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BANGER WATERSHED MANAGEMENT IN SEMARANG CITY

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ABSTRACT

High rainfall generally triggers floods on the north coast of Central Java, where water flows from upstream to downstream carrying soil, grain, and trash in the form of used bottles, plastic, and cans., tree branches, among other things, so that waste will disrupt and slow down water flow.Government initiatives to address flooding in the city of Semarang include maximizing retention ponds, such as those in Tawang, Muktiharjo, Tanah Mas, and Banger, If there is a tide or tidal flood that floods the streets and homes, the pump is turned on. These pools are used to collect water that will later be discharged using a pump to the river and then to the sea.In the meantime, The pump is turned off if the water recedes and avoids populated areas.As opposed to flood control, which employs a 50-year return count, the aim of this study is to establish a correlation between pumps and retention ponds.A 406,000 m^3 *pool with a depth of three meters is used for Banger watershed flood control.The pump is programmed to start at a depth of 2.5 meters and to stop at a depth of 0.5 meters..*

Keywords: Longstrorage, Banger, Pump.

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1. INTRODUCTION

In addition to high rainfall causing sedimentation, siltation, and damage to tertiary, secondary, and primary channels, including A2 channels, the city of Semarang frequently experiences floods during the rainy season, especially during high rainfall. As a result, during high rainfall, the water will not be accommodated in the channel.There is a lot of garbage on A2 channels and Kali Banger, which is evidence that people are aware of environmental.

Retention ponds in Tawang, Muktiharjo, Tanah Mas, and Banger, for example, are used to collect water and are later used to discharge water using a pump to the river and then to the sea as part of government efforts to combat flooding in the city of Semarang., The pump is activated in the event of a tide or tidal flood that floods the streets and residences. In the meantime, if the water recedes and spares populated areas, the pump is turned off. Planning a proper and integrated flood control system is essential to reducing the risk and frequency of flood events, and this system must be placed in an area with evaluation and analysis that considers flood inundation areas or their coverage. Planning a proper and integrated flood control system is essential to reducing the risk and frequency of flood events, and this system must be placed in an area with evaluation and analysis that considers flood inundation areas or their coverage. Kodoatie (2013). Semarang's efforts to avoid flooding primarily take three different tacks. a. Flood prevention from the Hulu watershed,b. the watershed in Hulu is used to control flooding c. flood control is caused by rob. (1)

The geographical features of the city of Semarang, which have potential flood zones because there are areas located in high areas and areas located in low-lying areas, contribute to flooding in the city of Semarang. This is due to shipments coming from the southern part of Semarang City and Semarang district. according to Pramono (2002), b. a the Mijen district's conversion of rubber forests to housing, c. the pressing of hills in various locations, which alters water flow patterns and causes erosion The poor conduct of the Semarang population is the non-technical issue. People's actions that disregard the environment, such as dumping trash in waterways and other random locations and blocking drainage channels to construct street vendors, have become commonplace. (2)

The extent to which tidal elevation had an impact on the Rob Flood in the Kaligawe Semrang region. When there is no rain, the Kaligawe Road embankment elevation in Semarang can still support traffic, but when there is daily rainfall of more than 80 mm, the Kaligawe area will become inundated. (3)

High tides and land subsidence are two additional dangers that the City of Semarang must contend with. (5) (6) (4). There are other factors that contribute to high tides and land subsidence (see "Land Su" for more information).By superimposing the DEM map of the flood water level with the DEM of the land surface, GIS Arc was used to analyze floods and tidal floods. According to the analysis' findings, the rate of land subsidence increased steadily from 0 in the southern region to a maximum of -5.58 cm per year in the north.. Over aperiod of 17 years 2014-2031(7)

In the East Flood Canal River Basin, changes in the characteristics of rain have occurred, with annual rainfall and maximum daily rainfall likely to rise while the number of rainy days tends to fall.The maximum daily rainfall increased by an average of 2.56 mm per year, the number of rainy days decreased by an average of 4 days per year, and the annual rainfall increased by an average of 22.64 mm per year. (7)(2)

In Semarang, the condition of land elevation below sea level will result in rob flooding, which will damage facilities and infrastructure including roads, housing, sanitation, and other infrastructure, having an impact on the lives of those who are directly impacted by tidal flooding.(8)

Given the sloping topography of the Tawang Sari and Tawang Mas areas, the drainage system is viewed as an effective and efficient alternative to addressing the issue of floods and tides in those areas.Planning for a drainage system entails arranging for long storage, pump housing, dykes, and floodgates. (1)(9)

2. METHODE OF RESEARCH

The research methodology employs a qualitative approach that is appropriate for the field.

which uses information from the Maritime Rain Station in 2018 and includes: Rainfall Data, Topographic Data, Pool Area, Pool / Longstorage Capacity, Pump Capacity, and Tidal Data.

The analysis techniques include these, among others.:

2.1. Hydrological Analysis

Find the Tanjung Mas Maritime Rain Station, which is the rain station closest to the Banger watershed, using the rainfall and catchment area data.The procedures for choosing the flood discharge plan will be covered in the hydrological analysis. Calculating regional average rainfall, planning rainfall, performing alignment tests to identify methods that pass the distribution test, calculating rainfall intensity, and planning flood discharge are the steps in determining the flood discharge plan. Calculate Regional Average Rainfall Using the Thiessen Method

2.2. Hydraulic Analysis

For the purpose of calculating the potential for retention pool discharge, which is based on the difference between the return flood flood discharge and the discharge capacity of each river cross section (9)

2.3. Flood Discharge Analysis Plan

The catchment area is represented by segmenting residential areas and roads that have been modified to fit the drainage channel under the current circumstances.Additionally, the elevation and flow direction in the current concession are used to determine how the catchment area is depicted. Residential areas and roads that have been modified to fit the drainage channel under the current circumstances are divided to represent the catchment area.

The depiction of the catchment area is also based on the elevation and flow direction in the current concession. The highest tides, wind and wave generation, sea level rise, and land subsidence at the dike site are taken into account when planning the sea dike.The retention pond is 126 hectares in size, has a depth of 3.4 meters, and has a 10-year flood plan of 126.6 m^3 per second. Each of the 4 pumps has a 15 m^3 per second capacity. The Sungaiingin River has a discharge of 49.6 m^3 per second, compared to the Tenggang River's 82.3 m^3 per second.The embankment is 1.73 kilometers long and is built from the East Flood Canal to the Babon River at a height of +2.7 meters above sea level.

3. RESULT AND DISCUSSION

3.1. Hydrological Analysis (Distribution of Rainfall in Watersheds)

The initial analysis in the design of hydraulic buildings typically includes a hydrological analysis.) The number of flood discharge plans in a plan is determined using a hydrological analysis.The following are the steps to obtain the discharge plan: a. Determine the size of the watershed (DAS). b. Establish the rain stations' influence area. c. Using the rainfall data already available, calculate the watershed's average maximum daily rainfall. Examine rainfall projections using a T-year return period. e. Determines the plan flood discharge using the planned rainfall over the T-year return period..

With the aid of the ArcGIS 10.5 software, experiments were checked on the two other nearby stations, Karangroto and Pucanggading, using the Thiessen method, which led to the division of sections and the area of influence of rain stations on each section.: (Ikhwanudin at.al, 2018)

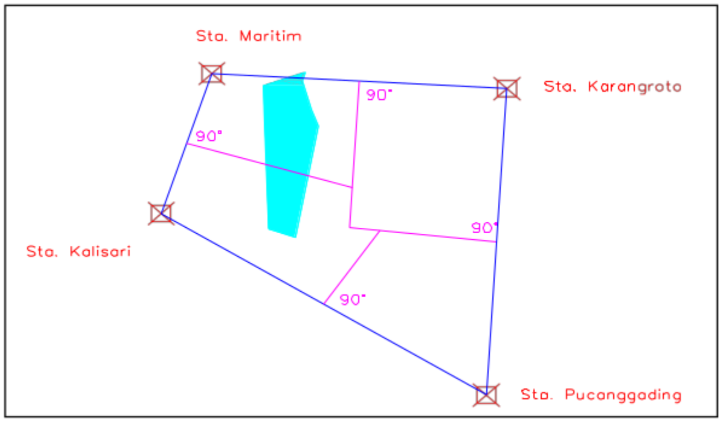

Figure 1 Cacthment Area DAS Banger

According to the image above, the Maritime Rain Station is the only source of water for the Banger Watershed Catchment Area. Consequently, the following is the catchment area coefficient:.

Table 1 Area of Rain Station's Influence on the Banger River Basin

	Luas Catchment Area (m^2)	Koefisien Thiessen
CA Maritim	5,675,210	1.00
Luas DAS Banger	5,675,210	1.00

Source: (Ikhwanudin at.al, 2018)

Table 2 The Maritime Rain Station's Regional Maximum Rainfall

No	year	date	Rainfall Maximum
1	2009	25 Desember	104,50
2	2010	11 Desember	168,60
3	2011	2 Januari	89,00
4	2012	4 Februari	96,00
5	2013	23 Februari	135,30
6	2014	23 Januari	120,50
7	2015	13 Februari	119,00
8	2016	11 April	74,00
9	2017	28 Oktober	99,50
10	2018	17 Februari	138,50

Source: (Ikhwanudin at.al, 2018)

In this study, the rain frequency frequency analysis was performed using A Prob software, version 4.1, which was created by Ir. Istiarto, a staff lecturer with an M. Eng., Ph.D. from Gajahmada University.The minimum maximum difference for the log Pearson III distribution is 0.090.The distribution of Pearson III Log data passed the Smirnov-Kolmogorof and Chi-Square tests, which demonstrated this. The rain return's size is as follows.:

Table 3 Banger River Basin Rainfall Based on Re-Period.

Kala Ulang	Log Pearson III
2	104
5	131
10	147
20	163
50	182
100	196

Source: (Ikhwanudin at.al, 2018)

This study is being conducted in the Banger River Basin's Catchment Area (CA). The topography is low and sloping in downstream areas.This area is always under water because water enters through the Banger River, which is connected to the East Flood Canal, where every sea experiences high tides (KBT). Flooding is also brought on by the inability of the available pumps to handle the flood discharge that results from heavy rain.It is intended to use the Polder system when designing the Banger drainage system, specifically by converting the drainage channel into a reservoir or so-called long storage..

3.2. Alternative Storage Plan

Figure 2 shows a drainage system plan for the Banger Catchment area that includes retention ponds, channels, and pumps to deal with flooding in the area.

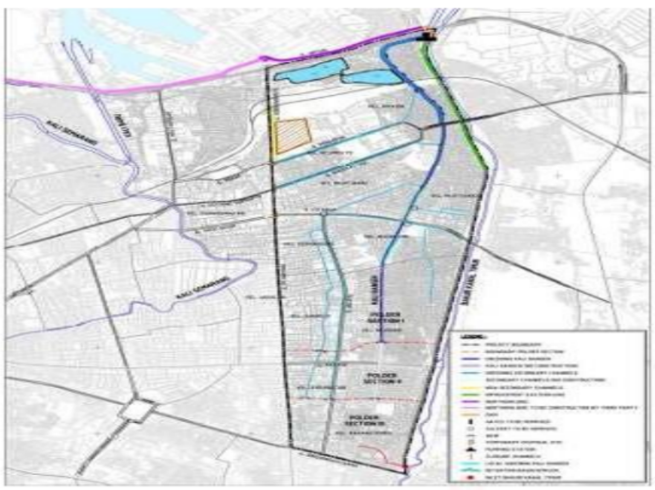

Figure 2 Alternative location plan for retention ponds (Ikhwanudin.at al., 2020)

The following tables display the attributes of the pool of ponds that have been identified and that will serve as the input database for the retention pool plan in this analysis.:

Table 4 Retention Pool

Depth (m)	Elevation (m)	Large (ha)	Volume (1000 m^3)	Pool Volume (1000 m^3)
3	2	13.54	135	406
2	1	13.54	135	271
1	0	13.54	135	135
0	-1	13.54	0	0

The Banger watershed, which is further divided into sub-watersheds, is the watershed examined in the calculation. By segmenting residential areas and roads that have been modified to function as drainage channels under the current conditions, the sub-watershed is represented.Additionally, the elevation and flow direction under the current circumstances are taken into account when drawing sub watersheds.The retention pond plan with pumps' capacity is to be evaluated using the polder system in the Banger Watershed Analysis is based on th e idea that retention ponds are a function of pump power. The required pump capacity decreases as retention pool storage increases, and vice versa.

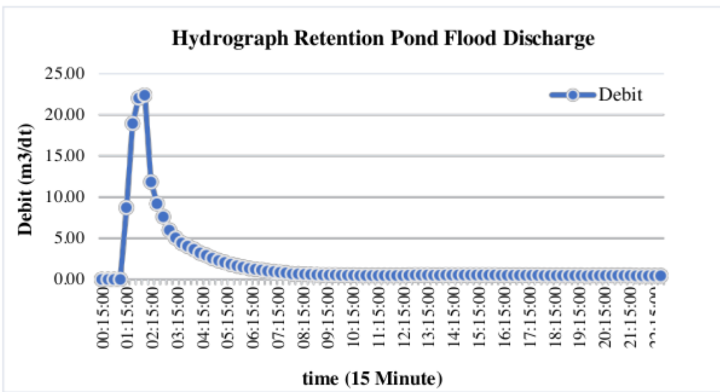

Figure 3 Hydrograph Retention Pond Flood Discharge (Ikhwanudin.at al., 2019)

With a retention pond area of 13.54 ha, the pool is 3.0 m deep, and 406,000 m3 of storage space are available 5-m3/s-capable pumps the pump is programmed to activate at 2.5 meters and to shut off at 0.5 meters.Variations in pump capacity of 3 x 1.5 m3/s and 1 x 0.5 m3/sec are shown in Table 5.The pump is programmed to start at 2.5 meters below the pond's bottom and to stop at 0.5 meters.Assuming the pond's water depth at the time of pumping is 2 meters.

Table 5 Pump Operation Schedulle

Water depth (m)	Elevation (m)	Pump debit (m^3/dt)
0	-2,7	0
0,5	-2,2	1,5
1	-1,7	1,5
1,5	-1,2	3
2	-0,7	3
2,5	-0,2	4,5

The depth of the pool is maintained in accordance with the pump operating schedule to prevent overflow or puddles. In order to achieve Figure 4, where the pool's surface water remains at a depth of 2.4 m and does not run off, the depth of the pool must be determined..

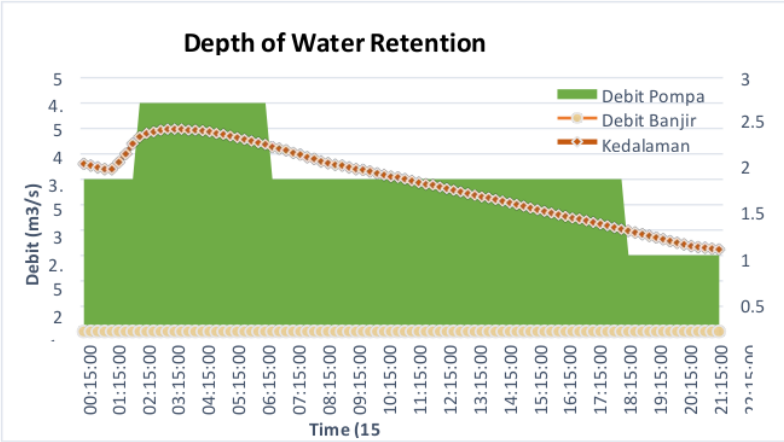

Figure 4. Depth of Water Retention Pool

The pump that is activated varies depending on the pond depth.A pump with a 2 m3/s capacity is started at 0.5 m of pond depth. The pump capacity increases to 2x2 m3/s at a depth of 4 m and remains constant until the water depth at the LS rises to 5 m..

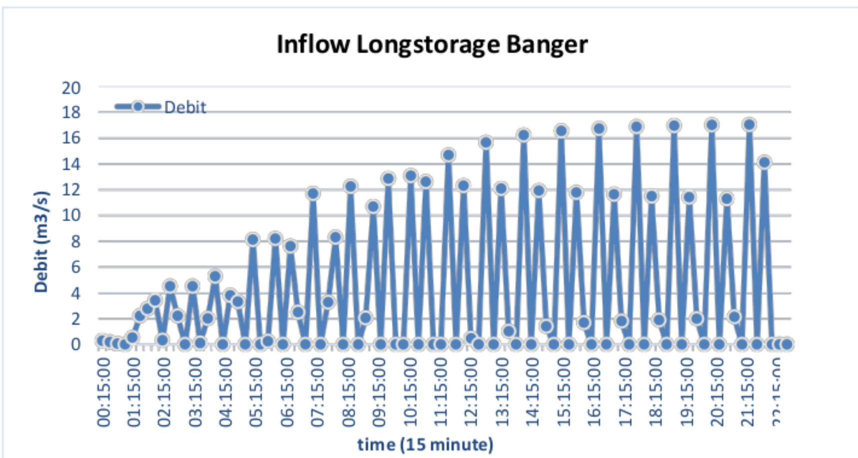

Figure 5 Inflow Longstorage Banger

Table 6 Pump Operation Schedule

Water depth (m)	Elevation (m)	Pump debit (m^3/dt)
0	-4.7	0
0.5	-4.2	2
1	-3.7	2
1.5	-3.2	2
2	-2.7	2

When the pump is running, Longstorage Banger's water level will fluctuate as shown below.Figure 6 shows that the pool's water level can be kept at 2.3 meters deep without overflowing.

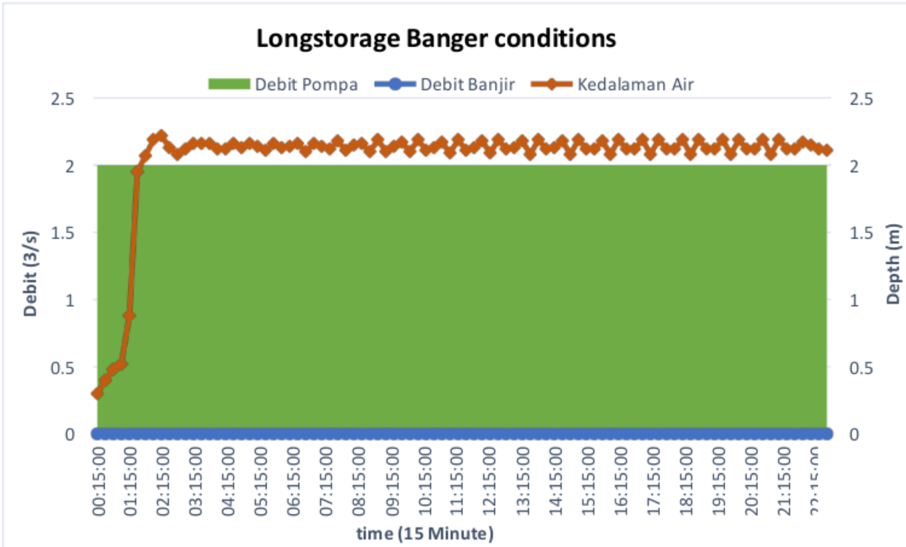

Figure 6 Banger Longstorage Depth Conditions

In order to implement the flood control model in the watershed, the banger watershed control model takes into account both the size of the aria catchment and the current conditions. According to Lina Damayanti's research, the retention pond has a 13.54 ha area, a pool depth of 3.0 m, and a reservoir volume of 406,000 m3. The pump capacity is 5 m3/s (2017). The long storage location in Madukoro is designed using 3 pumps with a capacity of 1.2 m3/s and 2 existing pumps with a capacity of 0.6 m3/s, and the long storage in Tawang Sari is designed using 5 pumps with a capacity of 3 m3/s and 2 existing pumps with a capacity of 0.6 m3/s.

4. CONCLUSIONS

The polder system, which is based on the idea of isolating sea water flow and controlling water elevation with pumps, channels, ponds, and embankments, is the most suitable treatment for tidal flood control in the Banger watershed.:

- The distribution of rain observed at Tanjung Mas Maritime Rain Observing Station in Semarang is the only factor affecting the Catchment Area (CA) of the Banger River Basin.With a CA area that is 567,521 ha, the size of the Banger watershed. A planned rainfall with a return period of 50 years is 182 mm, which has been statistically tested using the distribution of the Pearson III log distribution. This rainfall is based on the recording of the depth of rain in the Maritime Sta and analysis of the rain area using the Thiessen method..

- With a retention pond area of 13.54 ha, the pool is 3.0 m deep, and 406,000 m3 of storage space are available 5-m3/s-capable pumps, the pump is programmed to activate at 2.5 meters and to shut off at 0.5 meters. Variations in pump capacity of 3 x 1.5 m3/s and 1 x 0.5 m3/s

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