



December 21, 2015

Reference No. 1314470516-061-L-Rev0

Toby Seward, Community Development and Protective Services
City of Nanaimo
455 Wallace Street
Nanaimo, BC
V9R 5J6

**COLLIERY DAMS, NANAIMO BC
CONCEPTUAL PLAN FOR DAM SAFETY ANALYSIS OF THE MIDDLE DAM**

Dear Mr. Seward,

As requested, this letter has been prepared to outline a plan for further assessment of dam safety hazards for the Middle Colliery Dam in Nanaimo, BC, as required by an Order from the Province of BC (Province of BC, 2015). The Order requires;

“a revised conceptual plan that identifies and prioritizes any actions required to correct the potential dam safety hazard with Middle Dam, along with a timeline for taking those actions within a reasonably expeditious time frame, timed to follow after completion of actions to correct the potential safety hazard with Lower Dam,”

The Order requires the plan to be submitted to the Province by the end of 2015.

This proposed plan for the Middle Dam adopts a similar approach of dam safety analysis to that used previously (in 2014) for the Lower Dam. This approach will make use of a risk assessment model which was developed for both the Middle and Lower Dams, but which was applied only to Lower Dam as a means to assess remediation options in 2014. The risk model allows the assessment of the risk (consequences and likelihood) associated with the principal hazards (flooding and earthquake) and provides a means to determine the risk reduction which would occur due to the application of conceptual remediation options. In this work, we propose to follow the Canadian Dam Safety Guidelines as well as previous instructions from the Province of BC (Province of BC, 2014), which provide a framework for applying the risk assessment (also known as the risk-informed approach) to the Colliery Dams. In carrying out this next stage of the risk assessment, we propose to continue to utilize the services of Dr. Bill Roberds, a Principal of Golder and an internationally recognized specialist in the field of risk assessment and decision theory, and who carried out the previous stage of analysis on the Colliery Dams.



For the Middle Dam, the focus will be on identifying a remediation approach which satisfies dam safety requirements while minimizing impacts to the City and park users (including impacts due to cost, park aesthetics, and environmental impacts), and which considers the significant improvement in the safety of the Colliery Dam system which will occur once the Lower Dam remediation is complete. In particular, the improvements to the Lower Dam will mostly remove the cascading failure mode (whereby failure of the Middle Dam causes failure of the Lower Dam).

The proposed conceptual plan for this work includes the following steps;

- 1) Identify Conceptual Remediation Approaches. In collaboration with the City of Nanaimo, identify potential high-level remediation approaches, and carry out screening to reduce the list to a shortlist of 3 or 4 options;
- 2) Risk Assessment. Carry out a risk assessment to determine the risk reduction which would result due to the application of each of the shortlisted remediation approaches. Based on all factors, including the risk assessment results, select a preferred list of remediation approaches to be carried forward for further assessment;
- 3) Conceptual Development of Preferred Options. Carry out further evaluation of the preferred options to determine key performance criteria (construction cost, life cycle costs (design life and maintenance requirements), park impacts, environmental impacts and construction risk and schedule);
- 4) Seek feedback from the Province. As suggested in previous correspondence (Province of BC, 2014), feedback will be sought from the Province of BC in regards to the remediation approach for the Middle Dam. The remediation approach will consider the design of any required remediation and the timeline of application. In particular, we anticipate it could include a phased approach, initially involving additional monitoring and data collection and a revised emergency response plan, followed by any required remediation at a later date; and,
- 5) Selection of a dam remediation approach. Considering input from the Province of BC, a remediation approach (methodology and timeline) will be selected by the City of Nanaimo.

We recommend that the majority of this work is carried out once the key components for the Lower Dam remediation have been completed. It is anticipated that steps 1 to 4 (above) would be completed in the first four to six months of 2016.

We trust that the information provided herein meets your present requirements. Should you have any questions regarding the above, please do not hesitate to contact us.

Yours very truly,

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Bruce R. Downing, P. Eng.
Principal
BRD/HH/sq/kn

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Herb Hawson, P. Eng.
Principal

REFERENCES

Province of BC (Ministry of Forests Lands and Natural Resource Operations, Water Management Branch, Dam Safety Section), 2014. E-mail from Scott Morgan (Head DSS) to Toby Seward on "Middle Chase River Dam and Lower Chase River Dam - Consequence Classification", May 8, 2014.

Province of BC (Ministry of Forests Lands and Natural Resource Operations, Water Management Branch, Dam Safety Section), 2015. Letter on "Middle Chase River Dam and Lower Chase River Dam – Replacement Order", April 29, 2015.