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Review of Habitat Monitoring at Twenty-Two Independent Power Projects

March 2013

Prepared for:

Fisheries and Oceans Canada
Vancouver, British Columbia

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Review of Habitat Monitoring at Twenty-Two Independent Power Projects

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Page 25, Section 3.2.4.2 (Table 9)

Compliance rating for Authorization Condition D(3) should be categorized as Full Compliance. Ramping compliance analysis is conducted with continuously recorded data (i.e., more frequent than 15 second intervals).

Page 15, Section 3.2 (Table 3)

Total number of applicable monitoring conditions considered fully compliant at time of review should be 84 (49%). Total number of applicable monitoring conditions partially compliant at the time of review should be 65 (38%).

REVIEW OF HABITAT MONITORING AT TWENTY-TWO INDEPENDENT POWER PROJECTS

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LIST OF ACRONYMS

BA	Before-after design
BACI	Before-after control-impact
BC	British Columbia
DFO	Fisheries and Oceans Canada
EIA	Environmental impact assessment
HSI	Habitat suitability index/indices
IFR	Instream Flow Requirement
IPP	Independent power producer
MOE	Ministry of Environment
NA	Not applicable
RCA	Reference condition approach

ACKNOWLEDGEMENTS

This review was conducted under the direction of Herbert Klassen on behalf of Fisheries and Oceans Canada (DFO). Hatfield Consultants Partnership (Hatfield) would like to thank Herbert Klassen and Francesca Knight of DFO for providing comments on the Draft report of this review. Hatfield would also like to thank all DFO Area staff and industry proponents who provided us with the relevant monitoring reports required for this review. Jason van Rooyen and Valerie Smith of Hatfield Consultants prepared the extensive reference list and diligently reviewed each document for comparison against relevant monitoring criteria. Jason van Rooyen developed the results section of this report.

EXECUTIVE SUMMARY

Under the auspices of Fisheries and Oceans Canada, Hatfield Consultants Partnership conducted a review of habitat monitoring performance at 22 Independent Power Producer (IPP) projects across British Columbia and the Yukon. Overall industry performance was evaluated based on compliance with monitoring requirements outlined in the project specific Fisheries and Oceans Canada subsection 35(2) Fisheries Act Authorizations. A further review of monitoring data analyzed alignment with long term monitoring protocols presented in "Long-Term Aquatic Monitoring Protocols for New and Upgraded Hydroelectric Projects" (Lewis et al. 2012). Because these long-term monitoring protocols were developed subsequent to the construction and operation of the IPPs assessed in the current study, the analysis was conducted to determine how much industry effort would be needed to align with this new standard.

A full compliance audit of all IPP regulatory requirements was beyond the scope of this study and would have been redundant with a recent audit by BC Ministry of Forests, Lands and Natural Resources on ramping rates and documented fish kills (C. Menezes, 2012). Compliance with instream footprint requirements was also not part of the current study but could be a corollary study based on information in submitted "As-Built" drawings gathered through the current study. Similarly, matters regarding potential violations under the Fisheries Act currently under investigation at several IPPs were not included in this study as they will be addressed through other avenues.

The evaluation of the IPPs was based on a review of project monitoring reports provided by Fisheries and Oceans Canada, the BC Ministry of Natural Resource Operations and project proponents. The major limitation encountered during this review was a lack of available information that could be used to document compliance/conformance. Following the review of available monitoring reports, compliance ratings were assigned to each Authorization condition and alignment ratings to each of the long-term monitoring protocols. Results were summarized in three categories: (1) conformance ratings for monitoring/reporting criteria specified in the Terms of Reference; (2) compliance ratings for project specific Authorization conditions as they relate to monitoring; and (3) alignment ratings for the industry as a whole as they relate to the long-term monitoring protocols presented in Lewis et al. (2012). It should be noted that although the long-term monitoring protocols presented in Lewis et al. (2012) are based on existing published industry guidelines and methodologies, the final document was published in July 2012, and all of the project monitoring plans were developed prior to its release. Furthermore, the long-term monitoring protocols are not written requirements of regulatory approval documents. The intent of this review is to better understand the level of effort required by industry to achieve conformance to this new standard.

The level of compliance with DFO Authorizations and alignment with the long-term monitoring protocols varied across projects and DFO Areas; however, for the projects reviewed there was a common trend in compliance with project specific Authorizations versus alignment with the long-term monitoring protocols. All projects typically complied more to their respective Authorization than they aligned with the long-term monitoring protocols prepared for the industry as a whole. Industry trends in compliance with

Authorization conditions were less apparent because each Authorization is project specific; however, some common Authorization conditions that consistently failed to achieve full compliance included:

- Frequency/timing of monitoring activities were not consistent with Authorization conditions;
- Submission deadlines were not achieved;
- As-built drawings were not provided or missing information; and
- Photographic assessments failed to fulfill requirements of the Authorization.

The following industry trends regarding alignment with the Lewis et al. (2012) long-term monitoring protocols were noted:

- The frequency and location of water quality monitoring generally was inconsistent with the protocol;
- A lack of ramping studies was apparent prior to commissioning;
- Monitoring of instream flow requirements was consistently documented; however, the frequency of monitoring was less than specified in the protocol;
- The number and location of transects required to monitor stream channel morphology was less than specified in the protocol;
- A lack of footprint verification through the submission of as-built drawings;
- Monitoring of fish habitat compensation was not provided; compensation monitoring reports provided were typically missing comparisons to habitat suitability indices;
- Monitoring of species at risk was inadequate;
- Detailed photo-documentation to compare critical habitat sites prior to, during and post-construction were not provided; and
- Projects with intakes at or in proximity to the outlet of a lake failed to follow lake monitoring protocols.

A few similarities were observed between both the Authorization conditions and the long-term monitoring protocols with respect to the inability to demonstrate full conformance/alignment: frequency/timing of monitoring activities; submission of as-built drawings for footprint verification; and detailed photo-documentation.

To address the major limitation encountered during the current review (i.e., lack of available information), it is recommended that a web-based compliance monitoring system be developed to track compliance with approval requirements. The tracking

system should be developed by and maintained by the regulatory agencies, but should provide limited access for proponents to upload compliance documents. A notification system should also be incorporated to automatically notify the proponent and appropriate agency when specified submission dates or project milestones are forthcoming. This system would allow the appropriate regulator to easily confirm that required monitoring documentation has been received and uploaded to a common database. Non-compliance could be assessed more quickly, allowing for immediate enforcement and/or mitigation measures. Common feedback received from proponents was a frustration with the lack of non-compliance notification by regulators until the end of the monitoring program rather than early on in the life of the project when corrective measures are more easily implemented.

Based on feedback from DFO staff, it is recommended that the definition of operational non-compliance be standardized within the industry and include the development of a non-compliance reporting template for documenting the non-compliance.

Specific conditions of DFO Authorizations and BC MoE Water Licenses will always vary between projects; however, an IPP generic set of Authorization Conditions related to monitoring would provide continuity in standards across all projects with regards to monitoring. Further, if these generic set of Authorization conditions aligned with the Long-Term Monitoring Protocols (developed jointly by industry, provincial and federal regulators) proponents would likely be able to develop one monitoring plan that satisfies both levels of government. It is also recommended that the Long-Term Monitoring Protocols be periodically updated by an expert review panel or technical working group as the science of IPP monitoring evolves.

DISTRIBUTION LIST

The following individuals/firms have received this document:

Name	Firm	Hardcopies	CDs	Email	FTP
Herbert Klassen	Fisheries and Oceans Canada			✓	

1.0 INTRODUCTION

Hatfield Consultants Partnership (Hatfield) was retained by Fisheries and Oceans Canada (DFO) Habitat Monitoring Unit to review subsection 35(2) *Fisheries Act* Authorizations issued to proponents for 22 run of river hydro Independent Power Producer (IPP) projects in British Columbia (BC) and the Yukon. IPPs selected for review were chosen by DFO and include all run of river IPPs for which Authorizations were issued in the Pacific Region. The review was undertaken to evaluate industry standards with regards to compliance with monitoring requirements specified in each project Authorization and alignment with standards advocated in the Long-Term Aquatic Monitoring Protocols for New and Upgraded Hydroelectric Projects (Lewis et al. 2012; hereafter referred to as Long-Term Monitoring Protocols).

The results of this review are based on an evaluation of monitoring reports provided by DFO and proponents at the time of the assessment and do not constitute actual determination of compliance. Compliance can only be fully determined through detailed project audits. A full compliance audit of all regulatory requirements of IPPs was beyond the scope of this study and would have been redundant with a recent audit by BC Ministry of Forests, Lands and Natural Resources (C. Menezes 2012).

1.1 PROJECT LIST

All IPPs located in BC and the Yukon for which *Fisheries Act* subsection 35(2) Authorizations were issued were included in this review; the projects, listed by DFO Referral Centre Area (DFO Area) include:

- BC Interior North: Hauer Creek Power Project on Hauer and Duncan Creeks;
- BC Interior South: South Cranberry Creek Hydroelectric Project on Cranberry Creek and Kwoiek Creek Hydroelectric Project on Kwoiek Creek;
- BC North Coast: Dasque Cluster Hydro Project on Dasque and Middle East Creeks;
- BC South Coast: Lower Bear Creek Hydro Project on Bear Creek, Upper and Lower Clowhom Hydroelectric Projects on Clowhom River, Kokish River Hydroelectric Project on Kokish River, McNair Creek Project on McNair Creek, South Sutton Creek Green Hydropower Project on South Sutton and Marion Creeks, East Toba River and Montrose Creek Hydroelectric Project on Toba River and Montrose Creek;
- Yukon Trans-boundary: Forrest Kerr Hydroelectric Project on Iskut River near Forrest Kerr Creek, Atlin Hydroelectric Project at Surprise Lake on Pine Creek (Pine Creek discharges to Atlin Lake); and

- BC Lower Fraser: Ashlu Creek Hydropower Project on Ashlu Creek, Fitzsimmons Creek Hydroelectric Project on Fitzsimmons Creek, Upper Mamquam Hydro Project on the Mamquam River and the Lower Lillooet group of projects (Douglas Creek, Fire Creek, Lamont Creek, Northwest Stave, Stokke Creek, Tipella Creek, Upper Stave River).

1.2 TERMS OF REFERENCE

The objectives of this review as specified in DFO Invitation to Tender F1570-121014, dated September 14, 2012, were to evaluate conformance with both general and specific monitoring criteria as described below:

General monitoring/reporting criteria:

- Compliance with reported monitoring activities stipulated in project 35(2) Authorizations (see Section 2.2); and
- Alignment of reported monitoring activities with the Long-Term Monitoring Protocols (See Section 2.3).

Specific monitoring/reporting criteria:

- Quantification of habitat and fish mortality impacts during construction and operation;
- Quantification of compensation habitat size and effectiveness;
- Provision of adequate baseline habitat data for the statistical interpretation of habitat monitoring results;
- Timely submission of reports to DFO; and
- Documentation of all monitoring activities stipulated in their Authorizations.

2.0 METHODOLOGY

The review objectives were obtained by evaluating conformance with the monitoring/reporting criteria specified in the terms of reference for the current assessment, compliance with each project against its respective Authorization and alignment with the Long-Term Monitoring Protocols.

2.1 MONITORING/REPORTING CRITERIA SPECIFIED IN THE TERMS OF REFERENCE

For each project, a detailed review of available reports was conducted to assign a conformance rating to each of the monitoring/reporting criteria specified in the Terms of Reference. The specific criteria were further broken down and assessed as follow:

- Quantification of habitat and fish mortality impacts during construction;
- Quantification of habitat and fish mortality during operations;
- Quantification of habitat compensation area;
- Assessment of compensation habitat effectiveness;
- Assessment of alignment with the Long-Term Monitoring Protocols (Lewis et al. 2012);
- Provision of adequate baseline data for statistical interpretation of monitoring results;
- Timely submission of reports; and
- Documentation of all monitoring activities stipulated in their Authorizations.

To avoid redundancy, criteria relevant to the Long-Term Monitoring Protocols and project Authorizations were addressed separately in Sections 3.2 and 3.3. Timely submission of reports was determined through dates on email submissions to DFO or a DFO date stamped copy of the report. In most cases these were not available; therefore, the date on the report was used to determine the approximate date of submission.

2.2 AUTHORIZATION MONITORING REQUIREMENTS

For each project, relevant Authorization conditions (including amendments) related to monitoring were identified. A detailed review of available reports was then conducted to evaluate compliance with the Authorization monitoring requirements. Each project was assessed against its specific requirements and a level of compliance assigned based on evidence that the monitoring requirements were fulfilled in a satisfactory and timely manner.

2.3 LONG-TERM MONITORING PROTOCOLS

Salient Long-Term Monitoring Protocols for projects with stream intakes and those with lake/reservoir intakes were compiled into a checklist (Table 1) which references relevant sections of the Long-Term Monitoring Protocols. Available project monitoring reports were reviewed to determine if the checklist items were discussed and to what extent they aligned with the Long-Term Monitoring Protocols.

Table 1 Long-Term Monitoring Protocol checklist.

Sections 1 and 2 General monitoring parameters	
Section 1.4	Is the monitoring design before-after control-impact (BACI)-preferred, or before-after design (BA), trend-by-time design, or reference condition approach (RCA)?
Section 1.5/2.3	Two years of baseline and five years (or longer) of post-construction using standardized sampling protocols/location.
Section 1.5	Monitoring locations should be located in two of three of the following locations: upstream, diversion, and/or downstream sections.
Section 1.5	Control sites established according to recommendations.
Section 2.3	Power Analysis recommended to determine sample size.
Section 2.3	For non-continuous parameters (water quality, fish and invertebrate pops) monitoring should commence 3 months after project commissioning.
Section 3.1 Recommended monitoring parameters for stream intakes lacking a lake intake or reservoir)	
3.1.1.1 Water Quantity (instream flow)	At least one year of data and a rating curve based on 10-measurements annually.
3.1.1.1	For the life of the project: In fish-bearing streams real-time instantaneous flow data should be sampled every 15 s with a 2-minute average for storage in the data logger for verifying compliance with flow ramping requirements.
3.1.1.1	Flow measurements to be provided for the diversion section and the downstream section.
3.1.1.2 Ramping	To be measured continuously for the life of the project.
3.1.1.2 (1.)	Commissioning test: Identify aquatic species at risk by stream section (EIA).
3.1.1.2 (2.)	Commissioning test: Identify sensitive stranding sites (at least 5).
3.1.1.2 (3.)	Commissioning test: Define the stage discharge relationship at sensitive sites.
3.1.1.2 (4.)	Commissioning test: Measure habitat change (prior to, during and following the test).
3.1.1.2 (5.)	Commissioning test: Quantify fish stranding (presence and life-stage and condition).
3.1.1.2 (6.)	Commissioning test: Ramping protocol definition and documentation- use test results to develop an operating protocol (submit to DFO and MOE).
3.1.1.2 (5.)	Commissioning test: Monitor compliance with prescribed ramping rates during operations. Report non-compliance to DFO/MOE.
3.1.2 Construction Monitoring	Monitoring the screen, fishway and effectiveness of fish passage at intake. An annual report is required.
3.1.2.3 Habitat Compensation	Designed by an appropriately experience environmental professional, in compliance with protocols, as-built provided to DFO.
3.1.2.3	Measure: channel length, bankfull and wetted widths, substrate size, cover area by type, cross-channel transect at each hydraulic unit with depth, velocity, cover, and substrate recorded.
3.1.2.3	Score physical dimensions and flow using habitat suitability indices employed in the instream flow assessment-calculated using provincial HSI curves.

Table 1 (Cont'd.)

Section 3.1 (Cont'd.)	
3.1.2.3	Assess physical characteristics following construction and then 1, 5 and 10 years post-construction. Include assessment of riparian vegetation.
3.1.2.3	Monitor adult fish abundance and enumerate by species, sex, condition and status (live or dead). Monitor after 1, 2, 3, 5 and 10 years. Produce an annual report.
3.1.3 Footprint Impact Verification	Quantify and field truth aquatic and riparian area lost. Assess a min of 5 riparian sites. Collect information on riparian class, seral stage, stand age, plant composition, relative species abundance, existing disturbance indicators and proximity to water course.
3.1.3	Use data to assess the functional condition of the riparian zone based on ecosystem characteristics (species assemblage, soil moisture and nutrient regimes, acidity/alkalinity, and hydrodynamics)-Table 2 has a list of parameters.
3.1.3	Conduct an as-built survey following completion of project infrastructure, report results to DFO. Include same characteristics measured in baseline. For aquatic habitat describe material in impact zones (concrete, rip-rap). Describe reseeding/replanting.
3.1.3	Species used for reseeding/replanting must be native to the area and monitored in the late growing season on an annual basis for five years post-construction. Document in an annual report.
3.1.4 Temperature	Develop temperature models that examine the relationship between air temp, water temp and flow.
3.1.4	Continuously monitor instream temp for two years- u/s of the intake or head pond, in the diversion and d/s of the powerhouse.
3.1.4	During operations incorporate temp into models developed for the EIA. Review data annually and produce an annual report that assesses potential impacts and mitigation measures.
3.1.5 Stream Channel Morphology	Regional assessment and local assessment at the diversion section, downstream of the powerhouse and upstream of the intake.
3.1.5	Establish transects in alluvial/semi-alluvial sections- 5 in the diversion channel, 2 in upstream and downstream sections.
3.1.5	At each transect- substrate survey, photo surveys, thalweg profile in the diversion section, aerial photogrammetry over the diversion section and upstream of intake at low flow conditions.
3.1.5	Following project commissioning conduct a morphology assessment after the first large flood event, or five years after construction (whichever is first). Measure same parameters as baseline; provide information on sediment sampling in the head pond and detailed topographic survey showing floodplain. Produce report.
3.1.6 Fish Community	Metrics of fish community health studied at five high quality habitat sites in a control and impact (diversion) areas. Two-year minimum assessment. (Pages 50-51 good assessment of e-fishing).
3.1.6	Use a combination of methods to sample fish, over different seasons. Record CPUE, species, length, weight, abnormalities.
3.1.6	Collect mesohabitat and macrohabitat information (microhabitat information collected as part of instream flow assessment).
3.1.6	Monitor metrics at baseline sites 1,2,3,5 and 10 years post-construction. Produce a report annually.

Table 1 (Cont'd.)

Section 3.1 (Cont'd.)	
3.1.6	Recommended to perform quantitative multivariate analyses with power analyses. Report power and significance of test results.
3.1.6	Sample fish density upstream of the head pond post-construction and compare with densities sampled in the upstream section during baseline.
3.1.7 Water Quality	Baseline: measure quarterly for two years at water temperature baseline sites.
3.1.7	Parameters: DO, TGP, Alkalinity (T), Ammonia, Nitrate, Nitrite, pH, Ortho-phosphorus, Phosphorous (T), TDS, TSS, Turbidity, Spec. Conductivity. DOC, Sulfate, Total Metals, Dissolved Metals only if stream receiving waters (lake/reservoir) could flood soils/veg.
3.1.8 Invertebrate Drift	This is a secondary monitoring requirement to be determined during the EIA.
Section 3.2 Recommended monitoring parameters for Lakes and Reservoirs	
3.1.9 Species at Risk	If species of concern are identified for the project area, baseline data and monitoring requires will be designed specifically for that species and its habitat requirements, behavior and vulnerabilities.
3.2	Minimum baseline data collection will follow the lake inventory requirements as outlined in the Reconnaissance 1:20,000 Fish and Fish Habitat Inventory (RISC 2001).
3.2	Control lake included in the study.
3.2	Table 4 summary of baseline/monitoring requirements.
3.2.1 Physical Lake Characteristics	Baseline- terrain characteristics: lake setting, lake basin genesis, aspect, hillslope coupling, slope stability, land use and access. Shoreline characteristics: type, cover and recreational facilities.
3.2.1	A series of photographs illustrating physical/biological features.
3.2.1	A bathymetric survey and review of physical parameters is required every five years following commissioning. Report Produced.
3.2.2 Water Quantity	Same as for stream-based project, see above. A minimum of two years' worth of baseline.
3.2.2	Compliance with prescribed lake elevation limits, instream flow requirements (3.1.1.1) and ramping rates (3.1.1.2)
3.2.3 Water Quality	Temp/DO profile, Secchi Depth + parameters specified for streams (3.1.7).
3.2.3	Sediment quality parameters: Ammonia (available), Nitrate, Nitrite, Phosphorus (T), Sulphate, pH, Redox Potential, Particle Size Analysis, SEM-AVS, Metals (include Hg), Loss on Ignition, Temp.
3.2.3	Phytoplankton (chlorophyll a) measurement on a quarterly basis for two years. Taxonomic and community composition determined.
3.2.3	Monitor water/sediment quality 1 through 5 years after the project commissioning.
3.2.4 Fish Habitat	Quantify the area of deep water and littoral habitat through bathymetric and limnological surveys.
3.2.4	Conduct a shoreline habitat assessment. Record percentage cover in each habitat unit- substrate types, degree of embeddedness by fine sediment, presence and extent of macrophyte communities, presence of large woody debris or overhanging cover.
3.2.4	Use data to identify spawning and rearing habitat. Also can create a Habitat Suitability Matrix.

Table 1 (Cont'd.)

Section 3.2 (Cont'd.)	
3.2.4	Conduct fish habitat surveys in the inlet and outlet streams.
3.2.4	Following commissioning repeat baseline surveys at two and five years. Compare with baseline and report to DFO on an annual basis.
3.2.4	Monitor fish habitat compensation that affects lake habitat in years 1, 2, 3, 5 and 10.
3.2.5 Fish Community	Fish species presence, relative abundance, distribution, timing of migration and community characteristics (gillnets and minnow traps minimum). Record CPUE.
3.2.5	Mark re-capture program. All fish captured counted and identified to species. Measure fork length, weight, sex, maturity, age.
3.2.5	Sample Hg in fish if soil and vegetation are flooded.
3.2.4	Minimum 2 years.
3.2.5	Repeat sampling (consistent across years) at years 1, 2, 3, 5 and 10 post-construction.
3.2.6 Zooplankton and Benthic Invertebrates	Monitor with water and phytoplankton sampling and twice in the main growing season in two separate years.
3.2.6	Determine community composition and community structure.
3.2.7 Species at risk	If species of concern are identified for the project area, baseline data and monitoring requires will be designed specifically for that species and its habitat requirements, behavior and vulnerabilities.
Monitoring	Post-construction monitoring to occur at years 1 through 5 at the same times in the season as the baseline monitoring.
Section 4.0 Reporting	
	Compile baseline data for agency review following construction completion.
	Provide an annual monitoring report in subsequent years: detail methods, results, comparative analysis to baseline and recommendations.
	Include power analyses on baseline data to confirm appropriate sample size for monitoring response.
	Provide a construction monitoring report (within 60 days of project completion).
	Provide as-built survey reports (within 60 days of project completion).
	Provide a ramping rate study report (within 30 days of the completion of commissioning tests).
	Report any non-compliance, emergency unusual occurrences (within 24 hours).
	Summary report: after five years of post-construction monitoring.

2.4 DATA ACQUISITION AND ORGANIZATION

Documents and records were initially provided by DFO regional headquarters and later by proponents and DFO Area staff (see Section 7.0). The level of responsiveness from proponents and DFO staff who were approached for reports varied. Responsive proponents and DFO staff were able to answer questions about changes in scope and timing that ultimately impacted the assessment of compliance/alignment. For example, if the quantity of constructed habitat compensation was less than Authorized or a report submission date later than

specified in the Authorization, proponents who could provide documentation of communications with DFO about these changes were considered to be more compliant.

All reports were sorted by project and a reference list compiled by DFO Area. Reports reviewed for the conformance evaluation were cross-referenced to the corresponding Authorization condition or Long-Term Monitoring Protocol and presented in a schedule of compliance/conformance for each DFO Area (Hatfield 2013). This system of cross-referencing allows DFO to track the source (or lack of) information used for the current study to evaluate compliance with specific Authorization conditions or alignment with Long-Term Monitoring Protocols.

2.5 IDENTIFICATION OF DATA GAPS

A list of missing salient reports, such as post-construction monitoring reports, were identified early on in the review process and were requested from DFO or the proponent, as necessary. Once existing documents had been reviewed and cross-referenced with the checklist, additional sources of missing information could be identified. Identifying and sourcing missing documents was an ongoing process that exceeded the anticipated level of effort required for this review.

2.6 CONFORMANCE/COMPLIANCE/ALIGNMENT DETERMINATION

After cataloguing and reviewing all available information (see Section 7.0) a level of conformance, compliance or alignment was assigned to each of the identified monitoring criteria (both general and specific) for each project. For each question related to a specific monitoring criteria, project-specific Authorization, or Long-Term Monitoring Protocol, a level of conformance, compliance or alignment was assigned as either 'full', 'partial', not applicable (NA), or 'no information provided'.

2.6.1 Conformance with Monitoring/Reporting Criteria Specified in the Terms of Reference

2.6.1.1 Full Conformance

In order to achieve *Full Conformance*, a project needed to explicitly demonstrate that the monitoring criterion in question had been fulfilled. Projects that did not achieve conformance, but had mitigation measures documented later in the project cycle were considered fully conformant.

2.6.1.2 Partial Conformance

Partial Conformance was assigned if only a portion of the monitoring criterion in question could be verified.

2.6.2 Compliance with Authorization Monitoring Requirements

2.6.2.1 Full Compliance

In order to achieve *Full Compliance*, a project needed to explicitly demonstrate that the Authorization condition in question has been fulfilled. Projects that did not achieve compliance, but that had mitigation measures documented later in the project cycle were considered fully compliant.

2.6.2.2 Partial Compliance

Partial Compliance was assigned if only a portion of the monitoring criterion in question could be verified (e.g., an Authorization condition specifies that five sites per stream be monitored and only three sites were monitored).

2.6.3 Alignment with the Long-Term Monitoring Protocols

2.6.3.1 Full Alignment

In order to achieve *Full Alignment* with the Long-Term Monitoring Protocols, a project needed to explicitly demonstrate that the Long-Term Monitoring Protocol in question has been followed.

2.6.3.2 Partial Alignment

Partial Alignment was assigned if only a portion of the Long-Term Monitoring Protocol in question could be verified.

2.6.4 Not Applicable

Not Applicable was assigned if the monitoring criterion in question does not apply to the project at the time of review (e.g., annual submission of operational monitoring reports would not be applicable to a project currently under construction).

2.6.5 No Information Provided

No Information Provided was assigned to a monitoring criterion when a given project had no documentation available to evaluate conformance, compliance, or alignment. Reviewers could not assume any level of conformance, compliance, or alignment without supporting documentation.

Documentation of non-conformance or non-compliance in the absence of attempted remediation was not encountered during this review. Remedial actions typically emanated from environmental monitor recommendations or the direction of regulators (e.g., DFO Inspectors Directive). Assessing the effectiveness of documented remedial actions was beyond the scope of this review. As such, non-conformance and non-compliance categories were not included. Although partial compliance may be viewed as non-compliant by regulators, the degree to which a monitoring criterion is compliant or non-compliant should be distinguished in order to provide context. For example, it is

more informative when considering future industry policy or guidelines to know that most projects were only partially aligned with the Long-Term Monitoring Protocols due to common deficiencies across projects and DFO Areas rather than simply classifying the project as non-conformant. Furthermore, an absence of monitoring reports was not necessarily evidence of non-compliance, given the difficulties in obtaining data.

For any assigned level of compliance or conformance other than 'full', the rationale for the designation was provided.

3.0 RESULTS

Results are summarized in three separate categories:

- Conformance ratings for the specific monitoring/reporting criteria specified in the Terms of Reference;
- Compliance ratings of project specific Authorization conditions related to monitoring; and
- Overall industry alignment ratings and trends with respect to the Long-Term Monitoring Protocols.

It requires a high level of familiarity with each project to verify the absolute level of compliance with a specific project. Only a full project audit could specify compliance with absolute certainty. The following results are based on documentation available at the time of this review.

3.1 CONFORMANCE WITH SPECIFIC MONITORING/REPORTING CRITERIA SPECIFIED IN THE TERMS OF REFERENCE

The level of conformance with monitoring criteria specified in the Terms of Reference varied between projects and DFO Areas; however, some requirements were consistently less reported than others (Table 2):

- The requirement to **quantify habitat and fish mortality impacts during construction** was generally achieved across all Areas with 68 percent of projects being fully conformant. All of the BC South Coast, North Coast and Yukon Trans-boundary projects were fully conformant. Environmental monitoring reports and interim year baseline monitoring reports provided the best satisfactory evidence. Four projects were assigned partial conformance because of a lack of detail provided.
- No clear trends were apparent for the **quantification of habitat and fish mortality during operations**. These data were somewhat limited because six projects were still under construction, and another facility in the BC South Coast Area was only commissioned in 2011. Two of three projects in the Lower Fraser Area were fully conformant with this requirement;

however, half of the projects in operation in the Lower Lillooet group of projects did not supply enough information to be properly assessed. Overall 47 percent of applicable projects were fully conformant with this criterion.

- Information regarding **habitat compensation size** was provided through compensation habitat technical specification reports, footprint verification records and applicable sections in interim and yearly aquatics monitoring reports. The majority of projects were compliant (i.e., 80 percent of applicable projects) with the exception of one project in the South Coast Area (no as-built compensation plan was provided); and, a project in the Lower Lillooet group of projects (riparian area compensation size was not determined). One project in the Yukon Trans-boundary Area had no information available.

- **Compensation habitat effectiveness** did not apply to many projects in the Lower Lillooet group of projects in the Lower Fraser Area and the South Coast Area because habitat was compensated for by other projects in the area, the diversion reaches were non-fish bearing or the project was still under construction. One project in each of the Interior Sub-Areas, the South Coast and Lower Fraser Areas, respectively, did not make compensation habitat reports available. Partial conformance was given to three projects because information presented was limited. Species assemblages and soil nutrient regimes in the riparian areas and fish use studies were rarely reported. Overall 42 percent of applicable projects were fully conformant with this criterion.

- Assessing **alignment with the Long-Term Monitoring Protocols (Lewis et al. 2012)** was the most comprehensive aspect of this review. Of the 18 applicable projects only three (i.e., 17 percent of applicable projects) fully aligned with the Long-Term Monitoring Protocols. Low percentages of alignment were a result of absent documents. Of the information that was made available, the majority of documents only partially aligned with the Long-Term Monitoring Protocols. Project specific summaries for the Long-Term Monitoring Protocols are presented in Section 3.3.

- The requirement to **provide adequate baseline data for statistical interpretation of monitoring results** was assessed by comparing baseline data collected at each project with the recommended protocols specified in the Long-Term Monitoring Protocols. All projects collected baseline data in the Lower Fraser Area, and the majority (Lower Lillooet group of projects) generally aligned with the Long-Term Monitoring Protocols; however, two projects provided baseline monitoring reports which did not align with the monitoring protocols and had to be revised after operations commenced. Partial conformance was given to one project in the North Coast Area because only one year of fish data was provided, and to one South Coast project where baseline data lacked information

on water quality, periphyton and benthic invertebrates. Baseline information was not available for any of the projects in the BC Interior Sub-Areas, one project in the Yukon Trans-Boundary Area and four projects in the South Coast Area. Overall 45 percent of projects collected baseline data that was generally aligned with the Long-Term Monitoring Protocols.

- **Timely submission of reports** was generally met with partial conformance across all Areas; however, four of the six projects in the South Coast and all of the projects in the North Coast Areas showed full conformance. Many of the Authorizations stipulated that as-built drawings and a post-construction monitoring report, including information pertaining to water quality, fisheries and before-after photographs, be provided within 60 days of completion of construction. These reports were rarely submitted on time, and generally lacked some or all of the required information. One project in each of the BC Interior South Sub-Area and Yukon Trans-boundary Area and four projects in the Lower Fraser Area did not have information available to assess this requirement. Overall 32 percent of projects were fully conformant with this monitoring criterion.

- Only seven of the twenty-two projects (i.e., 32 percent) **documented all monitoring activities stipulated in their Authorizations**. It should be noted that assessment of this criteria included verification on reporting only, and not the level of compliance with the actual Authorization condition (see section 3.2). The BC South Coast and Lower Fraser Area had the highest proportion of fully conformant projects, while projects in the Interior Sub-Areas and the North Coast Area did not have any. Two projects in the Lower Fraser, three projects in the South Coast and one project in the Interior North Sub-Area were rated as partial conformance. This was the result of missing information and only partial reporting of monitoring requirements outlined in the Authorizations.

Six projects were under construction at the time of this review, and were therefore exempt from meeting a number of criteria in this section of the evaluation. There are three criteria that could be met by proponents regardless of the stage of development: (1) quantify habitat and fish mortality impacts during construction; (2) collect adequate baseline habitat data for statistical interpretation of habitat monitoring results; and, (3) timely submission of all reports. Item 3 is difficult to evaluate since often the deadline for baseline reports and weekly monitoring reports is based on what would be reasonable given the status of the project. Furthermore, the only assurance of timely submission is a copy of the email submission to DFO or a DFO date stamped copy of the report. In most cases these were not available; therefore, the date on the report was used to determine the approximate date of submission.

Table 2 Conformance with monitoring/reporting criteria specified in the terms of reference.

Criteria	Conformance Rating	Number of projects per Area and Region						
		BC Interior North	BC Interior South	BC North Coast	BC South Coast	Yukon Trans-boundary	BC Lower Fraser	Pacific Region
Quantify habitat and fish mortality impacts during construction	Full Conformance	-	1	1	6	2	5	15
	Partial Conformance	1	1	-	-	-	2	4
	Information Not Available	-	-	-	-	-	3	3
	Not applicable	-	-	-	-	-	-	0
Total projects per Area and Region		1	2	1	6	2	10	22
Quantify habitat and fish mortality impacts during operation	Full Conformance	-	-	-	2	-	5	7
	Partial Conformance	1	-	-	-	1	-	2
	Information Not Available	-	1	-	1	-	4	6
	Not applicable	-	1	1	3	1	1	7
Total projects per Area and Region		1	2	1	6	2	10	22
Quantify compensation habitat size	Full Conformance	1	1	-	3	-	7	12
	Partial Conformance	-	-	-	1	-	1	2
	Information Not Available	-	-	-	-	1	-	1
	Not applicable	-	1	1	2	1	2	7
Total projects per Area and Region		1	2	1	6	2	10	22
Quantify compensation habitat effectiveness	Full Conformance	-	-	-	1	-	4	5
	Partial Conformance	1	1	-	1	-	1	4
	Information Not Available	-	-	-	1	1	1	3
	Not applicable	-	1	1	3	1	4	10
Total projects per Area and Region		1	2	1	6	2	10	22

Table 2 (Cont'd.)

Criteria	Conformance Rating	Number of project per Area						
		BC Interior North	BC Interior South	BC North Coast	BC South Coast	Yukon Transboundary	BC Lower Fraser	Pacific Region
Monitoring aligns with Lewis et al. (2012) protocols	Full Conformance	-	-	-	-	-	3	3
	Partial Conformance	-	1	1	4	2	7	15
	Information Not Available	-	-	-	-	-	-	0
	Not applicable	1	1	-	2	-	-	4
Total projects per Area and Region		1	2	1	6	2	10	22
Adequate baseline habitat data for statistical interpretation of habitat monitoring results	Full Conformance	-	-	-	1	1	8	10
	Partial Conformance	-	-	1	1	-	2	4
	Information Not Available	1	2	-	4	1	-	8
	Not applicable							0
Total projects per Area and Region		1	2	1	6	2	10	22
Timely submission of all reports	Full Conformance	-	1	1	4	1	-	7
	Partial Conformance	1	-	-	2	-	6	9
	Information Not Available	-	1	-	-	1	4	6
	Not applicable							0
Total projects per Area and Region		1	2	1	6	2	10	22
Reports included all monitoring activities stipulated in the Authorization	Full Conformance	-	-	-	2	1	4	7
	Partial Conformance	1	-	-	3	-	2	6
	Information Not Available	-	1	-	-	1	3	5
	Not applicable	-	1	1	1	-	1	4
Total projects per Area and Region		1	2	1	6	2	10	22

3.2 COMPLIANCE WITH DFO AUTHORIZATIONS

Overall industry compliance with DFO 35(2) Authorization monitoring conditions is summarized in Table 3. Project compliance with habitat monitoring requirements outlined in project specific Authorizations is summarized by DFO Area and by project (Tables 4 to 24). Each project was assessed individually against the specific conditions outlined in its Authorization and any subsequent amendments. If the Authorization condition was considered to be not-applicable at the time of the assessment the corresponding cell was indicated with a dash; otherwise, a level of compliance is indicated. Where the level of compliance was 'partial' or 'no information available' a comment is provided.

Table 3 Summary of industry compliance (%) with DFO 35(2) Authorization monitoring conditions.

Summary category	No.	Percent
Number of Authorizations	22	100
Total number of conditions pertaining to monitoring in all Authorizations	255	n/a
Average number of monitoring conditions per Authorization	12	n/a
Total number of monitoring conditions not applicable at time of review	84	33
Total number of applicable monitoring conditions considered fully compliant at time of review	83	49
Total number of applicable monitoring conditions partially compliant at the time of review	66	39
Total number of applicable monitoring conditions with unknown compliance (i.e., info not available)	25	15
Total number of projects essentially compliant with all applicable monitoring conditions	4	18

3.2.1 BC Interior North

3.2.1.1 Hauer Creek Power Project

Development Stage: Operational

Refer to section 7.1.1 for a complete list of documents reviewed. The most obvious limitation in meeting the Authorization requirements was the inconsistency in monitoring of the compensation habitats. No monitoring reports were provided for the restoration of the abandoned stream channel and the monitoring of the fish barrier modification and tailrace channel habitat occurred for only three of the required five years.

Table 4 Hauer Creek Power Project (Authorization No. 02-HPAC-PA7-000-000974).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
7	A completion report detailing construction of compensatory habitat in A, B and C will be submitted prior to December 1, 2005. To include: as-built drawings, timing, photos, mitigation measures, unforeseen impacts.	✓			
9	Five year post-construction compensation monitoring program.		✓		Compensation works were not actually complete until 2007 and monitoring ended five years after the compensation works should have been finished (2005-2009).
9b	Monitor water flows: assessment of the bypass flows, wetted widths, proportioning of stream return volumes.	✓			
9c	Monitor Fish Barrier Modifications: assessment of fish presence, stability of structures, photographic documentation, and monitor in the fall and during high flow events.		✓		Only monitored in the fall over two years (September 2006 – 2008; see requirement 9g).
9d	Monitor Tailrace Channel Habitat: assessment of fish utilization and function of instream habitat, functioning of the works compared with the completion report, photographic and diagram documentation.		✓		Sampled in September 2007 and 2008 (see requirement 9g).
9e	Monitor Restoration of Abandoned Stream Channel: assessment of stability and fish usage.		✓		Abandoned stream was restored, but monitoring is not documented.
9f	Monitor each year during Bull trout migration (August through early October)		✓		Monitored in September 2007 and 2008 only.
9g	c, d and e will be monitored in 2006, 2007, 2008, 2009 and 2010.		✓		No records for 2007 and 2010.
9i	Monitoring reports due annually prior to December 1st. Must demonstrate that DFO's national No Net Loss Policy has been achieved.		✓		The 2007 report was submitted in November; the 2009 report was submitted in May.

3.2.2 BC Interior South

3.2.2.1 South Cranberry Creek Hydroelectric Project

Development Stage: Operational

Refer to section 7.2.1 for a complete list of documents reviewed. The most obvious limitation in meeting the Authorization requirements is the inconsistency in the monitoring of the revegetated riparian area. Survey of final compensation area and annual monitoring reports to DFO were not provided, and only one year of the required five years of revegetation monitoring is documented. This constitutes a large gap in overall effectiveness monitoring of compensation habitats.

Table 5 South Cranberry Creek Hydroelectric Project (Authorization No. 03-HPAC-PA1-000-000081).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
7	Minimum flow for the adaptive management studies will be set at 0.1 m^3/sec for the initial 5-year period with a possible further 5-year period at 0.2 m^3/sec.	✓			
8	Monitor the fish bypass located at the intake structure and monitor entrainment.	✓			
9	Impacts will be measured and assessed by the Environmental Monitor. Instream compensation will take the form of 150 m^2 of instream compensation works downstream of Cranberry Creek as additional works to those recommended in the Walter Hardman Water Use Plan.	✓			
10	The final compensation area and type of habitat created will be surveyed to create an as-built plan and the results provided to DFO for monitoring compliance.			✓	No survey results/as-built plan available.
11	Submit a final revegetation plan that includes timing of revegetation, number of trees, stock size/age.		✓		Riparian compensation of 3,576 m^2. Stock size/age not provided.
11 and 12	Revegetation monitoring must be undertaken annually in the spring following re-planting for a 5-year period.		✓		Only one year provided.

Table 5 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
12	Photographic assessment and recording of survival rates by planted stock.	✓			
12	Monitoring fish utilization and function in instream habitat over a ten year period (in years 1,2,3,5 and 10).	✓			
13	Report annually to DFO by July of each year of the Monitoring Program.			✓	No annual report provided.
Amended Authorization 2006	Authorized permanent riparian loss 3,200 m^2.	✓			A total permanent riparian impact of 2,957 m^2.

3.2.2.2 Kwoiek Creek Hydroelectric Project

Development Stage: Under Construction

Refer to section 7.2.2 for a complete list of documents reviewed. This project is under construction and therefore the majority of Authorization conditions are not applicable until operations begin. Four conditions were applicable to the construction phase of the project. Three were met with full compliance and the provision of a written notification prior to commencement of construction was not available at the time of this review.

Table 6 Kwoiek Creek Hydroelectric Project (Authorization No. 00-HPAC-PA1-00177).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
4.1	Revegetation of riparian areas associated with penstock construction.				Not applicable until operations.
Compensation Habitat 4.2, 4.3, 4.4	Construction of compensation habitat area, design specs and timing.				Not applicable until operations.
4.5, 4.6	Compensation habitat is functioning as intended.				Not applicable until operations.
Construction Monitoring 5.1	Summary As-Built report submitted within 90 days following completion of construction.				Not applicable until operations.
5.1.1	Provide details regarding sequence and quality of construction including as-built drawings.	✓			
5.1.2	Provided dated photographs pre-construction, during construction, and post-construction.	✓			
5.1.3	Description of contingency measures should mitigation not function as intended.	✓			
Compensation Monitoring 5.2.1	Complete compensation monitoring program as specified in Fish Habitat Compensation Plan.				Not applicable until operations.
5.2.2	Provide written description of the condition of the compensation habitat.				Not applicable until operations.
5.2.3	Provide dated photographs of compensation habitat.				Not applicable until operations.

Table 6 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
5.2.4	Submitted annual report by March 31 of following year.				Not applicable until operations.
Notification 7.1	Provide written notification at least 10 days prior to commencement of construction.			✓	No evidence provided.
Amended Authorization 2012	Habitat compensation of 81,435 m^2.				Not applicable until operations.

3.2.3 BC North Coast

3.2.3.1 Dasque Cluster Hydro Project

Development Stage: Under Construction

This project is under construction and none of the Authorization requirements are applicable until operations begin.

Table 7 Dasque Cluster Hydro Project (Authorization No. 10-HPAC-PA4-00042).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
3.5	Provision of as-built drawings of the intake structure, weir, etc. to be provided to DFO within 180 days of the completion of construction.				Not applicable until operations.
4	Compensate for the loss of 30,030 m^2 of riparian and 1,377 m^2 of aquatic fish habitat (no later than fall 2014).				Not applicable until operations.
5.4	Prepare a post-construction monitoring report describing the works methodology, water quality and fish sampling. Provided within 90 days of the completion of the project.				Not applicable until operations.
5.5	Success monitoring of the replanted/revegetated areas semi-annually for five years.				Not applicable until operations.
5.6	Compensation habitat must be inspected before July 15 every year- report to DFO annually by Nov 30 for 5 years.				Not applicable until operations.

3.2.4 BC South Coast

3.2.4.1 Lower Bear Creek Hydro Project

Development Stage: Operational

Operations commenced in 2011, monitoring reports were not available at the time of the assessment. The first year's monitoring report was scheduled for submission on January 31, 2012.

Refer to section 7.4.1 for a complete list of documents reviewed. Compliance with the relevant habitat monitoring conditions can only be assessed once the first year monitoring report is made available.

Table 8 Lower Bear Creek Hydro Project (Authorization No. 03-HPAC-PA3-00160).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C 12(d)	Post construction monitoring report with dated color pictures of site prior to, during and following completion of works. Describe methodology, water quality, fish sampling and a brief summary of the project and any problems.				2011 was the first monitoring year.
D 3(a)	Instream Flow Release information provided to DFO in the annual monitoring report.				2011 was the first monitoring year.
D 4	Report ramping rates in the annual monitoring report over a five-year period (also apply Lewis et al 2012 conditions).				2011 was the first monitoring year.
F	Requirements for compensation (see Authorization for details).				2011 was the first monitoring year.
I	Compensation and Operational Monitoring Program.				2011 was the first monitoring year.
I	Five year monitoring program of the habitat compensation works over 8 years- year 1,2,4,6 and 8.				2011 was the first monitoring year.
I(a)	Monitoring potential impacts to fish and fish habitat in the diversion reaches. Report results.				2011 was the first monitoring year.
I 2(a)	As-built drawings of the habitat compensation area to be provided to DFO within 60 days of completion with photographs. Conducted by a qualified land surveyor or equivalent. Similar indexed photograph assessment to be provided each year. Identify riffle and pool habitat expressed by area and average depth for pond and identification of any issues. Ascertain area and riparian stability over time.			✓	Not provided.

Table 8 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
I 2(b)	Biological survey assessment of compensatory habitat to identify use of habitat by fish species and life history phase.				2011 was the first monitoring year.
I 2('c)	Photographic assessment of compensatory habitat showing habitat values and physical stability of works undertaken.				2011 was the first monitoring year.
I 3	Penstock Intake Fish Deterrent Study:				2011 was the first monitoring year.
I 3(b)	Cameras placed upstream and downstream of the lower Bear intake. For year 1,2,4,6 and 8 monitor 72 hour periods each month June to October and 72 hour periods during two of the first fall high water events after October.				2011 was the first monitoring year.
I 3 Monitoring Conditions (a)	Monitoring Program to be conducted by a qualified biologist or equivalent.	✓			
I 3 Monitoring Conditions (b)	Provide results of the monitoring plan in a report annually by 31st of January for the previous year. Provide a final monitoring report after five years and summarize findings.				2011 was the first monitoring year.
Authorization Amendment (2012)					
Authorized HADD	Weir= 3,600 m^2 stream habitat, Upper and Lower Bear= 1,200 m^2 and 4,250 m^2 fish habitat, 28,400 m^2 logged and impacted riparian vegetation.				2011 was the first monitoring year.
D.4	Downstream water levels at Upper Bear Creek powerhouse will be monitored in the tailrace (2 recorders, one independent of controls).				2011 was the first monitoring year.
F. Compensation Amendments	New head pond (net gain of 3,850 m^2 or rearing habitat), off-channel network with a series of ponds (each pond 1m deep, total wetted pond area to exceed 2,400 m^2 and riparian habitat 3000 m^2), connect last pond to the mainstream of Bear Creek.				2011 was the first monitoring year.
I.2(b)	Biological survey of compensatory off-channel twice yearly, once in the winter and once in the summer.				2011 was the first monitoring year.
I.2.(d)	Continuous temperature data collected and DO measured in the summer in the off-channel.				Not applicable until operations.

Table 8 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
I.3(a) Penstock Study	Intake canal to be monitored seasonally by underwater cameras that capture both up and downstream of curtain.				2011 was the first monitoring year.
I.3(c)	Camera resolution able to identify fish as small as 50 mm. Mounted at the center of the intake channel with strobe used for backlighting. Downstream camera installed beyond the coarse trash rack.				2011 was the first monitoring year.

3.2.4.2 Upper and Lower Clowhom Hydroelectric Projects

Development Stage: Operational

Refer to section 7.4.2 for a complete list of documents reviewed. Overall, compliance with the Authorization criteria was excellent. There were no significant limitations in the investigation of this project and the proponent's willingness to provide information was a benefit.

Table 9 Upper and Lower Clowhom Hydroelectric Projects (Authorization No. 03-HPAC-PA3-000-00158).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
General	Loss of 1,650 + 850 m^2 fish habitat.				Not applicable until completion of construction.
C(11)	Prepare a post construction monitoring report with dated color pictures of the site prior to, during and following completion of works. Describes methodology, water quality and fish sampling results and any problems and how they were resolved.	✓			
D(3)	Ramping rates specified.		✓		Water levels recorded every 5 minutes instead of every 15 seconds.
E	Carry out a five year monitoring program of fish entrainment at intakes over years 1,2,4,6 and 8 following start-up of operations at both weir locations.	✓			
E(a-c)	Monitoring to include: twice a year seine netting of the head ponds, installation of bubble/strobe deterrent system, underwater video cameras to monitor effectiveness of deterrent and any entrainment.	✓			
I	Carry out a five year monitoring program of compensation side-channel area in years 1,2,4,6 and 8.				Compensation completed in 2011. First monitoring report to be delivered end of 2012.
I(a)	Provision of results of the OEMP to be submitted annually to DFO by March 1 for the previous calendar year.	✓			
I(b)	Provision of as-built drawings of the compensation side-channel to be provided to DFO within 60 days of the completion of construction. Include photos (and similar annual indexed photos) each year thereafter. As-built to identify pool and riffle habitat and average depth.	✓			

Table 9 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
I('c)	Biological survey of compensatory side channel to identify use of habitat by fish species and life history phase. Installation of a temperature logger to record summer water temperature.				First monitoring report to be delivered end of 2012.
I(d)	Monitoring of biological parameters (including fish abundance) to assess limiting factors- minimum of 2 visits per year in 5 years (2010-2017).				First monitoring report to be delivered end of 2012.
I(e)	Photographic assessment of compensatory habitat showing habitat values and stability of works- minimum of 2 visits per year in 5 years (2010-2017).				First monitoring report to be delivered end of 2012.
Amendment (2012)					
3.5	Include instream flow data in an annual monitoring report to DFO.	✓			
4.2	Ramping rate study to be carried out in June 2012.	✓			
5.2.1	Fish screening- abundance sampling four times per year in the head ponds.		✓		Sampling conducted in spring, summer and fall - three times per year.
5.2.2	Use an underwater video camera at both intakes at four specific times of the year to measure effectiveness of deterrent and any entrainment.	✓			
7.1.1	As built of side channel provided to DFO by June 30, 2012.	✓			
7.3.1	Operational monitoring in 2011, 2012, 2013, 2015 and 2017 - a minimum of 3 visits per year to assess potential impacts to fish and fish habitat in the diversion reaches.	✓			
7.3.2	Monitoring of instream flows, water temperature, fish abundance and benthic invert communities within the diversion reaches. Fish deterrent system.	✓			

3.2.4.3 Kokish River Hydroelectric Project

Development Stage: Under Construction

This project is under construction (as of 2012) and therefore the majority of Authorization conditions are not applicable until operations begin. Refer to section 7.4.3 for a complete list of documents reviewed. Applicable criteria during the construction phase include the requirement for weekly monitoring reports and monthly monitoring summary reports. Weekly reports are available and sufficient; however, monthly summaries were not provided for review. A partial compliance rating was applied to the reporting requirement.

Table 10 Kokish River Hydroelectric Project (Authorization No. 06-HPAC-PA3-00188).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
	Aquatic impacts: 2,359 m^2 Riparian Impacts: 25,686 m^2.				Not applicable - project under construction
3.10	Provision of as-built drawings (showing exact location) of the intake structure, weir, water conveyance system, powerhouse, tailrace, transmission line and access roads to DFO within 180 days of the completion of construction.				Not applicable until operations.
3.11	Fish passage to be monitored during the period of migration; June 1 to September 30, when flows are within the migratory range.	✓			
3.12	A physical scaled model of the intake and fish ladder will also be tested, prior to final design and construction.	✓			
4.5.1	***Estuary Berm Beach (Monitoring Parameters/Schedule)***				
4.5.1.2	Fish- relative CPUE determined by beach seining, 3 trips/year, 6-8 sampling sites, April-July for 5 year.				Not applicable until operations.
4.5.1.2	Water quality- (temp, DO, salinity) 3 trips/year, 6-8 sampling sites, April-July for 5 years.				Not applicable until operations.
4.5.1.2	Vegetation- area of vegetation (determined by GIS mapping) 3 trips/year, April-July in years 1, 3, 5.				Not applicable until operations.
4.5.2	*Nutrient Enrichment (Monitoring Parameters/Schedule).*				
4.5.2.2	Water quality- single water chemistry sample bottle collection at each of the four locations on each sample date: sample every 2 weeks during growing season (June to Sept) for 5 years.				Not applicable until operations.

Table 10 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
4.5.2.2	Periphyton - one foam collector plate per site with cores removed at each sample date: sample every 2 weeks during growing season for 1 year. Sampling will not be repeated in years 2-3 if growth targets are achieved in Year 1.				Not applicable until operations.
4.5.1.2	Flow- measure flow in berm beach, sampled at 3 flows in year 1, 3 and 5.				Not applicable until operations.
4.5.2.2	Fish- electrofishing for a target of 30 fish per age class at two sites (treatment and control): one sample trip at end of growing season in Year 1. Sampling will not be repeated in Years 2-5 if growth targets are achieved in Year 1.				Not applicable until operations.
4.5.2.2	Monitoring duration - 5 years at each site for water quality (year 1-5 at Upper Bonanza River site; year 6-10 at Kokish River diversion site); 1 year or more, up to 5 years for periphyton and fish, dependent on results.				Not applicable until operations.
4.5.3.2	Riparian Habitat Compensation Monitoring Parameters/Schedule: vegetation success- % survival, stems/ha; monitoring visit when planting completed, then 1,2,3,5 and 10 years after construction.				Not applicable until operations.
4.7.3	Prepare a "Post-Construction Verification Plan" by December 31, 2015.				Not applicable until operations.
4.7.4	A report of monitoring activities related to replanted/revegetated areas will be submitted annually with mitigation/compensation monitoring.				Not applicable until operations.
5.3	Weekly Monitoring Reports starting May 2012, Monthly monitoring summaries (starting May 2012), Audit of monitoring reports (once per year during construction).		✓		Weekly Monitoring reports available as of May 2012, however no monthly reports provided for review.
5.3	Other reports: Work completed to improve the health of wild coho stocks and fish habitat in Kokish River (as required), Plan to allow natural bedload movement to pass downstream of the weir (Prior to operation - Sept 2014), OEMP (Prior to testing - Aug 2014), Habitat Compensation Plan: Phase 2 (Prior to operation - Sept 2014), Post- Construction Verification Plan/Footprint Impact Verification (within 6- days of completion of project construction), Post-construction Monitoring Report (within 60 days of receiving 'leave to operate'), weekly monitoring reports, monthly monitoring reports, Audit of monitoring reports (once per year during construction and once upon completion of Habitat Compensation Monitoring Program), Riparian habitat compensation as-built report (within 60 days of completion of compensatory works), Annual mitigation/monitoring compensation monitoring report (Annually).				Not applicable until operations.

Table 10 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
5.3.5-5.3.6	Weekly monitoring reports to include: release of sediment concentration over 25 mg/L - record location, cause, turbidity levels and pictures. Any incidents non-compliance events - actions requested by the IEM, dates of request, contractor name and phone number of person directed, rational as to why mitigative works were not implemented, results of the non-compliance.	✓			
5.5	Post-construction monitoring report with dated, color pictures of the site prior to, during and following completion of Works.				Not applicable until operations.
Amended Authorization	Additional impacts: permanent riparian- 2,378 + 261 m^2 and temporary riparian- 1,340 and 712 m^2.				Not applicable until operations.

3.2.4.4 McNair Creek Project

Development Stage: Operational

Refer to section 7.4.4 for a complete list of documents reviewed. The underlying limitation in meeting the Authorization conditions is the partial adherence to the monitoring criteria, with specific reference to the lack of photo documentation in the post-construction monitoring report and baseline report. There were also insufficient sampling sites during the baseline data collection. The requirements for a side-channel monitoring program were achieved, but again a lack of photo-documentation was noted along with inconsistent timeliness of report submission. A number of the original Authorization conditions pertained to a fertilization study that was amended with approval from DFO. Whether or not this amendment also removed the obligation to monitor water quality, periphyton and benthic invertebrate data is unclear.

Table 11 McNair Creek Project (Authorization No. 02-HPAC-PA3-000-000240).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
B(10)	As-built drawings submitted to DFO after the construction is complete. As-built reports will detail exact location and footprint and identify how the intake weir allows natural passage of bedload and how fish access to the tailrace is prevented.		✓		No discussion about preventing fish access to the tailrace.
B(12-d)	Post-construction monitoring report with pictures of the site before, during and after construction. Include methodology, water quality, fish sampling results and summary of project works including problems and how they were resolved.		✓		No comparative before/after pictures, no water quality information.
C(1-a)	Construct a side channel that is a minimum of 150 m in length and provides a surface area of 1,209 m^2 of new fish habitat.	✓			
C(2-c)	Existing productivity will be determined in the first year by undertaking a baseline survey of the stream to monitor: water quality, periphyton, benthic invertebrates, and fish populations at four locations. Measure these parameters over the following five years to confirm fertilization is increasing productivity.		✓		Water quality, periphyton and benthic invertebrates were not mentioned. Fish populations only monitored in two locations.
C(2-d)	To evaluate compensation treatment, performance will be measured as a statistically significant trend in salmonid standing stock within the bypassed stream reach. Test significance using a BACI experimental design.	✓			

Table 11 (Cont'd)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C(4)	Ramping Rates specified in Authorization- (apply Lewis et al 2012 conditions).	✓			
F(2-c)	Baseline data collected as part of C(2-c) is to be summarized and presented to DFO on or before November 30, 2003.		✓		No mention of water quality, periphyton and benthic invertebrates- this is mentioned as having been provided to DFO in the fertilization baseline report.
F(d)	The fertilization treatment plan is to be prepared and forwarded to DFO on or before April 1 of each year of operation.				Not applicable. This was amended due to concerns over liability and health issues related to drinking water.
G(1)	Carry out a five year monitoring program for both of the proposed compensation proposals (side channel and fertilization).	✓			
Side-Channel Monitoring Program					
G(1-a)	A biological survey of the side channel that identifies the use of habitat by fish species and life history phase.	✓			
G(1-b)	A photographic assessment of compensatory habitat showing habitat values and physical stability. Minimum of three visits per year at three representative sites in the five years (2004-2008).		✓		Limited photographic assessment and only a summer assessment completed.
G(1-c)	Installation of a temperature logger to record water temperature in a select pond. DO and pH to be monitoring in a typical pond and riffle section. Three visits per year from 2004-2008.	✓			Mentions that a temperature logger is in place and that parameters 'such' as DO are being measured, no record of results or any mention after 2005.
G(1-d)	Construct, install, operate juvenile salmonid smolt trap at outlet of the channel. Fish over a 3-month period in the spring and record species, length and size of fish, migration timing and number of migrants by species.	✓			
G(1-f)	As-built drawings are to be submitted to DFO within 60 days of the completion of construction. Include photos. Identify pool and riffle habitat expressed by area and average depth for the channel and any issues.	✓			Unclear as to whether the 60 days post-construction deadline was met.
G(1-g)	Annual monitoring program results to be submitted to DFO in a written report, including relevant document and photographs by the 31st of January. Submit a final monitoring report at the end of the fifth year.			✓	

Table 11 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
Stream Fertilization Monitoring Program					
G(1-a)	Biological and water sampling of the diversion reach to start in the spring 2003 and continue for 6 years (until 2008).		✓		Unclear on requirements of amended program.
G(1-b)	Annual fertilization program results to be submitted to DFO in a written report, including relevant document and photographs by the 31st of January. Submit a final monitoring report at the end of the fifth year.		✓		Unclear on requirements of amended program.
G(1-d)	If after the fifth year the fertilization program shows a statistically significant increased trend in salmonid rearing standing stock within the bypassed stream reach, sampling can stop.		✓		Unclear on requirements of amended program.
G(1-e/f)	Water sampling will continue for the life of the project to maintain appropriate fertilization levels. Sample 3x per year: prior to, during and after fertilization.		✓		Unclear on requirements of amended program.
Authorization Amendment 2					
E(1)	Carry out an additional 3 year of monitoring at the side channel.			✓	No records available beyond 2010.
E(1-a to g)	Repeat conditions in the original authorization (G1) for three years.			✓	No records available beyond 2010.

3.2.4.5 South Sutton Creek Green Hydropower Project

Development stage: Operational

Refer to section 7.4.5 for a complete list of documents reviewed. Of fourteen conditions specified by the original Authorization, only two were met with full compliance based on available information. All Authorization conditions were achieved to some degree; however, most failed to meet the criteria for full compliance. Water quality monitoring and monitoring of the off-channel rearing pond were only documented during some years, even though the criteria stipulated multiple visits for consecutive years. This limited the ability to fully assess compliance with these requirements. General criteria relating to ramping rate monitoring and a five year monitoring program could not be properly assessed due to missing information.

Table 12 South Sutton Creek Green Hydropower Project (Authorization No. 01-HPAC-PA3-000-000710).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
B 12(d)	Post construction monitoring report with dated color pictures of site prior to, during and following completion of works. Describe methodology, water quality, fish sampling and a brief summary of the project and any problems.	✓			
C 4	Monitor the ramping rate for a period of three years (also apply Lewis et al 2012 conditions).			✓	
D	Compensation pond should be 250 m^2.			✓	
G	Conditions (G Monitoring Program) Five year monitoring program:			✓	
G 1	Carry out a five year monitoring program from 2004 to 2009.			✓	
G(a)	*Monitoring of the off channel rearing pond consisting of:*				
G(a-i)	Biological survey to identify use of habitat by fish species and life history phase. Viability of the habitat and a net gain of fish habitat.		✓		Biological survey of fish conducted but not of habitat viability.
G(a-ii)	Photographic assessment of compensatory habitat showing habitat values and physical stability.			✓	
G(a-iii)	Physical parameters including temperature, DO, turbidity, suspended sediment and pH.		✓		Only one year provided.
G(a-iv)	Minimum of three visits per year, each during a different season, in the five year period (2004-2009).		✓		Only record of visits in 2005 and 2006.

Table 12 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
G(a-v)	Monitoring conducted by a qualified biologist or other professional with experience.	✓			
G(a-vi)	As-built drawings of off channel pond to be provided to DFO within 60 days of completion with photographs (contradicts B 12). Conducted by a qualified land surveyor or equivalent. Similar indexed photograph assessment to be provided each year. Identify riffle and pool habitat expressed by area and average depth for pond and identification of any issues. Ascertain area and riparian stability over time.		✓		According to the monitoring report submitted to DFO on February 21, 2006 (not within 60 days of completion). No record of as-built provided.
G(b)	***Water Quality Monitoring:***				
G(b-i))	Verify that water exiting the tailrace is not super-saturated with respect to total gas pressure (also measure temperature). Sample three times per year under various flow and seasonal conditions. Samples taken immediately upstream of the tailrace (control) and within the tailrace.		✓		Only measured once - May 19, 2006.
G(c)	***Stream flow monitoring:***				
G(c-i)	Establish permanent flow meters in the stream. Data from the flow meters is to be reviewed on a twice-yearly basis by a qualified hydrologist with the flow model re-calibrated each time. Site visits to be undertaken four times over four years (min) a year to catch the various seasonal flows to confirm the rating curve. At the end of five years assess flow release and adjust as required. If flow data after five years differs in excess of natural variations another 5 years of data will be collected and the flow curve recalibrated.		✓		Two flow dataloggers established but not enough data in 2007 to re-calibrate the model. No reports provided post-2007.
G 2	Provide results of the monitoring plan in a report annually by 31st of January for the previous year. Provide a final monitoring report after five years and summarize findings.		✓		Only one report provided- dated July 2007. Does not adhere with DFO timing.

3.2.4.6 East Toba River and Montrose Creek Hydroelectric Project

Development stage: Operational

Refer to section 7.4.6 for a complete list of documents reviewed. The Toba River project has only been operational since June 2011. The first monitoring reports are expected at the end of 2012, and therefore were not available at the time of this review. The Authorization conditions that could be assessed pertained to the construction phase of the project. Although detailed pre-and post-construction photographs were taken, no information was available describing the sequence and quality of construction. Contingency measures were documented in non-compliance reports; however, without a tracking matrix it is difficult to assess whether or not all contingency measures/incidents have been reported. There was only a limited discussion regarding mitigation measures in the as-built report.

Table 13 East Toba River and Montrose Creek Hydroelectric Project (Authorization No. 04-HPAC-PA1-00061)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
4	Compensation for the loss of 302 m^2 of aquatic and 41,200 m^2 of riparian habitat (see Authorization for details).		✓		Compensation does not correspond exactly to Authorization because actual HADD ended up being less/more than predicted.
5(1)	As-built drawings submitted to DFO after the construction is complete. As-built reports will detail whether the construction was conducted within schedule and mitigations measures were applied.		✓		As-built comparison provided but limited discussion of schedule and mitigation measures.
5(1-1)	Include details on sequence of construction, quality of construction and providing as-built design drawings of completed works.			✓	
5(1-2)	Provide dated photographs of 1. site pre-construction, 2. works, 3. completed project.	✓			
5(1-3)	Provide description of any contingency measures in the event mitigation measures did not function.		✓		Although not mentioned specifically in any one report this is covered in non-compliance reports and communications with agencies.
6	Fish Habitat Monitoring Program that covers 8 years for each of the proposed fish habitat compensation areas.		✓		First monitoring report to be provided end of 2012.
6.1	1st Season- Assessment of the physical stability and functionality of the fish habitat compensation.		✓		First monitoring report to be provided end of 2012.

Table 13 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
6.2	Annual monitoring to be submitted by December 31st of each year on years 1, 3, 5 and 7 post-construction.		✓		First monitoring report to be provided end of 2012.
6.3	Water quality (Conductivity, DO, pH, temp) to be taken at instream compensatory habitats during each site inspection.		✓		First monitoring report to be provided end of 2012.
6.4	Fish presence sampling during spring and fall each year and for the duration of the monitoring program. Determine approximate densities.		✓		First monitoring report to be provided end of 2012.
6.5	Inspections of the planted veg. recording plant survival/mortality. Photographs taken at same locations each year (July-August).		✓		First monitoring report to be provided end of 2012.
6.6	Year 7 report will provide final year's results and summarize all previous year's results.		✓		First monitoring report to be provided end of 2012.

3.2.5 Yukon Trans-Boundary

3.2.5.1 Forrest Kerr Hydroelectric Project on Iskut River

Development Stage: Under Construction

This project is under construction, and therefore the majority of Authorization conditions are not applicable until operations begin. Refer to section 7.5.1 for a complete list of documents reviewed. Details of construction sequence, photo-documentation and description of mitigation measures were well documented.

Table 14 Forrest Kerr Hydroelectric Project on Iskut River (Authorization No. 01-HPAC-PA1-00157).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
	Proposed HADD of 800 m2 of fish habitat.				Not applicable until operations.
4.1	Provide a detailed design of 48,575 m^2 of compensatory fish habitat at low flows.				Not applicable until operations.
5.1.1-5.1.3	Provide a report on description of compensatory habitat with photos by November 31 of each year (years 1, 3 and 5).				Not applicable until operations.
5.1.4	The annual report of the fifth year of operation to include: original as-built photographs of compensatory habitat, assessment of functioning, proposed mitigative measures, assessment of need for further monitoring.				Not applicable until operations.
Monitoring and Reporting 6.1	Provide details of sequence of construction, quality of construction and 'as-built' drawings of completed works- focusing on instream.	✓			
6.2	Provide photographs of 1. the site pre-construction, 2. works in progress, and 3. completed project.	✓			
6.3	Dated photographs of sediment control measures employed and details of infilling and fish salvage ops.				Not applicable until operations.
6.4	Description of any contingency measures that were followed in the event mitigation measures did not function as expected.	✓			
Amended Authorization (2010)					
	HADD of 2081 m^2 of fish habitat.				Not applicable until operations.
4.1	Compensation area requirement the same as original- 4.1				Not applicable until operations.
4.3	Construction of compensatory habitat to be completed before July 1, 2014.				Not applicable until operations.

3.2.5.2 Atlin Hydroelectric Project at Surprise Lake on Pine Creek

Development stage: Operational

Refer to section 7.5.2 for a complete list of documents reviewed. Authorization conditions that pertain to construction works were well documented; however, documentation and reporting on habitat compensation and monitoring were not available. It was later noted by the DFO Area staff member that an overall loss in fish habitat as a result of the project had not occurred, thus negating the requirement to prepare a fish habitat compensation plan. It was also communicated that improvements to fish habitat which occurred as a result of this project included improved fish access between Pine Creek and Surprise Lake and an increase in the Surprise Lake littoral zone.

Table 15 Atlin Hydroelectric Project at Surprise Lake on Pine Creek (Authorization No. 05-HPAC-PA5-000-000054).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
	Proposed HADD of 440 m^2 of fish habitat.				
4.1	Provide 500 m^2 of by-pass channel habitat at low flows.			✓	
4.2	Provide a fish passage structure at the outlet of Surprise Lake.	✓			
4.3	Provide 2,500 m^2 of pool habitat upstream of water intake weir.			✓	
5.1	Monitor and report on compensation habitat over five years in years 1, 3, and 5.			✓	
5.1.1-5.1.5	The reports (submit each year required by Nov 31) will include: the condition of the habitat, photographs, possible effects of water levels on shoreline and inflow streams of the lake, possible effects of reduced flows.		✓		Limited information on the conditions of the habitat.
5.1.6	The annual report for the fifth year of service to include: as-built photos of the compensatory habitat, assessment of functioning as intended, assessment of increased water levels, assessment of reduced flow, proposed mitigative measures if appropriate and assessment of future monitoring requirements.				Not required until 2014.
Monitoring and Reporting 6.1	Provide details of sequence of construction, quality of construction and 'as-built' drawings of completed works- focusing on instream.		✓		Monitoring reports provided indicating sequence of construction, no as-built provided.
6.2	Provide photographs of 1. the site pre-construction, 2. works in progress, and 3. completed project.		✓		Missing pictures of the completed structures.

Table 15 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
6.3	Dated photographs of sediment control measures employed and details of infilling and fish salvage operations.	✓			
6.4	Description of any contingency measures that were followed in the event mitigation measures did not function as expected.	✓			
Amended Authorization (2008)					
4.4	Compensation to be completed no later than 31 May 2010.			✓	

3.2.6 BC Lower Fraser

3.2.6.1 Ashlu Creek Hydropower Project

Development stage: Operational

Refer to section 7.6.1 for a complete list of documents reviewed. Overall compliance with conditions pertaining to compensatory works was good. Revegetation efforts exceeded the criteria set out by the Authorization and compensation habitat reports were well organized and clear. It was unclear as to how often the environmental monitor was on site during the stipulated construction activities. Although a summarized construction monitoring memorandum was submitted, weekly environmental monitoring reports were not available.

Table 16 Ashlu Creek Hydropower Project (Authorization No. 04-HPAC-PA2-000-000530).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
	Habitat loss reported in Sigma Engineering. 2004.				
Instream Flow Release C(1)	Minimum flow release of 2.42 m^3/s to be maintained at all times during five years.		✓		Only one year of data, however this is being monitored.
C(1)	Five year monitoring program from the commencement of operations to determine presence/absence of rainbow trout and Coho salmon in the bypass reach, upstream of the current anadromous barriers.	✓			
North Side Channel Compensation D(1)	Compensatory works will provide a total of 5,000 m^2 habitat compensation and 5,160 m^2 riparian compensation.	✓			
Riparian Compensation D(12)	Riparian compensation: planting of 1,575 m^2 at headworks facility and access roads, planting of 70 m^2 in the vicinity of the powerhouse, planting of 2,700 m^2 in the vicinity of the transmission line.	✓			
Monitoring F(1)	Monitor to be on site full time during land clearing, instream works, works in the riparian area, inspection of sediment control works during construction.			✓	
F(2)	A brief environmental monitoring report to be provided to DFO weekly.			✓	
F(3-d)	Provide a post-construction monitoring report with dated, color pictures of the site prior to, during and following completion of works. Describe works methodology and water quality and fish sampling results and any problems and how they were resolved. Submit 60 days after completion of the Project.			✓	
G(1)	Annual assessment (at least 1 visit to site during the fall spawning season in the five years immediately after construction is completed) and annual report of compensatory habitat including: as-built plan and any document and photographs. To be submitted by Dec 1st of each year.	✓			

3.2.6.2 Fitzsimmons Creek Hydroelectric Project

Development Stage: Operational

Refer to section 7.6.2 for a complete list of documents reviewed. The only significant limitation in the ability to fully assess compliance with the Authorization for Fitzsimmons Creek was the amendment to the compensation habitat plan. The lower diversion reaches were first deemed to be non-fish bearing; however this was later revised. The compensation plan is to be revised sometime in 2011. The post-construction monitoring report was not available; therefore it is unknown whether or not it was submitted to DFO within the 60 days after completion of construction.

Table 17 Fitzsimmons Creek Hydroelectric Project (Authorization No. 02-HPAC-PA1-00100).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
	Temporary alteration of 2,600 m^2 riparian habitat, permanent alteration of 331 m^2 of streambed habitat and 4,175 m^2 of riparian habitat, modification of fish habitat in the diversion portion affecting 2,700 m^2 of instream habitat.		✓		Authorized for the permanent alteration of 331m^2 of stream bed habitat, as-built drawings show 903m^2 of permanent aquatic habitat loss.
Instream Flow C(1)	Minimum flow of 0.1 m^3/s to be maintained in the bypass reach of the creek - to continue over five years from the commencement of operations and to be reviewed on a daily basis. Report annually.	✓			
C(1)	A qualified biologist is to assess (over 5 years) fish habitat productivity: benthic production and aquatic drift through the bypass reach, immediately downstream of the project and in compensatory habitat.	✓			Has not been in operation for five years however adequate monitoring has begun.
Monitoring Report C(1-g)	Annual post-diversion operational monitoring report on findings of the Baseline and Operational Monitoring Program to be provided.	✓			
Compensation D	The deadline for the presentation of a final compensation plan that satisfies DFO is December 12, 2008.	✓			
D(1)	Compensatory works to provide a total of 8,100 m^2 of wetted stream habitat and associated riparian habitat.				Compensation plan to be revised in 2011 due to the presence of fish in the diversion reach.
Monitoring F(1)	Monitor to be on site full time during land clearing, instream works, works in the riparian area, inspection of sediment control works during construction.	✓			

Table 17 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
F(2)	A brief environmental monitoring report to be provided to DFO weekly.	✓			
Post construction monitoring F(2-d)	Provide a post-construction monitoring report with dated, color pictures of the site prior to, during and following completion of works. Describe works methodology and water quality and fish sampling results and any problems and how they were resolved. Submit 60 days after completion of the Project.			✓	
G(1)	Annual assessment (at least 1 visit to site during the fall spawning season in the five years immediately after construction is completed) and annual report of compensatory habitat including: as-built plan and any document and photographs. To be submitted by Dec 1st of each year.				Compensation plan to be revised in 2011 due to the presence of fish in the diversion reach.

3.2.6.3 Upper Mamquam Hydro Project

Development Stage: Operational

Refer to section 7.6.3 for a complete list of documents reviewed. Most of the conditions for this project were met or exceeded given the information available. Since the amendment to the compensation habitat plans, the Squamish River Watershed Society has well documented data and activities to satisfy the requirements for monitoring purposes. The long-term aquatics monitoring program yearly reports are detailed and include all monitoring activities stipulated in the Authorization. It is unknown whether or not DFO reviewed any pre-construction plans for the intake, intake weir, powerhouse, penstock and access roads as required in condition 5.

Table 18 Upper Mamquam Hydro Project (Authorization No. 02-HPAC-PA1-000-000086).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
5	Detailed plans for the intake, intake weir, powerhouse, penstock, access roads and transmission lines must be provided to DFO for review prior to construction.			✓	
13	The (construction) monitor will be required on-site full time during any land clearing, instream works and works in riparian areas, and a minimum daily visit during other times.		✓		Contradicted in section 3.1.3 of the Authorization - daily visit is not a requirement, instead three visits per week.
16	Monitoring studies shall be carried out annually for five consecutive years during the post construction period commencing September 2004, studies will include:	✓			
16(a)	Flow monitoring and corresponding habitat evaluations in the bypassed reach to determine quality of habitat at varying flows.	✓			
16(b)	Benthic diversity and abundance.	✓			
16('c)	Qualitative changes in channel substrate, channel width and riparian vegetation.	✓			
16(d)	Collected continuous records of tailwater elevation using a staff gauge. Submit records to DFO annually.	✓			
18	Specific habitat compensation works include: Planting of 785 m^2 or riparian veg in the vicinity of the Headworks facility and access road, Planting of 300 m^2 of riparian veg in the vicinity of the Powerhouse facility, Planting of 2,395 m^2 of riparian veg in the vicinity of the Raffuse Creek Campground and access road and deepening and widening of Brennan Channel.	✓			

Table 18 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
20('c)	Conduct an annual photographic assessment of all compensatory re-vegetation.	✓			
20(d)	Provide results to DFO in an annual Monitoring Program report. Include as-built plan, any other relevant documents and photographs by Dec 1 of each year.	✓			
Amendment (referred to in Focus Environmental Inc., Sartori Environmental Services Ltd. 2007.)	Mamquam Blind Channel Project. Section 4 of the agreement between SRWS, DFO and Canadian Hydro.	✓			
4(a)	Regular site visits and inspections to ensure physical stability of the works within the Compensation Area.			✓	
4(b)	Annual photographic assessment of the compensation area to show habitat values and physical stability of the works.	✓			
4('c)	In years 3, 4, and 5 after construction of the compensation area, conduct annual (Sept/Oct) mark-recapture minnow trap sampling (over two nights) to assess juvenile populations and productivity.	✓			

3.2.6.4 Lower Lillooet Group of Projects

Development stage: Operational (with the exception of NW Stave River)

Refer to section 7.7 for a complete list of documents reviewed. The production of a baseline and interim year monitoring report by Streamline Environmental Consulting for the Kwalsa and Upper Stave River projects (a.k.a. Lower Lillooet) clearly summarized the vast majority of monitoring activities that were required. Compensation habitat monitoring was not well documented and remained to be a limiting factor in the assessment of these projects. They have been in operation since late summer 2009, and construction of the compensation habitat was authorized to occur concurrently with the construction of the main facility. Excess compensation habitat built at the Douglas Creek facility was to compensate for habitat loss associated with the Tipella Creek project, and excess compensation habitat built at the Stokke Creek facility was to compensate for habitat loss associated with the Fire Creek project. No monitoring reports or updates were available. The Lamont Creek facility is exempt from providing compensation habitat as the diversion reach is non-fish bearing.

A common problem associated with these projects was the late submission of post-construction monitoring reports, and the lack of information regarding water quality and fish assessment results. Weekly environmental monitoring reports were being produced; however, independent audit reports were not sent to DFO within the 60 day deadline. Only one audit report was available for review, dated August 2012, two years after the commissioning of these facilities.

Table 19 Douglas Creek (Authorization No. 03-HPAC-PA2-000-000281).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C(1)	Minimum flow release requirements.	✓			
C(1-d)	Report daily instream flow to DFO annually.	✓			
C(1-h)	Annual post-diversion monitoring report.	✓			
F(2)	Weekly monitoring reports		✓		Reports only submitted periodically (Nov 14-Dec 2 2007, April 17-23 2007, May 21-June 3 2007, May 5-18 2008, July 6-Aug 30 2009).
F(3a-d)	Post construction monitoring report that includes: photographs of before, during and following construction, methodology, WQ, fish sampling results, summary of project including problems. To be submitted 60 days following project completion.		✓		Submitted late. No in situ WQ or fish assessment results.
G(1)	Compensatory habitat monitoring as described in Lewis A. Ganshorn K. Chilibeck B. 2007		✓		Compensation habitat has been built, however no year 1 monitoring report available.
H	Independent audit report to be provided to DFO within 60 days of receipt of any independent environmental monitoring reports.		✓		Independent environmental monitoring reports were sent to DFO in 2007 and 2008. Independent audit report is dated August 1, 2012.

Table 20 Fire Creek (Authorization No. 03-HPAC-PA2-000-000281).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C(1)	Minimum flow release requirements.	✓			
C(1-d)	Report daily instream flow to DFO annually.	✓			
C(1-h)	Annual post-diversion monitoring report.	✓			
D	Compensatory area of 2,548 m^2 for the Fire Creek Project.		✓		Compensation works for the Stokke Creek Project will also compensate for habitat loss associated with the Fire Creek Project. No data available pertaining to the Stokke Creek compensation.
F(2)	Weekly monitoring reports		✓		Reports only submitted periodically (Nov 14-Dec 2 2007, April 17-23 2007, May 21-June 3 2007, May 5-18 2008, July 6-Aug 30 2009).
F(3a-d)	Post construction monitoring report that includes: photographs of before, during and following construction, methodology, WQ, fish sampling results, summary of project including problems. To be submitted 60 days following project completion.		✓		Submitted late. No insitu WQ or fish assessment results.
G(1)	Compensatory habitat monitoring as described in Lewis A. Ganshorn K. Chilibeck B. 2007		✓		No data available pertaining to the Stokke Creek compensation monitoring.
H	Independent audit report to be provided to DFO within 60 days of receipt of any independent environmental monitoring reports.		✓		Independent environmental monitoring reports were sent to DFO in 2007 and 2008. Independent audit report is dated August 1, 2012.

Table 21 Lamont Creek (Authorization No. 05-HPAC-PA1-000-000004).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C(1)	Minimum flow release requirements.	✓			
C(1-d)	Report daily instream flow to DFO annually.	✓			
C(1-h)	Annual post-diversion monitoring report.	✓			
F(2)	Weekly monitoring reports		✓		Reports for a three month span in 2009.
F(3a-d)	Post construction monitoring report that includes: photographs of before, during and following construction, methodology, WQ, fish sampling results, summary of project including problems. To be submitted 60 days following project completion.		✓		Submitted late. No insitu WQ or fish assessment results.
G(1)	Compensatory habitat monitoring as described in Lewis A. Ganshorn K. Chilibeck B. 2007				Not applicable as diversion is not fish bearing.
H	Independent audit report to be provided to DFO within 60 days of receipt of any independent environmental monitoring reports.		✓		Independent environmental monitoring reports were sent to DFO in 2008 and 2009. Independent audit report is dated August 1, 2012.

Northwest Stave

This project is under construction and therefore the Authorization conditions are not applicable until operations begin.

Table 22 Northwest Stave (Authorization No. 10-HPAC-PA2-00314 –A NW Stave – Construction).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
3.8	Provision of as-built drawings of the intake structure, weir, water conveyance system, powerhouse, tailrace, transmission line and access roads must be provided to DFO within 180 days of the completion of construction of the Project. The survey must identify the exact location and physical footprint of the various structures.				Not applicable until operations.
4.2	*Instream habitat compensation*				
4.2.1	Enhancements to two beaver ponds and existing connecting channels resulting in the creation of 290 m^2 of aquatic habitat.				Not applicable until operations.
4.2.1	Fish access improvements to the downstream beaver pond, resulting in the creation and enhancement of not less than 1,739 m^2 of aquatic habitat.				Not applicable until operations.
4.2.2	Feasibility studies on the suitability (i.e., ultimate benefit to fish) of the instream habitat compensation will continue through the summer of 2011.				Not applicable until operations.
4.4	*Timelines for habitat compensatory works*				
4.4.1	The instream habitat compensation will be constructed no later than fall 2012.				Not applicable until 2012-2013.
4.4.3	The riparian habitat compensation will be carried out prior to September 2013.				Not applicable until 2012-2013.
4.5.1	*The habitat compensatory works will be deemed to be functioning as intended if the:*				
4.5.1 (a)	Creation and/or enhancement of instream habitat compensation is not less than 2,029 m^2.				Not applicable until construction completion.
4.5.1 (b)	The instream habitat compensation is physically stable, maintains suitable flows, has been demonstrated to provide new rearing habitat for fish, and has shown a statistically significant increase in fish abundance relative to the pre-project condition.				Not applicable until construction completion.

Table 22 (Cont'd.)

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Full Compliance	Full Compliance	
4.5.1 (c)	Creation and/or enhancement of riparian habitat compensation is not less than 18,190 m^2 or is not less than the m^2 agreed upon by the Proponent and DFO.				Not applicable until construction completion.
4.5.1 (d)	Survival rate of planted or seeded vegetation as part of the habitat compensatory works meets or exceeds a minimum 80% for ground cover, forbs and shrubs.				Not applicable until construction completion.
4.7.3	The Proponent shall prepare a report detailing the mitigation / restoration methodologies used at each of the "temporarily impacted" areas to enable recovery of aquatic and riparian habitats that were temporarily impacted by the project. The report should quantify the as-built temporary impact footprint for reconciliation with the temporary-impact habitat area (m^2) presented in Ecofish 2011.				Not applicable until construction completion.
5.2	The Monitor, or a designate, will be on-site full time during any land clearing that may effect sensitive habitat; instream works; works in the riparian area; inspection of sediment control works; and as deemed appropriate by the Monitor or DFO.		✓		Difficult to assess total monitoring time.
5.4	Preparation of a post-construction monitoring report with dated, color pictures of the site prior to, during and following completion of the Works. The report should describe the Works methodology and water quality and fish sampling results, and also provide a brief summary of the Project, including problems that occurred and how they were resolved. The report is to be submitted to DFO within 60 days after completion of the Project.				Not applicable until construction completion.
5.5	Success monitoring of the replanted / revegetated areas (the "temporarily impacted" areas) shall occur semi-annually for a period of five years.				Not applicable until construction completion.

Table 23 Stokke Creek (Authorization No. 03-HPAC-PA2-000-000281).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C(1)	Minimum flow release requirements.	✓			
C(1-d)	Report daily instream flow to DFO annually.	✓			
C(1-h)	Annual post-diversion monitoring report.	✓			
F(2)	Weekly monitoring reports		✓		Reports only submitted periodically (Nov 14-Dec 2 2007, April 17-23 2007, May 21-June 3 2007, May 5-18 2008, July 6-Oct 4 2009).
F(3a-d)	Post construction monitoring report that includes: photographs of before, during and following construction, methodology, WQ, fish sampling results, summary of project including problems. To be submitted 60 days following project completion.		✓		Submitted late. No in situ WQ or fish assessment results.
G(1)	Compensatory habitat monitoring as described in Lewis A. Ganshorn K. Chilibeck B. 2007			✓	
H	Independent monitoring reports to be provided to DFO within 60 days of receipt of report.		✓		Independent environmental monitoring reports were sent to DFO in 2008 and 2009. Independent audit report is dated August 1, 2012.

Table 24 Tipella Creek (Authorization No. 05-HPAC-PA1-000-000004).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C(1)	Minimum flow release requirements.	✓			
C(1-d)	Report daily instream flow to DFO annually.	✓			
C(1-h)	Annual post-diversion monitoring report.	✓			
F(2)	Weekly monitoring reports		✓		Reports for a two month period only.
F(3-d)	Post construction monitoring report that includes: photographs of before, during and following construction, methodology, WQ, fish sampling results, summary of project including problems. To be submitted 60 days following project completion.		✓		Submitted late. WQ taken on July 2, 2009 only, no fish assessment results.
G(1)	Compensatory habitat monitoring as described in Lewis A. Ganshorn K. Chilibeck B. 2007.		✓		Douglas Creek compensation habitat also compensates for Tipella Creek. Habitat has been built however no monitoring data available.
H	Independent monitoring reports to be provided to DFO within 60 days of receipt of report.		✓		Independent environmental monitoring reports were sent to DFO in 2008 and 2009. Independent audit report is dated August 1, 2012.

Table 25 Upper Stave River (Authorization No. 05-HPAC-PA1-000-000004).

Condition	Condition Details	Compliance Rating			Comments
		Full Compliance	Partial Compliance	Information Not Available	
C(1)	Minimum flow release requirements.	✓			
C(1-d)	Report daily instream flow to DFO annually.	✓			
C(1-h)	Annual post-diversion monitoring report.	✓			
F(2)	Weekly monitoring reports.	✓			
F(2-d)	Post construction monitoring report that includes: photographs of before, during and following construction, methodology, WQ, fish sampling results, summary of project including problems. To be submitted 60 days following project completion.		✓		Submitted late. No in situ WQ or fish assessment results.
G(1)	Compensatory habitat monitoring as described in Lewis. A. Granshorn. K. Chilibeck. B. 2007.			✓	
H	Independent monitoring reports to be provided to DFO within 60 days of receipt of report.		✓		Limited amounts of independent environmental monitoring reports were sent to DFO in 2008 and 2009. Independent audit report is dated August 1, 2012.

3.3 LONG-TERM MONITORING PROTOCOLS

This section presents the overall industry trends with respect to the Long-Term Monitoring Protocols presented by Lewis et al. (2012). Evaluation of each project with regards to alignment with each of the Long-Term Monitoring Protocols, whereby each protocol is cross-referenced with a specific proponent monitoring report is presented in Hatfield (2013). As these Long-Term Monitoring Protocols were developed subsequent to all IPPs being authorized in the current study, the analysis was conducted to determine where future industry improvements would be needed in future to align with the Long-Term Monitoring Protocols.

3.3.1 Water Quality

Frequency of sampling was generally not consistent with the recommended four times per year for two years, and construction/post-construction sample sites did not always coincide with all of the baseline sites.

3.3.2 Ramping

The largest gap in information for the industry as a whole was the lack of ramping rate study reports following commissioning tests. These reports comprise key information regarding sensitive stranding sites for fish and appropriate ramping rates to protect these areas. Combined with yearly operational reports presenting daily ramping rates these reports would provide a good indication as to whether or not reasonable efforts are being made to prevent fish stranding.

Instream flow requirements (IFR) were generally well monitored; however, measurements were often taken every minute or every five minutes instead of the prescribed 15 seconds.

3.3.3 Morphology

Stream morphology criteria were generally recorded; however, there were inconsistencies in the number and location of survey stations that were assessed. The protocol calls for five transects in the diversion reach and two in the upstream and downstream sections, respectively. In some cases transects were missing in one or more of the reaches, or fewer than five were established within the diversion. Some of the projects did not provide any documents with stream morphology assessments. Morphology assessments after the first large flood or after five years of operation did not apply to any of the projects at the time of assessment.

3.3.4 Footprint Verification/As-built Drawings

A consistent trend was the absence of footprint verification reports and as-built drawings. There was no consistent report that could be referred to for this information, which added a level of difficulty in attempts to track down specific pieces of information. Some projects presented limited footprint impact

verification information in interim or year one aquatic monitoring reports; however, stand alone as-built survey results were not included or documented elsewhere. Information pertaining to the materials in the aquatic impact zones was not available. Reseeding and replanting descriptions were sparse, but the information available showed that plants native to the areas were used. Assessments to determine the functional condition of the riparian areas, including ecosystem characteristics, were not available for most projects. It is possible that these data have not yet been collected. Another gap in information that was consistent across all DFO Areas was the absence of field truth information to confirm riparian areas lost as a result of each project.

3.3.5 Habitat Compensation

There were general inconsistencies in habitat compensation monitoring across DFO Areas. In many cases the status of completion and/or monitoring was unknown. The use of habitat suitability indices is a key component of assessing habitat compensation; however, many projects did not mention their use in assessing the habitats.

3.3.6 Species-at-Risk

Only a few projects provided reports detailing assessments for species at risk within the impact area. Key species in question include tailed frogs, northern goshawks, spotted owls and grizzly bears, among others. The presence/absence of species at risk was unclear as to whether or not measures had been taken to reduce impacts on habitat. Harlequin duck and bull trout monitoring has been fairly comprehensive with detailed documentation in most baseline and aquatic monitoring program reports. Projects that were issued an environmental assessment certificate from the BC Environmental Assessment Office typically had more documentation of species at risk monitoring.

3.3.7 Photos

Overall, there was a paucity of photos, especially for those required to compare pre-construction, during-construction and post-construction status of critical habitat sites.

3.3.8 Reservoir/Lake Intake Environments

Only two projects were assessed against Long-Term Monitoring Protocols for lakes. The two projects with intakes at or in proximity to a lake failed to address protocols specified for monitoring lakes and reservoirs and therefore scored low. The exact location of the intake weir with respect to lake/reservoir proximity is not clearly specified with regards to when a project should include lake Long-Term Monitoring Protocols or not. For the purposes of this report, projects were assessed against the lake Long-Term Monitoring Protocols if there was the potential to alter lake habitats even marginally.

4.0 DISCUSSION

The level of compliance with DFO Authorization monitoring requirements and alignment with the Long-Term Monitoring Protocols varied across projects and DFO Areas; however, there was a common trend within the industry with regards to compliance with project specific Authorizations versus alignment with the Long-Term Monitoring Protocols. All projects typically complied more to their specific Authorization than they aligned with the Long-Term Monitoring Protocols which were prepared for the industry as a whole. It is not surprising that all projects typically performed better when conforming to Authorization monitoring requirements than to the Long-Term Monitoring Protocols as the Authorizations are project specific and carry the enforceability of the *Fisheries Act*. Also, although the Long-Term Monitoring Protocols are based on existing published industry guidelines and methodologies, the final document was published in July 2012, after development of the project monitoring plans reviewed for the current assessment. We anticipate there would be elevated levels of conformance with the Long-Term Monitoring Protocols were they to be written into project specific approval documents. "Ultimately, the monitoring plan design is at the discretion of the professionals undertaking the studies and the regulators overseeing the licensing of the project." (Lewis et al. 2012).

Industry trends in compliance with Authorization monitoring conditions were less apparent due to project specificity of individual Authorizations; however, there are some common Authorization monitoring requirements that consistently failed to achieve full-compliance, including the following:

- Frequency/timing of monitoring activities were not consistent with Authorization conditions;
- Submission deadlines were not achieved;
- As-built drawings were not provided or missing information; and
- Photographic assessments failed to fulfill requirements of the Authorization.

The following industry trends with regards to alignment with the Long-Term Monitoring Protocols were noted:

- Frequency and location of water quality monitoring were not consistent with the protocol, and not all specified parameters were being measured;
- A lack of ramping studies was apparent prior to commissioning. These studies are required to adequately assess fish stranding;
- Monitoring of instream flow requirements was consistently documented; however, the frequency of monitoring was less than specified in the protocol;

- The number and location of transects required to monitor stream channel morphology was less than specified in the protocol;
- A lack of footprint verification through the submission of as-built drawings; also applies to compensation habitat;
- Monitoring of fish habitat compensation was not provided; monitoring reports provided were typically missing comparisons to habitat suitability indices;
- Monitoring of species-at-risk was inadequate;
- Detailed photo-documentation to compare critical habitat sites prior to, during and post-construction were not provided; and
- Projects with intakes at or in proximity to the outlet of a lake failed to follow protocols for monitoring lakes.

A few similarities were observed between both the Authorization monitoring requirements and Long-Term Monitoring Protocols with regards to the inability to demonstrate full compliance or alignment:

- Frequency/timing of monitoring activities;
- Submission of as-built drawings for footprint verification; and
- Detailed photo-documentation.

The major limitation encountered during this review was a lack of information needed to verify compliance with the various DFO Authorization monitoring requirements and alignment with the Long-Term Monitoring Protocols. Lack of information is attributable to the following: (1) monitoring reports either omitted or insufficiently documented the information required to assign a level of conformance; and (2) the inability to ascertain if data gaps identified in regulator databases (i.e., missing reports) were a result of proponent non-compliance. For example, a number of reports that DFO Area staff were unable to provide were readily available from the proponent upon request. In the absence of a detailed tracking system, the current assessment was unable to determine whether a particular report had not yet been submitted, was submitted late, or simply was not uploaded to the DFO database.

5.0 RECOMMENDATIONS

To address the major limitation encountered during the current review (i.e., lack of available information), it is recommended that a web-based compliance monitoring system be developed to track compliance with approval requirements. The tracking system should be developed by and maintained by the regulatory agencies, but should provide limited access for proponents to

upload compliance documents. A notification system should also be incorporated to automatically notify the proponent and appropriate agency when specified submission dates or project milestones are forthcoming. This system would allow the appropriate regulator to easily confirm that required monitoring documentation has been received and uploaded to a common database. Non-compliance could be assessed more quickly, allowing for immediate enforcement and/or mitigation measures. The tracking system should have user accessibility restrictions, whereby regulators can manage the information and proponents would only be able to upload information. Common feedback received from proponents was a frustration with the lack of non-compliance notification by regulators until the end of the monitoring program rather than early on in the life of the project when corrective measures are more easily implemented.

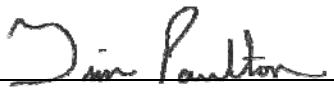
Based on feedback from DFO staff it is recommended that an industry standardized non-compliance reporting format be developed such that the information to be provided in the non-compliance report is not at the discretion of the project operator. To this end industry and regulators need to standardize the definition of an operational non-compliance incident such that the methodology for calculating an operational non-compliance is completed the same way across all projects (e.g., magnitude and duration of IFR or ramping non-compliance incidents during commissioning and operations).

Every project is different due to the specific nuances of individual sites. As such, specific conditions of DFO Authorizations and BC MoE Water Licenses will always vary among projects; however, an IPP generic set of Authorization Conditions related to monitoring would provide continuity in standards across all projects with regards to monitoring. Further, if these generic set of Authorization conditions aligned with the Long-Term Monitoring Protocols (developed jointly by industry and provincial and federal regulators) proponents would likely be able to develop one monitoring plan that satisfies both levels of government. It is also recommended that the Long-Term Monitoring Protocols be periodically updated based on feedback from industry and regulators. Updates may be more easily facilitated through the development of an expert review panel or technical working group.

6.0 CLOSURE

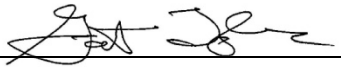
We trust the above information meets your requirements. If you have any questions or comments, please contact the undersigned.

HATFIELD CONSULTANTS:

Approved by:  March 26, 2013

Tim Poulton
Project Manager

Date

Approved by:  March 26, 2013

Garth Taylor
Project Director

Date

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7.6.3 Upper Mamquam

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Redundant box 1-2

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