

Peace Project Water Use Plan

Monitoring Program Terms of Reference

Peace Spill Protocol

- **GMSMON-12 Peace River Wildlife Survey**

February 9, 2008

Terms of Reference for the Peace Project Water Use Plan Monitoring Programs Peace Spill Protocol

1.0 OVERVIEW

This document presents Terms of Reference for the effectiveness monitoring programs for the Peace Spill Protocol (Table 1). These programs will monitor and quantify the environmental effects of spills. Information collected through the Peace Spill Protocol will be used, if appropriate, in the revision of future spill strategies. This document provides detailed Terms of Reference for the following programs:

- 1) **GMSMON-3 Peace River Fish Stranding:** A conditional monitoring program to be implemented immediately following a spill event that will assess the magnitude of fish stranding in the Peace River.
- 2) **GMSMON-4 WAC Bennett Dam Entrainment Study:** A conditional monitoring program to be implemented for a spill event that will estimate the number of fish entrained through WAC Bennett Dam and the rate of mortality experienced by entrained fish. Formerly known as the GMS Entrainment Study. The original project title was misleading as the focus of the study is spillway entrainment and not turbine entrainment.
- 3) **GMSMON-6 Peace River Riparian Flooding:** A conditional 2-year monitoring program to be implemented in Years 9 and 10 of the Peace Project Water Use Plan should a spill event occur during the 10-period.
- 4) **GMSMON-7 Peace River Side Channel Fisheries:** A 10-year required program to provide baseline data on flow, fish use, and substrate changes in side channels as well as to assess the response of trial sites (a physical works project).
- 5) **GMSMON-8 Peace River Side Channel Response:** A conditional monitoring program to assess the response of side channels to spill events in terms of flow, fish use, and substrate.
- 6) **GMSMON-9 Peace River Spill Hydrology:** A conditional program to ensure the collection and reporting of hydrological data associated with a spill event.
- 7) **GMSMON-10 Peace River Spill Photos:** A conditional monitoring program that captures the Peace River at five different flows during a spill event.
- 8) **GMSMON-11 Peace River Spill TGP/Temp:** A conditional monitoring program that monitors TGP and temperature levels of the Peace River during a spill and two weeks following.
- 9) **GMSMON-12 Peace River Wildlife Survey:** A conditional monitoring program that assesses the impact of a spill event on ungulates, beavers, riparian birds, and toads.
- 10) **GMSMON-13 Williston Fish Index:** A study that will estimate the abundance of fish in the pelagic area of the Peace Arm of the Williston Reservoir to assist in assessing the impact of entrainment on fish populations during a spill.

Table 1 Peace Spill Protocol Monitoring Program Terms of Reference Submission Information

Name of Monitoring Program	Order Clause Fulfilled	Submitted with this Package	Previously Submitted To CWR	Ordered Submission Date
GMSMON-3 Peace River Fish Stranding	Schedule D 3(a)	Yes	No	February 2008
GMSMON-4 WAC Bennett Dam Entrainment	Schedule D 3(b)	Yes	No	February 2008
GMSMON-6 Peace River Riparian Flooding	Schedule D 3(c)	Yes	No	February 2008
GMSMON-7 Peace River Side Channel Fisheries	Schedule C 4(d)	Yes	No	August 2008
GMSMON-8 Peace River Side Channel Response	Schedule D 3(d)	Yes	No	February 2008
GMSMON-9 Peace River Spill Hydrology	Schedule D 3(e)	Yes	No	February 2008
GMSMON-10 Peace River Spill Photos	Schedule D 3(g)	Yes	No	February 2008
GMSMON-11 Peace River Spill TGP/Temp	Schedule D 3(f)	Yes	No	February 2008
GMSMON-12 Peace River Wildlife Survey	Schedule D 3(h)	Yes	No	February 2008
GMSMON-13 Williston Fish Index	Schedule D 3(i)	Yes	No	February 2008

Monitoring Program No. GSMON-12 Peace River Wildlife Stranding Survey

1.0 MONITORING RATIONALE

1.1 Background

The Peace River Water Use Plan (WUP) Committee (hereafter known as the Committee) recognized that wildlife is impacted when a spill event occurs at Peace Canyon (PCN) Dam and consequently recommended the Peace River (PCR) Wildlife Stranding Survey to assess these impacts. Previous studies during spill events have included aerial surveys that target ungulate stranding on islands and bars (BC Hydro 1997; 2002) and an assessment of food supply for those stranded (BC Hydro 1997). Observations during these studies include mule deer, moose, and elk stranded on islands, swimming and presumably drowning in the river. Data from baseline wildlife studies indicates that during a major release of water low-nesting birds are vulnerable to losses during the nesting, incubation, and brood-rearing phases (TerraMar Environmental Research Ltd. 2000). The PCR Wildlife Stranding Survey will attempt to quantify wildlife stranding and losses as a result of spill events.

The Peace River Wildlife Stranding monitoring program addresses two management plans, the Peace Spill Protocol (PSP) and the Peace River Flood Pulse Plan, developed by the Committee. Both positive and negative impacts are expected from flood pulses (e.g., spills) and this monitoring program will focus on the negative impact on wildlife in terms of habitat loss and mortality. As part of the PSP, the study will address the uncertainty of the relative magnitude of habitat loss and mortality using existing knowledge of habitat use and survey methods. Information gained from this monitoring program will aid future decision-making related to spill risk strategies and environmental consequences. As part of the PCR Flood Pulse Plan, the results from this monitoring program may act as a weighting against the ecological merits of flood pulses. The monitoring programs within both of these management plans will be conducted opportunistically as no planned spill release is proposed. Spill events on the Peace system exceeding generation capacity of 70,000 cfs are rare, occurring only four times since 1968. Four additional spill events have occurred for other reasons during this period (BC Hydro 2003). These eight spills, in total, roughly equate to a spill occurring on average once every five years. Documentation describing the impacts of such flow events to the environment in the Peace River system is limited.

1.2 Management Questions

The key management question(s) are:

- 1) What are the impacts on ungulates and their habitat as a result of a spill event?
- 2) What are the impacts on beavers and their habitat as a result of a spill event?
- 3) What are the impacts on riparian birds and their habitat as a result of a spill event?
- 4) What are the impacts on the western toad and their habitat as a result of a spill event?

The western toad was not specifically identified as a concern by the Committee; however, as it is a SARA species of special concern the monitoring program has been expanded to assess the potential impact of a spill on this amphibian species.

1.3 Detailed Hypotheses about the Ecological Impacts

The primary hypotheses¹ to be tested are:

- H₁: Ungulate mortality/habitat loss resulting from a spill significantly impacts the ungulate population in the Peace River floodplain downstream of Peace Canyon Dam;
- H₂: Beaver mortality/habitat loss resulting from a spill significantly impacts the beaver population in the Peace River floodplain downstream of Peace Canyon Dam;
- H₃: Riparian bird mortality/habitat loss resulting from a spill significantly impacts the riparian bird population in the Peace River floodplain downstream of Peace Canyon Dam;
- H₄: Western toad mortality/habitat loss resulting from a spill significantly impacts the western toad population in the Peace River floodplain downstream of Peace Canyon Dam.

These hypotheses will use baseline information collected during previous wildlife surveys (e.g., Keystone 2006) to determine the status of the populations. Field surveys will be used to make inference regarding mortality of a given species; however, inferences based on habitat loss will likely be required. Hypotheses will be made species specific depending on the species observed during the field survey. For instance, if the only ungulate observed is mule deer then H₁ hypothesis will be adapted accordingly. Similarly for the H₂ hypothesis, hypothesis will be adapted based on a literature review that will identify the species at greatest risk to be impacted given the timing and expected size of the spill.

1.4 Key Water Use Decision Affected

The key water use decisions affected by the results of the monitoring program are the revision of future spill strategies and the necessity of flood pulse events to maintain side channel and riparian habitat. In addition to the information from this monitoring program, other studies within the Peace Spill Protocol and the Peace River Flood Pulse Plan will influence these water use decisions. These decisions have important implications for power generating and ecological values. Results of the monitoring could affect power generation as well as fish, wildlife, and vegetation downstream of the Peace Canyon Dam.

2.0 MONITORING PROGRAM PROPOSAL

2.1 Objective and Scope

The objectives of the monitoring program is to address the management questions identified in Section 1.2 by collecting the data necessary to draw inferences and to test the impact hypotheses outlined in Section 1.3. The study area will consist of the

¹ For clarity, the hypotheses are stated as the alternate hypotheses. Analyses will test the null hypotheses of no effect or difference.

floodplain of the Peace River from the PCN Dam to the confluence with the Pine River. Study sites will be selected based on existing terrestrial ecosystem mapping and flow mapping. Sampling will be carried out in a standardized manner and will follow a specified schedule to ensure consistency in data quality and collection procedures. All data will be archived according to RIC (1998b) and BC Hydro protocols. All species at risk (SAR) data will be provided to the Conservation Data Center (CDC) using appropriate forms, and data on other wildlife species will be provided to the Wildlife Species Inventory (WSI) database using appropriate forms. Contractors will provide the data directly to CDC and WSI.

The monitoring program will be implemented for each spill when total discharge is greater than 70,000 cfs (or 2000 cms) occurs for two days or longer.

2.2 Approach

Flight surveys will be to determine the number of ungulates on islands and beavers along the river. An assessment of bird and toad populations will be based on (i) literature/expert review to determine the bird species of greatest concern based on the timing of the spill and size of spill expected, (ii) index sites selected using existing terrestrial ecosystem mapping and flow mapping, and (iii) survey of western toad and targeted bird species to assess mortality or risk of mortality. A final report will be prepared at the end of the monitoring program that summarizes the results collected to date, discusses inferences that can be drawn pertaining to the impacts of the WUP over time, and presents conclusions concerning the management question in Section 1.2 and the impact hypotheses in Section 1.3.

2.3 Methods

2.3.1 Task 1: Project Coordination

Project coordination will involve the general administrative and technical oversight of the monitoring program. This task will include but not be limited to: 1) budget management, 2) study team management, 3) logistic coordination, 4) technical oversight of field and analysis components, and 5) facilitation of data transfer among other investigators associated with the Peace Spill Protocol and the Peace River Flood Pulse Plan.

2.3.2 Task 2: Ungulate Surveys

Aerial surveys targeting ungulates will occur over the course of the spill. The purpose of the aerial survey is to estimate the number of ungulates on islands or swimming in the water. An aerial survey will occur at the start of the spill, at the peak of the spill and at the conclusion of the spill. The pre-spill survey will provide an estimate of the number of ungulates initially stranded on islands and the post-spill survey will provide an estimate of the number of ungulates remaining on the islands. A peak spill survey will be conducted if the spill is large enough in magnitude that it is expected to fully or nearly fully inundate islands that could potentially force ungulates into the river. Although the counts will not provide a direct estimate of mortality, they will provide an estimate of individuals impacted. Of those impacted by the spill, some proportion would represent mortality. The impact to the population will be assessed by assuming a range of mortality rates (e.g., 25%, 50% and 100%) of the count for each species.

The large number of islands in the Peace River may require that a representative sample be surveyed. A stratification scheme will be developed based on island land area and type/volume of vegetation. Islands will be randomly selected based on this stratification scheme. A minimum of five islands per strata should be surveyed.

Survey information to collect should include but not be limited to:

- GPS location of observations
- Activity of subject(s)
- Life stage (e.g., juvenile, adult)
- Relative location (island, water, mainland)

A general flight survey data sheet will also be completed during each survey. Any incidental observations of other wildlife should be recorded. Infrared technology may be useful to assist in detecting wildlife; however, vegetation may hinder its effectiveness.

Population totals for mule deer, elk, and moose are available (Keystone Wildlife Research Ltd. 2006) to provide an estimate of the overall impact of the spill on the populations in the region. The project coordinator will seek out the most recent population data from BC Hydro and the Ministry of Environment.

Additional opportunistic monitoring of stranded ungulates may be possible in cooperation with other Peace Spill Protocol Plan studies (e.g., PCR Spill Photos).

2.3.3 Task 3: Beaver Surveys

A minimum of two surveys will be conducted to assess the impact of a spill on beavers. Timing of the surveys will coincide with the ungulate, toad, and bird surveys.

An aerial/boat survey will also be conducted. Survey information to collect should include but not be limited to:

- GPS location of observations
- Activity of subject(s)
- Life stage (e.g., juvenile, adult)

In case of beaver structures are encountered, information to collect should include but not be limited to:

- Type of structure (e.g., dwelling, food cache)
- Slope
- Substrate material
- Dominant tree species
- Habitat type
- Apparent damage/destruction from high flows (following spill only)

2.3.4 Task 4: Western Toad and Low-Nesting Bird Surveys

The proponent will collate and review existing information on the western toad and low-nesting bird species in the Peace River floodplain to assist in determining target bird species and site selection for the surveys. The field surveys will be planned based on timing of the spill, flow maps created after the 1996 spill (or more recent data if available), terrestrial ecosystem map (Keystone Wildlife Research Ltd. 2006), baseline wildlife studies (BC Hydro 1997; BC Hydro 1998; TerraMar Environmental

Research Ltd. 2000; BC Hydro 2002), and DEM (available through BC Hydro). The study sites will act as index sites for the larger study area and if possible (based on expected size of spill), index sites will be the same as study sites used in previous wildlife investigations (Keystone Wildlife Research Ltd. 2006) where target species have been detected. For instance, river backchannels were common locations for the detection of all life stages of western toad. The exact number and location of index sites is at the discretion of the researcher but a clear rationale should be presented on how these sites will be determined. The selection of sites will include areas adjacent to the expected area of inundation to assist in quantifying displacement of toads, in addition to mortality of toads and unfledged broods. Standards established by the Resources Information Committee (RIC) will be used as the basis for the methods and field data forms.

Two surveys will occur to estimate the impact of a spill on the western toad and target low-nesting bird species. The first survey will commence prior to the start of the spill then will be repeated immediately following completion of the spill at the same index sites. Survey methods will follow RIC standards and previous study methodology (RIC 1998b, Keystone Wildlife Research Ltd. 2006) to facilitate data transfer and statistical comparison. If appropriate based on timing of the spill, bird surveys will include nest searches to document potential population level impacts of brood loss. All bird observations and the ecosystem unit in which they were detected will be recorded on standard RIC datasheets. In the event that nests are observed, the location and description will be recorded on standard nest site description forms (RIC 1998a).

If Red- and Blue-listed species are encountered a ground inspection form (B.C. Ministry of Environment, Lands, and Parks and B.C. Ministry of Forests 1998) will be completed to record the habitat attributes. Incidental wildlife observations in addition to the target species will be recorded.

2.3.5 Task 5: Data Entry and Analysis

All data will be entered into a common database in a format consistent with RIC (1998b, 1999) standards, which include the use of standard attribute terminology, definitions, and coding schemes. Where possible, the data will be entered into standard forms as described in RIC (1998b, 1999). SAR data will be submitted to the Conservation Data Centre (CDC) and other wildlife data will be submitted to the B.C. Ministry of Environment Species Inventory (SPI) database in appropriate formats. Use of this standardized format will ensure that data collected over the years and across geographical areas are compatible and can be extracted and compared without concern regarding differences in file format or attribute definitions. Contractors and BC Hydro are expected to make adjustments to ensure that the best methods are used for analysis and presentation.

Analysis will include estimating area of habitat that was inundated by the spill for the target species. The impact may be specific to life stage and analysis will be adapted accordingly. Estimates of habitat area impacted will be based on aerial spill photos (PCR Spill Photos), TEM, and DEM (available through BC Hydro) to estimate habitat inundated by the spill. Analysis will also provide an estimate of number of individuals impacted per meter of inundated habitat based on field surveys of index sites. Estimates of total population sizes for ungulate and beavers are available (Keystone Wildlife Research Ltd. 2006 or more recent if available and MoE trend data) to provide an assessment as to relative impact of the spill on target populations in the

region. Density estimates are not currently available for western toads and many low-nesting bird species; consequently, assessment of relative impact to these populations may require inferences based on estimates of inundated habitat.

2.3.6 Task 6: Reporting

A report will be compiled following the spill event which will include:

- a) an executive summary of the project;
- b) description of site selection methods and rationale for target species selection;
- c) description of field methods, including maps of field sites and photographs;
- d) description of mapping and modeling procedures used to estimate inundation of water on habitat of target species;
- e) a summary of the direct observations of ungulates, beavers, target bird species, western toad, and other incidental observations;
- f) a detailed assessment of the findings as they relate to management question and objectives;
- g) any recommendations towards future monitoring (if any) needed to determine the effects of a spill event on wildlife.

A report will be provided in hard-copy and as Microsoft Word and Adobe Acrobat (*.pdf) format. The required maps and figures will be included as embedded objects in the report. All maps and figures will also be provided in their native format as separate files. Raw data will be submitted in a Microsoft Access database. All photos will be submitted electronically.

2.4 Interpretation of Monitoring Program Results

The key result of the monitoring is to assess the impacts of the spill on ungulates, beavers, low-nesting bird populations, and western toads. The impact will be measured by determining the area of habitat inundated by spill waters and estimating the density of the target species in these habitats. The significance of individual loss or habitat loss to the population overall may then be established. If the impact on wildlife populations is deemed significant, then spill strategies may require review to mitigate the negative impacts on wildlife along the Peace River. A significant impact may also discount the feasibility of flood pulse events of certain magnitudes. Alternatively, in the case of ungulates a wildlife rescue protocol or supplemental feeding program may be proposed if a change in spill strategy that minimizes impacts to ungulates is not feasible.

2.5 Schedule

Monitoring is conditional on a spill event at PCN facility where (i) total discharge is greater than 70,000 cfs (or 2000 cms) for two days or longer. Aerial surveys will be completed just prior to the spill and immediately following the spill to determine the impact to ungulates. If islands are expected to be submerged by spill waters, then an additional flight may be necessary during the course of the spill. This mid-spill survey will be implemented in consultation with the BC Hydro Study Lead. Two surveys will be completed for beavers, western toads and low-nesting birds. The first survey will occur immediately prior to the start of a spill and the second survey will be completed immediately following a return to normal operations at the dam.

2.6 Budget

For each spill, the estimated cost for the monitoring program is \$121,854. Table 12-2 summarizes the budget estimated in 2007 dollars.

Table 12-2: Estimated budget for the Peace River Wildlife Stranding Survey

Sub-total		\$103,050
Inflation	2%	\$13,001
Contingency	5%	\$5,803
Total		\$121,854

2.7 References

B.C. Ministry of Environment, Lands, and Parks and B.C. Ministry of Forests. 1998. Field Manual for Describing Terrestrial Ecosystems. Land Management Handbook Number 25. <http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh25/Lmh25.pdf>

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RIC (Resources Inventory Committee). 1998a. Inventory Dataforms for Species Inventory Fundamentals (Version 2.0) Standards for Components of British Columbia's Biodiversity No. 1 [Forms]. Prepared by Ministry of Environment, Lands and Parks Resources Inventory Branch for the Terrestrial Ecosystems Task Force Resources Inventory Committee.
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