

August 10, 2015

Reference No. 1314470516-029-L-Rev0

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

**COLLIERY DAMS, NANAIMO BC  
DESIGN SUBMISSION TO THE PROVINCE OF BC**

Dear Mr. Seward,

**1.0 INTRODUCTION**

As requested by the City of Nanaimo (the City), Golder Associates Ltd. (Golder) has prepared this letter which outlines the proposed remediation design for the Lower Colliery Dam. We understand that this letter will be used to support a submission to the Province of BC (Water Management Branch, Dam Safety Section) in response to a remediation Order dated April 29, 2015 (BC, 2015). This letter presents, at a conceptual level, the proposed remediation design for the Lower Dam. This letter also includes a discussion of areas of uncertainty related to the current design, a summary of additional site data which is to be collected and a summary of further design work. Finally, a proposed schedule to complete the design is provided.

**2.0 AUXILIARY SPILLWAY DESCRIPTION**

Recent work has been carried out to evaluate a number of potential options for remediating the Lower Dam, which principally consists of increasing the flood routing capacity of the reservoir. Most recently, options for constructing an auxiliary spillway were presented in a letter report prepared by Golder for the City titled, "Colliery Dams, Nanaimo BC Lower Dam – Development of Design Alternatives" (Letter Report), which was submitted on July 8, 2015. The auxiliary spillway concept was developed as it provides a means to generate additional spillway capacity without impacting the existing spillway. With this approach, the existing spillway would remain in place and serve as the primary spillway, while the auxiliary spillway would be constructed to provide the additional required capacity. As it is preferable that the existing spillway, and the existing river channel downstream of the spillway, serve as the primary flow channel, the auxiliary spillway would only be activated in the event of a storm.

Based on discussions with the City, the following auxiliary spillway alternative designs were developed, as discussed further in the Letter Report:

- Option 1 (Anchored Channel Option);

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- Option 1A (Anchored Channel Option 1A);
- Option 2 (Open Channel Option); and,
- Option 3 (Buried Option).

Option 2 (Open Channel Option) was selected by the City as the preferred option and is shown in Figures 8a and 8b of the Letter Report. This option consists of a labyrinth weir acting as the control structure, followed by a box culvert (which is used to provide pedestrian access across the spillway), followed by an open channel swale with final discharge into Harewood Creek. To prevent erosion, the open channel will be armoured or cut into bedrock (if encountered).

It is noted that the remediation options discussed in the Letter Report are of a preliminary nature (not detailed design). Golder worked with Herold Engineering Ltd. (Herold), the structural engineering consultant to the City, to develop the design options. Further, the drawings shown in the Letter Report are based on several assumptions as there has been no geotechnical investigation work carried out in the area of the proposed auxiliary spillway. The alignment shown for Option 2 on Figures 8a and 8b in the Letter Report may change once a geotechnical investigation has been completed.

### **3.0 PROPOSED PLANNING, ANALYSIS AND DESIGN ACTIVITIES**

The following is a proposed list of activities to be carried out in order to develop the design. Due to the time sensitive nature of this project, the work has been planned to be carried out in an expedient manner, thus requiring concurrent execution of a number of activities, including concurrent execution of design and construction work. A brief description of these upcoming work items is provided below;

- Carry out a geotechnical investigation
  - Plan site investigation work and compile an Environmental Management Plan (EMP) for the test pit and drilling investigation (assuming the City will provide water for the drilling work).
  - Flag and stake the proposed test pit and drill hole locations.
  - Fence off investigation area for public safety.
  - Excavate four test pits using an excavator in the proposed footprint of the auxiliary spillway to determine the soil stratigraphy and groundwater elevation and approximate elevation of the top of bedrock.
  - Hand excavate two test pits within the proposed footprint of the auxiliary spillway near the connection to Harewood Creek to identify potential areas of soil contamination (near historical trestle crossing).
  - Drill three to four boreholes in the proposed footprint of the auxiliary spillway to determine the soil and bedrock stratigraphy and groundwater elevation which will be used to develop parameters for the detailed design.
  - Carry out laboratory testing of soil and bedrock samples (which will be used to develop parameters for the detailed design).

- Site survey
  - Survey proposed footprint of auxiliary spillway and pick up any other applicable local features to supplement existing survey information. Survey borehole and test pit locations, reservoir limits, slope break lines, existing path alignments, tree species, size and trunk location as well as details of the Harewood Creek connection point.
  - Reservoir survey to include confirmation of bottom of reservoir 10 metres in each direction of centre of spillway.
  - Develop Digital Terrain Model (DTM) for AutoCad base plans.
- Permitting. Activities which are required in order to obtain the required permits for construction of the project have been commenced and will be carried out in parallel with the design and site investigation work. This work will be carried out collaboratively between staff from Golder and from the City.
- Detailed design.
  - If necessary, revise spillway alignment based on geotechnical information.
  - Finalize geotechnical, hydrotechnical and structural design.
  - Detailed drawings, contract documents and specifications. These will be prepared in a phased manner in order to expedite construction, as described below.
- Lower Dam instrumentation. As outlined in previous reports (Golder 2014), as part of the remediation work, structural instrumentation will be installed in the existing (open) boreholes that have been drilled in the concrete core of the Lower Dam. This instrumentation will be designed and installed as part of this current work.
- Tendering and construction.

It is currently anticipated that the site investigation work will be carried out in two stages. The work commenced on August 6 with the test pit investigation, which was described previously. The second stage of investigation will be a drilling investigation which is expected to be completed in the week of August 17, using a drill rig provided by Foundex Explorations Ltd.

The site investigation will be followed by detailed design and preparation of design and construction drawings. As discussed below, the design work will be carried out in parallel with the construction, which will require the submission of the design documents in a phased manner.

#### **4.0 DESIGN AND CONSTRUCTION SEQUENCING**

The design assumptions for the auxiliary spillway are discussed in the Letter Report along with key aspects related to the construction of the auxiliary spillway. As noted in the Letter Report, the ideal construction window is during the drier season from July to October. As the use of this full construction season is no longer feasible for construction this year, the project will be expedited to maximize the use of the remaining period of dry weather.

In order to be able to expedite the initiation of construction, a construction contractor will be engaged prior to completion of site investigation and design. Thereafter, the design and construction will be separated into two separate phases, thereby allowing some of the construction to start prior to the detailed design completion. Detailed planning of this phased construction is not yet complete, but it is currently envisaged that the design will be completed as follows;

- The first phase of design and construction is anticipated to include mobilization, access preparation, site clearing and excavation work. The design of these elements of the project is expected to be completed on or about the first week of September.
- The second phase is expected to consist of concrete forming and concrete placement, drainage and backfill, landscaping, plug removal and reinstatement. The design of these elements of the project is expected to be completed on or about the first week of October.

## 5.0 PROPOSED SUBMISSIONS

In order to provide future design submissions to the Province of BC in a timely manner, it is proposed that these submissions be completed in parallel with the overall project design as described above. With that in mind, it is proposed that the design submission to the Province of BC is also completed in a two phased process as follows;

- The first phase submission is anticipated to include updated general arrangement drawings, site clearing and excavation drawings and an accompanying preliminary design report. Given that the site investigation is anticipated to be completed by August 21, it is expected that this submission would be completed on or about the first week of September.
- The second phase is expected to consist of structural design drawings, backfill and drainage drawings and final grading and site re-instatement drawings, together with a detailed design report. It is expected that this submission would be completed on or about the first week of October.

## 6.0 CLOSURE

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.

### GOLDER ASSOCIATES LTD.



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## **7.0 REFERENCES**

BC Ministry of Forest, Lands and Natural Resource Operations, 2015. Letter to the City of Nanaimo “Middle Chase River Dam and Lower Chase River Dam – Replacement Order”, dated April 29, 2015.

Golder Associates Ltd. 2014. Report on “Colliery Dams– Remediation Options”, August 2014.

Golder Associates Ltd. 2015. Letter Report on “Colliery Dams, Nanaimo BC Lower Dam – Development of Design Alternatives”, July 8, 2015.