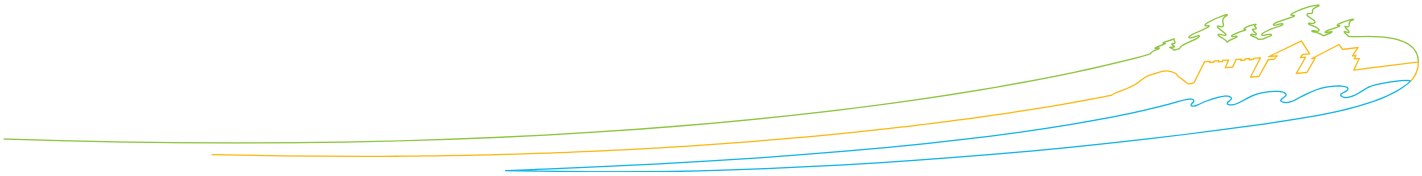
Parks Canada Parcs Canada



Parks Canada's Submission to the Joint Review Panel for BC Hydro's Site C Clean Energy Project

Submission of Parks Canada Agency November 25, 2013

Canada

Signed on behalf of Parks Canada Agency:

Original signed by
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Rob Kent
Field Unit Superintendent
Southwest Northwest Territories Field Unit
Parks Canada

November 25, 2013
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Date

Executive Summary

On November 19, 2013, the Joint Review Panel (JRP) wrote to the Parks Canada Agency (PCA) requesting the department's participation in the public panel hearings for the Site C Clean Energy Project (the Project). The JRP requested that PCA provide a written submission on the potential effects of the Project based on the agency's mandated areas of responsibility and expertise.

For projects that require a federal environmental assessment, the Parks Canada Agency (PCA), as a Federal Authority (FA), provides specialist or expert information or knowledge on environmental matters in accordance with the expertise that the department has available as it relates to PCA's mandate and responsibilities, and in accordance with sections 20 and 67[1] of the *Canadian Environmental Assessment Act, 2012* (hereafter CEAA 2012).

PCA is mandated to protect and present nationally significant examples of Canada's natural and cultural heritage and foster public understanding, appreciation and enjoyment in ways that ensure their ecological and commemorative integrity for present and future generations. Wood Buffalo National Park (WBNP) protects 80% of the Peace-Athabasca Delta (PAD), a Ramsar Wetland of International importance and one of the key features contributing to WBNP's designation as a World Heritage Site. Nonetheless, the PAD is vulnerable to environmental impacts that originate external to the boundaries of WBNP, and "is a clear example where cumulative effects have generated ecological change on a landscape scale" (Mackenzie River Basin Board, 2012).

PCA's submission focuses on issues related to surface water hydrology and the thermal ice regime in the Peace River. Flow regulation of the Peace River, as a result of the construction and ongoing operation of the W.A.C. Bennett and Peace Canyon dams by the British Columbia Hydroelectric and Power Authority (BC Hydro), has altered the surface hydrology of the flood-dependent PAD ecosystem (Peters and Buttle, 2009; Prowse et al., 2006). With respect to the Site C Clean Energy Project (Project), PCA has no decision-making or permitting role. PCA does however possess expert advice it feels is relevant to the review of the Project with respect to potential cumulative effects on the Peace-Athabasca Delta (PAD). This Written Submission presents PCA's views on the Project and its environmental effects as they relate to our mandate, based on the information currently available as contained in the Site C Clean Energy Project Environmental Impact Statement dated January 25, 2013 (the EIS), amended EIS, BC Hydro Technical Memo's and Information Request (IR) responses, the published and unpublished literature, and PCA's expertise on cumulative effects assessment and working knowledge of the lands and waters in the PAD within WBNP.

PCA has not provided detailed comments on the impact analysis within the Local Assessment Area (LAA) or Regional Assessment Area (RAA) as both of those areas as defined in the EIS do not include the PAD. PCA has participated in a federal review team working group looking at the downstream effects of the Project. PCA has provided rationale for why it considers comprehensive assessment of cumulative effects to be important to the environmental assessment review of the Project. These are detailed in the main body of this submission document. The supporting arguments focus on PCA's mandated responsibilities to manage for ecological integrity (EI) in WBNP, and more specifically the portion of the PAD within the park.

[1] Section 67 CEAA 2012 directs federal authorities to manage federal lands in a manner to avoid causing significant adverse environmental effects.

From the start of PCA's involvement in the EIS review of the Project, PCA has advocated for a comprehensive CEA of the flow regulation impacts to Peace River downstream environments up to and including the PAD, as part of the impact assessment. PCA documents on the Canadian Environmental Assessment Registry (CEAR) document this. PCA remains of the view that assessing the incremental effects of the Site C project is a rational approach for construction phase of the project, but not for operational phase. It is PCA's view that the assessment of impacts from the operational phase of Site C should include consideration of the impacts of sustained, ongoing operations of all three Peace River dams managed by BC Hydro.

In an effort to comprehensively assess and consider cumulative effects, PCA recommends to the JRP that the scope of the cumulative effects assessment include Peace River flow regulation impacts from all three dams on the downstream environment up to and including the PAD.

Although a range of views exists regarding the degree to which flow regulation on the Peace River has negatively impacted the PAD, it has been established that it has measurably affected the seasonal distribution and magnitude of Peace River flow, and as a consequence has reduced the frequency and magnitude of summer flood events at the PAD (Peters and Buttle, 2009). Flow regulation, in concert with climate effects, has also reduced the frequency and magnitude of ice jam flood events in the far downstream Peace River environments including the PAD area. Efforts to mitigate these impacts through outflow weir construction (PADIC, 1987) and strategic, periodic flow releases by BC Hydro to augment ice-jam flooding (such as in spring, 1996) attest to this. PCA suggests that the downstream boundary of the surface water regime study should extend beyond Peace Point and include the PAD. In other words, the study boundary should be determined by the cumulative effects of flow regulation from the three Peace River dams managed by BC Hydro, and not by the anticipated surface hydrology impacts of the Site C project alone. This would ensure a more comprehensive CEA, while adopting a precautionary approach that fully incorporates all relevant factors into the impact analysis and decision-making for the Site C project.

PCA's recommendations are summarised in Section 5.0 of this written submission.

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List of Abbreviations and Acronyms

AB	Province of Alberta
ABMI	Alberta Biodiversity Monitoring Institute
ACFN	Athabasca Chipewyan First Nation
BC	Province of British Columbia
BC Hydro	British Columbia Hydro and Power Authority
BCEAA	British Columbia *Environmental Assessment Act*
BC EAO	British Columbia Environmental Assessment Office
CBM	Community-Based Monitoring Program
CEAA	*Canadian Environmental Assessment Act*
CEA Agency	Canadian Environmental Assessment Agency
CEA	Cumulative Effects Assessment
CEAR	Canadian Environmental Assessment Registry
CEMA	Cumulative Environmental Management Association
cms	Cubic meters per second
EA	Environmental Assessment
EC	Environment Canada
EIS	Environmental Impact Statement
FA	Federal Authority
ha	Hectare
IR	Information Request
IUCN	International Union for the Conservation of Nature
JRP	Joint Review Panel
Km	Kilometre
Km^2	Square Kilometre
LAA	Local Assessment Area
LUF	Land-use Framework
m	Metre
MCFN	Mikisew Cree First Nation
MPMO	Major Project Management Office
NWT	Northwest Territories
park	Wood Buffalo National Park
PCA	Parks Canada Agency
PAD	Peace-Athabasca Delta
PADEMP	Peace-Athabasca Delta Ecological Monitoring Program
PADIC	Peace-Athabasca Delta Implementation Committee
Project	Site C Clean Energy Project
RAA	Regional Assessment Area
SARA	Species at Risk Act
T8TA	Treaty 8 Tribal Association
TC	Transport Canada
TK	Traditional Knowledge
UNESCO	United Nations Environmental, Scientific and Cultural Organization
VC	Valued Component
WBEA	Wood Buffalo Environmental Association
WBNP	Wood Buffalo National Park

1.0 INTRODUCTION

The objectives of the Parks Canada Agency's (PCA's) written submission to the Joint Review Panel (JRP) are to:

1. identify components of the Project that are relevant to PCA's mandate and expertise; and
2. comment on the analysis provided in the EIS review process relevant to PCA's mandate and expertise.

PCA has participated in the environmental assessment (EA) process evaluating the British Columbia Hydro and Power Authority's (BC Hydro) proposal to construct and operate the Site C Dam Clean Energy Project (Project) on the mainstem of the Peace River in northern British Columbia. The details of PCA's involvement in the Pre-Panel stages of the review process are summarized in the text box directly below.

Timeline Summary of Parks Canada's written submissions during the Pre-Panel Stage of the Site C Clean Energy Project EA Review

June 17, 2011: PCA letter to CEAA confirming that PCA will provide advice pursuant to section 12(3) of the Canadian Environmental Assessment Act 1992 (CEAA 1992) that is consistent with Parks Canada's recognition in the CEAA Reference Guide, Involving Expert Federal Authorities, as an expert federal authority in: cultural resources; historical, archaeological, paleontological and architectural resources; management of protected areas, national parks, national historic sites, historic rivers and heritage canals. Not listed on the Canadian Environmental Assessment registry (CEAR).

June 8, 2012: PCA submits comments on draft EIS Guidelines to CEAA; comments focus on characterization of residual effects, cumulative effects assessment methodology, need for inclusion of the Peace-Athabasca Delta (PAD) in Regional Assessment Area. CEAR Doc #344.

July 11, 2012: PCA submits comments by email to CEAA "Parks Canada Agency Comments on BC Hydro's Responses to Public, Aboriginal and Government Agency Comments on Site C Draft Environmental Impact Statement (EIS) Guidelines." Comments focus on cumulative effects assessment methodology, need for inclusion of the PAD in Regional Assessment Area, establishing a technical committee dedicated to defining ecological flow needs for lower Peace River and PAD, and identifying mitigation measures for impacts (past, present and future) on the Peace River and downstream ecological values. CEAR Doc #385

April 4, 2013: PCA letter to Major Projects Management Office (MPMO) submitting PCA's comments on the draft Site C Environmental Impact Statement. These comments focused on characterization of residual effects, need for comprehensive cumulative effects assessment methodology that includes impacts of low regulation from existing Peace River dams, need for inclusion of the PAD in Regional Assessment Area. These comments were submitted April 4th, 2013 to BC Hydro, and BC Hydro responded April 29th, 2013. CEAR Doc# 922.

June 28, 2013: PCA provides CEAA with PCA responses to BC Hydro responses to PCA's comments on the EIS (in form of tracking table and a covering letter). Comments reiterated need for comprehensive cumulative effects assessment of Peace River flow regulation and stated that BC Hydro's responses to PCA's April 4, 2013 comments were incomplete and did not fully address the cumulative environmental effects assessment needs that had been identified. CEAR Doc #1486

At all Pre-Panel stages of the review process, PCA has stated the need for a comprehensive cumulative effects assessment that includes consideration of the impacts of the Site C Project coupled with BC Hydro's ongoing flow regulation on the Peace River environments downstream of the W.A.C. Bennett and Peace Canyon Dams. PCA has also recommended further explorations into the feasibility of mitigating existing and proposed flow regulation impacts up to and including the Peace-Athabasca Delta (PAD).

This submission summarizes PCA's views based on information provided by BC Hydro within its application to the Government of Canada and the British Columbia Environmental Assessment Office (BC EAO), the supplemental information provided in response to review comments from PCA and others, and additional information submitted by BC Hydro throughout the EA review process. If any new information is brought forward, the conclusions and recommendations provided in this submission may be reconsidered and amended accordingly.

PCA's main interest in the Site C dam project is the potential of BC Hydro's Peace River flow regulation operations impacting the ecological integrity (EI) of the portion (80%) of the Peace-Athabasca Delta (PAD) within Wood Buffalo National Park (WBNP). PC's comments are therefore submitted from the perspective of how BC Hydro's operational management of all three dams (assuming the Site C is approved and built) on the Peace River, will impact the hydrograph and flow rates on the Peace River downstream of the dams, and the consequent downstream expression of these effects in the PAD. Rationale that supports the needs for a comprehensive assessment of the cumulative effects of BC Hydro's Peace River flow regulation on downstream environments including the PAD is provided.

2.0 PCA MANDATE

PCA fulfils its mandate through the management and administration of Canada's national heritage protected areas networks, which preserve and present the rich diversity of Canada's natural and cultural heritage to the benefit of Canadians and visitors from around the world. PCA derives its mandate from several pieces of legislation – *Parks Canada Agency Act; Canada National Parks Act; Canada National Marine Conservation Areas Act; Historic Sites and Monuments Act*; and the *Species at Risk Act*. In delivering this mandate, the Agency is also responsible for the development and implementation of policies, international agreements and related programs. Relevant legislation and policies and conventions administered or adhered to by PCA that influenced the content of this submission are briefly described below to provide context for PCA's legislated and policy based obligations.

2.1 Parks Canada Agency Act

Parks Canada is an Agency of the federal Government, formally established under the *Parks Canada Agency Act* (1998, c.31). The mandate of the PCA is defined by this Act, and states:

"On behalf of the people of Canada, we protect and present nationally significant examples of Canada's natural and cultural heritage, and foster public understanding, appreciation and enjoyment in ways that ensure the ecological and commemorative integrity of these places for present and future generations."

The *Parks Canada Agency Act* states it is in the national interest to carry out Canada's international obligations and agreements to protect, conserve and present that heritage and to contribute towards the protection and presentation of global heritage and biodiversity. This is an important obligation for WBNP as it is responsible for management of a UNESCO World Heritage Site, and a RAMSAR wetland of international importance (the PAD).

2.2 Canada National Parks Act

The *Canada National Parks Act*, passed in 2000, modernized Parks Canada's historic role and affirmed ecological integrity (EI) as the Agency's first priority when considering all aspects of national park management.

As defined in section 2 of the *Canada National Parks Act*, ecological integrity means, with respect to a park:

"...a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes."

While EI is the objective for park management, ecosystem management is the process used to achieve that outcome. Improvement of levels of EI in the PAD is a critical goal for PCA in WBNP as described in the Wood Buffalo National Park of Canada: State of the Park Report 2009 (Parks Canada 2009), and the Wood Buffalo National Park of Canada: Management Plan. (Parks Canada 2010).

2.3 Parks Canada Guiding Principles and Operational Policies

Parks Canada Guiding Principles and Operational Policies (Canadian Heritage. Parks Canada. 1994) provide context for the management of park ecosystems including collaboration with other land management agencies to develop a better understanding of the relationship between existing land use practices and their effects on the natural environment. In particular, section 3.2.14 of the Guiding Principles and Operational Policies states that:

> "Parks Canada will participate in environmental impact assessments for proposed developments outside national parks that may affect park ecosystems".

2.4 Canadian Environmental Assessment Act 2012 (CEAA 2012)

PCA is a Federal Authority (FA) pursuant to *Canadian Environmental Assessment Act 2012* (CEAA 2012) for the proposed Project. Section 20 of the CEAA 2012 sets out PCA's FA responsibilities as follows:

> "20. Every federal authority that is in possession of specialist or expert information or knowledge with respect to a designated project that is subject to an environmental assessment must, on request, make that information or knowledge available, within the specified period, to
>
> (a) the responsible authority;
> (b) the review panel;
> (c) ....."

The scope of specialist or expert information or knowledge provided by PCA in this submission to the Panel is within our mandate as defined by the relevant legislation, policies and conventions administered or adhered to by the PCA.

3.0 WOOD BUFFALO NATIONAL PARK

A World Heritage Site

Wood Buffalo National Park (WBNP) spans the boundary of Alberta and the Northwest Territories (NWT) (Figure 1). Encompassing an area of 44,807 square kilometres, WBNP is Canada's largest national park and the second largest national park in the world. WBNP was originally created in 1922 to protect the last free roaming herds of wood bison in Canada. The park was later designated a UNESCO World Heritage Site pursuant to the World Heritage Convention. World Heritage Sites are designated to protect those parts of cultural and natural heritage that are of outstanding interest and therefore need to be preserved as part of the world heritage of mankind as a whole. WBNP's globally significant natural features include:

- the world's largest population of threatened wood bison;
- the only breeding habitat in the world for the whooping crane, an endangered species brought back from the brink of extinction through careful management of the small number of breeding pairs in WBNP;
- the most ecologically complete and largest example of the entire Great Plains-Boreal grassland ecosystem of North America;
- great concentrations of migratory wildlife that are of world importance;
- rare and superlative natural phenomena that are internationally significant, including salt plains, an extensive gypsum karst landscape, and one of the world's largest inland deltas, the Peace-Athabasca Delta (PAD).

WBNP is also a homeland of the Aboriginal people of north eastern Alberta and the southwestern NWT. The park protects important natural systems and species that allow Aboriginal people to maintain their traditional life-ways and cultural connection to the land, and

to exercise their Treaty 8 rights and asserted Métis rights. The PAD is particularly important to the Aboriginal people of the community of Ft. Chipewyan.

Figure 1: Location of Wood Buffalo National Park and Peace-Athabasca Delta. (Source: Parks Canada)

3.1 The Peace-Athabasca Delta

The PAD is located where the Peace, Athabasca, and Birch Rivers converge at the western end of Lake Athabasca (Figure 2). At approximately 5000 km^2, the PAD is one of the world's largest freshwater deltas. Eighty percent of the PAD is located within WBNP, and the delta drains nearly 600,000 km^2 of northern British Columbia, Alberta and Saskatchewan.

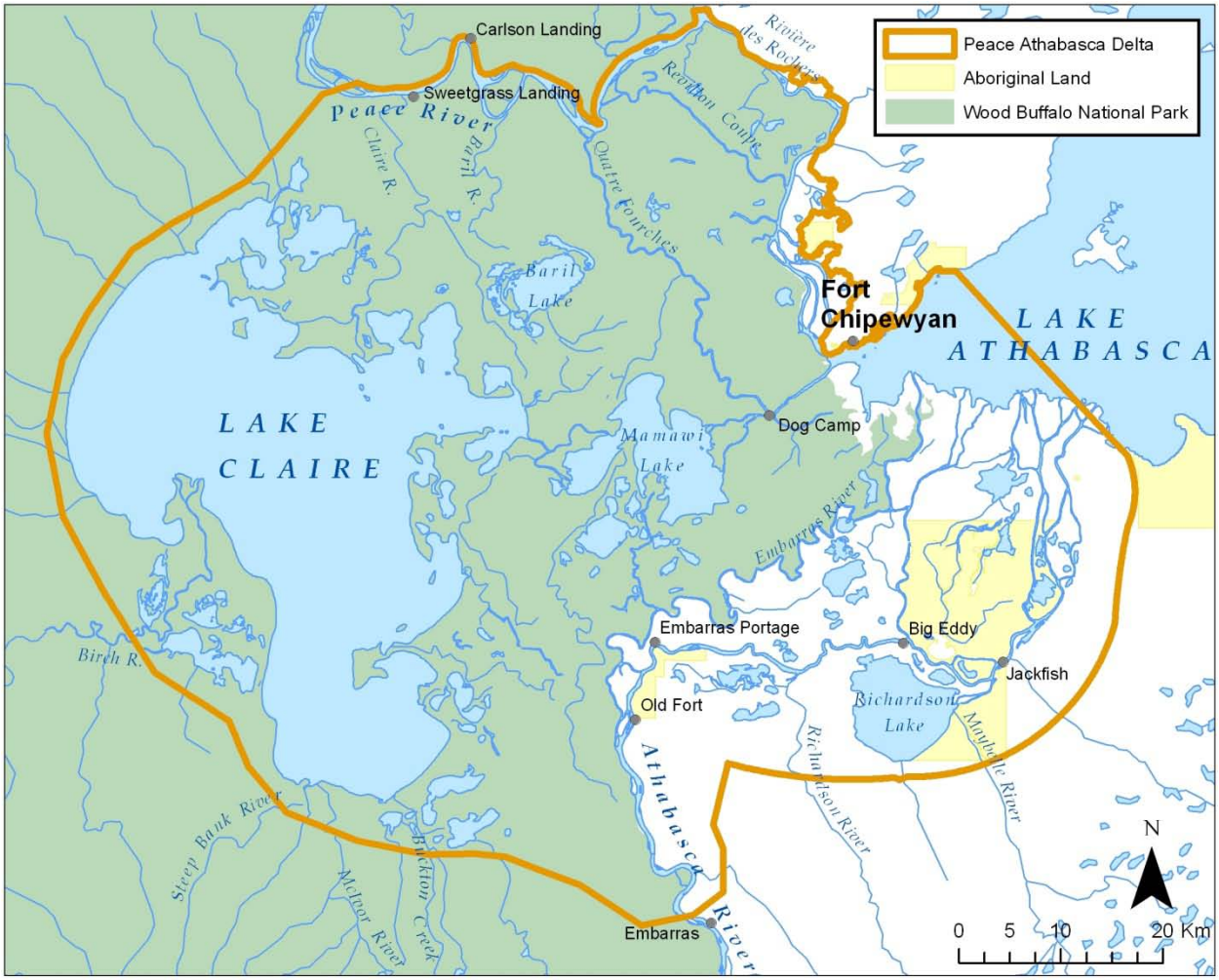

Figure 2: The Peace-Athabasca Delta. (Source: Parks Canada).

A Wetland of International Importance

The PAD is one of the most diverse ecosystems within the province of Alberta and all of Canada. The combination of flat topography, nutrient enriched flood plain, shallow water and abundant sunshine throughout the growing season results in the delta having an extremely high level of primary productivity that provides the basis of a rich food web. Previous inventory work completed on the PAD identified 11 different habitat types containing over 250 species of vascular plants (Environment Canada 2001). The PAD is also home to a vast array of fauna, including 215 species of birds, 42 species of mammals, 20 species of fish and countless invertebrates (Adams 1998). These species represent vital resources for the local First Nation and Métis people who hunt, trap and fish in the PAD, a place they have continuously inhabited for centuries.

The PAD can rightfully be considered the key, foundational element underpinning WBNP's designation as a World Heritage Site. The PAD's vast sedge meadows provide crucial habitat for

Species At Risk Act (SARA[2]) listed species including WBNP's wood bison population (SARA status threatened), and its extensive wetlands supply rich nesting and staging habitat for globally significant migratory bird populations, including the endangered Whooping Crane.

In recognition of its contribution to global biological diversity, the PAD has been designated a *Wetland of International Importance* pursuant to the Ramsar Convention, an inter-governmental treaty adopted in 1971 by countries concerned about the increasing loss and degradation of wetland habitat for migratory birds. The designation of Ramsar sites focuses on the protection of critical habitat for migratory birds and areas of international significance in terms of ecology, botany, zoology, limnology and hydrology. As a signatory to the Convention, Canada commits to designating Wetlands of International Importance and to ensuring their effective management. Refer to Appendix 1: Listing for Peace-Athabasca Delta in The Annotated Ramsar List of Wetlands of International Importance, for a more detailed description of the PAD wetland values.

A Flood-Dependent Ecosystem

Because the PAD landscape is extremely flat, a slight increase in water level results in a massive increase in wetted area. PAD water levels are influenced by many factors including local climate (precipitation inputs and surface water flows from local streams; evaporative losses) and long range surface transport of water carried by streams such as the Peace and Athabasca Rivers. Because local evaporation rates generally exceed precipitation inputs, flood waters from the Peace and Athabasca rivers are necessary to maintain PAD wetlands. Floods in the PAD can occur in (1) ***spring*** when river break-up creates ice-jam induced flood peaks, or in (2) ***summer*** when the melt of mountain snow packs and regional rainfall events generate peak open-water flows. During peak river stages brought about by these events, both the Peace and Athabasca rivers contribute flood waters to delta channels, lakes and surrounding wetlands. However, the Peace River carries a much greater volume of water and has a proportionately larger influence on the PAD flood regime.

At high stages the Peace River acts as a hydraulic dam - literally a wall of water. This reverses drainage patterns, causing channels that normally drain the PAD to the north to suddenly reverse flow and carry waters from the Peace River south into the PAD (Figure 3). With other direct inflows (Athabasca River, Birch River, Lake Athabasca) now confined to the delta (i.e. unable to drain to the north), lake volumes and levels increase and the connected lake surfaces expand into the surrounding flood plain and lower lying basins (Peters and Buttle, 2009).

[2] The Species At Risk Act defines species status as:
''endangered species'' means a wildlife species that is facing imminent extirpation or extinction.
''threatened species'' means a wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

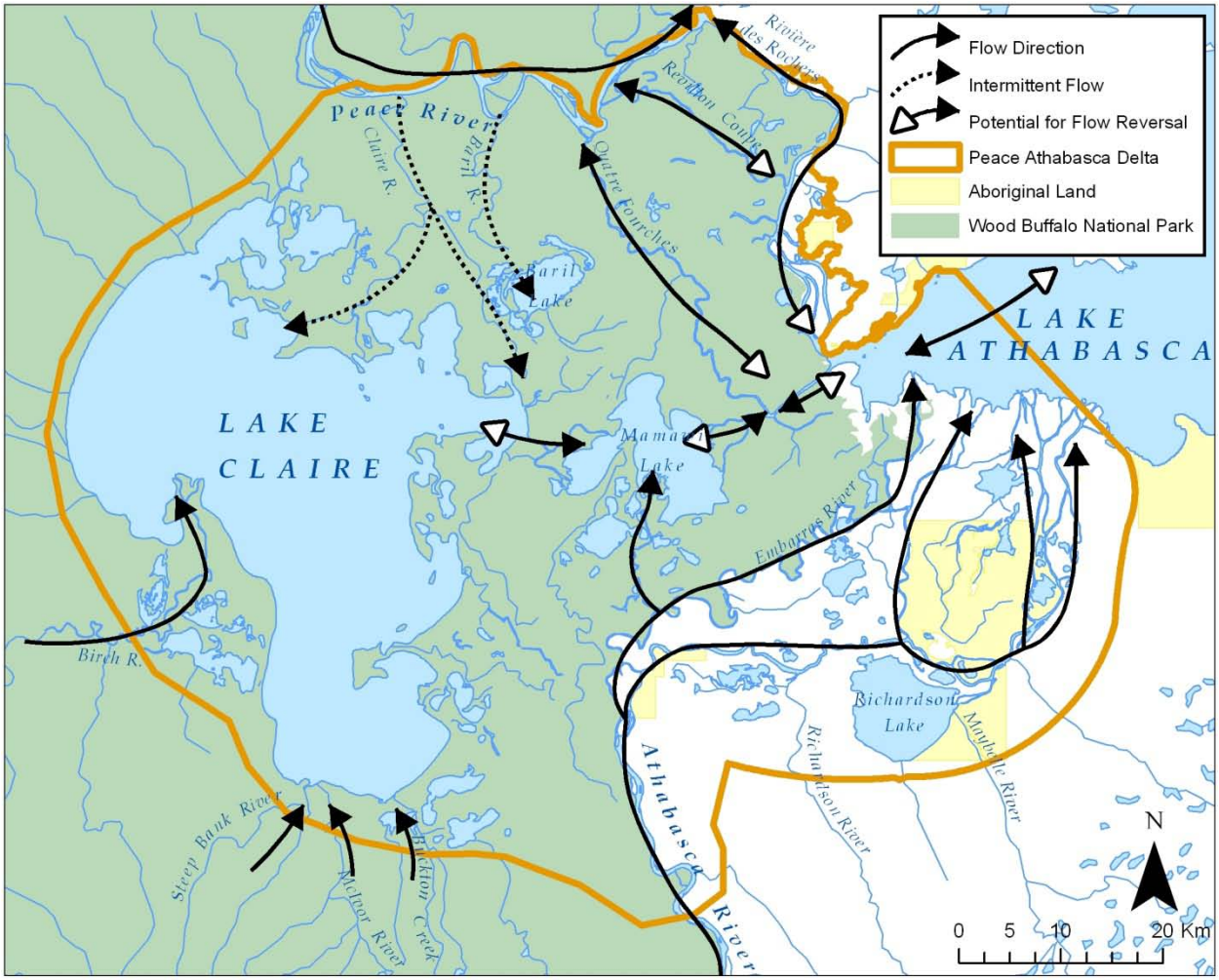

Figure 3: Flow directions in the Peace-Athabasca Delta. (Source: Parks Canada, after Peters, 2003).

However, summer peak water levels on the Peace and Athabasca rivers are not sufficient to flood the highest perched basins (those portions of the PAD landscape that are slightly elevated from the main channels, large lakes and adjacent wetlands). These basins require higher flood levels and over-bank flows that are only generated by ice-jams during spring-breakup. Periodic ice-jam flooding on the Peace River is required to replenish and maintain water levels in these sections of the PAD wetlands. In the absence of these flood events, perched basin wetlands begin to dry out. If drying trends are prolonged, woody vegetation encroachment occurs, and the ecology of the site changes.

An Ecosystem Vulnerable to Cumulative Effects

> *"The Peace-Athabasca Delta is a clear example where cumulative effects have generated ecological change on a landscape scale." Mackenzie River Basin Board, 2012*

Peace River flow regulation, acting in concert with a changing climate, has significantly altered the flood hydrology of the Peace-Athabasca Delta. Peace River hydroelectric flow regulation has significantly reduced river discharge in summer and has significantly increased river discharge

in winter. Figure 11.4.5 (Pre- and post-regulation monthly Peace River hydrographs) in Volume 2, Section 11 (Environmental Background, Surface water) of the EIS clearly illustrates these differences. The post-regulation Monthly Average flow peak (approx. 3400 cms in June) is less than half of what is was pre-regulation (approx 7200 cms) before the W.A.C. Bennett and Peace canyon Dams became operational. At the same time, climate effects have changed break-up conditions in the delta reach of the Peace River (Prowse et al., 2006).

Lower summer discharge means summer peak flows are smaller, and summer flood events are less frequent and shorter in duration. As a result, much less water enters the delta in summer than before. A mean annual reduction of approximately 1.8 billion m^3 in reverse flow (about 90% less than natural), and about 2 weeks shorter duration of obstructed outflow, can be attributed to flow regulation (Peters and Buttle, 2009).

Higher winter discharge creates higher ice cover elevations on the Peace River at freeze-up. This means that a bigger surge in spring flow at break-up is required to lift and break the ice-cover to generate ice-jam flooding (Beltaos et al., 2006). In general, though, lower spring freshet flows have been experienced since the mid-1970's due to lower snowpack accumulations in Peace River tributary headwaters (Prowse et al., 2006). As a result, ice-jam floods have been infrequent since Peace River flow has been regulated, resulting in only two periods of extensive delta-wide flooding in the 45 years since the Bennett Dam was completed (1972-74 and 1996-97[3]). This situation is occurring when the role of ice-jam flooding in maintaining delta wetlands is expected to become more important. Climate modeling indicates that warmer air temperatures in the future will increase evaporative loss in perched basins, resulting in more rapid declines in water levels despite expected increases in precipitation (Prowse et al., 2006).

The cumulative impacts of flow regulation and climate change on delta hydrology have had an impact on delta ecology. Local people are reporting that changing plant communities, water levels and use by wildlife have affected their traditional use of, and connection to, the area (Parks Canada, 2009).

With lower summer flood contributions, and as the time between major Peace River ice-jam floods increases, perched basins dry out and the extent of wetlands in the delta decreases significantly (Figure 4). For example, 55% of the Peace sector of the delta was covered by open water or flooded, emergent vegetation in 1998 but this had dropped to 33% by 2008 (Parks Canada, 2001). As wetlands and meadows dry out, the encroachment of willows and non-native species becomes a concern. The occurrence of non-native plants in vegetation monitoring plots in the Peace sector of the delta is increasing over time (Parks Canada, 2011).

The loss of wetlands has affected the abundance of important delta species such as muskrat. Muskrat are vital to the PAD ecosystem due to their pivotal role in the food web (Figure 5) and their effect on habitat structure. They are a common prey item and changes in their abundance are reflected in the abundance of predators such as mink. In addition, muskrat eat a range of plant species and alter the vegetation composition of wetlands (Hood, 2009). Culturally, muskrat have been described as a keystone species by the First Nations and Métis of the PAD region. A cultural keystone species is one that shapes "the cultural identity of a people, as reflected in the fundamental role the species has in diet, materials, medicine, and / or spiritual practices" (Garibaldi and Turner, 2004). The harvest, use and distribution of muskrat play a

[3] This period of flooding began with an ice-jam flood in spring 1996 that was significantly augmented by an emergency release of water from the WAC Bennett Dam for several weeks in summer 1996 to effect a precautionary drawdown of Williston reservoir while a structural fault detected in the earth-fill dam was repaired. Another ice-jam flood followed in spring 1997.

major role in sustaining the traditional values, spirituality, culture and economy of First Nations and Métis in the PAD (Athabasca Chipewyan First Nation and Mikisew Cree First Nation, 2010).

Muskrat are highly sensitive to changes in hydrology and their abundance varies with changes in the extent of suitable wetland habitat. Muskrat abundance in the delta has typically followed patterns of flooding, with abundance peaking in the years immediately following a flood (Peterson, 1992). Though occasional draw-downs are required to replenish aquatic vegetation, prolonged drought can reduce the ability of muskrat to recolonize flooded areas due to changes in vegetation (Wiacek and Westworth, 1999). Consistent with the observed lack of flooding in the delta since 1997, muskrat abundance in the delta is currently very low overall, including in the perched basins of the Peace sector (Patterson, 2013). Historically, perched basins have provided the majority of muskrat habitat in the PAD (Poll, 1980).

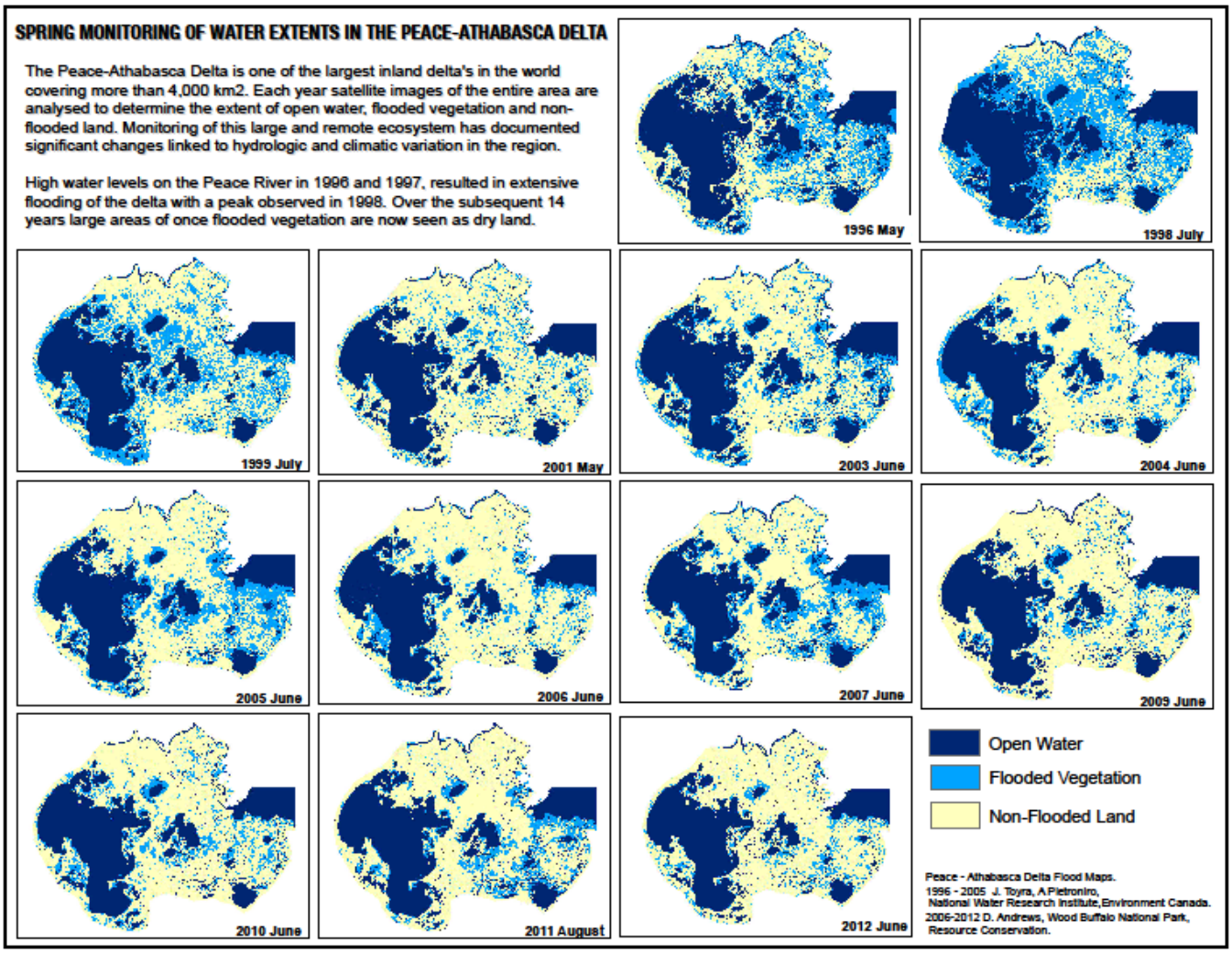

Figure 4: Changing water extents in the Peace-Athabasca Delta, 1996-2012. (Source: Parks Canada).

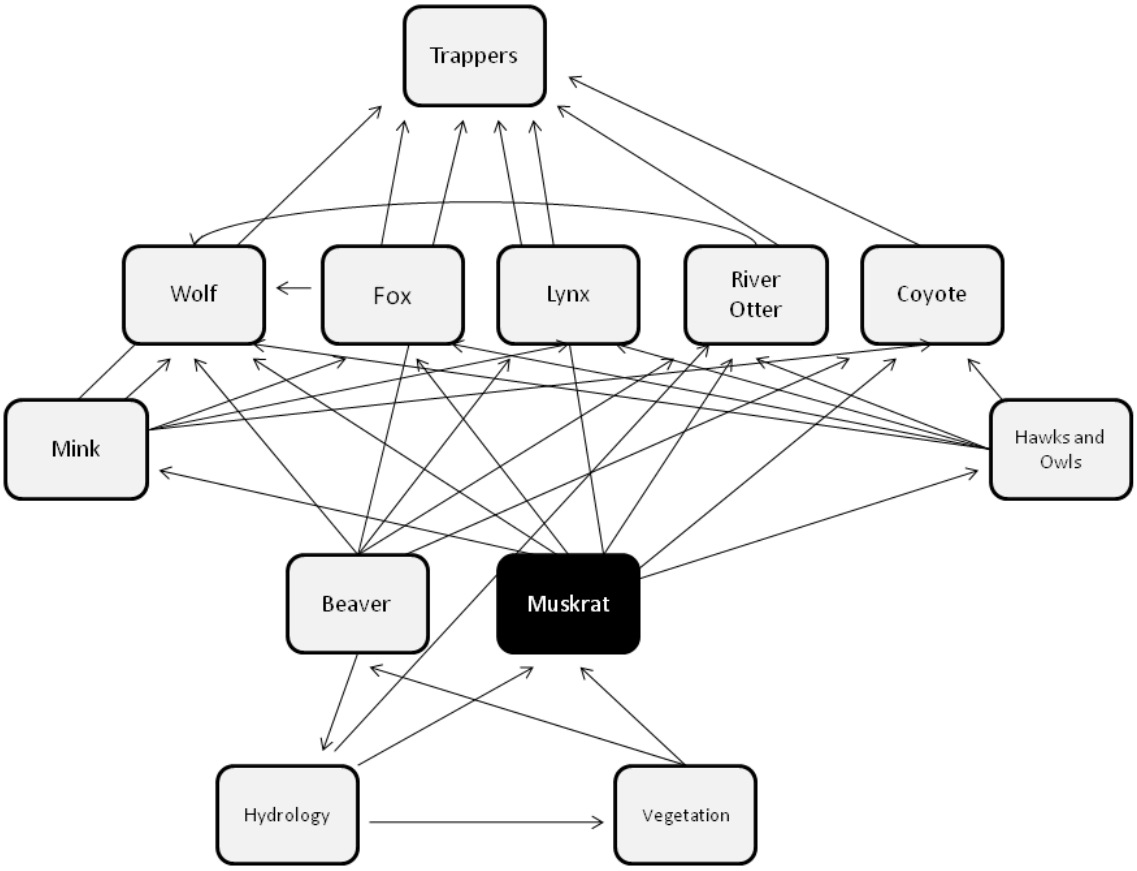

Figure 5: Position of muskrat in the delta food web. (Source: Parks Canada).

3.2 Wood Buffalo National Park Management Plan

A park management plan is the key document that guides PCA's decisions and actions in protecting, managing and operating a national park. As per the *Canada National Parks Act*, management plans are a legal requirement for all national parks. The management planning process involves extensive involvement of the Canadian public. To ensure the plans remain relevant and effective, they undergo a formal review, and if necessary, updating process every 10 years. Completed management plans, and plan updates following formal reviews are tabled in the Canadian Parliament. The management plan is not an end in itself, but rather it constitutes a framework that guides park planning, management and implementation.

Within a management plan, the development of an Area Management Approach can be recommended for a specific geographic location in a national park. These approaches present strategies for sections of the park that require more detailed direction beyond the general framework of the main management plan. Area Management Approaches reflect PCA's integrated mandate and their objectives address resource protection, visitor experience opportunities and public education.

Given the importance of the PAD, and the need for specific actions to address the challenges of maintaining, or in some cases improving, the PAD's EI and cultural value, an Area Management Approach for the Peace-Athabasca Delta is included in the 2010 Wood Buffalo National Park Management Plan. Consistent with PCA's integrated mandate, the three objectives with respect to the PAD Area Management Approach include; (1) the PAD's ecological integrity and cultural value is better understood, improved and maintained, (2) Canadians feel a sense of stewardship and support for the PAD through increased awareness and (3) visitors feel a sense of connection through meaningful experiences to the delta's natural and cultural heritage. The development and implementation of this Area Management Approach will be carried out in collaboration with Aboriginal partners, stakeholders, government and industry (PCA 2010).

3.3 Peace-Athabasca Delta Ecological Monitoring Program

In 2008, PCA initiated the Peace-Athabasca Delta Ecological Monitoring Program (PADEMP), a multi-stakeholder effort to develop an integrated ecological monitoring program that can measure, evaluate and communicate the state of the PAD ecosystem including any changes to this ecosystem that result from cumulative regional development. Please refer to Appendix 2 of this written submission for further details on PADEMP. The membership of PADEMP includes 11 Aboriginal governments, 6 provincial, federal and territorial governments, and 2 non-governmental organizations. Developed using both western science and Traditional Knowledge (TK), information generated through PADEMP supports the development of policy, as well as management approaches and regulatory practices necessary to protect the EI and cultural value of the PAD. PADEMP builds upon the legacy of knowledge developed through past monitoring efforts and complements other contemporary, regional monitoring efforts.

4.0 PROJECT ANALYSIS

4.1 Cumulative Effects Assessment Methodology

PCA notes that BC Hydro's downstream impact assessment findings for the Project indicate that the Site C dam will not produce detectable changes to surface hydrology or ice cover beyond Peace Point. PCA is interested in seeing a cumulative effects assessment of BC Hydro's flow regulation on the Peace River (3 dams) upon the distribution and magnitude of surface water flows downstream of the dams, up to and including effects on the PAD.

PCA notes that CEA practice (Hegmann et al. 1999. Cumulative Effects Assessment Practitioners' Guide) allows use of an approach as undertaken by BC Hydro for the Project, whereby the impacts of existing ongoing activities and past projects are incorporated into a baseline condition against which the potential impacts of the new project are reviewed. PCA also notes that BC Hydro has stated in its discussion of cumulative effects assessment methods on Page 2 of their Nov 20, 2013 IR response to the JRP:

> "This recognizes that the combined effects of other past and existing projects and activities are accounted for in the assessment of potential project effects because the effects of those other past and existing projects and activities are reflected in the existing conditions of the valued components (VCs) being assessed. This is consistent also with the original federal

cumulative effects assessment reference guide: Addressing Cumulative Environmental Effects (FEARO 1994), which noted that the "...baseline environmental conditions include the cumulative environmental effects of past and existing projects and activities.""

PCA observes that if the VCs include effects on downstream environments, and the CEA method advises to reflect the impacts of ongoing activities upon those VCs, it is reasonable to conclude that the scope of the impact to downstream environments from existing operations of the W.A.C. Bennett and Peace Canyon Dams should be included within the CEA assessing the operational impacts of all three dams on the downstream VC. The existence of a body of scientific investigations (well summarised in Prowse et al., 2006) that show there are causal linkages between Peace River flow regulation methods employed for optimising power generation by BC Hydro dams, and reduced incidence of PAD flooding events, indicate that the spatial scope of the CEA of downstream effects should include those ecosystems where demonstrable effects have been documented. Based on this logic, PCA observes that if the downstream effects of ongoing flow regulation for existing dams on the Peace River were scoped based on the spatial extent of those effects, it would be reasonable to conclude the spatial boundary should extend beyond the present EIS RAA boundary at Peace Point, and include consideration of impacts further downstream up to and including the PAD.

PCA recommends that the JRP direct BC Hydro to provide additional information regarding surface water hydrology, ice regime and climate change that addresses the full range of impacts on Peace River downstream environments (up to and including the PAD) from a program of continuous flow regulation resulting from the operation of the existing two dam sites and the proposed Site C dam.

PCA is particularly interested in gaining a better understanding of the cumulative impacts from flow regulation at three dams on the Peace River which as stated in the Peace-Athabasca Delta Technical Memo (May 8, 2013), will be operated in a manner that optimises low cost power generation. An excerpt from page 9 of the technical memo provides further detail on how BC Hydro intends to operate its dams:

"Some commenters have repeated suggestions made elsewhere that operations at upstream facilities should be altered to more closely replicate natural flows in the Peace River, or to provide occasional high discharges to encourage ice jam formation in the lower reaches of the Peace River in the spring. BC Hydro does not agree with the merits of these suggestions and they are not relevant to the environmental assessment of the Project. BC Hydro is not proposing to alter its operations in this manner as part of the Project or as mitigation."

PCA considers these matters relevant to the discussion of cumulative impacts to downstream environments during the operational phase of the Site C project, a dam which would be operated in concert with the Peace Canyon Dam and the WAC Bennett Dam. If no efforts are to be made to replicate natural flows , then the full cumulative impacts of the three dams on the hydrological regime downstream of the dams should be compared to that which would be present if the 3 dams were not in place and operational. This approach would be in keeping with accepted cumulative effects assessment methods whereby the impacts of all existing projects are assessed as well those of the proposed project. (CEA Agency, May 2013).

PCA recommends to the JRP that the strengths and weaknesses of methods assessing the incremental impacts of Site C versus assessing the cumulative impacts of flow regulation on the Peace River downstream environments, be further explored by an investigation using available subject matter experts during the panel review phase of the Project.

I.e the operation of 2 existing dams on the Peace River upstream of Site C should be seen as activities that have been, and will continue to be, carried out. Applying this logic it is reasonable to recommend that the scope of the cumulative effects assessment include consideration of the ongoing effects of flow regulation for the existing dams upon the Peace River downstream environments known to be affected by these activities.

I.e. the appropriate spatial boundary for cumulative effects of flow regulation is those lands and waters affected by the flow management activities. The body of peer reviewed scientific literature for the PAD (well summarised in Prowse et al., 2006) includes investigative findings that demonstrate the management of Peace River flows for hydroelectric operations at the W.A.C. Bennett and Peace Canyon Dams have significantly influenced the magnitude and seasonal distribution of Peace River surface flows and contributed to observed changes in the hydrology of the PAD. Figure 11.4.5 (Pre- and post-regulation monthly Peace River hydrographs) in Volume 2, Section 11 (Environmental Background, Surface water) of the EIS clearly illustrates these differences. Flow regulation has dampened the runoff hydrograph so that Peace River peak spring and summer flows downstream of the dams are much lower and winter flows are much higher in the Peace River than before the WAC Bennett and Peace Canyon dams were constructed and operating. Figure 11.4.5 illustrates the magnitude of change in the monthly average flows and highly dampened summer flows after regulation for all sites on the figure including Peace Point, AB which is very near to the PAD. The post-regulation Monthly Average flow peak (approx. 3400 cms in June) is less than half of what is was pre-regulation (approx 7200 cms) before the W.A.C. Bennett and Peace canyon Dams became operational.

I.e. past environmental conditions from the pre-impoundment timeframe should be included in the temporal scope of the CEA, and the PAD should be included in the spatial scope.

Furthermore, considering the complexity of the issues being considered by the JRP,

PCA recommends to the JRP that the EA analysis for the Project should analyse the full range of scientific information available for the Peace River and the PAD, as well as focus greater efforts on obtaining and incorporating into the impact analysis relevant traditional and local knowledge from persons living in or near the PAD.

4.2 Mitigation of Peace River Flow Regulation Impacts

PCA recognises the complexity of trying to produce an effective ice jam flooding event while respecting the existing flow restrictions in place for the community of Peace River, and accounting for the time lag in the system between water release from the dams and its arrival at the site of potential ice jam flooding further downstream. PCA also recognises that BC Hydro's primary objective when planning and executing Peace River flow regulation activities is to optimise the generation of power to match demand.

Despite these constraints, work by Prowse et al (2002), and Beltaos et al (2006) identifies the potential for such mitigation strategies to reduce the effects of flow regulation and increase the frequency or magnitude of ice-jam flooding events.

PCA recommends to the JRP that further effort be invested in studying the effects of flow regulation on the PAD, and in and trying to mitigate these effects by augmenting flows to induce ice jam flooding events in circumstances where there is a reasonable probability of success.

5.0 SUMMARY OF RECOMMENDATIONS

In summary PCA lists the following recommendations be considered during the JRP stage of the EA review of BC Hydro's Site C Clean Energy Project:

1. In an effort to comprehensively assess and consider cumulative effects, PCA recommends to the JRP that the scope of the cumulative effects assessment include Peace River flow regulation impacts from all three dams on the downstream environment up to and including the PAD.
2. PCA recommends that the JRP direct BC Hydro to provide additional information regarding surface water hydrology, ice regime and climate change that addresses the full range of impacts on Peace River downstream environments (up to and including the PAD) from a program of continuous flow regulation resulting from the operation of the existing two dam sites and the proposed Site C dam.
3. PCA recommends to the JRP that the strengths and weaknesses of methods assessing the incremental impacts of Site C versus assessing the cumulative impacts of flow regulation on the Peace River downstream environments, be further explored by an investigation using available subject matter experts during the panel review phase of the Project.
4. PCA recommends to the JRP that the EA analysis for the Project should analyse the full range of scientific information available for the Peace River and the PAD, as well as focus greater efforts on obtaining and incorporating into the impact analysis relevant traditional and local knowledge from persons living in or near the PAD.
5. PCA recommends to the JRP that further effort be invested in studying the effects of flow regulation on the PAD, and in and trying to mitigate these effects by augmenting flows to induce ice jam flooding events in circumstances where there is a reasonable probability of success.

Complimentary Observations and Recommendations from Environment Canada

PCA has greatly benefitted from having access to EC experts on surface water hydrology and ice regimes while participating in the federal review team downstream effects working group. PCA shares many aspects of EC's environmental mandate such as surface water quality and quantity as it relates to the EI of the PAD. The content, analysis, observations and recommendations documented in Chapter 3 (Surface Water Regime and Climate Change) of EC's written submission to the JRP are directly relevant to PCA as much of the material in this section deals with surface water dynamics that influence flooding frequency, magnitude, and duration in the PAD. PCA has chosen to highlight important aspects of the EC submission of direct relevance to PCA by listing them in the text box directly below. Please refer to full text of EC's Written Submission to the JRP for complete details on this topic.

Excerpts from CHAPTER 3 – SURFACE WATER REGIME AND CLIMATE CHANGE of SUBMISSION OF THE DEPARTMENT OF THE ENVIRONMENT TO THE JOINT REVIEW PANEL for BC HYDRO SITE C HYDROELECTRIC PROJECT
November 25, 2013

NOTE: The excerpts included here are from the draft final written submission of EC as of 4:30 PM PST on November 25, 2013. In discussions with EC staff, they indicated that minor wording changes may be made to these excerpted passages as part of the final review process prior to EC submitting its final written submission to the JRP. Staff also indicated that despite the potential of minor wording changes taking place, the intent of the excerpted statements would not substantially change.

3.2 Hydrology
3.2.2. Current Regulated System

(Paragraph 1) BC Hydro provided a narrative discussion on the hydrological changes on the Peace River and downstream PAD resulting from previous hydroelectric developments (Volume 2: Assessment Methodology and Environmental Effects Assessment, Section 11.1). However, the narrative provided did not incorporate several peer reviewed studies that examined the separate effects of historical climatic variability and flow regulation to demonstrate how hydroelectric operations of the existing WAC Bennett Dam and Peace Canyon Dam have affected key components of the PAD hydrology.
Overall, the narrative provided by BC Hydro in the EIS lacks important information about known effects of flow regulation on the hydrology of the PAD and Lake Athabasca.

(Paragraph 3) Ice jamming is a key mechanism for recharging elevated perched basins in the PAD (Peters et al., 2006a). Under the current regulated flow regime associated with hydroelectric reservoir operations, the water level at which the ice cover forms in the fall or in the winter is higher than under natural conditions. Come spring, dislodgement and breakup of the ice prior to its melting and rotting in place requires larger flows than under natural conditions. In addition, sufficient flow is required once the ice breaks up, to cause flooding behind the ensuing ice-jam. This, combined with less intense spring snow melt (a source of flow) in downstream tributaries because of generally declining snow depth since the 1970s, contribute to less frequent ice-jam flooding (Beltaos 2003, Beltaos et al., 2006; Romolo et al., 2006; Prowse and Conly, 1998). The most recent large ice-jam flood events in the Peace Delta occurred in 1996 and 1997.

3.2.3 Potential Effects of the Project

Caveat No 1.
The overview section of this Appendix [Volume 1, Appendix B Reservoir Filling Plan] provides an example based on average annual inflow of 1273 cms and a minimum outflow of 390 cms - it would take approximately 30 days to fill the 2310 million cubic metre volume of the reservoir. According to this scenario using average conditions, flows reaching the Peace Point study boundary would be lowered by about 880 cms for one month. A decrease in flow of this magnitude and duration may have a noticeable impact on downstream flow and water level conditions. This information would be needed to assess potential effects of various reservoir filling options on downstream flow and water level conditions and to plan for the least impact scenario.

Caveat No 2.
In order to take into account projected climate change impacts on flows, the JRP may wish to require that prior to the construction of the Project, BC Hydro assess a third modelling scenario "Site C with Climate Change" that considers the range of projected impacts of climate change on the timing and magnitude (including extreme events) of streamflow generation.

3.3 River Ice
3.3.2 Assessment of BC Hydro's Downstream Ice Regime Impacts

Recommendation 3.2
EC recommends that the JRP urge BC Hydro operate the Project in a manner that ensures that fall and winter flows do not increase relative to present conditions, so that ice jam flooding potential in the Peace-Athabasca Delta is not impacted.

Excerpts from CHAPTER 3 – SURFACE WATER REGIME AND CLIMATE CHANGE of SUBMISSION OF THE DEPARTMENT OF THE ENVIRONMENT TO THE JOINT REVIEW PANEL for BC HYDRO SITE C HYDROELECTRIC PROJECT
November 25, 2013

Continued from previous page.

3.5 Considerations Related to Effects of Existing Flow Regulation on Downstream Interests

(Paragraph 3) EC recognized those downstream interests in its June 2012 comments on the draft EIS Guidelines for Site C. In a letter to the Canadian Environmental Assessment Agency dated June 11, 2012 (www.ceaa.gc.ca/050/documents/57120/57120E.pdf), the Department noted that the Peace River is already subject to flow regulation as a result of the construction and operation of the WAC Bennett Dam and the Peace Canyon Dam, and that operation of Site C in combination with the existing hydroelectric generating stations had the potential to result in cumulative impacts on the PAD. EC went on to recommend that the EIS for Site C include a discussion of existing hydro developments on the Peace River, the environmental effects that have occurred as a result and the effectiveness of measures taken to manage them.

(Paragraph 4) In its comments the Department notes that the EIS did not include important information from published scientific studies dating back to the 1970s that have documented the effects of flow regulation on the hydrology of the PAD.

(Paragraph 7) In recognition of the known adverse effects of flow regulation on the hydrology of the Peace Athabasca Delta and the shared responsibility for understanding and managing them, a constructive next step could involve convening a multi-stakeholder technical committee to define the ecological flow needs that would be required to achieve specific environmental and/or traditional use objectives in the Peace Athabasca Delta.

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September 7, 2012. Site C Clean Energy Project - Environmental Impact Statement (EIS) Guidelines. CEAR Doc #404.

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November 7, 2013. Letter from the Joint Review Panel to BC Hydro concerning Sufficiency of Information Site C Clean Energy Project Amended Environmental Impact Statement. CEAR Doc #1651.

Appendix 1 Listing for Peace-Athabasca Delta in The Annotated Ramsar List of Wetlands of International Importance

Peace-Athabasca Delta. 24/05/82; Alberta; 321,300 ha; 58°42'N 111°08'W. World Heritage Site; National Park. Composed of three river deltas and four large freshwater lakes with rich growths of aquatic vegetation, linked to Lake Athabasca by meandering river channels. Underlain by permafrost, there are expanses of open grass and sedge meadows interspersed with hundreds of perched wetland basins, giving rise to thousands of kilometers of shoreline during spring high water. One of the most important nesting, resting and feeding areas for numerous species of waterbirds in North America. Up to 400,000 birds occur during spring migration, and more than one million occur in the fall. The delta meadows provide grazing for several hundred free-roaming bison, one of 44 other mammals recorded. Ramsar site no. 241. Most recent RIS information: 2001.

Source: http://www.ramsar.org/cda/en/ramsar-documents-list-anno-canada/main/ramsar/1-31-218%5E16491_4000_0__

Appendix 2 Backgrounder -Peace-Athabasca Delta Ecological Monitoring Program (PADEMP)

Parks Canada has been leading the Peace-Athabasca Delta Ecological Monitoring Program (PADEMP) since 2008, with the goal of developing an integrated ecological monitoring program that can measure, evaluate and communicate the state of the Peace-Athabasca Delta ecosystem, including any changes resulting from cumulative regional development and climate change. The program is being developed using both Traditional Knowledge (TK) and western science.

PADEMP is guided by a Steering Committee comprised of representatives from:

- Mikisew Cree First Nation (MCFN), Ft.Chipewyan Métis Local 125, Athabasca Chipewyan First Nation (ACFN)(observer status), Salt River First Nation, Smith's Landing First Nation, Deninu'Kue First Nation, Katl'odeeche First Nation, NWT Métis Nation, Ft. Resolution Métis Council, Hay River Métis Council, Little Red River Cree Nation.
- Parks Canada Agency, Environment Canada, Fisheries and Oceans Canada, Aboriginal Affairs and Northern Development Canada (NWT), the Government of the Northwest Territories (Environment and Natural Resources), Alberta Environment and Sustainable Resource Development.
- World Wildlife Fund Canada and Ducks Unlimited Canada.

PADEMP's progress to date includes:

- Relationship building among partners with a shared interest in the PAD
- Collection and synthesis of available information on the delta (both TK and western science-based)
- Identification of key monitoring questions and information gaps
- Development of a Vulnerability Assessment (currently in final draft form), which includes recommendations to guide development of an integrated ecological monitoring program and area management plan for the Peace-Athabasca Delta in Wood Buffalo National Park
- Coordination of the first PADEMP Forum in Ft. Chipewyan, November 2012. This Forum brought those engaged in regional monitoring programs [Joint Oil Sands Monitoring Plan, Alberta Biodiversity Monitoring Institute (ABMI), MCFN / ACFN community-based monitoring (CBM) Program, etc.] together with local Traditional Knowledge holders and community members to discuss key concerns and questions, and to stimulate collaboration and communication.

The design of PADEMP takes into consideration work being undertaken by other relevant monitoring programs in the region that have other specific goals. Key regional monitoring programs that PADEMP complements, and incorporates the results of, include: the Joint Alberta-Canada Implementation Plan for Oil Sands Monitoring, community-based monitoring (CBM) programs (Mikisew Cree First Nation and Athabasca Chipewyan First Nation CBM, Slave River and Delta Partnership), Alberta Biodiversity Monitoring Institute (ABMI), Wood Buffalo Environmental Association (WBEA), and research undertaken by the Cumulative Environmental Management Association (CEMA).

Communication and engagement of PADEMP with these other programs is an important, on-going activity. PADEMP will not duplicate sound monitoring efforts being undertaken by other programs. Rather, PADEMP addresses those areas where key monitoring information is not being collected, and ensures that TK and traditional use values are incorporated into its monitoring efforts. PADEMP assessments of the state of the delta ecosystem will utilize the best information available through PADEMP and other monitoring programs. To this end, PADEMP will ensure that its monitoring results can be compared with those of other key regional monitoring programs.

Prepared by:
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(Updated: November, 2013)

Appendix 3 Authors Curricula Vitae - Parks Canada Agency Submission

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Education:

1987 - Master of Natural Resource Management, University of Manitoba

1985 – Bachelor of Science, University of Manitoba.

Relevant Experience:

2008 -present: Chair, Peace-Athabasca Delta Ecological Monitoring Program (PADEMP): responsible for coordinating the activities of the PADEMP Steering Committee.

2007-present: Manager, Resource Conservation, Wood Buffalo National Park, Ft. Smith, NT: responsible for the management of natural and cultural resources in the park.

2005-2007: Biologist, Wood Buffalo National Park, Ft. Smith, NT: responsible for development and implementation of protocols for ecological integrity monitoring in the park.

1995-1997: Coordinator - Peace-Athabasca Delta Technical Studies (PADTS), Wood Buffalo National Park, Ft. Chipewyan, AB: provided program support to the PADTS Steering Committee; coordinated and conducted field work; produced status reports and compiled the program's Final Report; program contact for external agencies, stakeholders and companion studies (Northern River Basins Study, Mackenzie Basin Impact Study, etc.)

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1982 – Bachelor of Science (Physical Geography/Biology), Simon Fraser University.

Relevant Experience:

1994 -present: Environmental Assessment Scientist, Parks Canada-Vancouver Office: responsible for coordinating the environmental review of complex, large scale or controversial projects in or near Parks Canada assets in British Columbia and the Yukon Territory. Provide advice to senior managers and staff at National Parks and National Historic Sites on application of the Canadian Environmental Assessment Act (CEAA), British Columbia Environmental Assessment Act, and other environmental assessment regimes.

1992-1994: Aquatic Ecologist, Prince Albert National Park, Saskatchewan: managed and coordinated development and implementation of a comprehensive aquatic ecology program at Prince Albert National Park. Initiated and managed a five year project restoring the Kingsmere aquatic ecosystem, a dammed first order stream.

1990-1992: Senior Park Warden (Environmental Assessment), Prince Albert National Park, Saskatchewan: managed the Environmental Assessment and Review Process (EARP) for Prince Albert National Park averaging approximately 75 environmental reviews per year.