Peace Project Water Use Plan

Physical Works Terms of Reference

- GMSWORKS-16 Williston Reservoir Wetlands Inventory
- GMSWORKS-17 Williston Reservoir Trial Wetland

April 21, 2008
1.0 INTRODUCTION

This Terms of Reference describes a Wetlands Inventory and Trial Wetland(s) for the Williston Reservoir. These are the two Primary Implementation Projects identified by the Peace Water Use Planning Committee in the Riparian and Wetland Enhancement Management Plan. The Peace Water Use Plan water use planning process was initiated in February 2001 and completed in May 2003.

These Terms of Reference are submitted in response to the Order (Files No. 76975-35/Peace) issued by the Comptroller of Water Rights on August 9, 2007. The Order states, in schedule A, that:

The licensee shall submit, within nine months of the date of this Order, for approval by the comptroller, terms of reference for the following works:

a. develop a wetlands inventory and create trial wetlands at specific sites around Williston Reservoir to improve foreshore habitat for fish and wildlife.

These Terms of Reference provide a two stage program of work. The first stage will result in a list of sites with the potential for creation of wetlands in the Williston Reservoir area including a description of each site and its relative merits and method of wetland creation (including estimations of the cost of the physical works required). The second stage of the program will, on one of more of these selected sites, undertake the physical works to develop a trial wetland. These trial wetlands will demonstrate the techniques used and a follow-up monitoring program will provide an opportunity to assess the intermediate and longer term efficacy of such works. If more than one wetland creation technique is recommended in the first stage then the second stage should, if possible, demonstrate different techniques in the trial wetlands.

2.0 DESCRIPTION OF PROJECT

2.1 Location

The headwaters of the Peace, a part of the Mackenzie River Basin, are located in north-eastern British Columbia (Figure 2-1). The Peace is formed by the confluence of the Finlay and Parsnip rivers flowing in opposite directions in the Rocky Mountain Trench. At the confluence the Peace flows east and is the only river to cut through the Rocky Mountains. Once out of the Peace Canyon the river maintains an easterly direction, crossing the B.C./Alberta border. The Peace is tributary to the Slave River in Alberta, which drains into Great Slave Lake. The outflow of Great Slave Lake marks the start of the Mackenzie River that flows north to the Arctic Ocean.
2.2 Existing Works

The existing works comprising the Peace project include:

**W.A.C. Bennett Dam:**
- This dam, commissioned in 1967, is located at head of the Peace Canyon forming Williston Reservoir. The earthfill dam is 2040 m (6692.8 ft.) in length at the crest and 183 m (600.4 ft.) high with a crest elevation of 679.7 m (2230.0 ft.) above sea level.
- Williston Reservoir covers approximately 1773 square kilometres (km²) (684.6 square miles (miles²)) at full pool and has an active storage of 393 Million cubic metres (Mm³) (32 Million acre feet (MAF)). The operating range of the reservoir for power generation is between 672.08 m (2205.0 ft.) and 642.00 m (2106.3 ft.).
- The spillway has three radial gates and nine sluice gates. The sill elevation for the radial gates is 653.53 m (2144.1 ft.) and the sluice gates 641.60 m (2105 ft.).
The maximum discharge is 9200 m$^3$/s (325 000 ft$^3$/s) using the radial and sluice gates.

- Power Intakes: There is one power intake for each unit. They are located on the left side of the dam. Intakes are 3.96 x 5.94 m (13 x 19.5 ft.). The sill elevation for intakes 1 to 3 is 594.36 m (1950.0 ft.). The sill elevation of intakes 4 to 10 is 627.89 m (2060.0 ft.).

**G.M. Shrum Generating Station:**

- The underground G.M. Shrum Generating Station has 10 units with a total installed capacity of 2730 MW. Once through the turbines, the water is discharged through two manifolds, one for units G1 to G5 and one for G6 to G10, into the upper end of Dinosaur Reservoir.

**Peace Canyon Dam:**

- This dam is located at the foot of the Peace Canyon forming Dinosaur Reservoir. The Peace Canyon Dam consists of a concrete gravity dam and earthfill saddle dam on the right abutment. The main dam is 325 m (1066.3 ft.) long and 61 m (200.1 ft.) high with a crest elevation of 507.5 m (1665.0 ft.) above sea level. The saddle dam is 200 m (656.2 ft.) long and 20 m (65.6 ft.) high.
- Dinosaur Reservoir covers approximately 9 km$^2$ (3.5 miles$^2$) at full pool. It has limited active storage. The shoreline length is 54.4 km (33.8 miles). The normal operating range is between 502.92 m (1650.0 ft.) and 500.00 m (1640.4 ft.).
- The spillway has six radial gates. The sill elevation for the radial gates is 491.3 m (1611.9 ft.). The maximum discharge is 10 280 m$^3$/s (363 000 ft$^3$/s).
- Power Intake: There is one power intake for each unit. The intakes are 6.7 x 12.4 m (22.0 x 40.7 ft.). The sill elevation is 426.3 m (1516.5 ft.).

**Peace Canyon Generating Station:**

- The Peace Canyon Generating Station has four units with a total installed capacity of 700 MW. The water is discharged into the Peace.

### 3.0 BACKGROUND

The Peace Water Use Planning Committee (the Committee) recommended a package that included operating constraints and non-operating programs for the Peace system. One of the non-operating programs recommended by the Committee was Riparian and Wetland Habitat Enhancement for Williston Reservoir. The scope of this enhancement program is to improve foreshore habitat for fisheries and riparian habitat for wildlife and survey areas that may be suitable to exploit opportunities for “perched” wetlands or lakes. The Committee’s management plan further recommended that trial wetland(s) would be created during the first five years following government approval of the Peace WUP. Subsequent wetlands could be created depending on the success of the trials in the succeeding five years. Ancillary benefits may include localized dust abatement, erosion control and improved aesthetics.
The Williston reservoir receives an annual average inflow of about 1100 m³/sec partitioned approximately equally between snowfall run-off and rainfall run-off. On an annual cycle the reservoir reaches its maximum elevation by the end of August and its minimum elevation at the end of April. The annual drawdown of the reservoir is about 10–12 m. As the water levels recede during the drawdown cycle (September to April), pools and isolated backwater areas are formed on the exposed shoreline. Productivity of these pools depends greatly on topography and drainage. For example, a large pool with stable water may provide valuable fish and wildlife habitat.

The drawdown shoreline itself is characterized by expansive mudflats, sand and large wood debris. Vegetation in the drawdown area is limited even after extended periods of non-inundation, in the uppermost drawdown zone, that exceeds 3–8 years. Consequently these areas generally represent poor habitat for most terrestrial wildlife and may pose increased predation risks to animals traversing the drawdown zone for access to the wetted edge. In addition, the exposed drawdown areas without large woody debris are particularly susceptible to dust creation when the areas become dry.

In their report of December 2002, the Peace Water Use Planning Committee recommended that the Demonstration Wetland(s) would be constructed using a combination of debris, soil and geotextiles. These structures should increase the water holding capacity of the foreshore perennial vegetated areas increasing the success of crop establishment in the first year. On a longer term basis, these berms will temporarily hold water during high water years adding to wetland species health. Depending on the given situation, additional features that might be considered in the design would be fish access to and from the reservoir at high pool.

Following the establishment of the wetland(s) habitat and effectiveness-monitoring program will be developed “to establish the benefits of Demonstration Wetlands to aquatic and riparian vegetation, fisheries and wildlife”. For 10 years following construction of the demonstration wetland, data will be collected on:

- Primary productivity in the wetland relative to the reservoir;
- Fish abundance and biodiversity in the wetland relative to the reservoir;
- Wildlife utilization of the habitat relative to the “non-enhanced” drawdown zone;
- Vegetation communities biomass and diversity relative to the “non-enhanced” drawdown zone;
- Influence on mitigating dust and erosion.

4.0 RATIONALE FOR WETLAND INVENTORY AND DEMONSTRATION

Wetlands are often considered one of the most productive habitats types in the temperate region. They are also one of the habitat types that are most often significantly impacted when reservoirs, such as Williston, are created by flooding large valleys. As a result of the annual draw down and because in some years it may not reach full pool the Williston Reservoir has a poorly developed riparian zone and essentially no productive littoral zone. Creating wetland habitats in these zones and particularly in the higher elevations that may be dewatered for long periods can improve reservoir riparian and increase the utility of the draw down zone for some
wildlife and fish species. As well there will be local ancillary benefits in dust control in the areas that remained watered longer and where vegetation is encouraged to establish and persist.

The inventory will lead to a list of candidate sites around the reservoir that could benefit wildlife and fish by improving conditions in the drawdown zone for portions of the year. Cross-referencing this inventory with surveys undertaken for other projects, such as Trial Tributaries or Dust Control, may lead to synergies where one or more sites can be developed as multi-purpose mitigation. Initially, one or more of the candidate sites, identified in the inventory, will be developed to demonstrated techniques for retaining water in these areas of the drawdown zone and the efficacy of establishing and maintaining some kind of vegetation community in the area. These trials will, hopefully, lead to improved techniques and development of additional sites from the list in later years.

5.0 DESIGN AND DELIVERABLES

This project includes the following deliverables:

**Stage One**

- A compilation of candidate sites, adjacent to the Williston Reservoir, which would be useful for the creation of permanent or ephemeral wetland habitats following some physical works modification.
- Complete biophysical descriptions (including a map) of each site such that they can be suitable ranked on the basis of:
  - Area of inundation potential,
  - Wildlife and fisheries benefits,
  - Overview environmental and archaeological assessments of the sites;
  - Accessibility;
  - Capital cost of the physical works required,
  - Projected maintenance costs (debris management, erosion control),
  - Ancillary benefits for all stakeholders.
- Proposed ranking of the candidate sites.

**Stage Two**

- One or more sites selected for wetland demonstration,
- For each site selected as a demonstration site:
  - Preliminary engineering and design;
  - Final design;
  - Construction;
  - End of construction report that includes;
    - Annual maintenance schedule,
    - As built drawings and site map,
    - Landscape scheme and vegetation list.
6.0 PROPOSED PROGRAM DETAILS

6.1 Objective

The objective of the first stage of this program is to identify the areas around the Williston Reservoir that are suitable for the creation of wetland habitats following some physical modifications. The second stage objective is to select one or more of these sites as demonstration wetlands. The wetland(s) will be constructed for the purpose of demonstration of technique and monitoring to assess the efficacy of the Riparian and Wetland Habitat Management Program.

6.2 Approach

The suggested approach for this program is to undertake the survey for candidate sites (stage one) prior to selecting the site(s) that will be come the demonstration wetlands (stage two). Once the stage two candidate site(s) has(ve) been identified preliminary design and engineering, and construction may begin.

6.3 Methods

6.3.A Project Coordination

Project coordination involves the general administration and technical oversight of the program, which will include but not be limited to: 1) budget management; 2) study team selection; 3) logistics coordination; 4) technical oversight in field and analysis components; and 5) liaison with regulatory agencies, BC Hydro and other interested parties.

6.3.B Stage One: Reconnaissance and Survey

A reconnaissance survey of the proposed locations in the spring of 2008 is required to document existing conditions as they relate to the physical works proposed at each location. Site surveys should occur in May to take advantage of forecast low-water conditions, when the maximum shoreline will be exposed. Candidate sites should be selected on the basis of ecological benefits, ease of engineering and ancillary benefits for localized dust management.

This reconnaissance will assess each site in terms of accessibility and suitability for physical works, as recommended in the Committee report (see Background above), to retain water on site. The inventory report should recommend if other methods or physical works are estimated to be lower cost and/or more technically feasible for the construction of a wetland at any particular site. The availability of materials at or nearby the site can be addressed in this reconnaissance.

A detailed examination of the existing site plan and profile, including reservoir grades to identify the average pool line and full pool line as well as low pool line. Bathymetric surveys to collect cross-sectional information may be required at those sites where visual confirmation of the reservoir grade below the water surface is not possible. Sufficient on-site survey and other information that will allow final design at the recommended sites is to be collected during stage one. It is recommended that
Terrestrial-based LiDAR be used to collect this detailed elevational information at each of the candidate sites.

A conceptual design recommendation for each site should be presented.

6.3.C Stage One: Archaeological Overview Assessment

The WUP Committee stressed the importance of archaeological sites in the Peace River basin during the Water Use Planning process. One portion of this Stage One wetlands survey will investigate whether the any proposed physicals works may conflict with identified archaeological sites in those locations.

An archaeologist will be contracted to undertake an archaeological overview of each candidate wetland location. A review of maps, reports on prior archaeological work in the area, site records and other pertinent historical or ethnographic studies will be conducted for all locations.

The archaeological overview will include a preliminary field reconnaissance of the candidate sites. Also, the “Remote Access to Archaeological Data” (“RAAD”) database is to be reviewed to determine if there are any registered archaeological resources at the proposed locations.

The archaeologist will be responsible for identifying potential conflicts between the wetland objectives for the site and any known archaeological sites in accordance with BC Hydro’s “Best Management Practices” (BMP) for heritage resources. Interviews with appropriate First Nations may provide additional information.

Local First Nations will be given the opportunity to comment on the all proposed wetland sites before the report is finalized. The study will outline how the input of First Nations, recognized by BC Hydro as having an interest in the study area, was used to rank the efficacy of the each site and affect the wetland proposal. All final reports will be shared with interested local First Nations.

Additionally, as part of the preliminary field reconnaissance, the archaeologist will document any surface evidence of archaeological sites near the proposed wetland site in accordance with BC Hydro’s Reservoir Archaeology General and Technical Standards and provide recommendations regarding project design changes or further archaeological work needed to address unavoidable impacts, if any. As this overview work will not be conducted under a Provincial Heritage Inspection Permit, no subsurface testing, or collection of artifacts or other archaeological materials exposed on the surface, will occur.

A detailed report on each candidate wetland site will be prepared by the archaeologist, documenting existing conditions, and including recommendations for mitigating works through project design or for further investigation in the form of an archaeological impact assessment (AIA), if required.

BC Hydro’s Heritage Procedures Flowchart and Field Guide have been included as Attachment 1.
6.3.D Stage One: Environmental Impact Assessment

The WUP Committee stressed the importance of environmental values in the Peace River basin. The environmental coordination portion of this feasibility study will investigate whether the proposed works may conflict with environmental values at those locations.

A registered professional biologist (RPBio) will be contracted to accompany the study area reconnaissance team to all of the candidate wetland sites. The role of the biologist will be to evaluate potential impacts to environmental resources, such as fish and fish habitat, wildlife and wildlife habitat, and vegetation, as a result of the proposal to construct a wetland at the candidate locations.

The biologist will be responsible for identifying sensitive areas in the vicinity of the proposed wetlands, proposing alternative design options as required, suggesting methods for avoiding impacts, or providing mitigation plans for each location, if necessary. The biologist will produce an environmental management plan (EMP) for each site to ensure that potential environmental impacts associated with the work are avoided or minimized. The biologist will also be responsible for identifying areas that are not suitable for construction due to the potential for considerable environmental impacts, and for recommending alternate sites in the immediate vicinity where impacts could be avoided or minimized.

The biologist will coordinate directly with the engineering technical feasibility team to evaluate each proposed site from an environmental perspective. The biologist will also be responsible for liaising with the necessary environmental regulatory agencies to determine regulatory requirements for any proposed physical works. A report detailing each site will be prepared by the biologist documenting existing conditions and including recommendations, as described above.

6.3E Stage One: Reporting

Reports will follow the standard format that is being developed for WUP monitoring programs. All reports will be provided in hard-copy and as Microsoft Word and Adobe Acrobat (*.pdf) format, and all maps and figures will be provided either as embedded objects in the Word file or as separate files. Raw data is to be provided in an Excel spreadsheet or other suitable format acceptable to BC Hydro.

Engineering Technical Feasibility

A detailed technical report outlining the findings from the reconnaissance and investigation, as they relate to the primary components under Stage One, will be prepared. A brief report on potential heritage and environmental impacts taken from items (C) and (D) above will be provided. Engineering aspects for each site will be discussed and notes made where it is believed the site will prove difficult and/or infeasible.

The report will make a final recommendation for each site, with site-specific details as to what is deemed feasible for each location, including an approximate cost estimate to complete the recommended works. Conceptual designs including sketches should accompany the report.
Aspects discussed above and in Section 6.3.B are the minimum expected content for the report.

**Archaeological Feasibility**

It is expected the archaeologist will issue a detailed report, including the aforementioned Best Management Practices and Field Guidelines, in an easily-referenced format that could be used by field crews.

The report will provide details on sites where potential conflicts exist, and itemize mitigating measures, if necessary. Additionally, the report should include procedures to undertake should a heritage site be discovered at one of the proposed boat launch ramp sites. Those aspects discussed in Section 6.3.C are the minimum content expected for report.

**Environmental Feasibility**

A report detailing the conditions and circumstances at each site will be prepared by the biologist, including site-specific recommendations on how to proceed with work in a manner that satisfies environmental concerns. The aforementioned EMPs will accompany the report in an easily referenced format.

The biologist will identify any mitigating measures and permitting requirements related to environmental concerns. Procedures on how to secure all regulatory permits will be documented. Those aspects discussed in Section 6.3.D are the minimum content expected for the report.

### 6.3E Stage Two: Demonstration Wetlands

Following completion of the field reconnaissance and site surveys of the candidate areas, work can commence on selecting the site or sites for the construction of demonstration wetland(s). The expectation is that following a stage one start beginning in the spring of 2008, work can begin on stage two later in 2008 with detailed design and approvals taking place in late 2008 and early 2009 such that it is possible to begin construction in spring of 2009. Selection of the site or sites for the stage two trials should consider the outcome of the stage one inventory and ranking. Cost of construction, archaeological and environmental impacts, size of the habitat area created and potential benefits and the techniques that are demonstrated should all be considered in the selection of the demonstration sites. These rationale need to be documented in the final project report.

Although some engineering feasibility will be undertaken in the stage one project, these ideas should be developed in more detail in the preliminary engineering stage to work out any potential design difficulties and firm up the construction costs to support the final approval stage. Final design can begin once first nations and the public have accepted the project and a final leave to commence has been received from the Comptroller of Water Rights.

Annual maintenance requirements (cost and scope) will be considered as part of Stage Two. This investigation will incorporate site-specific maintenance requirements (e.g., removal of debris accumulations on-site) and consider the costs or benefits of
other boat launches in the vicinity. Additionally, anticipated day-to-day maintenance and operational requirements that would not typically be incorporated into an annual (once-per-year) maintenance program should be presented in the report.

6.3F Stage Two: Reporting

It is anticipated the final reporting structure for Stage Two will entail four components:

1. Final Design and Site map
2. Project Report including recommendations, problems encountered etc.
3. Annual Maintenance Schedule
4. As built drawings

7.0 SCHEDULE

The following are the milestone dates for the work:

- Submission of Terms of Reference to the Comptroller of Water Rights – May 2008.
- Stage One Field work – May 2009.
- Stage One Final Report – September 2009
- Stage Two Final Design – November 2010
- Stage Two Approval by Comptroller of Water Rights – February 2011.
- Stage Two Construction – May 2011.

8.0 COST OBJECTIVES

The following tables show the estimated costs associated with this project.

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<th>GMSWORKS #16 Wetland Inventory</th>
<th>GMSWORKS #16 Total</th>
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<td>GMSWORKS #17 Total</td>
<td>$333,500.00</td>
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</tbody>
</table>
Attachment 1

BC Hydro Heritage Procedures Flowchart and Field Guide

Start

No/Not Applicable

Does the project or work involve ground surface alteration (e.g., excavation, soil removal, recontouring)?*

Yes/Possible

Is there a known archaeological site or potential archaeological site in the project or work area or within 50 m of the area? (use EGIS)

Yes/Possible

Contact First Nations and engage heritage consultant for appropriate study and any follow-up studies and recommendations

No/Not Applicable

Does the project or work involve the felling of mature western red cedar or mature lodgepole pine?

Yes/Possible

Contact First Nations and engage heritage consultant for appropriate study and any follow-up studies and recommendations

No/Not Applicable

Does the project or work area contain buildings, industrial remains, heritage trees, trails, or other built remains that are protected under legislation? (contact local government to determine if property is included in community heritage register)

Yes/Possible

Instruct field crews to avoid impacts to heritage trees or heritage buildings

No/Not Applicable

(1) Proceed with work; and
(2) Refer to Field Guidelines for Emergency Heritage Procedures