

The Impact If Ngancar Dam in Wonogiri Regency Fails to Operate

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Abstract:- One of the dams managed by Balai Besar Sungai Bengawan Solo area is Ngancar dam. Ngancar Dam was built by the Government of the Dutch East Indies in one of the basins in Sungai Jarak in 1944 to meet irrigation water needs in Temon Irrigation Area with an area of 637 hectares in Batuwarno sub-district precisely located in Selopuro Village Batuwarno Sub-District Wonogiri Regency and if viewed geographically located at 7O48'5" LS and 110O53' 53" BT.

The position of ngancar dam with the construction of Gajah Mungkur dam in 1976 is located upstream one of the sub-watersheds of Gajah Mungkur dam. Over time from the beginning of the construction of Ngancar dam to the present day as well as the rapid development of the population and the rapid development of both the community and the government to fill the independence and to fulfill the need for his life then the condition of the location between Ngancar dam and Gajah Mungkur dam is also very much changed. By using the HEC-RAS method will be obtained high inundation from each area affected by the dam collapse and created a map and followed up with inventory in the field

As a result, the villages affected if ngancar dam is overtopping Ngancar are Selopuro Village, Belikurip, Temon, Batureto, Saradan, Gambirano and Talunombo with an affected population of 5,927 flooded areas of 511 hectares and a total loss of Rp 99,337,493,953 (Ninety-Nine billiond three hundred thirty-seven million four hundred Ninety-three thousand Nine hundred and fifty-three rupiah.

Keywords : *Impact, Ngancar Dam, Overtopping, Failed Operation.*

1. INTRODUCTION

Dam one of its functions is a building that is made to hold water during the rainy season and release it during the dry season with the function as a water container then the dam has many benefits, but besides having many benefits it turns out that the dam also holds a detrimental potential if during the operation process there is no monitoring and evaluation so that its safety is maintained.

One of the dams managed by Balai Besar Sungai Bengawan Solo area is Ngancar dam. Ngancar Dam was built by the Government of the Dutch East Indies in one of the basins in Sungai Jarak in 1944 to meet irrigation water needs in Temon Irrigation Area with an area of 637 hectares in Batuwarno sub-district precisely located in Selopuro Village Batuwarno Sub-District Wonogiri Regency and if viewed geographically located at 7O48'5" LS and 110O53' 53" BT.

Ngancar Dam has a Zonal type with a dam height of 20 m and a peak length of 179 m and a peak width of 5 m. The type of pelimpah building is in the shape of Ogee IV with a pelimpah length of 34.1 m and a launcher length of 82 m and the type of omlaya is USBR III



Figure 1 Location of Ngancar Dam

The position of ngancar dam with the construction of Gajah Mungkur dam in 1976 is located upstream one of the sub-watersheds of Gajah Mungkur dam. Over time from the beginning of the construction of Ngancar dam to the present day as well as the rapid development of the population and the rapid development of both the community and the government to fill the independence and to fulfill the need for his life then the condition of the location between Ngancar dam and Gajah Mungkur dam is also very much changed.

The condition of the location between Ngancar dam and Gajah Mungkur dam and the increasing age of Ngancar dam and the potential for disaster from the dam building, it is necessary to conduct research to anticipate if there is a failure of ngancar dam operation.

2. PROBLEM LIMITATIONS

The research conducted under the title Impact inflicted if Ngancar Dam in Wonogiri Regency experienced a failure of operation" has the following limitations:

1. What is meant by the failure of operations in this study is the inadebe of ngancar dam to perform its function as a water container due to dam collapse so that the failure of Ngancar dam in meeting the water needs in Temon Irrigation Area is not carried out a review.
2. Dam collapse in this study is caused only by overtoping, so piping collapse is not done

3. BENEFITS AND OBJECTIVES

The benefits and objectives to be achieved from this research activity are :

1. The benefits of this research if viewed from the science side, it is expected to add to the efficacy of science, especially the issue of dam safety.
2. The benefits of this research for policy makers are expected to be considered in managing dams because dams in addition to carrying benefits also save potential disasters.

4. THEORYTICAL BACKGROUND.

dams is buildings that form of soil, stone and concrete urugan, it built in addition to holding and holding water, it can also be built to hold and hold mine waste or hold mud so that it is in the form of reservoirs.

The design flood hydrograph in this study used nakayasu synthetic unit hydrograph method. With the following equation form:

$$Q_p = \frac{A \cdot R_o}{3,6(0,3 \cdot t_p + T_{0,3})}$$

Where:

Q_p = peak flood discharge (m³/sec)

R_o = rain unit (mm)

T_p = time log from the beginning of the rain to the peak of the flood (hours)

$T_{0,3}$ = time required by decreased discharge, from peak debit to 30% of peak debit (hours)

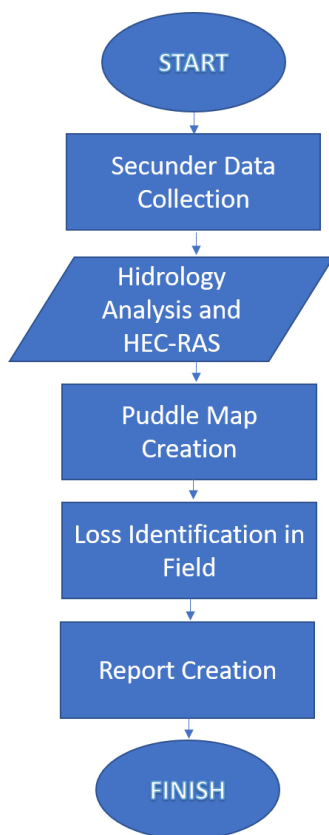
HEC-RAS is a mathematical model program created by the US Army Hydrologic Engineering Centre that can be obtained freely and can be used to analyze if a dam collapses so that by utilizing HEC-RAS software it can be known how much speed and depth of flow in each cross section changes according to time.

The losses incurred are the result of dam ngancar experiencing collapse done by conducting field searches based on maps of the affected areas from the results of running the HEC-RAS program and carried out field searches to inventory buildings or land affected by flooding. So the loss is the result of multiplication of each unit of loss multiplied by the unit price of each unit cost.

5. RESEARCH METHOD.

The research method is the whole stage of research conducted from start to finish so that a conclusion can be drawn. The steps can be seen in Figure 1. the following.

Figure 2. Research Flow Chart



6. RESULTS AND DISCUSSIONS.

The results of flood analysis plan by using Nakayasu method then the flood discharge can be seen in Table 1

Table 1. Debit Flood Plan

No	Repeated	Debit (m ³ /S)
1	5	59.495
2	10	71.157
3	25	91.136
4	50	107.739
5	100	128.628
6	200	154.590
7	1000	229.892
8	½ PMF	132.743
9	PMF	256.487

The flood discharge plan was used as input running model HEC-RAS to get the elevation of inundation in each flooded area as a result of the collapse of ngancar dam. The results of running model HEC-RAS and Flood Map as a result of the dam collapse can be seen in Figure 2 and Figure 3 .

Map of flood inundation dam collapse ngancar

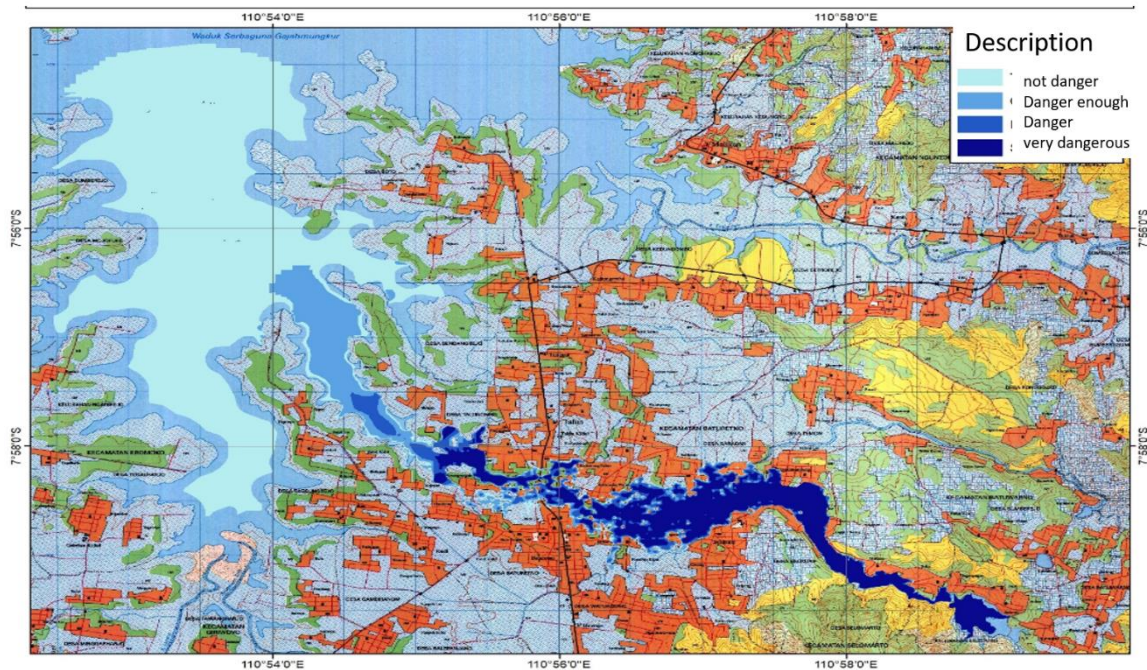


Figure 2 Map of Flood Inundation Caused by Dam Collapse

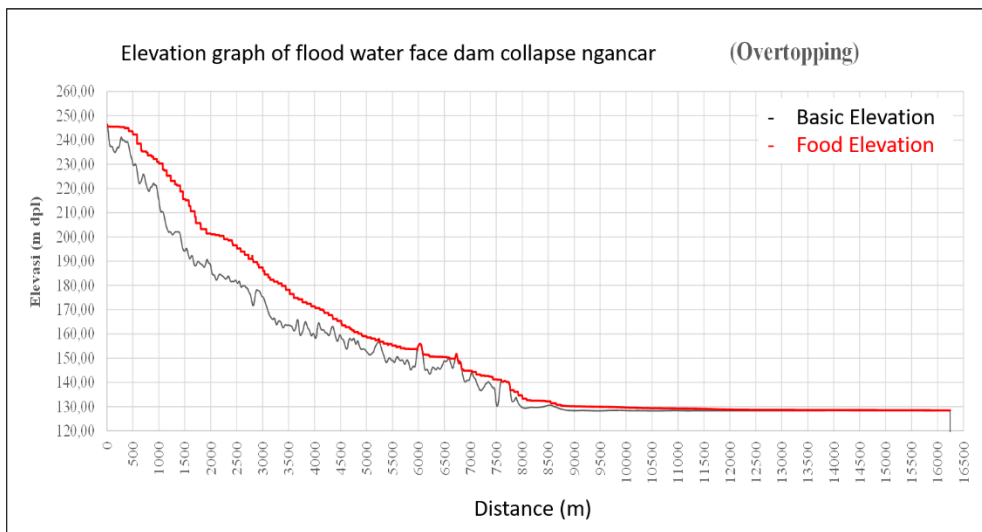


Figure 3 Flood Elevation Chart due to ngancar dam collapse

Characteristic of flooding caused by overtopping in Ngancar dam is the maximum flood depth reaching an altitude of 23.57 meters at a distance of 1.46 km from the downstream of the dam and its maximum flood speed of 92.02 m/s at a distance of 1.15 km from the dam downstream.

Based on the elevation of the full condition water level (normal water level +136 m) then if there is overtopping in Ngancar dam then the maximum water level elevation occurs an increase of 0.18 m so as to 136.18 m while the elevation of the peak of Gajah Mungkur dam (+ 142 m)

The villages affected if there is a collapse due to overtopping at Ngancar dam are Selopuro, Belikurip, Temon, Batureto, Saradan, Gambirano and Talunombo villages with a large number of flood inundations and the number of affected residents can be seen in Table 2

Table 2 Area of Inundation and Number of Affected Populations

No	Sub- District	District	Puddle Area	Number of affected
			m2	People
1	Selopuro	Baturetno	52263,34	15
2	Belikurip	Baturetno	851018,52	418
3	Temon	Baturetno	387319,52	121
4	Saradan	Baturetno	1813710,97	1615
5	Baturetno	Baturetno	981778,55	3026
6	Gambiranom	Baturetno	627527,85	515
7	Talunombo	Baturetno	401059,88	219
Total			5114678,63	5927

While the value of losses incurred as a result of the collapse of Ngancar Dam can be seen in table 3

Table 3 Loss Value due to Ngancar dam collapse

No	Exposure Type	Cost of loss based on flood area		
		PMF	½ PMF	1000years
		2130.02 Ha	1621.79 Ha	1961.37 Ha
		Rp	Rp	Rp
1	Minimum Refugees needed	Rp 3.872.580.600	Rp 3.140.704.500	Rp 3.587.496.800
2	Land Production	Rp 2.764.516.353	Rp 2.409.741.758	Rp 2.617.336.302
3	Road Repairs	Rp 10.051.147.000	Rp 8.526.598.000	Rp 9.590.405.000
4	Structural Improvements	Rp 82.649.250.000	Rp 73.247.250.000	Rp 79.602.000.000
Total		Rp 99.337.493.953	Rp 87.324.294.258	Rp 95.397.238.102

8. CONCLUSION

The conclusions of this study are :

- PMF flood discharge of 256,487 m³/s
- High flood inundation caused by the failure of ngancar dam collapse 23.57 meters with a speed of 92.02 m/s
- Villages affected by the collapse of ngancar dam include Selopuro village, Belikurip, Temon, Saradan, Baturetno, Gambiranom and Talunombo with a genengan area of 511, 5 hectares and an affected population of 5,927 and a large loss of Rp 99,337,493,953 (Ninety-Nine billiond three hundred thirty-seven million four hundred Ninety-three thousand Nine hundred and fifty-three rupiah).

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