LABORATOIRE DE CONSTRUCTIONS HYDRAULIQUES

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Sedimentation of the Esserts compensation basin (1996-1998)

Olivier Baud, Erik Bollaert

Situation and function of the reservoir

The Esserts basin is a part of the hydro-electric power plant of Emosson. This French-Swiss realization collects water from the high valleys situated upstream of Martigny and Chamonix in order to allow accumulation in the Emosson reservoir. The installation consists of two power plants, one at Vallorcine near the French-Swiss border, and the other one at La Bâtiaz in Switzerland. The turbinated water is connected to the Rhone river near Martigny.

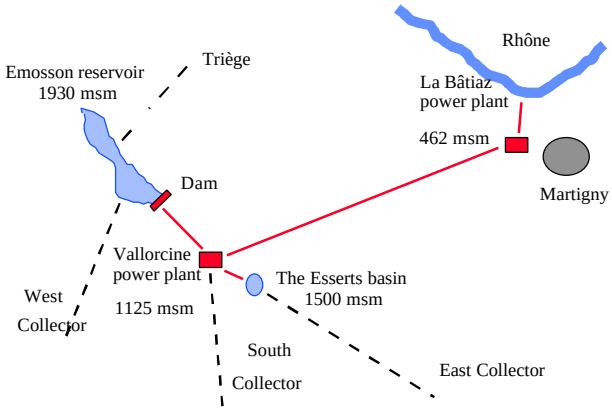

Fig. 1. Plan view schema of the installation

The Esserts compensation basin allows a temporary storage of flowing water supplied by the East collector and controls in that way this part of the catchment area. From the Esserts basin, the water can be directly turbinated at Vallorcine and at La Bâtiaz, or can be pumped up to the Emosson reservoir. The Esserts compensation basin has a storage capacity of 220'000 m^3, allowing so the settling of particles transported by suspension in the water. These particles reveal a very fine grain size distribution ($d_{50} \cong$ 0.1 mm) because all water intakes are equipped with sand traps. Thus flushing operations at least every two years, in order to evacuate the accumulated sediments, are required.

Fig. 2. Plan view of the Esserts compensating basin.

Scaled model study

A physical model of the Esserts compensating basin has been realized in the Laboratory of hydraulic constructions at a 1:30 scale, in order to study the relative importance of the different parameters responsible for the sediment processes.

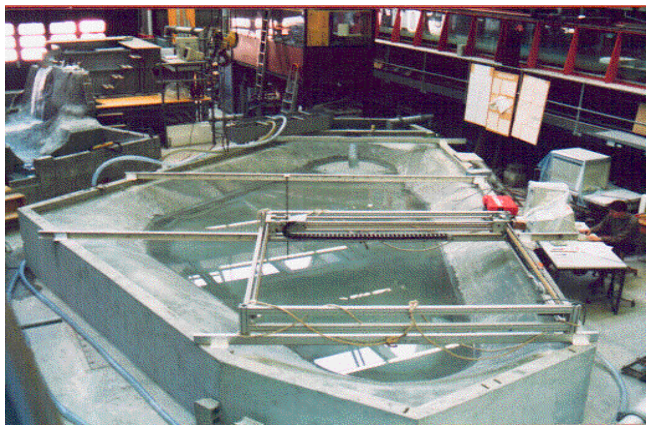

Fig. 3. Model of the Esserts basin.

The study aimed the following major objectives :

- To ameliorate the fall-out capacity of the basin in order to reduce turbine damages,
- To evaluate the effect of a settled sediment layer on the settling capacity, in order to optimize the outlet operations frequency,
- To obtain a homogenous distribution of the sediment layer on the whole area of the basin and to reduce the energy losses at the water intake.

The research of a solution was based on an analysis of all available operation data and in situ measurements. Velocities were measured by means of a UVP (Ultrasonic Velocity Profiler) instrument. The two-dimensional numerical flow modeling allowed to describe and explain internal basin circulation mechanisms. The actual running study proposes the construction of a supplementary energy dissipation structure at the intake of the basin for a discharge of 22 m^3/s. The purpose of the structure is to guarantee a homogenous velocity distribution on the whole length of the basin.

A proposition of this type of solution is presented at fig. 4.

Fig. 4. Tested dissipation structure.