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The Affect of Physical Parameters on Flood Potential in the Upstream River and the Musi Watershed of Kepahiang, Indonesia

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Abstract: Fllod often occur if the rainfall is high, the flood-affected areas are downstream areas around the Musi Watershed of Kepahiang. The purpose of the study was to find out the characteristics of the physical parameters that affect the potential for flooding in the upstream river and the Musi Watershed. The method used are in situ measurement and laboratory analysis. The results of research, the characteristics of the river's physical parameters after the rain, the river flow discharge is 14.50 m3/s, floating sediment discharge 1.13 kg/s, bottom sediment discharge 43 x 10-4 kg/s, and total sediment discharge 113 x 10-2 kg/s. While the condition is not raining, the river flow discharge is 5.37 m3/s, the floating sediment discharge is 0.30 kg/s, the bottom sediment discharge is 32 x 10-4 kg/s, and the total sediment discharge is 30 x 10-2 kg/s. The dominant sediment texture is sand, clay and silt with a grain size of 1.4 mm - 600 µm. The river bathymetry has a lower elevation at the confluence of the Gegasan River and Lanang River which causes the river currents to reverse, if there is an increase in rainfall it will cause flooding in the area around the river.

Keywords: Discharge; Elevation; Musi river; Sediment

Introduction

Flooding can be indicated as the inability of an ecosystem to provide environmental services, as a result of degradation of environmental functions and the carrying capacity of river basins (Putra & Pramungkas, 2017; Handayani et al., 2024). If flooding in river basins increases widely, it results in social and economic losses, this condition is categorized as a natural disaster. There are several factors that cause flooding, one of which is sedimentation. Increasing river sediment causes river shallowing, as a result of this river shallowing it can block river flow and floods occur (Srijati et al., 2017; Junianto, 2023; Virgota et al., 2024). In addition, shallowing of rivers can cause an increase in water discharge that exceeds the carrying capacity of the river flow. According to Pangestu et al. (2013), to find out how far sedimentation affects flooding, several analyzes are needed. Apart from that, sedimentation is greatly influenced by the physical parameters of a body of water, including area, flow speed, depth, discharge, sediment characteristics and others (Supiyati et al., 2011; 2021; Supiyati et al., 2011; 2021; Karnan, 2022; Nugroho, & Basit., 2014; Wijaya et al., 2014).

One of the rivers in Ujan Mas District, Kepahiang Regency is the Musi River. This river is one of the rivers in Bengkulu Province that has the potential to cause flooding. The Musi River is where the Gegasan River and Lanang River flow. In the upstream sub-region of the Musi River, it is included in the Musi River watershed which is used for the Musi Hydroelectric Power Plant. According to residents, the water flow that has merged between the Gegasan River and the Lanang River is used by the community for irrigation and bathing. Even before the increase in sedimentation, the community used this river flow for fish cages, but now it is no longer possible to use it for fish cages.

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Based on the initial survey obtained during the intake conditions of the Musi hydroelectric power plant (PLTA), closed river current speed is relatively small. During these conditions, it is assumed that no sediment transport will occur, due to small changes in the flow of the Gegasan River, Lanang River, the confluence of the Gegasan River and Lanang River, and the flow of the Gegasan River and Lanang River towards the Musi River. Therefore, to observe sediment transport occurring, one of the treatments carried out is to open the intake of the Musi Hydroelectric Power Plant. When the intake conditions are opened, it causes very significant changes in river flow, and in these conditions it is certain that sediment transport will occur. One example of a flash flood due to the overflow of the Musi River is the flood that occurred on April 26 2019. This flood submerged Tanjung Alam Village, Kampung Bali and Air Hitam Village, Ujan Mas District, Kepahiang Regency. Floods cause many losses to the community, such as damage to people's houses, dozens of hectares of gardens and rice fields (Antoni, 2019; Saputro et al., 2021; Safitri et al., 2022; Dwinanda et al, 2024) .

Increased sedimentation causes a narrowing of the Gegasan River and Lanang River towards the Musi River. This condition means that if heavy rain occurs, the water will overflow and cause flooding in villages around the upstream river and the Musi watershed. This problem will continue and even get worse and spread to surrounding villages, thereby hampering the community's economy, if it is not handled properly without paying attention to the characteristics of the physical parameters of the upstream river and the Musi watershed. To overcome the problems that occur, so far the temporary treatment has only been dredging in the Musi River, However, the issue remains unresolved because flooding events continue to recur. It is suspected that no scientific study has yet been conducted on the physical parameters of the upstream area of the Musi watershed. In fact, these frequent floods are closely related to the characteristics of the physical parameters of the upstream river and the Musi watershed. Therefore, to overcome the problems that occur, it is very necessary to carry out research on the influence of physical parameters on flood potential.

Method

The research location is on the Gegasan River, Lanang River, the confluence of the Gegasan River and Lanang River, the flow of the Gegasan River and Lanang River towards the Musi River, Ujan Mas District, Kepahiang Regency geographically located at coordinates 3°32'4.89" - 3°32' 6.32" South Latitude and 102°29'40.39" - 102°29'42.35" East Longitude as shown in Figure 1. The tools and materials that will be used in this research are current meters, GPS, sample bottles, meter, rope, Arcgis 10.4 dan Surfer.

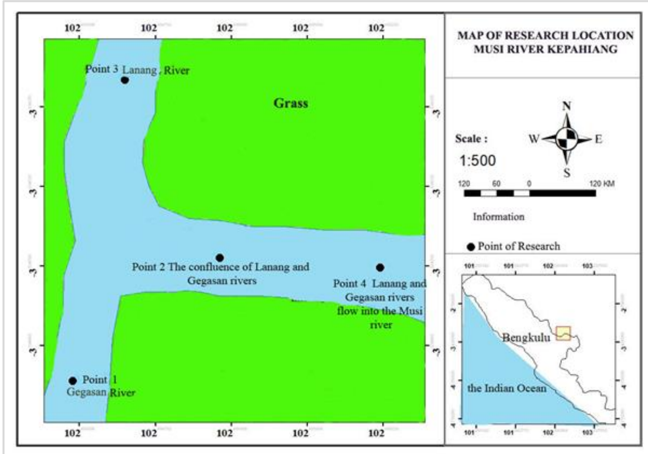

Figure 1. Research location

In this research, before data collection, a literature study was carried out first to support theoretical research activities. The data used in this research is divided into two, namely secondary data and primary data. Secondary data is in the form of data: rainfall obtained from the Kepahiang Meteorology and Climatology Agency (BMKG), Musi River surface elevation data obtained from the Musi Kepahiang hydropower data center. Primary data is data obtained from in situ measurements in the form of river physical parameters in the form of: area, current speed, depth and width of the river as well as bed load and suspended sediment, each of which is measured at 4 location points such as which can be seen in Figure 1. Measuring the speed of the river flow using a current meter, for the cross-sectional area of the river is done by measuring the width of the river surface and the depth of the river.

After data collection, parameter processing is then carried out to determine river discharge, where river discharge is determined using Equation 1 (Sasrodarsono & Takeda, 1987; Purnama et al ., 2015).

$$Q = v\ x\ A \quad (1)$$

$$A = 2xbx\frac{c+2d+e}{4} \quad (2)$$

Where: Q = River discharge (m^3/s), A = Cross-sectional area between measuring lines in water c, d, and e (m^2), v = flow velocity at the drainage line c, d, e (m/s), b = width of the river surface (m), and c, d, e = water depth for each measurement (m).

Next, analysis of samples of bottom sediment and floating sediment was carried out in the laboratory. Bottom sediment samples were analyzed using a multilevel filter. Drift sediment samples were analyzed to determine the suspension load content (C_s). using the APHA method (Pradipta & Siddhi, 2013; Supiyati et al., 2015; Khalis et al., 2024), where the suspension load content is obtained based on calculations using Equation (3).

$$C_s = \frac{b-a}{V} \quad (3)$$

With C_s= Suspension concentration (mg/l), b= Weight of filled filter (mg), a= Weight of empty filter (mg), and V =Water volume (l)

The results of laboratory analysis of bottom sediment and floating sediment samples were then calculated to calculate the amount of bottom sediment transport using the Meyer Peter Equation (Supiyati et al ., 2015):

$$\frac{\gamma R(\frac{k}{k'})^{3/2}}{D(\gamma_s-\gamma)} - 0{,}047 = 0{,}25\sqrt[3]{\gamma/g}\,\frac{q'_b{}^{2/3}}{D(\gamma_s-\gamma)} \quad (4)$$

$$q_b = q'_b\,\frac{\gamma_s}{\gamma_s-\gamma} \quad (5)$$

$$Q_b = B\ x\ q_b \quad (6)$$

Where: Q_b= Debit of bed load throughout the width of the stream bed (kg/s), q_b= Discharge of bed load per unit width (kg/ms), q'_b = Bed load rate (kg/ms), D = Average sediment grain diameter (m), g = Gravitational acceleration (m/s2), R = Hydraulic radius (R = $\frac{A}{P}$) (m), k = Coefficient channel bed roughness (k/k') = 1, γ_s= Specific weight of sediment, γ = Specific weight of water, and B = Bottom width (m). Next, the sediment volume is calculated using the equation: $V = \frac{Q_b}{\rho_s}.t$
With: V = sediment transport volume (m^3), Q_b = bottom sediment load discharge (kg/s), ρ_s = sediment density (kg/m^3), ρ = water density (kg/m^3), and t= time (s). Calculation of floating sediment discharge according to Suparto (2014) calculated based on the suspension load content value using Equation 7.

$$Q_s = 0{,}001\ x\ C_s\ x\ Q \quad (7)$$

Where: Q_S = Suspension discharge (kg/s), Q = Water discharge (m^3/s) , C_S= Suspension concentration (mg/l) and 0.001 = Conversion factor.

After obtaining the floating sediment discharge and bottom sediment, then the total sediment discharge is calculated using the equation $Q_t = Q_s + Q_b$ Ansar et al. (2014), where: Q_t = Total sediment discharge (kg/s), Q_s = Floating sediment discharge (kg/s), Q_b = Sediment discharge basis (kg/s). The results of the sediment calculations are then presented in graphical form, while the sediment distribution and river bathymetry are mapped using *software surfer* and Argics 10.4 (Nandi et al ., 2015). The complete stages of this research can be seen in the flow chart in Figure 2.

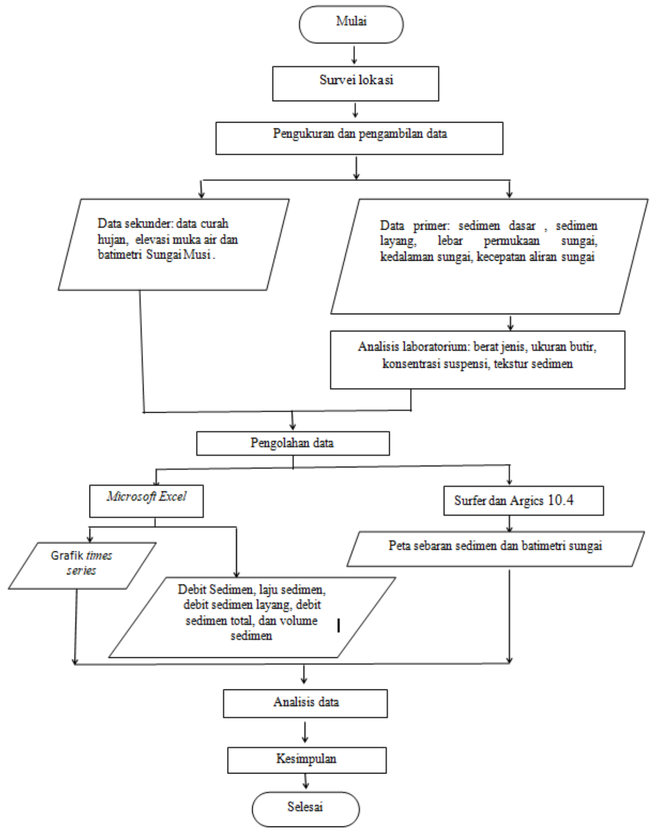

Figure 2. Research flow chart

Result and Discussion

Characteristics of Upstream Physical Parameters and the Musi Watershed

The physical parameters reviewed in this research are flow speed, depth, width and river discharge as well as sediment in the upstream and Musi watersheds. The upstream location and the Musi watershed are represented by 4 measurement points, namely point 1 (Gegasan River), point 2 (meeting of the Gegasan River and Lanang River), point 3 (Lanang River) and point 4 (flow of the Gegasan River and Lanang River towards the River Musi). Speed is carried out by measuring in situ using a current meter when it is not raining and after it rains. The current speed measurement results obtained are averaged to represent the river flow speed in each condition.

Results of measuring river flow speed in the upstream and Musi watersheds can be seen in Table 1. It can be seen that the highest average current speed in the upstream and Musi watersheds is 0.08 m/s and the lowest is 0.04 m/s when it is not raining. Meanwhile, after the rain, the highest current speed was 0.19 m/s and the lowest was 0.15 m/s. River flow speed is influenced by topography and river depth, because the shape of the river basin has an influence on river flow patterns (Wisha et al., 2017). According to Staddal et al. (2017), the shape of the river greatly influences the time it takes for the river to flow, a watershed that is wide or circular has a slower effect on the rate and volume of surface flow, compared to a watershed that is elongated and narrow. In this study, river discharge was obtained based on calculation results using Equation 1, with the river cross-sectional area calculated using Equation 2. The results of parameter measurements and discharge calculations are as shown in Table 1.

Table 1. Results of Measurements and Calculations of Width, Depth and Cross-Sectional Area of the Musi River Upstream and Watershed

Research point	River width (m)	River depth (m)						A(m)	
		Th			Sh				
		c	d	e	c	d	e	Th	Sh
Point 1	9.99	0.60	0.50	0.45	1	0.70	0.55	10.24	10.99
Point 2	21.91	1.20	2.70	0.83	1.20	2.80	1.10	81.40	82.82
Point 3	11.47	0.42	1.50	1.35	0.50	1.60	1.70	27.36	34.64
Point 4	17.92	0.30	0.95	1	0.60	1	1.05	28.67	42.11

Information: Th = No rain, Sh = After rain

Based on Table 1, it can be seen that the widest river width is at the confluence of the Gegasan River and the Lanang River, namely 21.91 m, and the narrowest river width is at the downstream Gegasan River, namely 9.99 m. This widening of the river is caused by erosion of the left and right sides of the river so that it expands and the results of the river erosion can settle in the river and reduce the capacity of the river. The measurement results showed that the highest river depth value occurred at point 2, where this point is the confluence of the Lanang River and Gegasan River with a depth value reaching 1.7 m in conditions after rain. Meanwhile, in non-rainy conditions, the river depth is 1.5 m. As a result of the meeting between these two rivers, the speed of the river flow increases, resulting in an erosion event which has an impact on increasing the depth at that point, where the river flow rate is greatly influenced by the flow speed and depth of the river (Puteri et al., 2020; Miardini, 2019; Elpiyani et al., 2023). The results of river discharge calculations can be seen in Table 2.

Table 2. Results of Measurements and Calculations of River Discharge

Point	Wide	V(m/s)		A (m^2)		Q (m^3/s)	
		Th	Sh	Th	Sh	Th	Sh
Point 1	9.99	0.05	0.16	10.24	10.99	0.508	1.85
Point 2	21.91	0.07	0.17	81.4	82.82	5.37	14.5
Point 3	11.47	0.04	0.15	27.36	34.64	1.16	5.44
Point 4	17.92	0.08	0.19	28.67	42.11	2.37	8.27

Information: Sh = after rain, Th = no rain, V = river flow speed, A = cross-sectional area of the river, Q = river discharge

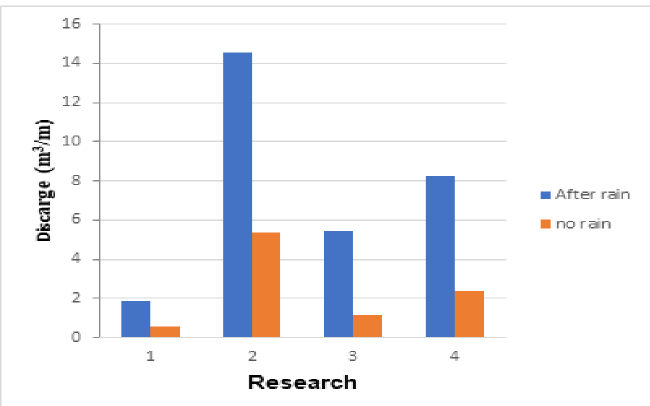

Figure 3. Upstream river flow discharge and the Musi watershed

Results shown in Table 2 show that the discharge value increases at all measurement points after the rain. This condition shows that the intensity of rainfall greatly influences water discharge in upstream streams and the Musi watershed. Apart from that, the cross -sectional area at point 2 has the largest area compared to the other measurement points, namely 81.40 m^2 when it is not raining. Meanwhile, after the rain the cross-sectional area reached 82.82 m^2. The cross-sectional area at point 2 is influenced by the increase in river width at point 2, causing point 2 to have a higher river discharge compared to other research points.

Figure 3 shows that the highest discharge occurs at point 2, namely at the confluence of the Gegasan River and the Lanang River, both after rain and when it is not raining, namely 14.50 m^3/s after rain and 5.37 m^3/s when it is not raining. Even though at point 2 the river has a relatively small depth, the river speed is greater than at other points. Apart from that, the large slope of the river also influences the flow speed, so that the flow discharge at the confluence of the Gegasan River and the

Lanang River is quite large. The increasing river flow caused by this rainfall will further increase the potential for flooding in the area. This is in accordance with Staddal et al. (2017) and Yulisa et al. (2016) who stated that the intensity of rainfall on surface flow is very dependent on the infiltration rate, so that surface runoff occurs in line with increasing rainfall.

Suspended Load

The results of the laboratory analysis of suspended sediment were then calculated using Equation 6, the results of which can be seen in Table 3. It can be seen that the highest suspended load discharge was found at the confluence of the Gegasan and Lanang Rivers towards the Musi River, namely 1.13 kg/s after the rain, whereas when it is not raining the suspended load discharge is 0.30 kg/s. The greater the river flow, the more floating sediment is transported. According to Supiyati et al. (2022) and Supiyati et al. (2021) sediment transport is the movement of particles generated by acting forces and one of the factors that influence these acting forces is current speed. If the current speed is strong, it can cause sediment movement and if the current speed is weak, the particles will remain still and settle on the river bed as a result of this deposition, bed load is formed (Monecke et al., 2015; Atmodjo, 2010).

Table 3. Flying Sediment Parameters

Research Point	Conversion Factor	Q (m^3/s)		Cs (mg/l)	
		Th	Sh	Th	Sh
Point 1	0.001	0.58	1.85	24	36
Point 3	0.001	1.16	5.44	30	48
Point 4	0.001	2.37	8.27	91	102

Information: Sh = after rain, Th = no rain, Q = river flow discharge, Cs = suspension concentration, Qs = floating sediment discharge

Bed Load

The amount of bottom sediment transport in conditions after rain is greater than in conditions without rain. This is caused by the weak current speed so that sediment transport can only transport small sediment particles (Ansar & Sulistiawaty, 2014; Antari et al., 2020; Wahyudi et al., 2024; Azhari et al., 2024). Based on the results of laboratory analysis, in the form of a sediment grain size distribution map as can be seen in Figure 4(a), it can be seen that the distribution of bottom sediment grains after rain on the Gegasan River is 1.4 mm as shown in white. The Lanang River has dominant grains measuring 0.5 mm which are shown by the brown color. Meanwhile, at the confluence of the Gegasan River and Lanang River, and the river flows towards the Musi River, the grain size is 600 µm, which is indicated by the color dark green and some light green.

The distribution of bottom sediment grains in non-rainy conditions, as can be seen in Figure 4(b), was obtained in the Gegasan River and Lanang River. The dominant distribution of sediment particles was 1.4 mm, which is indicated by the white color. Meanwhile, at the confluence of the Gegasan River and Lanang River, and the river flows towards the Musi River, the grain size is 600 µm, which is indicated by the color dark green and some light green.

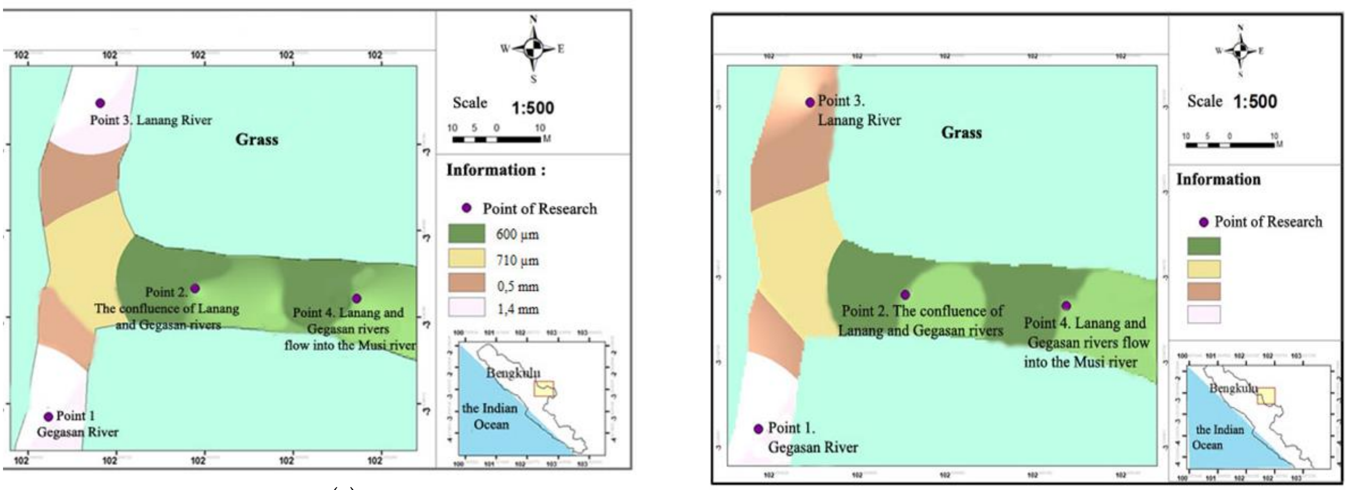

Figure 4. Distribution of bottom sediment: a) Condition after rain; b) conditions without rain

Judging from the results of laboratory analysis, the texture of basic sediment samples obtained after rain shows that in the Gegasan River, the dominant texture percentage was 73.68% sand, 9.86% clay and 16.46% dust. The dominant texture percentage of the Lanang River is 70.01% sand, 9.92% clay, and 20.08% dust. At the confluence of the Gegasan River and the Lanang River, the dominant texture percentage is 67.83 % sand, 15.58% clay, and 16.58% dust. Meanwhile, the location of the Gegasan River and Lanang River towards the Musi River is dominated by 63.52 % sand, 15.27% clay and 21.20% dust. In non-rainy conditions, the texture of the basic sediment samples obtained for the Gegasan River showed that the dominant texture percentage was 77.77 % sand, 8.93% clay, and 13.30% dust. The dominant texture percentage of the Lanang River is 64.59% sand, 13.71% clay, and 21.71% dust. At the confluence of the Gegasan River and the Lanang River, the dominant texture percentage is 68.89% sand, 15.57% clay, and 15.54% dust. Meanwhile, the flow of the Gegasan River and Lanang River towards the Musi River is dominated by 62.20 % sand, 14.84% clay and 22.95% dust.

Based on the percentage of basic sediment texture in the upstream and Musi watersheds, both after rain and non-rainy conditions, it shows that the highest percentage of texture is basic sediment in the form of sand. This is caused by erosion in the upstream river. Apart from that, the bathymetric conditions of the river are not too deep and the river flow speed is small, resulting in more sediment being deposited, due to the lack of pushing force to move the bottom sediment. Even though sand is a fairly large particle and requires a fairly large current speed to move it (Amri, 2022). Highly turbulent flow speeds will deposit coarser material more quickly than fine grains (Dianpurnama, 2013). This is in accordance with Nursiani et al. (2020), Supiyati (2022), Andayani et al. (2019) which states that the larger the sediment grain size, the greater the current speed required to transport the particles, and vice versa.

The bottom sediment load is particles that move by rolling, jumping and sliding. The bottom sediment discharge in this study was obtained based on calculations using Equation 2.5, and the bottom sediment transport volume using Equation 2.6, with time (t) is 60 minutes. The calculation results can be seen in Table 4.

Table 4. Sediment Discharge and Volume

Research point	ρ_S(kg/m^3)		Qb(kg/s)		V(m^3)		T (s)
	Th	Sh	Th	Sh	Th	Sh	
Point 1	1818	1965	3×10^{-4}	2×10^{-4}	6×10^{-4}	3×10^{-4}	3600
Point 2	1442	1533	32×10^{-4}	43×10^{-4}	81×10^{-4}	101×10^{-4}	3600
Point 3	936.50	1939	-3×10^{-4}	16×10^{-4}	-1×10^{-4}	29×10^{-4}	3600
Point 4	1657	2089	13×10^{-4}	23×10^{-4}	28×10^{-4}	39×10^{-4}	3600

Information: Sh = after rain, Th = no rain, ρ_s= sediment density, Qb = bottom sediment discharge, V = sediment volume

The results of calculating sediment discharge and volume based on Table 4 show that there is an increase in sediment volume when the sediment discharge is greater, both after rain and after rain. The highest volume of sediment is found at the confluence of the Gegasan River and the Lanang River when it is not raining at 81×10^{-4} m^3 and after rain it is 101×10^{-4} m^3. At point 3, you can see that the sediment volume value is negative, this shows that at point 3, namely in the Lanang River, sediment transport occurs in the river flow. In accordance with Mokonio et al. (2013) stated that a negative value (-) indicates that sediment transport (erosion) is occurring. Meanwhile, a positive value (+) indicates sediment deposition (sedimentation).

Total Sediment Discharge

The total sediment discharge is the sum of the elevated sediment discharge and the bottom sediment discharge. The total sediment discharge calculation is carried out using Equation 9. The results of the total sediment discharge calculation are as shown in Table 5, where it can be seen that the highest total sediment discharge value is at point 2, namely the confluence of the Gegasan River and the Lanang River, with a value of 30×10^{-2} kg/ s when it doesn't rain, whereas after rain the total sediment discharge is 113×10^{-2} kg/s.

Table 5. Total Sediment Discharge

Research point	Qs (kg/s)		Qb (kg/s)	
	Th	Sh	Th	Sh
Point 1	0.01	0.07	3×10^{-4}	2×10^{-4}
Point 2	0.30	1.13	32×10^{-4}	43×10^{-4}
Point 3	0.03	0.26	-3×10^{-4}	16×10^{-4}
Point 4	0.22	0.85	13×10^{-4}	23×10^{-4}

Information: Sh = after rain, Th = no rain, Qs = elevated sediment discharge, Qb = bottom sediment discharge, Qt = total sediment discharge.

The confluence of the Gegasan River and the Lanang River is a location that has the potential for flooding. This is because this location has a high total sediment discharge, resulting in rapid sedimentation and shallowing in this area.

Flood Analysis

The flooding that occurred around the Musi watershed can be seen from the rainfall that occurred during the flood, namely rainfall in April 2019. In the form of a rainfall graph for April 2019 and based on observations at three different times before and after the flood event as can be seen in Figure 5. The highest rainfall intensity value was seen on April 12, 2019 at 120 mm per hour. However, a flood event occurred on April 26 2019 with a lower rainfall intensity compared to the intensity on April 12, 2019.

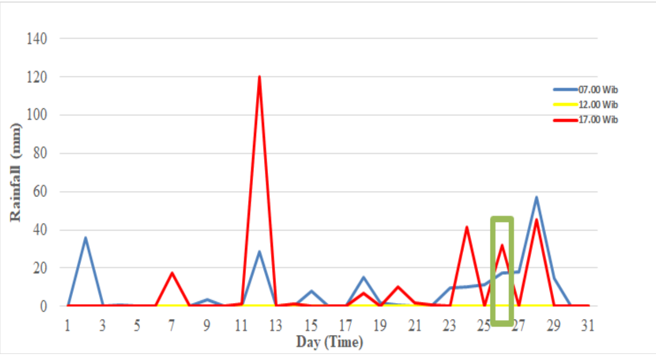

Figure 5. Rainfall in 2019 (BMKG, 2019)

Events occurred due to high rainfall, resulting in an increase in the water level of the Musi River as shown in Figure 6 with rainfall intensity reaching 18.2 mm. The high water level condition causes the intake of the Musi Hydroelectric Power Plant which is located in the downstream part of the Musi River Basin to exceed its intake capacity, because the Musi Dam is unable to accommodate river flow due to the accumulation of previous rain. For this reason, the hydropower plant opened the intake because the maximum intake capacity is 579.2 m above sea level. Opening the intake is carried out if the discharge level at the intake has reached the maximum usage for the hydropower generator. Apart from that, the flood that occurred on April 26 2019 was greatly influenced by the physical parameters of the river.

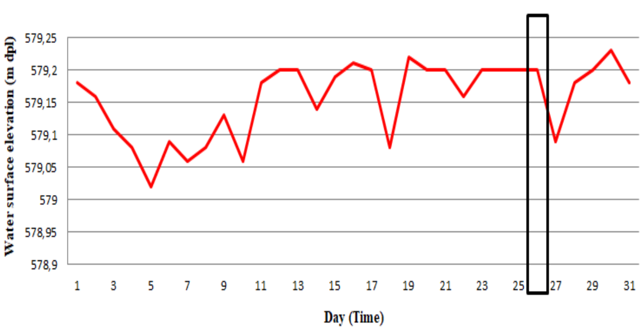

Figure 6. Musi river water level elevation in April 2019 (PLTA, 2019)

The results of this research show that the discharge and sediment volume are increasing in the area where the Gegasan River and Lanang River meet. This condition results in when there is high rainfall, the capacity of the upstream and catchment areas of the Musi River as well as the land around the river experiences saturation point and is unable to accommodate unstable rainfall. Another physical parameter that influences flooding is the bathymetric condition of the river bed which is deeper (lower) in the area where the Gegasan River and Lanang River meet compared to the downstream area, namely in the Musi watershed as can be seen in Figure 7.

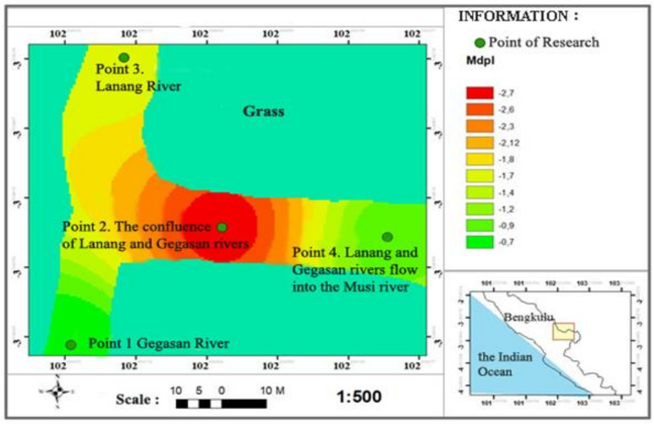

Figure 7. Bathymetry of the upper river bed and the Musi watershed

Difference in elevation causes the flow to reverse direction, so that the water will pile up at the confluence of the Gegasan River and the Lanang River. The higher the rainfall, the river water level will increase and this will be accompanied by increased sediment so that the river flow will become narrower (Cahyadi et al., 2017; Hambali & Apriyanti, 2016). This condition causes the river flow to be unable to accommodate the river water which continues to increase, resulting in flooding of villages around the river flow, especially Tanjung Alam Village, Air Hitam Village, and Bali Village which are passed by the Gegasan River and Lanang River, which then merge into a sub-district, river that flows into the Musi River. This will be further exacerbated if the Musi Hydroelectric Power Plant intake is opened, river discharge will increase, because the water flow due to the opening of this intake reverses direction and does not completely flow downstream.

Conclusion

Based on the results of the research that has been carried out, it can be concluded that the characteristics of the physical parameters that influence the potential for flooding in the upstream river and Musi watershed obtained after the rain, the river flow is 14.50 m^3/s, floating sediment discharge 1.13 kg/s, bottom sediment discharge 43 x 10^{-4} kg/s, and total sediment discharge 113 x 10^{-2} kg/s. While the condition is not raining, the river flow discharge is 5.37 m^3/s, the floating sediment discharge is 0.30 kg/s, the bottom sediment discharge is 32 x 10^{-4} kg/s, and the total sediment discharge is 30 x 10^{-2} kg/s. The dominant sediment texture is sand, clay and silt with a grain size of 1.4 mm - 600 µm. The river bathymetry has a lower elevation at the confluence of the Gegasan River and Lanang River which causes the river currents to reverse, if there is an increase in rainfall it will cause flooding in the area around the river. The highest values at the confluence of the Gegasan River and the Lanang River. Conditions after the rain obtained a river flow discharge of 14.50 m^3/s, a floating sediment discharge of 1.13 kg/s, a bottom sediment discharge of 43 x 10^{-4} kg/s, and a total sediment discharge of 113 x 10^{-2} kg/s. s. In non-rainy conditions, the river flow discharge was 5.37 m^3/s, the drift sediment discharge was 0.30 kg/s, the bottom sediment discharge was 32 x 10^{-4} kg/s, and the total sediment discharge was 30 x 10^{-2} kg/s. s. The dominant sediment texture is sand, clay and dust with grain sizes ranging from 1.4 mm - 600 µm. The bathymetry of the upstream and Musi watersheds has a lower elevation difference at the confluence area of the Gegasan River and the Lanang River which causes the river flow to experience backflow, resulting in the river not being able to flow downstream. If there is an increase in rainfall it will cause flooding in the area around the river. namely Tanjung Alam Village, Air Hitam Village, and Bali Village.

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Conflicts of Interest
No conflict interest.

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