above the axis of the proposed Site C dam site. This shale slump (slide), directly on the centerline of the proposed Site C, occurred sometime during the last 24 months and has buried the exploratory adit (mine or tunnel) that was constructed by BC Hydro (BCHPA) in the late 1970s. This failure of the shale substrate parallels the causes of the Peace River Bridge failure in 1957. The other numerous slope failures along the River Valley can likely be attributed to the wetting of the Montmorillonite clay soils overlying this shale base.

It is interesting to note that there is no known reference in any of the engineering reports referring to or acknowledging the presence of Montmorillonite clay soils and their unique characteristics. These characteristics contribute to the unstable shorelines and breaks all along the lower Peace River valley.

A detailed explanation of Montmorillonite clay follows on the next page.

The structure of Montmorillonite clay (excerpted from US Department of Agriculture Yearbook 1957, pg. 34):



The wetting of these unconsolidated materials with water causes the thin plates to separate. When the platelets are on an inclined plane the coefficient of friction is reduced to the point where they will slide due to gravitational forces. The Attachie Slide in 1973, the BCR hill in the 1980s, and the Big Bam ski hill slide in 1996 are all examples of this phenomenon. Numerous other slides in earlier eras are located all along the undisturbed valley slopes. Any human disturbance in combination with high rainfall events exacerbates the slumping process along the edges of the Peace River Valley. There were extremely high rainfall years preceding the bridge collapse (1957), the Attachie slide (1973), and the ski hill failure (1996).

Aerial view of the Attachie Slide May 26, 1973 which dammed the Peace River for approximately 10 hours. This site is within the proposed Site C reservoir.

The proceeding discussion illustrates why the following comments were made by the BCHPA engineering contractor firm: Pg. 9 Klohn Crippen Berger and SNC-Lavalin September 2009 Report

http://www.bchydro.com/energy_in_bc/projects/site_c/document_centre/stage_2_reports.html
"..the uncertainties in predicting both the extent and rate of the shoreline impacts lead to the proposal to adopt an observational approach for periodically reviewing and updating the reservoir impact lines after the reservoir has been filled."

This proposal by a professional engineering firm should have had the proponents' (BC Gov't) hair standing on end and basically been a show stopper. Now it is doubtful that there will be any further objective analysis, as it appears that this firm has now taken an advocacy role. It is interesting to note that Gwyn Morgan, Chairman of SNC Lavalin is now the energy advisor to the Premier of BC, Christy Clark.

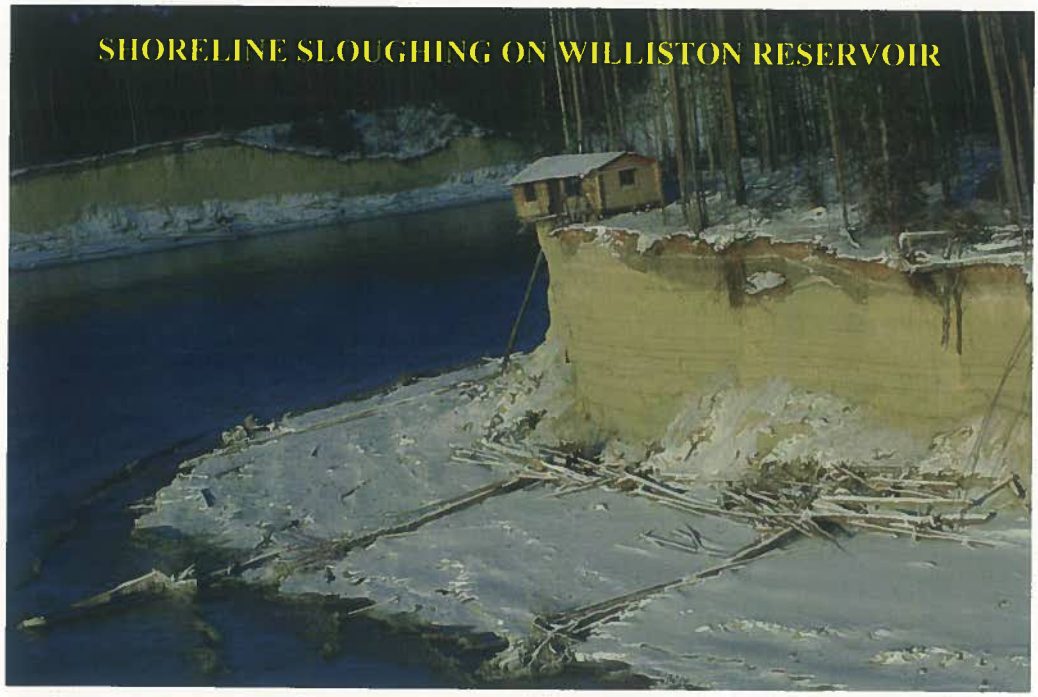
From the Thurber 1976 report on proposed Site C:
"The preliminary "safeline" is a conservatively located line above which the security of minor physical facilities, particularly dwellings, can be assured. It is based only on probable effects of the reservoir upon slope stability with causes unrelated to reservoir action being excluded. The safeline is not to be confused with the probable limit of erosion or sloughing(sometimes called the "breakline"), which does not allow for any margin of safety, or with the "takeline" which is a line used to designate land to be purchased or restricted, as a result of development."

These lines have not been defined for the proposed Site C reservoir. **WHY NOT?**

BCHPA needs to be compelled to define these lines within the proposed reservoir prior to advancement of this project. If they are unable to undertake this task then it is suggested that this project cannot proceed any further as a fiduciary responsibility to the citizens of BC is implicit in this utility's (BCHPA) mandate.

It is also interesting to note that a small area near the WAC Bennett dam was mapped, defining a SAFELINE in the early 1970s. That line has since been exceeded in many places by the sloughing shoreline of that reservoir. The soils in this particular area are sandy and silty loam and have a different failure pattern as compared to the montmorillonite soils that are predominant in the proposed Site C reservoir. The following photo (from 2009) of a cabin lying on the expanding shoreline of the Williston Reservoir illustrates the inability of engineering technologies to accurately predict shoreline impacts along reservoir perimeters. Please note that the expansion of this shoreline perimeter still continues, some 42 years after the impoundment of the Williston Reservoir.

CA-7



This site is approximately 8 miles west of the WAC Bennett dam. This cabin was built in 1976, at that time, the shoreline of the Williston reservoir was one third of a mile away from the cabin site. The cabin was built on the safe side of the defined safeline, 33 years prior to that picture being taken. Today this cabin is no longer there.

These factors are all contributing to and reinforcing common sense observations that to proceed with further reservoir construction within the sedimentary basin of the lower Peace River is to create an environmental mess of unknown magnitude.

BC Hydro is on slippery ground in more ways than one. Citizens are encouraged to find out more about BC Hydro's $13.5 Billion debt, deferral payments on unknown debt, plus the total debt commitment due to Independent Power Producers [rumoured to be 30+ Billion]. Citizens need to take back their ownership of their Public Utility. Ask yourself why the BC Utility Commission is not involved in this process.

The alternate energy equivalent of 6 Site C's can be built for the projected $8 Billion cost.

Destroying a river valley is neither clean nor green.

Submitted by
Arthur A. Hadland

Arthur Hadland is a farmer, consulting Agrologist and Peace River Regional District Area C Director.

March 14, 2013

The Association of
PROFESSIONAL ENGINEERS AND GEOSCIENTISTS
of the Province of British Columbia
PEACE RIVER BRANCH

The 1957 Peace River Bridge Collapse, Taylor BC

Did you know that one of Canada's most costly landslides occurred right here in the Peace River region? At a cost of 60 million dollars to dismantle and replace the collapsed Peace River bridge near Taylor, BC, the landslide that destroyed that bridge remains probably the costliest ever. This bridge collapse illustrates the important linkage between engineering and geosciences in the Peace River region.

The original bridge was built in 1942 by the US Public Roads Administration as part of the wartime construction of the Alaska Highway. At the time of its opening it was considered one of the great bridges in the Dominion of Canada. The bridge was a suspension type bridge. The length of the bridge was 647 m. At the time of the bridge collapse (October 16, 1957), the highway was part of the Northwest Highway System under the authority of the Government of Canada. The Princess Patricia's Canadian Light Infantry, based out of Whitehorse, Yukon, was responsible for the maintenance of the bridge and highway.

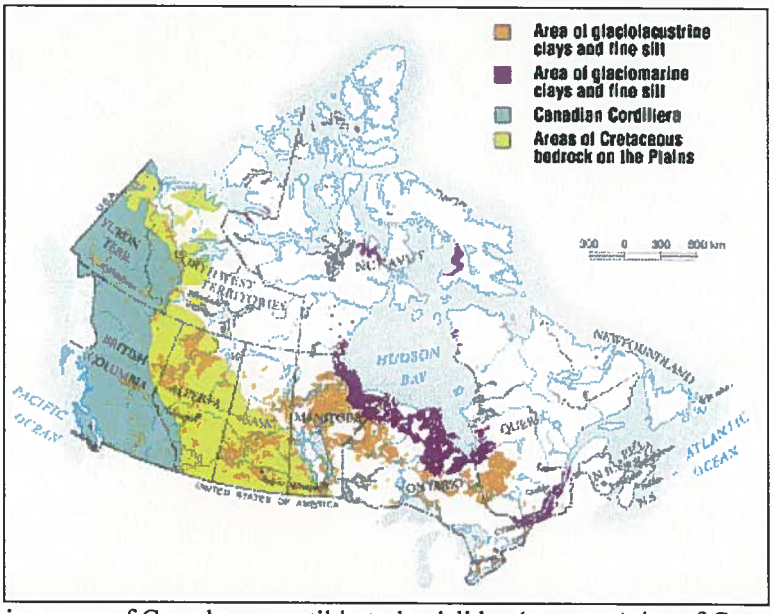
The suspension bridge over the Peace River near Taylor BC (1942 to 1952)

Movement of the bridge's north abutment was first noticed in 1952. A survey was conducted to monitor this movement. The survey was re-done in early October 1957 following a season of higher than normal precipitation (rain and/or snow). The survey showed that bridge structures at the north end of the bridge had moved. Cracks in the road leading to the bridge were also noticed. On October 15, 1957, an alert truck driver noticed unusual settlement in the road. Upon inspection, the army immediately closed the road. Throughout that evening, slow but continuous movement of bridge structures were observed. By just after noon on October 16, the bridge collapsed.

Later investigations found that the bridge failed due to a landslide in the shale bedrock beneath the bridge. A landslide is the down-slope movement or rock or sediment under the influence of gravity. The landslide was about 330 metres wide and extended some 35 metres off shore. The offshore extent of the landslide was indicated by a pressure ridge that stuck out above the water. A pressure ridge looks similar to a ridge pushed up by a bulldozer.

A landslide destroyed the bridge on October 16, 1957. The landslide was in Cretaceous shale.

At the time of construction, little was known about the problems with building on the shale rock type found in the region. Geologists call this shale the Shaftesbury Formation. The shale began as mud that was deposited on a sea floor during the Cretaceous period (65 to 144 million years ago), when dinosaurs walked the earth. At that time an inland sea occupied a large portion of North America. With time, the mud eventually became rock (shale). However, these rocks are very weak and quickly turn back into mud when they are near the surface and when they are exposed to water.



Major areas of Canada susceptible to landslides (source: Atlas of Canada)

Valley slopes in the Peace River region are susceptible to landslides because of the nature of the rocks and sediments that are found in the area. Building in the valleys can make this situation worse. It is now believed that deterioration of the stability at the site of the Peace River bridge likely began soon after the bridge was first constructed and continued for a number of years afterwards. However, the final trigger for the landslide was probably high precipitation.

More to Explore

Hardy, R.M. 1963. The Peace River Highway Bridge – A Failure in Soft Shale. Highway Research Record, 17, pp. 29-39.

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another 100 years? In 1000 years? Will we still have enough land and water for agricultural use?

Soil

Only a small percentage of the land in British Columbia has been classified as agricultural, and much of this is not yet in use. Taking Canada as a whole, however, a very high percentage of the agricultural land is already under cultivation. Most of the increase in food production that we will need will have to come from an increase in production per acre. This can be accomplished by more and better irrigation, more and better use of fertilizers, improved breeds and varieties, better control of insects, diseases and weeds, and better farm management. Even conceding this, however, we still cannot afford to lose our present and potentially arable land from agriculture.

The greatest danger to our agricultural land in British Columbia is loss from urban sprawl. We see it especially in the southwestern corner of the province and in the Okanagan Valley. So far, this urban sprawl has been practically uncontrolled. The Okanagan Valley is, of course, a fine place in which to live, and this fact is being used to attract people from the less attractive parts of Canada. Such people are flowing in like lemmings and may eventually urbanize this whole area. Since 1945 our population here has doubled.

It may not be desirable or possible to stop this inflow. Something might be done, however, to place homesites on land that is not suited to commercial agriculture. A public authority on zoning should replace the present laissez-faire procedure, so that we can have properly planned urbanization. This is being done successfully in Great Britain. If we do not prevent this urban sprawl we will, in 100 years, be living in the valleys and farming the mountains.

There is great danger also of losing large tracts of agricultural land to forests, to reservoirs for water power, or to parks and campsites.

We believe that as far as possible all agricultural land in the province should be saved for the future needs of agriculture. However, the needs of agriculture are not pressing at present. Perhaps we can forego agricultural use of portions of this land for the time being, as long as they can be returned to agriculture later.

It is our suggestion, therefore, that other uses than agriculture can be entertained *on a temporary basis* for agricultural land. In such cases the land should be considered to be only *on loan* from agriculture.

If the High Arrow dam is built, about 23,000 acres of agricultural land will be covered with water. If this is done, it should be clearly understood that when land becomes too scarce it might be considered advisable to drain the reservoir and use the land again for agriculture. Fortunately, long immersion will not destroy the usefulness of the land for agriculture. In some cases it may even improve it if sediments help to deepen the soil or level the soil surface. This will, of course, not apply if international agreements prevent review of the situation at some future date. We are then, not opposed to development of reservoirs for any purpose as long as no more