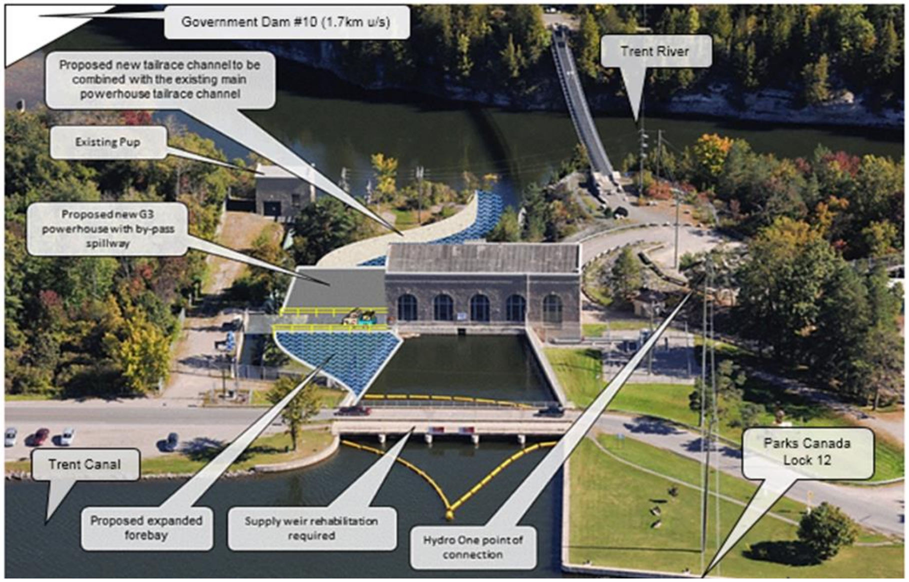
A Hydraulic Physical Model Study of the Ranney Falls Hydropower Plan in Ontario



Existing and Proposed Ranney Falls Hydropower Generation Station

Funded by Ontario Power Generation and WSP Canada Inc.

<u>Duration</u>: 2016

Professor James Li combined forces with Cole Engineering Ltd and colleagues from Queen’s University to solve Ontario Power Generation challenges. OPG is proposing an expansion at the Ranney Falls Generation Station (located near Trent River of Cambellford, Ontario) to double its hydroelectric capacity as part of the OPG Renewable Energy Initiative.

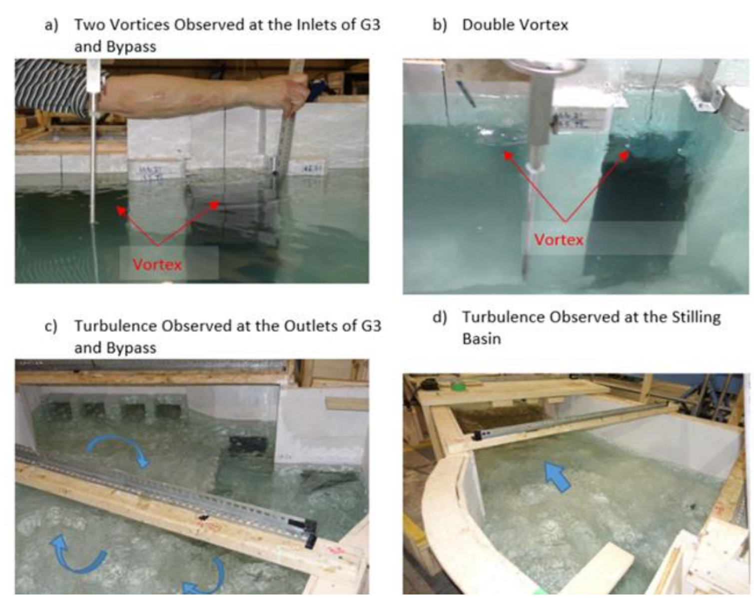
The study focused on hydraulic issues associated with the entrances/exits of the powerhouse and tailrace channel, and structural vibrations to the turbine and housing structure caused by tailrace channel gate operation. James Li, Shelley Kuan from Cole Engineering and Prof. Ana Maria da Silva from Queen’s University used Queen's University’s hydraulic research facility for the research project. **This research involved one of the largest physical model studies of hydroelectric power generation in Ontario and demonstrates the excellent collaboration among universities, consulting engineering companies, and OPG.**

The physical hydraulic model (13m by 4 m by 1.5 m, 1:25 scale) was constructed and tested to various operational modes (water levels, velocities, and structural vibrations) of the powerhouse and tailrace tunnel by Ryerson’s hydraulic research team.

<u>Major findings:</u>

1. The physical model study results indicate the complex inlet hydraulics may trigger damaging vortices that can affect power generation and vortex breaking design should be considered;
2. The submerged jet turbulence and circular flow patterns in the tailrace stilling basin always occurred if flow was discharged through the bypass tunnel. This suggests the stilling basin (including bypass energy dissipation basin is acting effectively as an energy dissipater);
3. No significant vibrations were observed at the control gate of the bypass spillway.

Figure 5.7 Run 7 Photo - G3 and Bypass Flow Total of 55 L/S (172 m^3/s)



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