Duncan Dam Project Water Use Plan
Monitoring Program Terms of Reference

- DDMMON-10 Duncan Reservoir Fish Habitat Use Monitoring

December 15, 2008
DUNCAN DAM
TERMS OF REFERENCE

1.0 OVERVIEW

This document presents Terms of Reference for monitoring program and physical works for the Duncan Dam Water Use Plan (Table 1). The monitoring programs will address key questions that affected decision making throughout the consultative process. They will assess expected outcomes of operational changes recommended in the Water Use Plan and will provide improved information for future operating decisions. The physical works programs will reduce ongoing erosion to a valuable wetland area, install a boat ramp, develop an action plan to minimize stranding of kokanee spawning in Duncan River side channels, and compensate for nutrient loss to Kootenay Lake.

This document provides detailed Terms of Reference for the following programs:

1) DDMMON-07 Lower Duncan River Water Quality Monitoring: A 2-year project with a 1-year contingency to collect temperature and total gas pressure concentration data in the Lower Duncan River and correlate changes in data with dam operations.

2) DDMMON-10 Duncan Reservoir Fish Habitat Use Monitoring: a multi-year program to monitor habitat use of reservoir fish species of interest (rainbow trout, kokanee, bull trout and burbot), reservoir water quality variables, and spawning timing data on a seasonal basis. The information collected in this program will be used in future water use planning processes to assess potential effects of operating alternatives.

3) DDMMON-15 Lower Duncan River Protocol Development and Finalization: a multi-year program to synthesize the results of the Adaptive Stranding Protocol and Development (ASDP) monitoring program studies (DDMMON#1, DDMMON#2, DDMMON#3 and DDMMON#16), identify data gaps as studies progress, provide the basis for recommending changes to the Lower Duncan River Stranding Protocol, and communicate to stakeholders at key decision points.

Table 1: Duncan Dam Water Use Plan Physical Works and Monitoring Program Terms of Reference Submission Information

<table>
<thead>
<tr>
<th>Name of Monitoring Program or Physical Works</th>
<th>Order Clause Fulfilled</th>
<th>Submitted with this Package</th>
<th>Previously Submitted To CWR</th>
<th>Submission Date</th>
<th>Leave to Commence</th>
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<tbody>
<tr>
<td>DDMMON-1 Lower Duncan River Ramping Rate Monitoring</td>
<td>Clause 5(e)</td>
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<td>Yes</td>
<td>3 April 2008</td>
<td>Yes</td>
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<td>DDMMON-2 Lower Duncan River Habitat Use Monitoring</td>
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<td>No</td>
<td>Yes</td>
<td>30 July 2008</td>
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<td>Name of Monitoring Program or Physical Works</td>
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<td>Submitted with this Package</td>
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<tr>
<td>Name of Monitoring Program or Physical Works</td>
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<td>DDMWORKS-3 Kootenay Lake Nutrient Loading Funding</td>
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<td>No</td>
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<td>DDMWORKS-4 Action Plan to minimize stranding of kokanee stranding in Lower Duncan River Sidechannels.</td>
<td>Clause 5(c)</td>
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10.0 DDMMON#10 – Duncan Reservoir Fish Habitat Use Monitoring

10.1 MONITORING PROGRAM RATIONALE

10.1.1 Background

Prior to the Duncan Dam Water Use Plan project (DDM WUP), Duncan Reservoir operations were optimized for water storage to meet Columbia River Treaty (CRT) commitments, and to support downstream operations constrained by the CRT and fisheries requirements. In typical WUP processes, data collection during the project would help support assumptions around impacts of reservoir operations on key areas of interest. However, the project was limited in resources and time and was unable to collect much of the data required to support fisheries and aquatic objectives of defining operations that would improve ecological conditions in the reservoir. High level approximations of stranding risk and tributary access were considered but then eliminated from the process when they proved to be insufficient aids to decision making (see BC Hydro 2005).

A study brief provided by Perrin (2002) outlined the data collection program required to address uncertainties outlined in the DDM WUP process, related to the habitat use of species of interest in the Duncan Reservoir:

- Species life histories in the littoral and pelagic zones of the reservoir;
- Habitat origins and life history requirements of fish food organisms;
- Tributary stream habitat requirements of fish species of interest; and
- Biomass and species composition of fish food organisms in littoral and pelagic zones of reservoir.

At the conclusion of the DDM WUP project, the Consultative Committee (CC) recommended as part of the WUP monitoring program that the critical data gaps relating to fish use in the reservoir be addressed. This will ensure that future planning processes can integrate this knowledge to better accommodate fish requirements during future planning processes.

Completing this study program will result in partial fulfillment of requirements ordered by British Columbia’s Comptroller of Water Rights, and will specifically address clause 6(f) of BC Hydro’s Duncan Dam Conditional Water License 27027, monitoring kokanee and rainbow trout populations in Duncan Reservoir.

10.1.2 Management Questions

The key question related to the operations recommendations defined during the DDM WUP process is:

*Will the recommended reservoir operations improve fish productivity through habitat and fish-food abundance and distribution?*

There was very little baseline information collected prior to/during the DDM WUP process and therefore, the management questions pertaining to the question above are formulated to address uncertainties related to interactions between reservoir management and fish/fish-food:

1. *What is the relative abundance and distribution of key fish life histories in the pelagic and littoral zones of the reservoir?*
2. *What is the relative abundance and distribution of fish-food organisms in the pelagic and littoral zones of the reservoir?*
3. *What is the life history timing associated with fish species of interest?*
Finally, once the three management questions are addressed, the final question can be considered in the context of possible impacts to fish:

4. How are key fish life histories (spawning and rearing) influenced by reservoir management?

In addressing these management questions during the current DDM WUP review period it is anticipated that, where identified as a critical uncertainty, ongoing monitoring of fish productivity may be recommended in future water planning processes for Duncan Dam. Other monitoring components (DDMMON#11 – Duncan Reservoir Burbot Monitoring and DDMMON#17 – Duncan Reservoir Kokanee Stock Assessment) will monitor specific species abundance in the reservoir, but will require long term monitoring to correlate reservoir management with productivity indicators.

10.1.3 Summary of Alternate Hypotheses

To address the management questions above the following hypotheses will be tested over the duration of this monitoring program:

H01: Life history timings of fish species of interest are consistent with those defined during the WUP data collection phase.

This hypothesis will be evaluated by assessing use throughout (and adjacent to) the assumed life history windows, including spawning and rearing phases, for key fish species in the reservoir and/or its tributaries.

H02: Reservoir operations do not negatively affect fish life history uses of pelagic, littoral or tributary zones.

This hypothesis will be tested by analyzing reservoir operations in consideration of observed habitat use, identifying areas of use that are marginalized through reservoir operations, and quantifying those habitats in the context of overall availability.

Distribution of fish species of interest and fish-food organisms will be assessed during this monitoring program as well, although the outcomes of these program components do not lend to the testing of specific hypotheses, since there were no pre-conceived distribution patterns for fish/food species in the reservoir.

10.1.4 Key Water Use Decision Affected

The results from this monitoring program will be used to create and refine fish habitat/fish food performance measures to be used during future Duncan Dam water planning processes following the completion of the 10-year review period associated with the current Water License. Where results of performance measures associated with different operating alternatives warrant changes to the current WUP recommendations, a decision process may lead to revised operating parameters, and associated monitoring programs. Only where significant adverse fisheries impacts are observed, as interpreted by BC Hydro and key regulatory representatives reviewing monitoring program results, will operating changes be considered during the current review period.

10.2 MONITORING PROGRAM PROPOSAL

10.2.1 Objective and Scope

The end objective of this monitoring program is to determine how reservoir operations interact with fish and fish-food habitat uses. Specifically, the “means” objectives are as follows:

- To determine the habitat requirements of different life history stages for fish species of interest in the Duncan Reservoir; and
To document the influence of reservoir operations on life history success for species of interest in the Duncan Reservoir. This will be accomplished through several seasonal surveys over the 10-year review period. Specifically, the level of effort will be distributed as follows:

- Years 1 to 3: Annually, a minimum of three seasonal habitat use surveys of tributary, littoral, and pelagic zones; and
- Years 2, 4, 6, 8 and 10: Spawning surveys in tributary and shoreline areas for all species of interest.

Species life histories of interest in this study program are as follows (also see assumed life history timing utilized in the WUP, Table 10-1):

- Rainbow trout (*Oncorhynchus mykiss*): spawning, incubation, juvenile and adult rearing phases;
- Kokanee (*O. nerka*): spawning phase; and
- Bull trout (*Salvelinus confluentus*): spawning, incubation, juvenile and adult rearing phases.

Other than spawning, habitat use assessments of stream phases (incubation and juvenile rearing) for rainbow and bull trout will be focussed on the stream reach influenced by reservoir management (i.e., the drawdown zone). All work will be based on index assessments as follows:

- Spawning surveys: at 4-5 index streams (for rainbow trout and bull trout spawners) and at 4-5 index sites (for kokanee shoreline and/or stream spawning sites combined);
- Littoral surveys: adjacent to the confluence zones of the 4-5 index streams identified above. The survey area will extend 50 m either side of the confluence point, and into the reservoir as far as can be defined as littoral or 50 m, whichever is less; and
- Offshore surveys: (pelagic and profundal) 3-4 index sites will be chosen in the pelagic zone to conduct stock surveys, distributed along the length of the reservoir to reflect available habitats.

The life history timing for species of interest are summarized in the table below, but will be refined based on the information collected for this study program.

**Table 10-1: Life history timing for reservoir fish species of interest (Vonk 2001). Red annotations indicate revised timing utilized in the DDM WUP process based on professional opinion.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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<td>Kokanee</td>
<td>Spawning</td>
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<td>15</td>
<td>32</td>
<td>47</td>
<td>60</td>
<td>74</td>
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<td>105</td>
<td>121</td>
<td>135</td>
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<tr>
<td>Rainbow Trout</td>
<td>Spawning</td>
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<td>15</td>
<td>32</td>
<td>47</td>
<td>60</td>
<td>74</td>
<td>91</td>
<td>105</td>
<td>121</td>
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<td>105</td>
<td>349</td>
</tr>
<tr>
<td>Bull Trout</td>
<td>Spawning</td>
<td>1</td>
<td>15</td>
<td>32</td>
<td>47</td>
<td>60</td>
<td>74</td>
<td>91</td>
<td>105</td>
<td>121</td>
<td>135</td>
<td>105</td>
<td>349</td>
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<tr>
<td>Burbot</td>
<td>Spawning</td>
<td>1</td>
<td>15</td>
<td>32</td>
<td>47</td>
<td>60</td>
<td>74</td>
<td>91</td>
<td>105</td>
<td>121</td>
<td>135</td>
<td>105</td>
<td>349</td>
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</tbody>
</table>

### 10.2.2 Approach

This monitoring program is divided into two components: habitat collection and aquatic inventories. The following tasks define the total study program:

- **Study planning and site selection:** Care will be taken in each of the surveys to choose sites that are representative, accessible for study, and are appropriate...
(i.e., accessible to fish, affected by operations and available for long-term monitoring);

- **Habitat data collection**: Stream surveys and bathymetric surveys will be initiated at the start of the review period.

- **Stream surveys**: Stream surveys will focus on 4-5 index streams with full access through the drawdown zone, and consistent annual streamflow. The survey length will extend from the reservoir confluence to 100m (stream length) above the full pool mark.

- **Littoral surveys**: Littoral surveys will focus on the confluence zones of the candidate streams described above. The survey area will extend 50 m either side of the confluence point, and into the reservoir as far as can be defined as littoral or 50 m, whichever is less.

- **Offshore surveys**: (Pelagic and profundal) 3-4 index sites will be chosen in the pelagic zone to conduct stock surveys, distributed along the length of the reservoir to reflect available habitats.

### 10.2.3 Methods

The following methods are proposed to support DDM WUP CC recommendations, and reflect the data gaps identified in the decision process. Changes to the methodology will be considered and approved if the objectives, scope and budget considerations for this program are met.

#### 10.2.3.1 Study Planning and Site Selection

**Information Review and Study Plan Modifications**

Prior to field work, the program biologist will conduct a review of the existing information, including retaining all habitat and survey information for the reservoir and its tributaries to determine the data gaps that need to be addressed to test the hypotheses stated above. In particular, the initial review will include a review of study programs associated with various development and regulatory agencies in the area:

- **IPPs**: the ongoing environmental assessment associated with independent power producers in the Duncan Reservoir watershed;

- **BC Hydro Compensation Programs**: the Columbia Basin Fish and Wildlife Program may have conducted work in the past or is planning work that overlaps with this mandate; and/or

- **Ministry of Environment**: the Nelson office has undertaken ongoing monitoring of bull trout and burbot populations that may be of interest to this program.

Where studies that are ongoing as part of other programs overlap with this project, there is an expectation that this monitoring program will be revised accordingly such that duplicate information is not collected, site locations are replicated where warranted, and methodologies are consistent with other programs where warranted. The information review and revised study plan will be submitted to the study coordinator for approval in advance of any field program implementation.

Note that the Ministry of Environment has outlined standards for data collection to be followed where applicable in the application of the following methods. These standards must be applied where appropriate/feasible to meet Ministry expectations and to be comparable to other data collected by the Province. Refer to the “Fish Collection Methods and Standards V4” by website:

http://ilmbwww.gov.bc.ca/risc/pubs/aquatic/fishcol/assets/fishml04.pdf
Study implementation schedules will be communicated with BC Hydro and regulatory staff to facilitate their potential involvement and oversight.

**Site Selection**

Once complete, stream and reservoir monitoring locations will be chosen and timing for the field studies will be determined according to operations and fish life history timing. Budget for monitoring up to five tributaries and up to 10 reservoir sites (pelagic and littoral combined) is available. Streams will be selected such that each of the key species will use at least three of the streams for a portion of their life history (e.g., kokanee spawning streams may not overlap with bull trout spawning).

As part of the planning, a safety plan will be prepared and all scientific collection permits retained. Subcontracts for bathymetric surveys will be scheduled in advance to ensure timing requirements are met.

**10.2.3.2 Habitat Data Collection**

Collection of habitat information is a one-time data requirement to adequately contextualize reservoir/tributary stream information collected in the fish surveys.

- Bathymetric data collection: a detailed DEM will be developed for the Duncan Reservoir consistent with the budget and effort defined in Section 10.2.6 below. Bathymetric surveys will occur at full pool to maximize the amount of information to be collected.

- Stream spawning habitat evaluation: within the drawdown zone of fish bearing streams, substrate maps will be developed, such that area of substrate by size category relationships with elevation will be developed. Surveys will take place at low pool to maximize the amount of information to be collected.

**10.2.3.3 Stream surveys**

Two survey types will occur over the review period:

- Seasonal habitat use studies: for Years 2, 3 and 4 of the review period, and
- Spawner surveys: for Years 3, 5, 7, 9 and 11 of the review period.

Physical measurements at each stream will be collected during each field visit: temperature, approximate stream flow and wetted area being sampled, dissolved oxygen, turbidity, pH/alkalinity, and water quality samples from a representative site (three replicate samples will be lab analyzed for organic/inorganic suspended/dissolved solids, and nitrogen and phosphorous concentrations). In addition, during the initial stream habitat use field survey, temperature dataloggers will be installed in duplicate at a representative site at each index stream, with data downloaded during each seasonal survey.

**Seasonal Habitat Use Study**

For three years evaluate on a seasonal basis (three seasons: late summer - CPSF, late spring, and winter) the habitat use of reservoir fish species affected by reservoir operations. Surveys will occur once per season for each of the years.

Habitat use will be documented in two ways:

- **Gee trapping:** in a minimum of 10 locations per stream, juvenile habitat use will be documented by overnight gee-trapping in a variety of habitat types and cover situations. Trapped fish will be enumerated and habitat preference noted, including elevation of habitat relative to full pool.
• **Snorkel surveys**: one swim in each stream per season will be conducted to document juvenile fish distribution and relative use between reaches above and within the drawdown zone. Stock abundance estimates for juvenile species of interest using methods proposed in Hagen and Decker (2006).

Where electrofishing surveys are more appropriate than snorkel surveys for juvenile assessments, and can be accommodated within the budget provided, abundance estimates will be accepted using this approach (methodology for single pass open-net electrofishing estimates are outlined in Riley and Korman 1995).

Where seasonal assessment timing will be dictated by temperature, reservoir conditions may be variable between years and therefore may result in variations in data explained by habitat changes. Where possible, studies will be planned to ensure that (a) reservoir operations are consistent between years, and (b) that habitats being sampled are relatively stable prior to sampling. These requirements may be difficult to meet in periods of rising and falling reservoir levels and the schedule will be rationalized and finalized with BC Hydro prior to implementation.

**Spawner Surveys**

Each of the three spawning seasons (timing will be reflective of current information: kokanee and bull trout [late summer/early fall], rainbow [mid spring], burbot [mid winter]), field technicians will visit index streams AND stream fans to document adult escapement, spawning location and/or habitat preference. If spawning numbers are low within the established survey length, the survey will be extended above to adequately capture habitat preference and use of spawners for that particular season, and into the future. Year 3 (i.e., the first year of stream spawning surveys) will focus primarily on refining timing windows and locations of spawning, and refining methodologies for future assessments in Years 5, 7, 9 and 11.

• **Start-up data collection**: based on local information, and periodicity defined in the WUP, plan for additional field visits in Year 3 survey to ensure the full spawning period is known. Utilize this information for future surveys to minimize wasted effort.

• **Annual data collection**: seasonal spawner surveys will be conducted by experienced field technicians at a frequency no less than one in 10 days, over a period of up to six weeks. There is budget for up to six surveys per species spawning life history. The frequency should reflect spawner intensity, and in particular the species spawning timing.

**10.2.3.4 Lake Surveys**

Both littoral and pelagic fish sampling surveys will be carried out seasonally (three seasons as above) as dictated below for each of the first three years of this program.

In addition to the fish sampling programs, water quality monitoring will be carried out for each of the three seasons as above, at each pelagic sampling site:

• temperature-depth profile;
• location (by GPS);
• light penetration-depth profile;
• dissolved oxygen*, turbidity*, pH/alkalinity*, and analyzed water quality*: three replicate samples from three sites of the 10 sampled will be lab analyzed for organic/inorganic suspended/dissolved solids, and nitrogen and phosphorous concentrations; and
• zooplankton sampling: four of the 10 sampling sites (located in each lake quadrant) will be sampled in late spring only using a plankton net/straining bucket
pulled from the critical zone (as described by pre-defined oxygen levels) to the surface at a constant rate. See Schneider (2000) for details on methods, equipment and analysis

* These parameters will be measured between 1-2 m below the water surface to ensure representativeness.

**Littoral Surveys**

Seasonal assessments of fish use in the first three years of the review period will be repeated for the littoral zone at key locations defined above. To document juvenile use, Gee-traps will be set over a 24-hour period in a minimum of 10 sites within each index area, set at various habitat types and proximities to stream mouths. To document adult use in the littoral area at each index site, a six-panel variable mesh size floating gill net will be set at two different times of day: dawn and dusk, consistent hours each set. In both survey types, fish will be enumerated (species, age, length, weight, adult scale sample), indicating the habitat preference (adjacent substrate size, depth, proximity to shoreline, and local cover/vegetation).

Stomach contents of a select number of each species (total n=<20 and at least five samples for species) will be analysed as part of this program, to determine diet needs and therefore habitat requirements for operations.

**Pelagic Surveys**

Offshore habitat use will also be evaluated seasonally (three seasons as above) for the first three years of the review period at sites planned for in this contract. Gill netting will be conducted on one day each season to determine the pelagic (off shore, light penetrating) distribution of adult species of interest, adjacent to the lake survey locations determined above. Net panels will be configured to drift in the pelagic areas and sink in profundal zone. Both sets will be done twice per day, at dawn and dusk, with consistent hours each set.

Again, stomach contents of a select number of each species will be analysed as part of this program.

10.2.3.5 **Analysis and Reporting**

The analysis will focus on the development of performance measures related to the outcomes of the studies defined above. Refining life history timing and habitat use, defining available habitats, and monitoring population level impacts of operations will more clearly outline impacts of operations on reservoir fish populations for the benefit of future planning processes. The following analytical steps will be taken:

- **Habitat – Elevation Profiles:** Based on bathymetric and stream habitat surveys, all habitats within the reservoir drawdown zone will be compiled and habitat-elevation relationships will be developed from enhanced digital elevation models. This will be completed directly after the data is collected.

- **Water Quality monitoring:** Based on the first three years of data, temperature and oxygen profiles will be defined for each season. Nutrient concentrations will be converted to nutrient loading and compared to other concentrations in the regions. Zooplankton population estimates will be derived from each spring sampling program, and compared to regional data. All water quality data will be analyzed and presented in the context of regional data and where applicable, potential bottlenecks to fish life history development will be highlighted.

- **Compile Life History Information:** Based on information collected in the seasonal habitat use studies and spawner surveys, life history timing and habitat preferences will be defined after the three-year data collection program is completed. Relative abundance or spawning escapement estimates will be
derived for respective life histories monitored. Data gaps will be identified and
species periodicity charts revised.

- Operational Requirements: Based on habitat preference and timing of specific
  species, including their diets, provide the likely operating scenarios that would
  optimize these uses.

Reporting will require the following reporting periods:

- Annual Reporting: the contract authority will receive reports on monitoring results
each year and provided a forum for discussion and revision where appropriate.

- Milestone Reporting: particularly for front-end programs such as seasonal habitat
  use studies, wrap-up reports and performance measure developments will be
  provided to the BC Hydro contract authority upon their completion.

### 10.2.4 Interpretation of results

The stated hypotheses will be tested directly according to data collected during the
seasonal habitat use and spawner survey data. Most data are being collected to
meet specific performance measure requirements that could not be collected during
the WUP, and so effectiveness monitoring of those data once they are used in a
future operation will be conducted at a later date.

### 10.2.5 Schedule

In general, the following schedule applies to this monitoring program over the 11-
year review period:

- Years 2-4: Annually, a minimum of three seasonal habitat use surveys of tributary,
littoral, and pelagic zones; and

- Years 3, 5, 7, 9 and 11: Spawning surveys in tributary and shoreline areas for all
  species of interest.

Specifically, the timing for various milestones are outlined in the following table.

#### Table 10-2: Proposed monitoring program schedule assuming 2009 (Year 2 of the review
period) start date.

<table>
<thead>
<tr>
<th>Component</th>
<th>Proposed Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Award/Work Start</td>
<td>February 2009</td>
</tr>
<tr>
<td>Information Review and Study Plan Modifications (Draft Report)</td>
<td>March 2009</td>
</tr>
<tr>
<td>Site Selection</td>
<td>April/May 2009</td>
</tr>
<tr>
<td>Habitat Data Collection</td>
<td>August-September 2009</td>
</tr>
<tr>
<td>Seasonal Habitat Use (Stream, Littoral and Pelagic surveys)</td>
<td></td>
</tr>
<tr>
<td><strong>Spring</strong></td>
<td>May 2009, 2010, 2011</td>
</tr>
<tr>
<td>Spawner Surveys</td>
<td></td>
</tr>
<tr>
<td><strong>Bull trout</strong></td>
<td>August-September 2010, 2012, 2014, 2016, 2018</td>
</tr>
<tr>
<td><strong>Kokanee</strong></td>
<td>September-October 2010, 2012, 2014, 2016, 2018</td>
</tr>
<tr>
<td>Year 2 - Draft Data Report (2009 data)</td>
<td>January 2010</td>
</tr>
<tr>
<td>Year 2 - Final Data Report (2009 data)</td>
<td>March 2010</td>
</tr>
<tr>
<td>Year 11 (last year) - Draft Summary Report</td>
<td>January 2019</td>
</tr>
<tr>
<td>Year 11 (last year) - Final Summary Report</td>
<td>April 2019</td>
</tr>
</tbody>
</table>
10.2.6 Budget

The monitoring program as proposed in these terms of reference is estimated to cost $581K in 2004$. The total inflated cost for this program assuming 2008 implementation is $674K. The CC approved a budget for $373K in 2004$. The difference in estimates between the two programs is primarily due to the assumption of jet boat access for habitat surveys, and the increased sampling effort required to conduct the littoral and pelagic sampling. Options for revising the sampling program include reducing the sample size from 10 littoral/pelagic sites to five. This will reduce the inflated cost of the program to $575K (2008$).

10.3 REFERENCES


Hagen, John and Scott Decker. Seasonal abundance and habitat use of fish species utilizing side channel habitats of the lower Duncan River, BC (2004-2005). Prepared for BC Hydro, Castlegar, BC.

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