

Optimization of Sangju Weir operations to minimize sedimentation problems

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Abstract. The Four River Restoration Project (FRRP) was initiated for flood control, water quality improvement, secure clean water, and stream restoration in South Korea. The construction of along the Nakdong River changed many channel characteristics such as longitudinal slope, cross-sectional area, water stage, etc., which affected the sediment regime of the river. Specially, Sangju Weir may be prone to greater sediment problems. Sangju Weir is located on northern part of the Nakdong River. The catchment area is 7,407 km² and total storage is 27.4×10^6 m³ when reservoir water level is 47 m above sea level that is the regular reservoir operation level. The length of the weir is 355 m, of which 230 meter is fixed concrete structure and the rest of which composed of two shell type roller gates with 45 m long and 10 m high. Also it has hydropower generator with 3,000 kW of the capacity. It is necessary to assess reservoir sedimentation to alleviate this problem. The current weir operation rules are being reviewed for (1) flood control and dredging, (2) reservoir operation for hydropower production, (3) water supply stability, etc. To integrate these multiple factors, the Multi-Criterion Decision Analysis (MCDA) provides a detailed method to solve this complex problem. Using the flow-duration/sediment-rating curve method, a Benefit and Cost Analysis (BCA), and the MCDA method, we found that: (1) total incoming sediment load is about 300,000 tons/year; (2) average trap efficiencies vary from 84% to 90% depending on the reservoir operation level; and (3) a flow discharge threshold of approximately 70 m³/sec may be balance both hydropower production revenue and sediment excavation cost.

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