EVALUATION OF DRAINAGE NETWORK ON GAYA MOTOR ROAD OF SUNGAI BAMBU SUB-DISTRICT TANJUNG PRIOK

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ABSTRACT

Drainage is a way to dispose of excess water that is not in an area. In other words, this drainage also works in controlling checked areas, puddles, and also flooding. Flooding is an event when excessive water flows overland. North Jakarta is an example of the city area in Indonesia that often experiences such flooding events with a repeated frequency every year. With low topographic conditions and also located in the northern coastal area of Java Island, resulting in a large flow of water through North Jakarta. One of the areas that always experiences flooding is Jalan Gaya Motor, Sungai Bambu Village Tanjung Priok sub-district. Flooding in this area caused major losses in economic mobility in North Jakarta because the road is the main access to an s considerable automotive factory area in the Jakarta area. Drainage systems in the area need to be designed to accommodate water discharge especially when it is raining. Drainage capacity needs to be accounted for to accommodate existing water discharge. From the results of the analysis obtained the amount of channel capacity value of 0.46 m$^3$/s, then bulk discharge flood plan in the period of-2 Years 22.95 m$^3$/s, for 5 Years 34.26 m$^3$/s, for 10 Years 41.75 m$^3$/s. With the flooded value of the plan, it was concluded that the capacity of the existing channel could not accommodate rain at the peak discharge of the plan, so the area always experienced flood events. Also, drainage channels in the area were affected by the high rise in water levels due to the influence of tides with an average increase of 0.6 m with an average elevation of water level of 0.607.

Keyword: drainage; flood; flood discharge; tidal; capacity.

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INTRODUCTION

Drainage is a system for channelling rainwater. This system has a very important role in creating a healthy environment, especially in densely populated areas. Drainage is a way to dispose of excess water that is not in an area. In other words, this drainage also works in controlling checked areas, puddles, and also flooding. The growing number of settlements and urban areas makes this drainage system more needed, especially lately the knowledge of the community in the management of drainage system is still lacking as a result of many areas that are often inundated until flooding in the rainy season arrives.

Flooding is an event when excessive water flows overland. Flooding is a popular event in Indonesia considering the number of regions that have experienced this event. This event is almost every year repetitive, especially when the rainy season even the frequency of events increases. Flooding in urban areas has different characteristics with natural land (plantations, rice fields, etc.). In general, rainwater that falls will flow into artificial channels that will be flowed into the river. However, there are times when the capacity of the channel is insufficient to accommodate the rainwater that falls and results in flooding.

North Jakarta is an example of the city area in Indonesia that often experiences such flooding events with a repeated frequency every year. With low topographic conditions and also located in the northern coastal area of Java Island, resulting in a large flow of water through North Jakarta. With these conditions, the flow of water that can flow in North Jakarta depends on the level of sea level. One of the areas that always experiences flooding is Gaya Motor Road, Sungai Bambu Village Tanjung Priok.
sub-district. Flooding in this area caused major losses in economic mobility in North Jakarta because the road is the main access to as considerable automotive factory area in the Jakarta area.

Drainage systems in the area need to be designed to accommodate water discharge especially when it is raining. Drainage capacity needs to be accounted for to accommodate the water discharge in the area so that the area can be free from flood events.

In calculating the tide and the condition of the flow of water, determine the location and location of the water source. Water will flow according to the laws of nature, from the highest to the lowest. The estuary is the place where the flow of water ends up to the wide sea. This condition is very influential with the rainfall in the mountains as a natural source of water (Iban S 2017; Alam MP, Lutfi M 2016; Imamuddin MI, Larasati L, 2021; Imamuddin MI, Cahyanto D, 2020).

**RESEARCH METHODS**

This research was conducted at Gaya Motor Road Sungai Bambu Subdistrict Tanjung Priok City Administration North Jakarta Implementing this Research in from March to May 2020.

![Figure 1. Research Site Map (Source: Analysis Results)]
The stages of this research are displayed in the form of flow charts such as the following:

![Flow Chart](image)

Figure 2. Flow Chart

RESULTS AND DISCUSSIONS

Drainage Network Condition

The state of drainage infrastructure in the research area is still relatively poor. This can be seen from some of the frequent flooding events in the area. On the Highway, there are drainage lines on both sides of the road which is the primary channel in the area. The channel serves to drain incoming water from secondary channels located on Gaya Motor Barat Road, Gaya Motor 2 Road, and Gaya Motor 3 Road.

| No. | Channel       | Dimensions (m) | Category | Channel Condition |
|-----|---------------|----------------|----------|-------------------|
| 1   | GM-BARAT-LEFT | 1.00 0.25 0.95 | Secondary| Open              |
| 2   | GM-BARAT-RIGHT| 0.70 0.30 1.00 | Secondary| Open              |
| 3   | GM-RAYA-LEFT  | 1.20 0.30 1.90 | Primary  | Open              |
| 4   | GM-RAYA-RIGHT | 1.00 0.30 1.50 | Primary  | Open              |
| 5   | GM-1-LEFT     | 1.10 0.50 1.20 | Primary  | Open              |
| 6   | GM-1-RIGHT    | 1.00 0.30 1.50 | Primary  | Open              |
| 7   | GM-2-LEFT     | 1.10 0.43 1.40 | Secondary| Open              |
| 8   | GM-2-RIGHT    | 1.10 0.30 1.90 | Secondary| Open              |
| 9   | GM-3-LEFT     | 1.20 0.30 1.20 | Secondary| Open              |
| 10  | GM-3-RIGHT    | 1.20 0.30 1.00 | Secondary| Open              |

(Source: Survey Results)

Rainfall Frequency Analysis
Frequency analysis required a series of rain data obtained from the rain pen post. This analysis is based on the statistical nature of past event data to get the probability of future rainfall. Assuming that the statistical nature of a rain event that will date is still the same as the statistical nature of past rain events. Daily maximum rain data obtained from 3 observation stations is as follows:

- Halim Perdana Kusuma
- Kemayoran Meteorological Station
- Tanjung Priok Maritime Meteorological Station

### Table 2. Maximum rainfall

| No. | Year | Halim Perdana Kusuma | Kemayoran Meteorological Station | Tanjung Priok Maritime Meteorological Station |
|-----|------|----------------------|----------------------------------|-----------------------------------------------|
| 1   | 1999 | 42.0                 | 147.2                            | 106.0                                         |
| 2   | 2000 | 54.3                 | 94.8                             | 65.2                                          |
| 3   | 2001 | 92.8                 | 82.2                             | 210.0                                         |
| 4   | 2002 | 107.6                | 168.5                            | 147.1                                         |
| 5   | 2003 | 71.7                 | 199.7                            | 126.7                                         |
| 6   | 2004 | 39.8                 | 129.3                            | 121.4                                         |
| 7   | 2005 | 96.6                 | 124.1                            | 109.9                                         |
| 8   | 2006 | 88.5                 | 72.0                             | 90.3                                          |
| 9   | 2007 | 217.6                | 234.7                            | 182.2                                         |
| 10  | 2008 | 136.1                | 192.7                            | 87.9                                          |
| 11  | 2009 | 140.4                | 122.5                            | 148.9                                         |
| 12  | 2010 | 96.8                 | 93.0                             | 88.3                                          |
| 13  | 2011 | 305.0                | 119.2                            | 78.5                                          |
| 14  | 2012 | 94.4                 | 105.2                            | 75.1                                          |
| 15  | 2013 | 161.0                | 193.4                            | 117.8                                         |
| 16  | 2014 | 120.8                | 147.9                            | 284.0                                         |
| 17  | 2015 | 124.6                | 277.5                            | 247.0                                         |
| 18  | 2016 | 111.6                | 124.5                            | 112.7                                         |
| 19  | 2017 | 136.3                | 179.7                            | 148.6                                         |
| 20  | 2018 | 101.2                | 104.6                            | 129.6                                         |

(Source: dataonline.bmkg.go.id)

From the daily rain data mentioned can be seen the number of extreme rain events during 20 Years in Figure 3. As follows:
Figure 3. Frequency of extreme rain events (Source: Results of daily rain analysis of Tanjung Priok Maritime Meteorological Station 1999-2018)

The methods used in this rainfall calculation plan are as follows:

a. Gumbel Method

Table 3. Gumbel method frequency analysis

| No | Years | $X_i$ | $X_i - \bar{X}$ | $(X_i - \bar{X})^2$ | $(X_i - \bar{X})^3$ |
|----|-------|-------|-----------------|----------------------|----------------------|
| 1  | 106.0 | -27.86| 776.18          | -21624.36            | 602454.77            |
| 2  | 65.2  | -68.66| 4714.20         | -323676.67           | 22223640.16          |
| 3  | 210.0 | 76.14 | 5793.30         | 441406.39            | 33608682.65          |
| 4  | 147.1 | 13.24 | 175.30          | 2320.94              | 30729.25             |
| 5  | 126.7 | -7.16 | 51.27           | -367.06              | 2628.16              |
| 6  | 121.4 | -12.46| 155.25          | -1934.43             | 24103.06             |
| 7  | 109.9 | -23.96| 574.08          | -13758.77            | 329569.68            |
| 8  | 90.3  | -43.56| 1897.47         | 2320.94              | 300406.06            |
| 9  | 182.2 | 48.34 | 2366.76         | 112958.77            | 3600406.95           |
| 10 | 68.6  | -68.66| 4714.20         | -323676.67           | 22223640.16          |
| 11 | 148.9 | 15.04 | 226.20          | 30729.25             | 30729.25             |
| 12 | 88.3  | -45.56| 2075.71         | -94569.51            | 4308586.95           |
| 13 | 78.5  | -55.36| 3064.73         | -169663.43           | 9392567.52           |
| 14 | 75.1  | -58.76| 3452.74         | -202882.86           | 11921396.93          |
| 15 | 117.8 | -16.06| 257.92          | -4142.25             | 66524.58             |
| 16 | 284.0 | 150.14| 22542.02        | 3384458.82           | 508142647.65         |
| 17 | 247.0 | 113.14| 12800.66        | 14482666.63          | 163585686.20         |
| 18 | 112.7 | -21.16| 447.75          | -9474.30             | 200476.12            |
| 19 | 148.6 | 14.74 | 217.27          | 3202.52              | 47205.21             |
| 20 | 129.6 | -4.26 | 18.15           | -77.31               | 329.34               |

Sum 2677.2 63693.27 4374112.71 768332330.73

(Source: Analysis Results)

Calculate average rainfall:

$$\bar{X} = \frac{\sum X_i}{N}$$

where: $X_i$ = Maximum rainfall value (mm)

$
\bar{X}$ = Average value

$N$ = Number of years of observation

Calculate standard deviation:

$$S_x = \sqrt{\frac{\sum (X_i - \bar{X})^2}{N-1}}$$

where: $S_x$ = Standard Deviation

$X_i$ = Maximum rainfall value (mm)

$
\bar{X}$ = Average value

$N$ = Number of years of observation

Calculate probability factor value:

$$K = \frac{Y_{tr} - Y_n}{S_n}$$

where: $K$ = Probability factor value

$Y_{tr}$ = Reduce Variate

$Y_n$ = Reduce Mean

$S_n$ = Reduce Standard Deviation
The amount of rainfall data available is \( N = 20 \) years, so that the value of \( Y_n \) and \( S_n \) are as follows:

\[
Y_n = 0.5236 \\
S_n = 1.0628
\]

Calculate rainfall in return period (T):

\[
X_{tr} = \bar{X} - K S_x
\]

where:

\[
\bar{X} = \text{Average value} \\
K = \text{Probability Factor} \\
S_x = \text{Standard Deviation}
\]

Rainfall plan in year T presented in Table 4.

**Table 4. Calculation of rainfall gumbel method**

| Return Period | Yt   | Yn   | Sn   | Kt   | Xavrg. | Sx   | Rainfall plan (Xtr) |
|---------------|------|------|------|------|--------|------|---------------------|
| 2             | 0.3668 | 0.5236 | 1.0628 | -0.148 | 133.9       | 57.90 | 125                 |
| 5             | 1.5004 | 0.5236 | 1.0628 | 0.919  | 133.9       | 57.90 | 187                 |
| 10            | 2.251  | 0.5236 | 1.0628 | 1.625  | 133.9       | 57.90 | 228                 |

(Source: Analysis Results)

b. Log Pearson III Method

**Table 5. Frequency analysis of Log Pearson III method**

| No | Years | \( X_i \) | \( \log X \) | \( \log X - \bar{\log X} \) | \( (\log X - \bar{\log X})^2 \) | \( (\log X - \bar{\log X})^3 \) |
|----|-------|-----------|-------------|-----------------|----------------|----------------|
| 1  | 1999  | 106.0     | 2.03        | -0.07           | 0.0046        | -0.0003        |
| 2  | 2000  | 65.2      | 1.81        | -0.28           | 0.0777        | -0.0217        |
| 3  | 2001  | 210.0     | 2.32        | 0.23            | 0.0525        | 0.0120         |
| 4  | 2002  | 147.1     | 2.17        | 0.07            | 0.0056        | 0.0004         |
| 5  | 2003  | 126.7     | 2.10        | 0.01            | 0.0001        | 0.0000         |
| 6  | 2004  | 121.4     | 2.08        | -0.01           | 0.0001        | 0.0000         |
| 7  | 2005  | 109.9     | 2.04        | -0.05           | 0.0027        | -0.0001        |
| 8  | 2006  | 90.3      | 1.96        | -0.14           | 0.0189        | -0.0026        |
| 9  | 2007  | 182.2     | 2.26        | 0.17            | 0.0281        | 0.0047         |
| 10 | 2008  | 87.9      | 1.94        | -0.15           | 0.0222        | -0.0033        |
| 11 | 2009  | 148.9     | 2.17        | 0.08            | 0.0064        | 0.0005         |
| 12 | 2010  | 88.3      | 1.95        | -0.15           | 0.0216        | -0.0032        |
| 13 | 2011  | 78.5      | 1.89        | -0.20           | 0.0393        | -0.0078        |
| 14 | 2012  | 75.1      | 1.88        | -0.22           | 0.0473        | -0.0103        |
| 15 | 2013  | 117.8     | 2.07        | -0.02           | 0.0005        | 0.0000         |
| 16 | 2014  | 284.0     | 2.45        | 0.36            | 0.1298        | 0.0468         |
| 17 | 2015  | 247.0     | 2.39        | 0.30            | 0.0898        | 0.0269         |
| 18 | 2016  | 112.7     | 2.05        | -0.04           | 0.0017        | -0.0001        |
| 19 | 2017  | 148.6     | 2.17        | 0.08            | 0.0062        | 0.0005         |
| 20 | 2018  | 129.6     | 2.11        | 0.02            | 0.0004        | 0.0000         |
| Sum |       | 2677.2   | 41.86       | 39.77           | 0.5553        | 0.0425         |

(Source: Analysis Results)

Calculate average rainfall:

\[
\bar{X} = \frac{\sum X_i}{N}
\]

where:

\[
X_i = \text{Maximum rainfall value (mm)} \\
\bar{X} = \text{Average value} \\
N = \text{Number of years of observation}
\]

Calculate standard deviation:
\[ S_x = \sqrt{\frac{\sum (\log X_i - \log \bar{X})^2}{N-1}} \]

where:  
- \( S_x \) = Standard Deviation  
- \( \log X_i \) = Maximum rainfall value (mm)  
- \( \log \bar{X} \) = Average value  
- \( N \) = Number of years of observation

Calculate skewness coefficient (G):
\[ Cs/G = \frac{N \sum (\log X_i - \log \bar{X})^3}{(N-1)(N-2)s^3} \]
\[ = \frac{20 \times 0.0425}{(20-1)(20-2) \times 0.16^3} \]
\[ = 0.50 \]

Calculate rainfall in return period (T):
\[ \log X_T = \log \bar{X} + K S_x \]

where:  
- \( \log X_T \) = Rainfall antilog  
- \( K \) = Probability factor  
- \( S_x \) = Standard Deviation

with a value of \( G = 0.50 \) then the value of \( K \) for 2-years, 5-years and 10-years is as follows:

- \( K_2 = 0.082 \)  
- \( K_5 = 0.877 \)  
- \( K_{10} = 1.320 \)

**Table 6. Comparison of rainfall plans**

| Return Period (T) | Gumbel | Log Pearson III |
|-------------------|--------|-----------------|
| 2 years           | 125    | 128             |
| 5 years           | 187    | 175             |
| 10 years          | 228    | 208             |

(Source: Analysis Results)

From the two calculations of rainfall, presented in Table 6 where the results of both calculations have a not far difference, therefore for the next calculation used gumbel method that has the largest value and also based on Volume I Procedure Manual Preparation of Urban Drainage System Master Plan 2012 by Directorate General of Cipta Karya, Ministry of PUPR and SNI 2415-2016 On How to Plan Floods.

**Rainfall Intensity**

The maximum rainfall unit is converted into a unit of rainfall within a certain time usually used unit mm/hour. By using formulas Mononobe as follows:

\[ I = \frac{R_{24}}{24} \left( \frac{24}{t} \right)^{2/3} \]

where:  
- \( I \) = Rainfall intensity (mm/hour)  
- \( R_{24} \) = Maximum rainfall in 24 hours (mm)  
- \( t \) = Duration of rainfall (hour)

**Table 7. Rainfall intensity**

| Duration of rainfall (minutes) | 2 Years | 5 Years | 10 Years |
|--------------------------------|---------|---------|----------|
| 1                              | 125     | 187     | 228      |
| 2                              | 665.85  | 993.98  | 1211.24  |
| 3                              | 419.46  | 626.17  | 763.04   |
| 4                              | 320.11  | 477.85  | 582.31   |
| 5                              | 264.24  | 394.46  | 480.68   |
| 6                              | 227.72  | 339.94  | 414.24   |
Then after the calculation of rainfall intensity in the return period 2, 5, 10 years is shown in Figure 4.

**Figure 4.** Rainfall intensity graph (Source: Analysis Results)

### Flood Discharge Analysis Plan

The method for estimating flood discharge plans that are commonly used is the Rational Method. The formula used in this calculation is:

\[
Q = 0.00278 \cdot C \cdot I \cdot A
\]

where:
- \( Q \) = Discharge (m\(^3\)/s)
- \( C \) = Runoff coefficient
- \( I \) = Rainfall intensity
- \( A \) = Flow area (Ha)

Gaya motor industrial area, thus having a runoff coefficient value \((C) = 0.91\). Thus obtained the discharge value of the flood plan as shown in Table 8 as follows:

| No | Period | R24 (mm) | C   | I (mm/hour) | A (km\(^2\)) | Qr (m\(^3\)/dk) |
|----|--------|---------|-----|-------------|--------------|----------------|
| 1  | 2 Tahun| 125     | 0.91| 67.77       | 133.21       | 22.95          |
| 2  | 5 Tahun| 187     | 0.91| 101.16      | 133.21       | 34.26          |
| 3  | 10 Tahun| 228    | 0.91| 123.27      | 133.21       | 41.75          |

(Source: Analysis Results)
Channel Capacity Calculation

Debit analysis on the channel is carried out to determine the capacity that can be flowed on the channel. The calculation of channel capacity can be seen in Table 9.

**Table 9. Channel capacity calculation**

| No. | Channel     | \( h_1 \) (m) | \( h_2 \) (m) | \( b \) (m) | \( p \) (m) | \( A \) | \( R \) | \( S \) | \( N \) | \( V \) | \( Q \) |
|-----|-------------|----------------|---------------|------------|------------|-------|-------|-------|-------|-------|-------|
| 1   | GM-BARAT-LEFT | 1.00           | 0.25          | 0.95       | 2.95       | 0.95  | 0.322 | 0.00027 | 0.03   | 0.26  | 0.24  |
| 2   | GM-BARAT-RIGHT| 0.70           | 0.30          | 1.00       | 2.40       | 0.70  | 0.292 | 0.00093 | 0.03   | 0.45  | 0.31  |
| 3   | GM-RAYA-LEFT | 1.20           | 0.30          | 1.50       | 4.30       | 2.28  | 0.530 | 0.00034 | 0.03   | 0.40  | 0.92  |
| 4   | GM-RAYA-RIGHT| 1.00           | 0.30          | 1.50       | 3.50       | 1.50  | 0.429 | 0.00034 | 0.03   | 0.35  | 0.53  |
| 5   | GM-1- LEFT | 1.10           | 0.50          | 1.20       | 3.40       | 1.32  | 0.388 | 0.00039 | 0.03   | 0.35  | 0.46  |
| 6   | GM-1-RIGHT | 1.00           | 0.30          | 1.50       | 3.50       | 0.429 | 0.00067 | 0.03   | 0.49  | 0.73  |
| 7   | GM-2- LEFT | 1.10           | 0.43          | 1.40       | 3.60       | 1.54  | 0.428 | 0.00033 | 0.03   | 0.34  | 0.53  |
| 8   | GM-2-RIGHT | 1.10           | 0.30          | 1.90       | 4.10       | 2.09  | 0.510 | 0.00059 | 0.03   | 0.52  | 1.08  |
| 9   | GM-3- LEFT | 1.20           | 0.30          | 1.20       | 3.60       | 1.44  | 0.400 | 0.00037 | 0.03   | 0.35  | 0.50  |
| 10  | GM-3-RIGHT | 1.20           | 0.30          | 1.00       | 3.40       | 1.20  | 0.353 | 0.00051 | 0.03   | 0.38  | 0.45  |

(Source: Analysis Results)

Channel calculation sample of Gaya Motor Barat road left side:

- **Area (A)**
  
  \[ A = b \times h \]
  
  \[ A = 0.95 \times 1.00 \]
  
  \[ A = 0.95 \text{ m}^2 \]

- **Circumference (P)**
  
  \[ P = b + 2h \]
  
  \[ P = 0.95 + 2.1.00 \]
  
  \[ P = 3.45 \text{ m} \]

- **Hydraulic radius (R)**
  
  \[ R = \frac{A}{P} \]
  
  \[ R = 0.95 / 2.95 \]
  
  \[ R = 0.344 \text{ m} \]

- **Channel speed (V)**
  
  \[ V = \frac{1}{n} \cdot R^2 \cdot S^\frac{1}{2} \]
  
  \[ V = \frac{1}{0.03} \cdot 0.322^2 \cdot 0.00027^\frac{1}{2} \]
  
  \[ V = 0.26 \text{ m/s} \]

- **Channel debit (Qs)**
  
  \[ Q_s = A \times V \]
  
  \[ Q_s = 0.95 \times 0.26 \]
  
  \[ Q_s = 0.24 \text{ m}^3/\text{s} \]

**Water Level**

The results obtained from field surveys on normal conditions of the average water level are at an elevation level of +0.607 or 30 cm from the bottom of the channel. This condition is the position where
the water level of the channel outlet located in Sunter C river is in normal condition with an average level of +0.280. From Figure 4 it is seen that the highest increase in the water level of the channel is in November. In addition, the highest flood conditions that have occurred in the motor force area are at an elevation level of +2,367 or are at an average height of 60 cm from the surface. In these conditions flooded almost the entire Gaya Motor area and caused considerable losses.

![Figure 5. Water level graphic (Source: Analysis Results)](image)

**Tidal**

In this study presented tidal data for 20 years from 2000 to 2019 presented in Figure 6.

![Figure 6. Tidal graphic (Source: Analysis Results)](image)

**Tidal effect on drainage system**

Sea level tides have a considerable influence on drainage systems in urban areas located in coastal areas, especially for flat areas with low ground elevation. In this study, a comparison of flood events at the time with the high tide level of the sea level. Data is displayed in the following Table 10:

| Period of flooding |
|--------------------|
| No | Date            | High puddle (cm) | Duration (hour) | Rainfall (mm) | Tidal level (m) |
|----|-----------------|------------------|-----------------|---------------|----------------|
| 1  | 01 February 2002| 80               | unknown         | 138.00        | 0.355          |
| 2  | 01 February 2007| 120              | unknown         | 235.00        | 0.577          |
| 3  | 21 February 2017| 50               | 7.00            | 180.00        | 0.571          |
| 4  | 14 November 2017| 15               | 4.00            | 60.70         | 0.210          |
| 5  | 12 December 2017| 15               | 2.00            | 90.70         | 0.446          |
| 6  | 16 February 2018| 50               | 2.00            | 105.00        | 0.373          |
| 7  | 28 March 2018   | 60               | 10.00           | 130.00        | 0.337          |
| 8  | 29 October 2018 | 40               | 3.00            | 94.50         | 0.382          |
| 9  | 30 January 2019 | 30               | 6.00            | 128.00        | 0.601          |
| 10 | 25 December 2019| 15               | 4.00            | 103.00        | 0.547          |

(Source: Water Resource Agency of North Jakarta)

CONCLUSION

From the results of hydrological analysis to discharge flood plans that occur in the return period of 2 Years can be a maximum rainfall value of 125 mm and discharge flood plan (Qr) 22.95 m3/s, in the period of 5 Years maximum rainfall of 187 mm and flood discharge plan (Qr) 34.26 m3/s, and also at the time of the 10-year period the maximum rainfall is 228 mm with a flood discharge plan (Qr) of 41.75 m3/s. Based on the calculation of channel capacity located in Gaya Motor area is not able to accommodate rain discharge plan. With a capacity value of 0.46 m3/s on the channel outlet. The performance of this drainage network is affected by the level of water level that is at sunter river especially in December to February which is the highest average water level occurs. When the water level rises at the drainage outlet on Gaya Motor 1 road will reduce the discharge capacity that the channel is able to flow.

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