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August 18, 2016

VIA ELECTRONIC MAIL

British Columbia Utilities Commission
6th Floor, 900 Howe Street
Vancouver, B.C.
V6Z 2N3

Attention: Ms. Laurel Ross, Acting Commission Secretary and Director

Dear Sirs/Mesdames:

Re: FortisBC Inc. ("FBC") Application for a Certificate of Public Convenience and Necessity for Replacement of the Corra Linn Dam Spillway Gate, Project No. 3698883

We are counsel to the Commercial Energy Consumers Association of British Columbia (CEC). Attached please find the CEC's first set of Information Requests with respect to the above-noted matter.

If you have any questions regarding the foregoing, please do not hesitate to contact the undersigned.

Yours truly,

OWEN BIRD LAW CORPORATION

Christopher P. Weafer

CPW/jlb
cc: CEC
cc: FBC
cc: Registered Interveners

COMMERCIAL ENERGY CONSUMERS ASSOCIATION OF BRITISH COLUMBIA

INFORMATION REQUEST #1

FortisBC Inc. Application for a Certificate of Public Convenience and Necessity for Replacement of the Corra Linn Dam Spillway Gate
Project No. 3698883

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1. Reference: Exhibit B-1, Page 2

> The replacement or rehabilitation of the spillway gates and associated equipment is essential for the Corra Linn Dam to align with industry standards, meet current regulation and minimize the risks to public and employee safety. Since 2007, there have been amendments to the Canadian Dam Association Dam Safety Guideline (CDSG) and the British Columbia Dam Safety Regulation (BCDSR), which are relevant to the Corra Linn Dam.
>
> These amendments revised the "Dam Failure Consequence Classification", a measure that classifies dams based on the severity of the potential consequences of a dam failure, resulting in the Corra Linn Dam being reclassified from a "Very High" consequence classification to an "Extreme" consequence classification. The amendments have also updated the magnitude of the "design flood" and "design earthquake", which are used to define the severity of hazards that the Corra Linn Dam is recommended to be able to withstand. The Corra Linn Dam spillway gates do not have the strength to withstand the recommended design earthquake for a dam with a consequence classification of "Extreme". The spillway gate system does not meet present day requirements of the BCDSR and the recommendations for withstand capability requirements under the latest edition of the CDSG. Accordingly, the spillway gates and the associated structures require either significant refurbishment or replacement, to align with these amendments and to be able to withstand the design earthquake.

1.1. Are there restrictions on the timing for this project, such that it must be completed prior to a particular deadline to ensure compliance? If so, please explain.

2. Reference: Exhibit B-1, Pages 2, Page 23 and Page 23 Footnote

> In order to validate the current structural conditions and the original design of the various spillway components, FBC recently completed inspections on three of the 14 spillway gates at the Corra Linn Dam. These inspections revealed that the spillway gates are in fair to poor condition, and FBC considers the gates to be approaching end of life, unless significant rehabilitation is performed. The findings of these inspections, therefore, have been used to establish the extent of the reinforcement requirements based on the existing structural integrity of each component.

In January 2016, various inspections were performed both by FBC and external specialist consultants to assess the condition of the gates, to determine the extent of the refurbishment that would be required to reinforce or replace the components. The three major components inspected were the three spillway gates[24], the steel superstructure supporting the spillway gate hoists and the spillway gate hoists. The inspections included visual inspection, non-destructive testing, electrical testing and metallurgical testing. The inspections indicate that the condition of the spillway gates are in fair to poor condition. The inspection reports are presented in Confidential Appendix F and consist of:

- Dam Visual Inspection;
- Dam Electrical Visual Inspection;
- Dam Gate Thickness; and
- Electrical Site Visit.

On this basis, FBC considers the gates to be approaching end of life unless significant rehabilitation is performed.

inspections or work to be completed.

[24] The three spillway gates that were selected for detailed inspection were chosen because they were assessed to be of the worst condition based on a visual inspection of the gates.

2.1. Why did FBC not complete inspections on all of the 14 spillway gates?

2.2. Which three of the spillway gates did FBC inspect?

2.3. What are the circumstances that likely caused the three spillway gates to have worse condition than other gates? Please explain.

2.4. What was the cost of inspecting three gates?

2.5. What would have been the cost of inspecting more spillway gates? Please provide quantification for any different options that FBC considered.

2.6. Please provide FBC's understanding of the other 11 spillway gates' condition.

2.7. Does FBC consider the three gates to be approaching the end of life unless significant rehabilitation is performed, or all the gates to be approaching end of life?

2.8. Could knowing the condition of the other spillway gates have any bearing on the alternative FBC selected for remediation? Please explain why or why not and provide quantification of any costs that would relate to the decision.

3. Reference: Exhibit B-1, Pages 5 and page 6

The Project was later discussed in FBC's 2014-2018 PBR Application (PBR Application) as a capital expenditure that would be the subject of a separate application for a CPCN. As is described in the PBR Application, the scope of the original project identified in the 2012 ISP had expanded due to a change in regulation. Specifically, section 5.4.2.2 of part C the PBR Application states:

> As a result of the reclassification from "Very High" to "Extreme", and consistent with the information provided in the PBR Application, FBC's original plan of isolation, access, sandblasting and recoating the spill gates has now increased in scope to also include the work necessary to upgrade the strength of the spillway gates and associated equipment to withstand the design earthquake forces for a dam with a consequence classification of "Extreme".

3.1. Please confirm that neither the increase in scope nor other changes to the project result in a transfer to the CPCN of any expenditures that would otherwise have been covered by the formula spending under PBR. Please consider both current spending and future maintenance expense.

 3.1.1. If not confirmed, please provide details with quantification and forecast timing of the expenditures that will be included in the CPCN that would otherwise have been covered by formulaic spending.

4. Reference: Exhibit B-1, Pages 8, 9, 21 and 27

> In addition, in recent years the Company has completed several major projects including the Advanced Metering Infrastructure project (total value of approximately $51 million) and the Okanagan Transmission Reinforcement project (total value of approximately $104 million). FBC proposes that the construction for the Project be done by a reputable contractor, with specialized experience in the design, supply and installation of spillway gate systems. FBC engaged HMI Construction, a firm specializing in spillway gate systems, to complete the

> preliminary engineering and to support the development of the Project Cost Estimate. Engaging a specialized constructor at this early stage of the Project lends to improved project risk identification, ensuring constructability of the proposed solution and increased confidence in the Project Cost Estimate.

seismic withstand capability of the spillway gates, towers, bridges, and hoists. FBC also retained HMI to assist in developing the spillway gate and superstructures reinforcement requirements, if any. HMI's report (HMI Preliminary Engineering Report) is included as Confidential Appendix E to the Application.

HMI's scope of work entailed reviewing the latest dam safety regulations and guidelines and determining if the current equipment meets the design withstand capacity. In the review process, the following equipment were analyzed and evaluated:

- the capacity of the gates to withstand the "Extreme" classification design earthquake event;
- the capacity of the gates to operate during the "Extreme" classification design flood event;
- the capacity of the superstructures to remain operable after the "Extreme" classification design earthquake event; and
- the capacity of the hoists to remain operable after the "Extreme" classification design earthquake event.

HMI also evaluated the reliability of the facility and the following potential safety hazards:

- structural failure of the spillway gates during a flood or seismic event which would lead to downstream water surges/uncontrolled release of water;
- structural failure or overturning of the superstructure during a seismic event that would render the gates inoperable which may potentially make the Dam vulnerable to overtopping and potential catastrophic failure of the Dam;
- structural failure or overturning of the travelling hoist during a seismic event would render the gates inoperable which may potentially make the Dam vulnerable to overtopping and potential catastrophic failure of the Dam; and
- mechanical failure of the hoist preventing the spillway gates operation that could be hazardous to facilities and public downstream of the Dam.

To further assess Alternative 3: Gate Refurbishment and Alternative 4: Gate Replacement, FBC sought HMI's assistance to conduct a detailed review of the risks for each feasible alternative. Project designs were developed to sufficient detail so that a fair comparison could be made with respect to overall risk reduction, project schedule risk, operational and maintenance considerations, reliability characteristics and potential environmental impacts. This analysis comprises the HMI Preliminary Engineering Report (PER) included as Confidential Appendix E.

HMI was also engaged to assist in preparing an AACE Class 3 Project estimate for both Alternative 3: Gate Refurbishment and Alternative 4: Gate Replacement. No cost estimates were prepared for Alternative 1: Do Nothing or Alternative 2: Deferral because these alternatives did not achieve the Project objectives or meet the technical criteria identified in Section 4.1.1.

4.1. What was the total cost of the work undertaken to date by HMI?

4.2. Did FBC undertake a competitive tendering process in the engagement of the engineering firm HMI?

4.2.1. If not please explain why not.

4.2.2. If so, how many firms did FBC consider and receive bids from?

4.3. What is the total expected cost of the preliminary engineering and support for the development of the Project Cost Estimate?

4.4. Is it standard practice for FBC to engage a construction firm at the early stage of a major project?

4.4.1. If no, please explain why this project has received non-standard treatment.

5. Reference: Exhibit B-1, Page 20

> In the Dam Stability Study, KP concluded that the Corra Linn Dam concrete structure is expected to perform satisfactorily under the maximum design earthquake (MCE) and Maximum Design Flood (PMF) event if all the potential stabilizing forces can be relied upon.[19]
>
> [19] Page 1 of Confidential Appendix D, Structural Stability Analysis – Corra Linn Dam.

5.1. If not confidential, please provide a brief description of the stabilizing forces which will be relied upon as identified above.

5.2. Is there any reason to believe that all the potential stabilizing forces are unable to be relied upon? Please explain and provide quantification of any risks for which FBC has information that is available and not confidential.

6. Reference: Exhibit B-1, Page 21

> As summarized above, further studies were recommended by KP in the 2012 DSR which included a recommendation that FBC re-assess the seismic structural stability of the dam using the longer seismic return period and the increased ground motion acceleration associated with that return period (Dam Stability Study) and assess the seismic withstand capacity of the spillway gates and associated equipment to ensure they would be operable after an earthquake (Gate Withstand Study). These follow-up studies are discussed in the next sections.

In 2015, as a follow-up to the recommendations in the 2012 DSR, FBC engaged KP to perform the Dam Stability Study to re-assess the structural stability of the Corra Linn Dam.[18] This assessment was focussed on the structure of the Dam itself, and did not include the spillway gates and associated equipment within the scope of the analysis. KP considered previous upgrades completed on the Dam, together with the new "Extreme" dam failure consequence classification and the associated requirements for the design flood and design earthquake values outlined in the CDSG. As an additional input into the Dam Stability Study, KP engaged Wutec Geotechnical International in May 2015 to create a technical report that provided the earthquake design loads which would inform the design criteria to be used for dam and spillway gates: *Corra Linn Dam – Seismic Hazard Assessment and Input Ground Motions* (Wutec Report). A copy of the Wutec Report is attached as Appendix C.

6.1. What was the total cost of the studies performed by KP?

6.2. Did FBC conduct a competitive bidding process in the hiring of KP?

6.2.1. If not, please explain why not.

7. Reference: Exhibit B-1, Page 23

The recommended design life of a new gate is 100 years as per the US Army Corps of Engineers,[22] assuming appropriate repairs and rehabilitation projects are performed during the gate service life. Further, the Corra Linn Dam was not constructed with a means of isolating the spillway gates, such as a bulkhead,[23] making routine maintenance difficult. As such, maintenance and refurbishment activities on the gates have been appropriate but minimal due to limited access.

150%. The dogging beam should be reinforced".

[22] US Army Corps of Engineers (USACE) Engineer Technical Literature (USACE ETL) 1110-2-584 and Design of Hydraulic Steel Structures and Engineering Manual (USACE EM) 11100-2-8159 Life Cycle Design and Performance.

7.1. Is the US Army Corps of Engineers the standard Canadian reference source for gate service life?

7.1.1. If no, what alternative Canadian reference material is typically relied upon for gate service life?

7.1.2. If no, do other reference materials recommend different design lives? Please explain.

8. Reference: Exhibit B-1, Page 23

> While FBC would have preferred to also conduct an inspection of the embedded parts[25] of the spillway gates, this is not possible due to the Corra Linn Dam's design, which makes it challenging to isolate and dewater the spillway gates. In order to assess the extent and type of rehabilitation required, FBC used the results from the inspection of the embedded parts of the spillway gates at another plant which FBC considers to be comparable to the Corra Linn Dam, based on spillway gate size, design and age. The dam used as a proxy for the embedded parts inspection is approximately 12 years newer than the Corra Linn Dam, therefore more corrosion may exist on the embedded parts at the Corra Linn Dam. This site was chosen because maintenance was underway and one of the gates was fully isolated, making a detailed inspection of the embedded parts, which are typically submerged in water, possible.
>
> The general conclusion from the inspection is that there was heavy corrosion observed in most areas in contact with water.

8.1. At what other plant did FBC conduct the inspection as a proxy for Corra Linn?

8.2. Are there any other material differences other than age which would factor into the corrosion levels? Please explain.

   8.2.1. If yes, please provide a discussion of these differences and how they might result in different corrosion levels in Corra Linn.

9. Reference: Exhibit B-1, Pages 26 and 32

> ### 4.2.3 Alternative 3: Gate Refurbishment
>
> Alternative 3: Gate Refurbishment would include: refurbishment of the spillway gates structure, painting of all exposed steel to provide corrosion protection, replacement of the roller bushings, rehabilitation of the embedded parts,[26] refurbishment of the spillway gate hoists, reinforcement of the towers and bridges that support the spillway gate hoist, and upgrades to the power distribution and control systems for the spillway gates.
>
> The Gate Refurbishment alternative would retain the majority of the spillway gate structure, with repairs and replacements to the various structural components of the spillway gate being done as needed. Each spillway gate would be thoroughly inspected to identify damage, determine the reduction in skin plate thickness and to determine the actual surface area to be repaired. Repairs would be completed through the removal of damaged or corroded areas and the addition of similar components such as structural steel shapes and structural steel plates. The actual percentage of skin plate replacement would vary from gate to gate. To increase the

spillway gate capacity and to increase the stiffness to meet the strength required, the addition of new structural steel components would also be required; these additions would include both new horizontal and vertical structural members.

The associated spillway gate equipment would also be inspected to determine the actual condition, and repairs or replacement undertaken to upgrade the original design to meet current day design requirements.

4.2.4 Alternative 4: Gate Replacement

Alternative 4: Gate Replacement would include the construction of 14 new gates. The new gates would be manufactured offsite in a factory environment to present day design requirements. The existing embedded parts would be inspected and repaired or upgraded as required to support the new spillway gate. The towers and bridges that support the spillway gate hoist would require reinforcement. The spillway gate hoists would be inspected to determine the actual condition and any repairs or replacement would be done to upgrade the original design to meet current day design requirements. In addition, upgrades to the power distribution and control systems for the spillway hoists would be completed.

- Replacement would provide the most reliable flow control system of the identified alternatives through replacing aging and obsolete equipment significantly reducing the risk of future spillway gate failures (Criteria 4);
    - This approach would replace the entire spillway gate with a new gate and would therefore fully incorporate the 85 years of engineering development that has occurred since the original gate construction;

9.1. Did FBC consider an alternative of conducting further inspections prior to making a determination regarding Replacement or Refurbishment? Please explain why or why not.

9.2. Would it be feasible to replace some of the spillway gates and refurbish others? Please explain why or why not.

9.2.1. If yes, did FBC consider such an alternative and please explain why or why not.

10. Reference: Exhibit B-1, Page 31

electrical power supply, hoists and towers (Criteria 4), however, there is the potential for latent defects to remain following refurbishment[35]; and

- Maintenance would be simplified through the installation of low maintenance equipment.

[35] the skin plate stresses are inversely proportional to the square of the thickness and significantly increase as the material loss increases

10.1. Please elaborate further on the latent defects that could remain and explain how these could affect the integrity of the dam.

10.2. Please confirm or otherwise explain that Maintenance would also be simplified in Alternative 4.

11. Reference: Exhibit B-1, Page 31

Disadvantages:

- The Project risks related to unexpected conditions are highest for this alternative (Criteria 3). Project risks would include:
    - The schedule could be negatively impacted because the construction method is expected to be more complex due to refurbishment activities of the spillway gates that are required to be undertaken in the field;
    - The Project scope could potentially be impacted once the actual extent of refurbishment work required is determined; the potential for scope variation during the construction period is more likely because the condition of each gate cannot be confirmed until it is be removed from service and inspected. While this risk is partially mitigated by the inspections done on three of the Corra Linn spillway gates, there continues to be uncertainty associated with each individual spillway gate and hence to the overall required refurbishment scope.
    - Refurbishment of the gates in situ requires removal of lead paint, repainting, and millwork in close proximity to or immediately above water and would require environmental mitigation measures;
    - Refurbishment of the gates in situ increases the safety risk to workers because this work would be performed at locations above or in close proximity to water or in constrained areas that are not easily accessible (i.e. the lower bay of the gate which is 1.1 m high and 1.4 m deep and where a significant amount of reinforcing steel would need to be installed). As a result, these activities would require extensive temporary scaffolding and associated complex work procedures; and
    - Cost variances could result from any of the above factors.
- It is expected that this alternative would extend the expected life of the existing gate by approximately 11-25 years, therefore replacement of the spillway gates would need to be considered within the next 15 years.

11.1. Please confirm that the project scope under Alternative 3 could be reduced if the gates are in better condition than anticipated, and that cost variances could result in significantly lower costs than presently anticipated.

11.2. What is the cost variance that could occur under a best case scenario with Alternative 3? Please quantify and provide both a figure and a percentage cost difference.

11.3. What is the cost variance that could occur under a worst case scenario with Alternative 3? Please quantify and provide both a figure and a percentage cost difference.

12. Reference: Exhibit B-1, Pages 3 and 35

To further compare the two feasible alternatives, a financial criterion of minimizing the financial impacts of the Project was used. While Alternative 3: Gate Refurbishment had lower initial capital costs than Alternative 4: Gate Replacement, this did not take into account the fact that the existing gates are 84 years old, and that, even with extensive refurbishment, the current gates are likely to need replacement by 2032, when they will be 100 years old. Taking into account the refurbishment costs and the estimated capital costs associated with this replacement in 2032 associated with Alternative 3: Gate Refurbishment, Alternative 4: Gate Replacement minimizes the financial impacts of the Project and is the most long term cost-effective solution.

Table 4-2: Comparison of Initial Capital Costs between Alternative 3 and 4 ($ millions)

	Alternative 3: Gate Refurbishment		Alternative 4: Gate Replacement	
	2015 $	As Spent $	2015 $	As Spent $
Engineering	2.492	2.665	2.349	2.506
Supply, Installation & Testing	20.278	21.687	18.098	19.302
Site-Support Work	7.732	8.269	9.443	10.071
Indirect Costs	0.720	0.770	0.624	0.666
Project Management	6.375	6.818	4.322	4.610
Subtotal Construction	*37.596*	*40.209*	*34.837*	*37.155*
Removal Cost[39]	-	-	5.331	5.804
Construction Contingency	2.255	2.412	2.008	2.148
Subtotal Construction & Removal	*39.851*	*42.620*	*42.177*	*45.108*
FBC – Project Management	2.920	3.155	2.920	3.155
Generation Admin Overhead	0.543	0.589	0.543	0.589
Project Contingency[40]	6.497	6.955	6.846	7.328
Pre-Approval Project Costs[41]	1.062	1.081	1.062	1.081
Subtotal (incl. Construction & Removal)	*50.873*	*54.400*	*53.548*	*57.260*
AFUDC	n/a	5.394	n/a	5.434
TOTAL Project Capital Costs	*50.873*	*59.794*	*53.548*	*62.694*

12.1. Please confirm that Alternative 3 has a greater likelihood of changes in Project Scope than Alternative 4.

12.1.1. If confirmed, please explain why the Project contingency is larger for Alternative 4 than it is for Alternative 3, given that Alternative 3 has greater likelihood of changes in project scope.

12.2. Please identify where in the application the costs associated with the possible need for replacement are evaluated and accounted for financially.

13. Reference: Exhibit B-1, Page 45

5.3.1 Contractor Selection and Award

Given the specialized nature of the Project, the Company is evaluating the merits of an alliance agreement with a contractor, as compared to using a traditional Design Build tender. Under this approach, the contractor is selected based on qualifications, experience and reputation. This process makes the contractor a member of the collaborative Project team, centralizing responsibility for design and construction under one contract, creating transparency in risk allocation, and leveraging the experience of the contractor to reduce schedule and cost. The Project achieves competitive market rates by tendering various construction and supply agreements, which are then subsequently evaluated and awarded by the collaborative Project team.

Alternatively, the Company may select a contractor based on a more traditional tender process.

13.1. When will FBC make its determinations with respect to the 'Alliance' agreement or the Design Build tendering process?

13.2. What criteria will FBC use to determine the best methodology?

13.3. Has FBC utilized the alliance approach before?

13.3.1. If yes, please explain when this approach has been used and provide a discussion as to FBC's views of its cost-effectiveness.

13.4. Please outline the differences in the activities that are performed by an Alliance partner versus a contractor selected through the tendered Design Build process.

13.5. Please outline the advantages and disadvantages of the two methodologies.

13.6. Would FBC agree that a tendering process is intended to select a contractor with the best mix of cost-effectiveness, qualifications, experience and reputation from several qualified alternatives?

13.6.1. If not, please explain why not.

13.7. Would FBC agree that the selection of an 'alliance contractor' could result in greater costs than might be achieved under the tendering process? Please explain why or why not.

13.8. Are there regulations or other stipulations that FBC typically or is required to follow that recommend or require a tendering process for large contracts?

13.8.1. If yes, please identify the rules/regulations that recommend or require a tendering process for large contracts and provide access to those regulations either by way of website link or other means.

13.9. How does an Alliance partner reduce FBC expenditures relative to the Design Build tendering process?

13.10. Does FBC have an "Alliance" partner identified already?

13.10.1. If yes, who is the anticipated 'Alliance' partner?

13.10.1.1. Is there any reason why the anticipated Alliance partner selected might not win in a Design Build tendering process? Please explain.

13.10.2. If no, how will FBC select the 'Alliance' partner?

14. Reference: Exhibit B-1, Pages 49 and 59

5.5.1 Project Management

FBC will assign a Project manager who will manage the construction contractor on a daily basis throughout the Project. An FBC Construction Manager will lead the Project site team and is accountable to the FBC Project manager for all aspects of construction. The Construction Manager will have support for each of the following disciplines: contract administration, administrative support including document control, safety audits and environmental monitoring. In order to minimize disruptions with operations and to have clear communications between the Project team and the operation team, an operations liaison will be assigned to the Project.

The construction contractor will also have a Project management team composed of qualified personnel including a Project manager, discipline Project engineers, a superintendent, a construction safety officer, a shop quality inspector and other support personnel. The Contractor Project manager and Project engineers will be involved from the beginning of the Project to also manage the engineering and procurement phases before mobilization on site.

Table 6-1: Summary of Estimated Project Capital Costs ($ millions)

	2015 $	As-Spent $
Contractor's Costs		
Engineering	2.349	2.506
Supply, Installation & Testing	18.098	19.302
Site-Support Work	9.443	10.071
Indirect Costs	0.624	0.666
Project Management	4.322	4.610
Subtotal	*34.837*	*37.155*
Removal Cost[50]	5.331	5.804
Construction Contingency	2.008	2.148
Total Contractor Costs	*42.177*	*45.108*
FBC Owner's Costs		
FBC – Project Management	2.920	3.155
Generation Admin Overhead	0.543	0.589
Project Contingency[51]	6.846	7.328
Pre-Approval Project Costs	1.062	1.081
Subtotal (Contractor & Owner's Costs)	*53.548*	*57.260*
AFUDC	n/a	5.434
TOTAL Project Capital Costs	*53.548*	*62.694*

14.1. Please confirm that FBC owners' costs including project management and general admin are included in the CPCN costs, and are therefore tracked outside of PBR.

14.2. Are the 'FBC owner's costs' expenditures that would normally be covered by or tracked within PBR formulaic spending?

14.3. If so, how does FBC adjust its formulaic O&M and capital spending under PBR?

14.4. How is the Project Contingency treated under PBR, to the extent that contingency covers costs that would otherwise be covered by the PBR formulaic spending allowance? Please explain.

15. Reference: Exhibit B-1, Pages 51 and 52

5.7.2 Risk Identification Planning

The risks were identified through a collaborative process between HMI and FBC. The first step of the process was the identification of the general risks categories that are applicable to the various phases of the Project. These categories are: design, procurement, fabrication, construction, environment and transportation. A comprehensive list of risks was then identified in each category. This list forms the basis of the risk register. The next step of the process was to establish the context for the risk identification in terms of:

- Proposed mitigation measure;
- Risk likelihood and consequence scales; and
- Responsibility for each risk (FBC or Contractor).

The appropriate risk likelihood and consequence (probability and exposure) scales relevant to the Project are based on the 5x5 risk assessment matrix recommended in the AACE 62R-11 illustrated in the following figure.

FBC then allocated the responsibility for each risk to either FBC or a contractor using the principle that risks are typically allocated to the party best able to manage a particular risk. The concept behind this principle is based on the fact that the party that manages the risk must also bear the financial cost, so as to provide that party an incentive to mitigate the risk.

15.1. Please confirm or otherwise explain that the responsibility for each risk, either FBC or Contractor would not necessarily have to change under either the Alliance option or the tendered Design Build option.

15.2. If not confirmed, please explain which option is being presented as the default option in this application.

16. Reference: Exhibit B-1, Pages 56 and 57

In the case of BC Hydro, HMI successfully responded to an international call for tender for the first phase of BC Hydro's Spillway Gate Rehabilitation Program. The first phase consisted of the rehabilitation of three spillways. After successfully completing the first phase of this project, HMI was then selected by BC Hydro for the rehabilitation of BC Hydro's remaining 19 sites including inspection, design, procurement as well as implementation. To date, HMI has completed spillway gate rehabilitation work at several of the BC Hydro dams; several of which are similar to the scope of work at the Corra Linn Dam with increased seismic loads.

16.1. Please confirm that FBC did not issue a call for tender for HMI's present roll in this this application.

17. Reference: Exhibit B-1, Page 58

1. Front End Engineering costs have been included for all mechanical, electrical and civil components of the Project scope.
2. Supplies and fabrications costs have been evaluated based on HMI database prices which are premised on recent awarded tenders.
3. Transportation costs have been evaluated by allocating transportation costs to all the supplies and fabricated items to be delivered to site.
4. Construction costs have been evaluated based on HMI's experience and are composed of the following costs:
    i. Direct labor, which was estimated in detail for each activity part of the WBS. Labor cost is calculated on the number of hours per trade times the associated labor rate;
    ii. Supervision costs, which was evaluated as a percentage of the direct labor based on construction industry standards;
    iii. Lifting equipment, which was evaluated based on the various scenarios; and
    iv. Temporary access equipment such as scaffolding and temporary roads, which was evaluated based on the various scenarios analyzed.
5. Site establishment costs are composed of the equipment and temporary installations required to support construction. Site trailers, rest rooms, etc. were evaluated based on the number of workers estimated for the work and the duration of the work on site.
6. Commissioning and Start-up costs were evaluated based on HMI's experience and are mainly composed of the personnel, equipment and tools required for performing dry testing and wet testing activities.
7. Quality Assurance and Quality Control costs were evaluated based on the Project team's experience with other similar type projects. They involve shop inspections, laboratories (shop and site) and consultants required to ensure the delivery of a quality product.
8. Financial costs such as bonding and insurance have been included.
9. Project Management and Owner costs have been based on the proposed organizational chart, list of deliverables and contractual deliverables.

17.1. Are the 'recent awarded tenders' those tenders that HMI has awarded?

17.1.1. If not, please clarify.

17.1.2. If so, please provide the practices and criteria that HMI uses to award its tenders.

17.1.3. What steps, if any, has FBC taken to verify the cost-effectiveness of HMI's estimates relative to the market?

17.1.4. Please provide the total dollar value of the estimates that have been made based on HMI's experience and database

18. Reference: Exhibit B-1, Pages 60 and 61

To determine the Project contingency, a risk register (Confidential Appendix H) as described in Section 5.7 was established by FBC and HMI collaboratively for the risk elements that could be identified for the Project. These risks are commonly termed known risks and they were identified based on HMI's extensive experience in recent similar spillway rehabilitation work in the Province and FBC's experience on past projects. Examples of these known risks are: delay in obtaining necessary permits/approvals, unforeseen conditions of embedded structure, parts and concrete, unforeseen project management resourcing requirements, construction delays and re-work.

Table 6-3: Format of Risk Register Established for Project

Probability rating (1 to 5)	Impact rating (1 to 5)	Overall Risk Level (1 to 25)	Estimated Financial impact of risk event ($)	Amount to add to project contingency (prob x cost)
Estimate based on experience and analysis	Estimate based on experience and analysis	*Probability rating* x *Impact rating*	HMI estimate based on experience and current analysis	*Probability (%)* x *Estimated Financial impact ($)*

18.1. Is HMI able to provide evidence of a strong track record in appropriately estimating project contingencies?

18.1.1. If yes, please provide.

18.1.2. If no, why not?

19. Reference: Exhibit B-1, Pages 59 and 61

Table 6-1: Summary of Estimated Project Capital Costs ($ millions)

	2015 $	As-Spent $
Contractor's Costs		
Engineering	2.349	2.506
Supply, Installation & Testing	18.098	19.302
Site-Support Work	9.443	10.071
Indirect Costs	0.624	0.666
Project Management	4.322	4.610
Subtotal	*34.837*	*37.155*
Removal Cost[50]	5.331	5.804
Construction Contingency	2.008	2.148
Total Contractor Costs	*42.177*	*45.108*
FBC Owner's Costs		
FBC – Project Management	2.920	3.155
Generation Admin Overhead	0.543	0.589
Project Contingency[51]	6.846	7.328
Pre-Approval Project Costs	1.062	1.081
Subtotal (Contractor & Owner's Costs)	*53.548*	*57.260*
AFUDC	n/a	5.434
TOTAL Project Capital Costs	*53.548*	*62.694*

The risk register also determined which of these known risks are most likely held by a contractor and the financial impacts of these contractor related risks. The sum of these financial impacts were included to the construction cost as contingency (i.e. Construction Contingency) in the AACE Class 3 cost estimate developed by HMI (Confidential Appendix L). This contingency is also shown in Table 6-1 above as Construction Contingency. All of the other known risks identified in the risk register that are not to be held by a contractor will be likely held by the owner (owner's known risks). The financial impact of these owner's known risks was included to the Project Contingency shown in Table 6-1 of Section 6.3.1 above.

19.1. Why is the Construction Contingency less than 5% of the Contractor's costs, when the project contingency is over 12% of the total project cost? Please explain and provide quantification where available.

19.2. Is it typical for the Construction Contingency to be less than a quarter of the overall project contingency? Please explain and provide examples from other construction projects.

20. Reference: Exhibit B-1, Page 61

> It is worthwhile noting that there is no AACE standard that outlines the "correct" or "appropriate" level of contingency to include in a project. There are studies however, that suggest an appropriate contingency for projects with high complexity and medium technology in the process industry[55] and in 2014 AACE published a technical paper which presented a case study of estimating in the Canadian Hydropower Industry indicating that contingency and reserves estimated were lower than required[56].
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> [55] Hollmann, J. "Improve Your Contingency Cost Estimates For More Realistic Budgets", Chemical Engineering, Dec 2014. http://www.chemengonline.com/improve-your-contingency-estimates-for-more-realistic-project-budgets/?printmode=1.

20.1. The CEC is unable to access the cited document. Please indicate what the appropriate contingencies might be, and provide copies of the articles.