

**Lake Geraldine Dam  
Iqaluit, Nunavut  
Dam Safety Inspection**

*October 29, 2009*

*REPORT*



**Produced For:**  
THE CITY OF IQALUIT

**Produced By:**  
CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

**Concentric Project Reference Number:**  
09-2922



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## **1. EXECUTIVE SUMMARY**

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the Lake Geraldine Dam. The scope of work for the assignment has been undertaken in accordance with Concentric's proposal 09-2922 dated October 15 2009.

The site inspection was conducted on October 21, 2009, by Allan Murray, P.Eng., of Concentric.

It is recommended that the next DSI be conducted prior to October 2010.

### **OBSERVATIONS:**

With the exception of the following items, no significant changes in condition of the concrete dam structure and retention berms were observed since the previous DSI, which was conducted in 2006.

- A significant leak has developed in the concrete dam structure south of the spillway section.
- Upwelling along the south concrete wing wall appears to have increased moderately since originally identified in 1997.

Representative existing conditions have been documented by photographs in Appendix A.

The required documentation (discussed further below) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.

### **RECOMMENDATIONS:**

1. A grouting program should be designed for implementation in 2010 to address observed leakage.
2. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.
3. The Emergency Preparedness Plan has not been completed. This is considered a high priority.
4. Remote and possibly site based monitoring equipment should be researched, design/specified, and installed.
5. An underwater survey should be conducted prior to August 2010.
6. Complete the next DSI prior to October 2010.



## **2. INTRODUCTION**

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the Lake Geraldine Dam located in Iqaluit, Nunavut.

This assignment and the scope of work described herein has been undertaken in accordance with Concentric's proposal 09-2922 submitted on October 15, 2009.

The site visit was conducted on October 21, 2009.

Allan Murray, P.Eng., of Concentric, met with the following personnel at the City of Iqaluit:

- Paul Clow, Director of Engineering, City of Iqaluit

This report summarizes our terms of reference for the assignment, observations, conclusions and recommended action.



### **3. BACKGROUND**

The Canadian Dam Safety Guidelines (DSG) requires that all structures exceeding prescribed height and volume minimums be subject to Dam Safety Reviews (DSR's) and Dam Safety Inspections (DSI's) at regular intervals.

A DSR is a comprehensive, formal review process that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The Lake Geraldine Dam requires a DSR every seven (7) years. The last DSR was conducted in 2006 by Concentric.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection only to identify any changes in condition, or any observed concerns.

A detailed historical perspective may be referenced in the DSR on file with the City of Iqaluit.



#### **4. SCOPE OF SERVICES**

Our directive has been to undertake a Dam Safety Inspection (DSI) in accordance with the DSG, for the Lake Geraldine Dam. The inspection consisted of an on-site visual assessment, notation of any significant changes in condition since the last available DSI, preparation of a written report in a format compatible with the DSR, and a photographic record.

The following is a summary of the scope of work for this assignment. The DSI report is the primary deliverable, and has been prepared in accordance with the DSG document.

- ☐ Review available record documentation.
- ☐ Conduct a visual on-site assessment of the sewage lagoon
- ☐ Prepare a photographic record documenting general and representative conditions
- ☐ Identify, characterize, and risk-assess any actual or potential concerns
- ☐ Prepare a written report summarizing our observations, items of concern, and recommendations
- ☐ Indicate any recommended repairs
- ☐ Prioritize action items
- ☐ Submit final documents in electronic format and hard copy

#### **Limitations**

The DSI is based on visual assessment; no invasive inspection/assessment was done.

This report has been prepared for the sole use of The City of Iqaluit.



## **5. SUMMARY OF PREVIOUS DSI'S**

The original DSR was conducted in 2001. In 2005, a major alteration to the dam was designed, and implemented over a two (2) year period. The major alteration triggered the requirement for a revised DSR. The DSR was prepared by Concentric in late 2006.

There has been no DSI undertaken since 2006.

This DSI should be read in conjunction with the current DSR, which contains the historical record, the bulk of which is not repeated here.

A summary of observed conditions and recommendations from the 2006 DSI (with updated information added as appropriate) is as follows:

- The visible portions of the concrete structures are generally in good condition.
- There was no evidence of distress or overstressing of any portion of the visible concrete structures.
- The embankments (berms) appeared to be in a stable condition. Slopes of 2H:1V were maintained on the downstream rip-rap and in the upstream rock fill.
- Most of the vertical extension had not been impacted by rising water levels.
- A leak was noted in the spillway portion of the dam; this leak was subsequently repaired in 2007.
- The required Operation & Safety Manual, Logbook, and Permanent File were prepared in 2007 however they have not been updated.
- The Emergency Preparedness Plan has not been done.
- An underwater survey has not been completed since 2002.



## **6. COMMENTARY ON DAM SAFETY GUIDELINES**

The Canadian Dam Association publication, Dam Safety Guidelines (DSG), governs the nature and frequency of inspection and review activities for structures which fall under its umbrella criteria.

The DSG applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity.

The DSG document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple embankments or dikes to massive and complex dams associated with hydroelectric generating facilities, irrigation, flood control, etc.

The DSG requires that all structures exceeding the height and volume minimums described above be classified according to their “consequence category”, that is, the consequence of dam failure in terms of life safety, and socio-economic impact. The category assigned may range from very low to very high. The consequence category dictates the requirement and frequency of Dam Safety Reviews.

A Dam Safety Review (DSR) is a comprehensive, formal review process, conducted at regular intervals, that involves completion of checklist items in accordance with the Dam Safety Guidelines.

The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The frequency of DSR’s varies depending on consequence category. For structures where significant life safety and/or socio-economic consequence exist, the DSR is usually conducted every five (5) to ten (10) years. The Lake Geraldine Dam requires a DSR every seven (7) years. The current DSR for the Lake Geraldine Dam was conducted in 2006; therefore, the Lake Geraldine Dam is due for an updated DSR in 2013. If significant alterations (not including repairs that do not change the height or volume of the structure) to the structure take place before this date, an updated DSR would be required.

It is required in the DSG document that in the interval between DSR’s, a Dam Safety Inspection (DSI) would be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection to identify any changes in condition, or any observed concerns. The results of the DSI are incorporated into the DSR documentation. A DSI may trigger repairs, or changes in standard operating procedures.





## **7. OBSERVATIONS**

The Lake Geraldine Dam was accessed on foot. Based on our visual assessment we have the following comments:

- The concrete portions of the dam structure are in general unchanged from that observed for the 2006 DSI.
- The berm structures are in general unchanged from that observed for the 2006 DSI.
- A significant leak has developed in the concrete dam structure south of the spillway section.
- Upwelling along the south concrete wing wall appears to have increased moderately since originally identified in 1997.

To our knowledge, the required documentation (discussed previously) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.

Specifically, the Permanent Record File, Logbook, and Operation & Safety Manual have not been updated.

The Emergency Preparedness Plan has not been completed.



## **8. RECOMMENDATIONS**

The following actions are recommended:

1. A grouting program should be designed for implementation in 2010 to address the observed leakage. The grouting program should include injection of the vertical and transverse joints in the vicinity of the above grade leak in the concrete section south of the spillway.

A grouting program should also target the upwelling source. It is possible that the underwater survey (recommended below) will assist in assessing the source and developing a repair strategy.

2. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.
3. The Emergency Preparedness Plan has not been completed. Given the vertical extension of the dam in 2006, we view this requirement as high priority. The Emergency Preparedness Plan should be completed in 2010.
4. In concert with Item 3 above, and the DSG's, remote, and possibly site based monitoring equipment should be installed at the dam. This will require some research, and a design/specification process.
5. An underwater survey should be conducted prior to August 2010.
6. Complete the next DSI prior to October 2010.

We would be pleased to discuss this report with you. Should there be any questions, please contact the undersigned.

Yours truly,

**Concentric Associates International Incorporated**

Allan Murray, P.Eng.,



## APPENDIX A

### Photographs



Photograph 1  
Overview of North berm.



Photograph 2  
Overview of upstream face of concrete structure.



Photograph 3  
Overview of spillway section, downstream face.



Photograph 4  
Overview of South berm.





Photograph 5  
New leak South of spillway section.



Photograph 6  
Upwelling area previously identified in 1997.