Flow Pattern at Sand Pocket

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Abstract: ***Sand pocket as one of the sediment control structures such as Sabo dam, check dam, consolidation dam, has a very important role to protect the dam site. Sand pocket located at the downstream near the dam and also as the location of sand mining. In Bili-Bili dam system, there are 5 (five) units, sand pocket, but all of the structures, have been collapsed after the gigantic caldera of mount Bawakaraeng collapse At March, 2004. This experimental study shown that the capacity of the sand pocket is enough for the design discharge to flow through the opening of the sand pocket, and the hydraulic jump not happened at the stilling basin, but at the down stream of the sand pocket. And this caused depth scouring about 3,50 – 6 metres***

Keywords: sediment, sediment transport, sedimentation, sandpocket

1. Introduction

The Bili - Bili dam has been operated since 1999 year, serious sediment issues have been occurred in the Jeneberang river basins. Especially after the gigantic caldera of mount Bawakaraeng collapse at March, 2004. Actually, there are several kinds and several units of sediment control structures like Sabo dams, consolidation dams and sand pockets have been constructed along Jeneberang River.

This study focus on sand pocket, as this structure has an important role as sediment control structure, and also as the location for sand mining The method of this study is the experimental study by doing physics model in the laboratory to evaluate the flow pattern at sand pocket.

The prototype is sand pocket 3, which has 336 meter length, 7 meter height and has a storage capacity of 129,000 m3.The principles of dong the physical model must be consist of several aspects, as; geometric similarity, kinematic similarity and dynamic similarity. The Scale of the model is 1 : 40

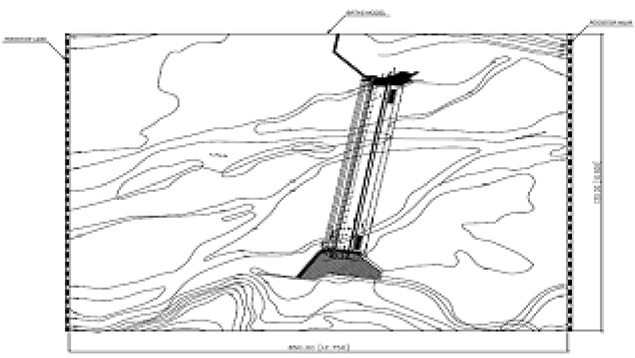

Figure 1: Model Situation of Sand Pocket

The experimental study doing by the physical model using undisturbed model, of which at the upstream of the sand pocket constructed with fixed bed model, and at the downstream of the sand pocket constructed with moveable bed model

2. Results and Discussion

The experimental study doing by using 30% of design discharge (Q=720 m3/s). 60% (Q=1440 m^3/s), Q = 1900 m3/s (at Sand Pocket) , and design discharge Q=2400 m3/s, to simulate about 6,5 hour of flooding. Figure 1 shown the Model situation of Sand Pocket at the Laboratory.

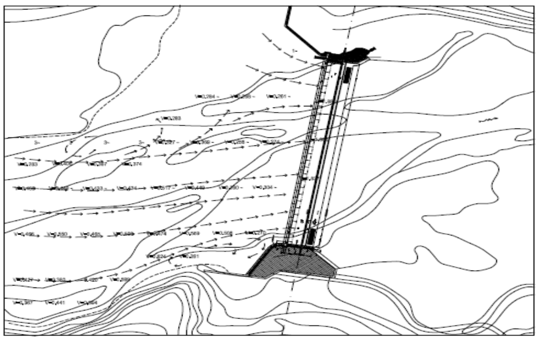

Figure 2: Flow Direction with Discharge Q = 720 m^3/s

Figure 2, shown the flow direction with discharge (Q= 720 m^3/s) , water level at upstream +123.000 and at the down stream +117.330

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

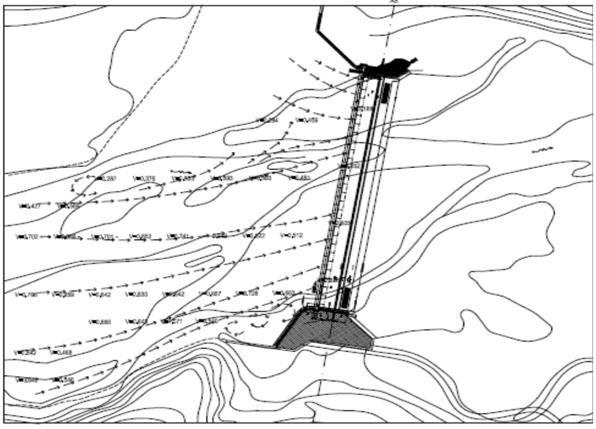

Figure 3: Flow Direction with Discharge Q = 1440 m3/s

Figure 3. Shown the flow Direction with Discharge (Q = 1440 m^3/s), water leavel at up stream + 123.700, and at the down stream + 118.100

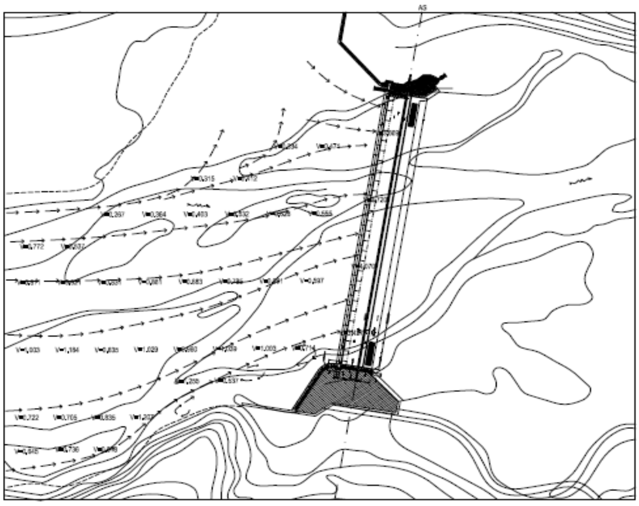

Figure 4: Flow Direction with Discharge Q = 1900 m3/s

Figure 4. Shown the flow Direction with Discharge (Q = 1900 m^3/s), water leavel at upstream + 123.930, and at the down stream + 118.600

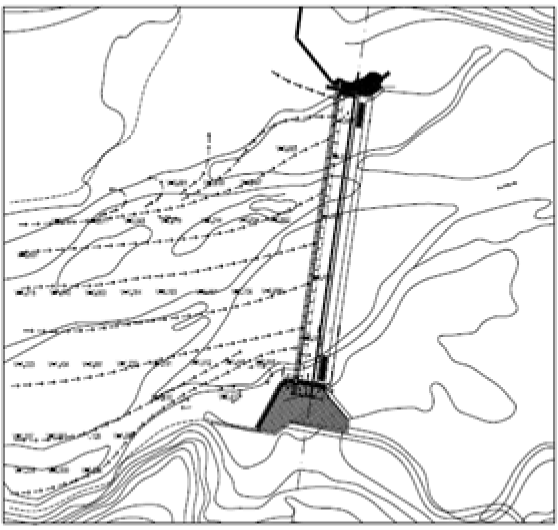

Figure 5 : Flow Direction with Discharge Q = 2400 m3/s

Figure 5. Shown the flow Direction with Discharge (Q = 2400 m^3/s), water leavel at upstream + 124.230, and at the down stream + 119.030

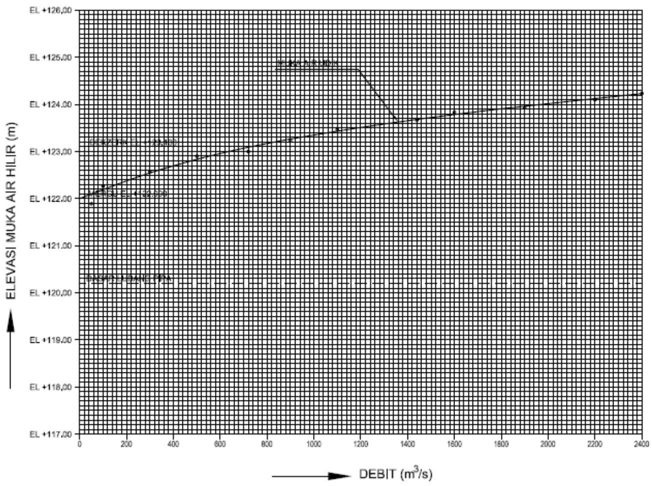

Figure 6: Relationship between Discharge and Water Level at Up Stream

Figure 6 shown the relationship between discharge and water laval at up stream, ohwhich the crest of the weir is + 122.000, and the the result can be seen on Table 1.

Table 1: Discharge >< Water Level at Up Stream

No.	Discharge (m^3/s)	Period	Water Level at Up Stream
1	50		121.890
2	100		122.266
3	300		122.566
4	500		122.900
5	720	30 %	123.000
6	900		123.230
7	1100		123.466
8	1440	60 %	123.666
9	1600		123.830
10	1900		123.930
11	2200		124.100
12	2400	100 %	124.230

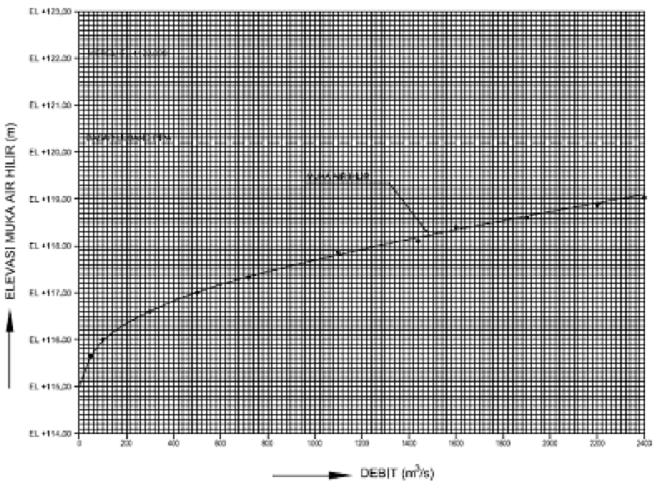

Figure 7: Relationship between Discharge and Water Level at Down Stream

Figure 7 shown the relationship between discharge and water lavel at down stream, ohwhich the crest of the weir is + 122.000, and the the result can be seen on Table 2.

Table 2: Discharge >< Water Level at Down Stream

No.	Discharge (m^3/s)	Period	Water Level at Down Stream
1	50		115.653
2	100		116.000
3	300		116.600
4	500		117.000
5	720	30 %	117.330
6	900		117.666
7	1100		117.866
8	1440	60 %	118.100
9	1600		118.400
10	1900		118.600
11	2200		118.866
12	2400	100 %	119.030

Firther more , from the experimemt can be found the flow velocity are as shown on Table 1

Table 1: The Result of Velocity

Discharge ($m^{3/s}$)	Velocity (m/s) Left	Velocity (m/s) Middle	Velocity (m/s) Right
720 (30%)	0.261	0.304	0.270
1440 (60%)	0.459	0.512	0.683
1900	0.471	0.597	0.714
2400 (100%)	0.665	0.686	0.956

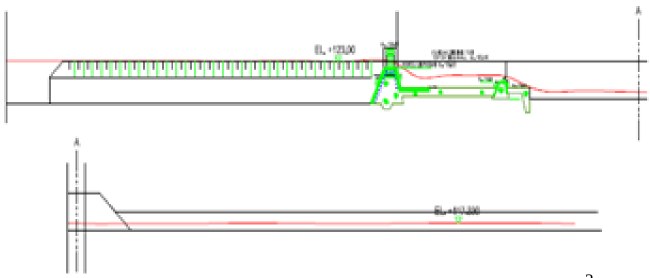

Figure 8: Flow Profile with Discharge Q = 720 m^3/s

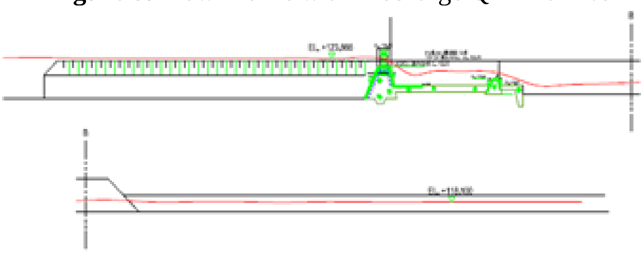

Figure 9: Flow Profile with Discharge Q = 1440 m^3/s

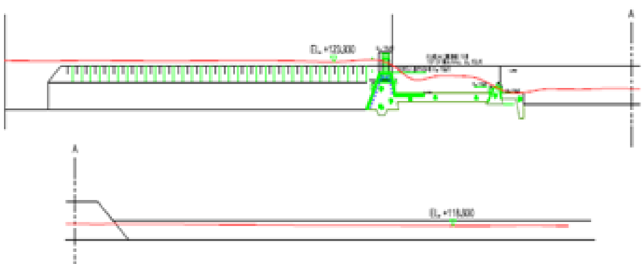

Figure 10: Flow Profile with Discharge Q = 1900 m^3/s

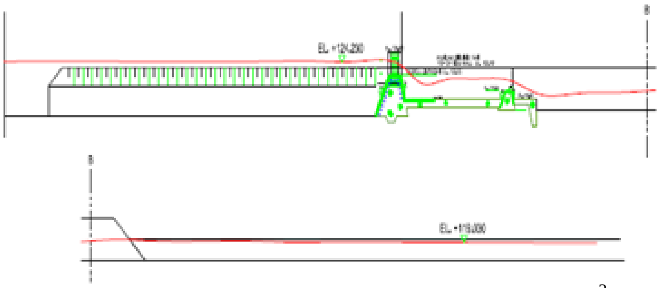

Figure 11: Flow Profile with Discharge Q = 2400 m^3/s

Based on the experimental study, shown that on each variant of flow the hydraulic jumpnot not happened at the stilling basin but the hydraulic jump at the downstream of the sand pocket, of and caused scouring about 3.50 – 6,00 m

3. Conclusion and Recommendation

The capacity of sand pocket at Jeneberang river is enough for the design discharge to flow through the opening of sand pocket. The velocity distributed levelly at each race. The scouring at downstream relatively very deep (3.5 – 6.00 M).. To reduce the depth of scouring, the riprap construction is needed to protect the sand pocket at the downstream site.

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