Effect of Thermal Stratification on Hydropower Intake Induced Flow-field

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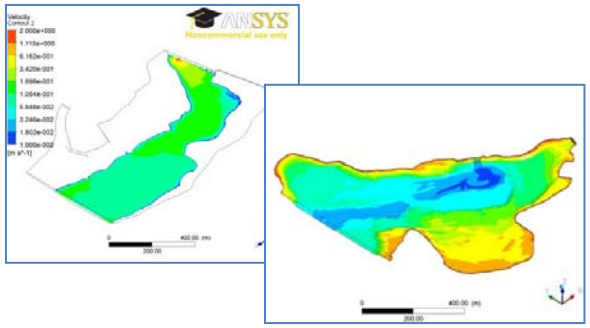
Project Code: 2.2.1



Rationale: *Temperature stratification in Summer can significantly affect the intake induced flow-field of a hydropower dam, which in turn can affect the fish entrainment pattern. The objective of this study is to extend our knowledge on the effect of stratification on the intake induced flow field.*

Description: *In Summer, lake water becomes stratified and is divided into two distinct layers. Surface water gets warmer due to the solar radiation, and the bottom water remains colder. The hydropower intake can either selectively withdraw only one layer (cold or warm water) or both the layers; which can be identified by a densimetric Froude number developed by Craya. The Craya's Froude number does not consider the effect of boundary, and therefore, is not applicable when the intake is located close to the bottom. This study overcomes the limitation by formulating a densimetric Froude number, which considers the effect of boundary.*

This study successfully applied Computational Fluid Dynamic (CFD) solver in simulating selective withdrawal scenario by formulating its boundary conditions. The solver has been used in generating flow field for the Hugh Keenleyside Dam, John Hart Dam, and Aberfeldie Dam, all located in BC. The modeled data have been used by BC Hydro for fish risk assessment.

Outcomes:

- Formulation of a densimetric Froude number which considers the boundary effect on the selective withdrawal scenario.
- Formulation of the boundary conditions for the CFD solver to simulate the selective withdrawal scenario.
- Analyzed the intake induced flow-field affected by the stratification.

Benefits from this research: This study will help to better assess the velocity field induced by the dam operations in Summer. This in turn will help to better understand the fish movement pattern and entrainment risk, reservoir sedimentation, etc. and other flow induced phenomena.

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