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# Flood Assessment Study in the City of Tangerang, West Java

Acep Hidayat

Mercu Buana University, Jakarta, Indonesia

***Abstract:*** **Tangerang city is a region which has a relatively flat and inclined contour-shaped basin so that in some areas when the rains come will experience flooding. The cause of the flooding is necessary to identify the field. From the results obtained that the identification of flood discharge for the region amounted to 29.91 $m^3$ / s with 1.65 $km^2$.Dari watershed area of this discharge can only be accommodated by the existing drainage network is only 5 $m^3$ / sec so that the excess is what makes this region flood. For excess of 24.91 $m^3$ / s is done by creating a polder or ponds so that these advantages can be accommodated. Polder or ponds that can accommodate this excess area of 6.3 hectares with a depth of 4 meters. In addition to planning embung / Polder required also increase drainage infrastructure sehigga can flow smoothly.**

***Keywords:*** **Flood discharge, Embung / Polder.**

## I. INTRODUCTION

Flooding is a popular word among Tangerang City Government, particularly in the rainy season. Flooding in the city of Tangerang influenced by several things, including natural factors such as the characteristics of a river with a small river channel capacity, the rising tide of sea water that block the flow of rivers, as well as topography is relatively flat so that about 40% of the area of Tangerang City is a flood plain

## II. METHOD

### *A. Analysis Hydrology :*

Land use change from the open area into the area awoke also increase erosion. Erosion material carried along into the water channel, time, and resulted in the silting of reservoirs and constriction.

Based on the above, it would require a treatment program (control) by planning the manufacture of reservoir. The planning of the expected flow of rain water can be optimally accommodated in the reservoir which is in accordance with its capacity.

Determination of maximum precipitation with a specific return period can be calculated using frequency analysis methods. Several well-known methods such as Method Log-Pearson Type III, Haspers, and Gumbel. The method used will be determined by looking at the characteristics of the local area rainfall distribution. Return period will be calculated for each method is repeated for a period of 2, 5, 10, 25, 50, and 100 years. As the examples below are presented the calculation method based on Gumbel.

Frequency distribution Gumbel.

Gumbel distribution method is widely used in the analysis of the frequency of rain that has formula

Rt = R + K. Sx

K = (yt - yn) / Sn.

Yt = - (0834 + 2303 log T / T-1)

Where:

Rt = Rainfall for year return period T (mm).

R = maximum rainfall average.

Sx = standard deviation.

K = factor frequency.

Sn, Yn = Factor reduction in the average standard deviation as a function of the amount of data.

*Debit calculation Flood:*

In planning the maximum discharge in a channel which involves hydrological therein, often encountered estimate the flood peak is calculated by a simple and practical method, in which the calculation technique by inserting a factor of rainfall, physical state and nature of the hydraulics flow area. Determination of flood discharge plan, made in accordance with the Procedures for Flood Discharge Calculation Plan, SNI. Determination of flood discharge can be done in two (2) ways, namely Rational Method or Method Unit hydrograph (Synthetic hydrograph).

**Metode Rasional:**

Procedures rational use of the formula method. Rational use of the formula method procedure is given in the figure below. The following points should be noted:

There are four components of this formula which must be obtained magnitude.

- Look for a unit intensity of the rain, when the intensity in liters / detik.ha, and streams in the area ha, it will obtain the discharge in liters / sec.

- If the intensity in mm / h, then it should be first converted into units of liters / detik.ha

*Analysis Calculation:*

Resume Calculation Frequency Distribution Analysis

| Periode Ulang | Metode | | | |
|---|---|---|---|---|
| | Normal | Log Normal | Log Person Type III | Gumbel |
| 2 | 130.513 | 129.916 | 127.272 | 129.238 |
| 5 | 140.629 | 140.414 | 139.005 | 144.831 |
| 10 | 145.927 | 146.262 | 147.547 | 155.153 |
| 25 | 151.081 | 151.283 | 158.952 | 168.200 |
| 50 | 155.200 | 157.163 | 167.825 | 177.877 |
| 100 | 158.572 | 161.208 | 176.969 | 187.482 |

| Periode Ulang (tahun) | Hujan Rencana $R_{24}$ (mm) | Debit Banjir Rencana ($m^3$/dt) | |
|---|---|---|---|
| | | Metode Rasional | Metode Haspers |
| 2 | 127.272 | 23.952 | 25.162 |
| 5 | 139.005 | 26.160 | 27.481 |
| 10 | 147.547 | 27.767 | 29.170 |
| 25 | 158.952 | 29.914 | 31.425 |
| 50 | 167.825 | 31.584 | 33.179 |
| 100 | 176.969 | 33.304 | 34.986 |

***B. Analysis Hydraulics:***

With the reservoir is expected to be able to drain the primary drainage channel flood discharge of 25 years. Analysis of flood water surface profile in this scenario using the steady.


**Flow analysis. Here layout plan**

Debit Pondok Arum village will be added to the watershed discharge Cimone. The amount of discharge is added to the primary drainage channel adapted to the capacity of the channel so that the excess will be accommodated by the reservoir.

On this model, the channel capacity is still able to accommodate the additional discharge Cimone watershed of 5 m3 / s, so that the excess flow of 24.91 m3 / s will be accommodated by the reservoir (Q25 DAS Cimone = 29.91 m3 / s).

**Calculation of flood discharge plan Rational Method**

| Periode T (tahun) | A (km²) | $R_{24}$ (mm) | L (km) | H (km) | C | w (km/jam) | t (jam) | I (mm/jam) | Qt (m³/dt) |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 3.790 | 127.272 | 3.430 | 0.010 | 0.70 | 2.168 | 1.582 | 32.502 | 23.952 |
| 5 | 3.790 | 139.005 | 3.430 | 0.010 | 0.70 | 2.168 | 1.582 | 35.498 | 26.160 |
| 10 | 3.790 | 147.547 | 3.430 | 0.010 | 0.70 | 2.168 | 1.582 | 37.679 | 27.767 |
| 25 | 3.790 | 158.952 | 3.430 | 0.010 | 0.70 | 2.168 | 1.582 | 40.592 | 29.914 |
| 50 | 3.790 | 167.825 | 3.430 | 0.010 | 0.70 | 2.168 | 1.582 | 42.858 | 31.584 |
| 100 | 3.790 | 176.969 | 3.430 | 0.010 | 0.70 | 2.168 | 1.582 | 45.193 | 33.304 |

**Method of calculation of flood discharge plan Haspers**

| Periode Ulang (tahun) | Hujan Rencana $R_{24}$ (mm) | Luas DAS A Km² | Durasi hujan t (jam) | Distribusi hujan Rn (mm) | Debit tiap Km q (m³ /km /dt) | α | β | Qt (m³/dt) |
|---|---|---|---|---|---|---|---|---|
| 2 | 127.272 | 3.790 | 0.897 | 60.172 | 18.639 | 0.866 | 0.412 | 25.162 |
| 5 | 139.005 | 3.79 | 0.897 | 65.719 | 20.357 | 0.866 | 0.412 | 27.481 |
| 10 | 147.547 | 3.79 | 0.897 | 69.757 | 21.608 | 0.866 | 0.412 | 29.170 |
| 25 | 158.952 | 3.79 | 0.897 | 75.150 | 23.279 | 0.866 | 0.412 | 31.425 |
| 50 | 167.825 | 3.79 | 0.897 | 79.345 | 24.578 | 0.866 | 0.412 | 33.179 |
| 100 | 176.969 | 3.79 | 0.897 | 83.667 | 25.917 | 0.866 | 0.412 | 34.986 |

This scenario will be performed on the stages of the design as follows:

a) hydrograph discharge into the reservoir together with scenario 3 amounted to 24.91 m3 / s.

b) Inlet reservoir is next to the spillway and outlet B = 10m water reservoir door dimensions are 0.5x0.5m (BxH) and 4 units of the pump.

c) The depth of the reservoir is 4 m, with consideration of the level of security for areas outside the reservoir is a settlement.

## III. CONCLUSION

From the results of modeling of flood water surface profile, it can be concluded:

1. The cause of flooding in Perum Pondok Arum, including:

a. Culverts are not able to accommodate the discharge of a cottage complex Arum and Cimone.

b. Wet cross-sectional area small bridge into a bottle neck stream, causing backwater.

Solution Perum Pondok flooding in Arum:

c. Culverts will not be used again, because the sewer lines will be created ponds.

d. By implementing the solution of flooding on points a - c, complex drainage channel capacity cottage Arum only can stream discharge from watersheds and watershed Cimone cottage Arum for 5 m3 / s. So there are excess flow 24.9 m3 / s that can not be drained by drainage channels.

e. To accommodate the excess discharge of 24.9 m3 / s, it will be planned two scenarios, ie with and without the pump flood pump flood.

2. In this work, time Sabi not go into design planning restrictions so it is not done modeling of flood water surface profile in Kali Sabi. So the flood water level in Kali Sabi (downstream drainage channels) are assumed to be able to accommodate the discharge of a cottage complex Cimone if Arum and watershed planning Sabi normalization has been carried out. Due to the normalization Sabi planning would have take into account the DAS cottage Arum and Cimone.

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