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Oxygen Transfer and Energy Dissipation by Flow Characteristics at Stepped Drop Structure

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Drop structure is usually installed to protect the stream bed against scour since it is the typical case for energy dissipation. It may also be useful for air entrainment by the stepped type of the downstream part of the flow section.
This paper deals with oxygen transfer by air entrainment and energy dissipations by flow characteristics at the stepped drop structure. Nappe flow occurred at low flow rates and for relatively large step height. Dominant flow features included an air pocket, a free-falling nappe impact and a subsequent hydraulic jump on the downstream step. Most energy was dissipated by nappe impact and in the downstream hydraulic jump.
Skimming flow occurred at larger flow rates with formation of recirculating vortices between the main flow and the step corners.
Oxygen transfer was found to be proportional to the flow velocity, the flow discharge, and the Froude number. It was more related to the flow discharge than to the Froude number. Energy dissipations in both cases of nappe flow and skimming flow were proportional to the step height and were inversely proportional to the overflow depth, and were not proportional to the step slope.
The stepped drop structure was found to be efficient for water treatment associated with substantial air entrainment and for energy dissipation.

Figure 1: Flow Characteristics at Stepped Drop Structure

References

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