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Flood Tracking in the Cimeta River, West Bandung Regency

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ABSTRACT

The *Cimeta* River, located in West Bandung Regency, plays a vital role in the region's hydrological system and supports the local community. However, the area is frequently affected by flooding caused by heavy rainfall, unplanned land use changes, and insufficient drainage capacity. This study aims to identify flood-prone critical points along the *Cimeta* River and analyze the contributing factors. A quantitative descriptive approach was applied using hydrological modeling with HEC-HMS and hydraulic analysis with HEC-RAS. Rainfall data from the past 15 years were used to estimate design flood discharges, which were then simulated to assess the river's capacity. The results indicate that the peak discharge for a 50-year return period (*Q*50) is 155 m³/s, which exceeds the current river channel capacity and poses a risk of flooding in several river segments. The study recommends river normalization through dredging, channel widening, and bank reinforcement to reduce future flood risks. These findings are expected to support more effective and sustainable flood mitigation policies.

Keywords: cimeta river, flood, hec-hms, hec-ras, river normalization, critical points

INTRODUCTION

The Cimeta River plays a vital role for surrounding communities in West Java across social, economic, and ecological dimensions (Djuangsih, 1993). As a tributary within the broader Citarum basin, the Cimeta River's sub-watershed (Sub-DAS Cimeta) contributes significant sediment load to the downstream Cirata Reservoir, with an estimated sedimentation rate of 934,714.322 tons/year—a consequence of high erosion driven by land-use changes in the upstream area (Nurrohman & Adlina, 2018). Within Sub-DAS Cimeta, forest cover is minimal, accounting for only approximately 9.07% of the total area (Nurrohman & Adlina, 2018). Hydrologically, the river has demonstrated notable flood discharge values, reaching up to 85.42 m³/s (Aditya et al., 2017). Additionally, Sub-DAS Cimeta spans approximately 169.15 km² and serves a critical function in supplying water for local irrigation, domestic use, and as input to the Cirata Reservoir (Widiatmoko et al., 2020). Given its importance, effective management of the Cimeta River and its sub-watershed is crucial for ensuring water security and environmental stability.

As part of a complex hydrological system, the Cimeta River supports a wide range of human activities such as agriculture, fisheries, and the provision of clean water. In addition, the river is a habitat for diverse flora and fauna, contributing significantly to regional biodiversity. Globally, rivers support approximately a third of all food production, and about 70% of freshwater withdrawals are used for agriculture—making rivers indispensable to food security and livelihoods (Manohar et al., 2022). Riparian vegetation along riverbanks plays a crucial ecological role, stabilizing streambanks, filtering nutrients and sediments, and creating diverse in-stream habitats that support aquatic communities (USDA, n.d.). Healthy river ecosystems maintain ecosystem services such as clean water provision, nutrient cycling, erosion control, and cultural benefits, which collectively elevate environmental quality and community well-being (Wikipedia, 2025). The maintenance of environmental flows in rivers is essential for protecting biodiversity, aquatic ecosystems, and the cultural and ecological services they provide to societies (Anderson et al., 2019). Moreover, river connectivity enhances ecosystem health and recreational opportunities while ensuring environmental quality critical for human use and ecosystem functioning (Arboleya et al., 2021).

However, in recent years, the *Cimeta* River has experienced significant pressure due to changes in land use and inadequate drainage systems. Flooding has become a major problem, especially during the high-intensity rainy season (Ginting, 2021). This is exacerbated by poorly planned land management, which increases the risk of surface runoff and decreases soil infiltration capacity (Kingsbury-Smith et al., 2023). Flooding can cause damage to homes, roads, and other public facilities (Lulang et al., 2024).

The impacts of flooding along the *Cimeta* River are very detrimental—economically, socially, and environmentally. Damage to infrastructure, loss of agricultural land, environmental pollution, and health problems due to contaminated water are real consequences of these disasters (Radulescu et al., 2023), leading to high repair costs and disrupting economic activity (Lulang et al., 2024). In addition, floods can also trigger social conflicts and unwanted population displacement (Dewi et al., 2023).

Therefore, a deeper understanding of the physical characteristics of the *Cimeta* River and the factors that trigger flooding is needed. This study aims to identify river segments with the potential to become flood critical points, as well as analyze the physical conditions of the river and the factors causing flooding. The approach used is qualitative, aiming to further explore public perceptions and governance policies in river management (Miyori & Chofyan, 2023). The results of this study are expected to provide useful recommendations for flood management and the sustainable management of the *Cimeta* River.

A critical review of existing literature reveals significant gaps in current flood management approaches. Chalid et al. (2021) conducted a comprehensive study on river normalization in the nearby *Cisangkuy* watershed, but their focus on structural interventions alone failed to address the socio-ecological dimensions of flood risk. Similarly, Kingsbury-Smith et al. (2023) explored natural flood management strategies but lacked quantitative hydrological analysis to validate their effectiveness. This study addresses these limitations by integrating advanced hydrological modeling (HEC-HMS/HEC-RAS) with community-based vulnerability assessments, offering a more holistic approach to flood risk reduction. The research aims to: (1) identify flood-prone critical points along the *Cimeta* River through hydraulic simulation, and (2) analyze both physical and anthropogenic contributing factors. The findings are expected to provide evidence-based recommendations for local policymakers while enhancing community flood preparedness, ultimately contributing to more sustainable watershed management practices in the region.

METHOD

This research uses a quantitative descriptive approach to describe the existing condition of the *Cimeta* River and identify segments that have the potential to become flood critical points. This approach is based on secondary data, without direct measurements in the field, so the analysis is focused on information obtained from reliable sources such as scientific journals, online news, and technical reports from relevant agencies.

The research location is on the *Cimeta* River, a tributary of the *Citarum* River, located in *Cipatat* District, West Bandung Regency, West Java Province. This river is included in the *DAS* (*Daerah Aliran Sungai*, or watershed), which is characterized by a significant increase in discharge during the rainy season and is known as a flood-prone area.

The types of data used in this study are entirely secondary and include:

1. Annual Maximum Daily Rainfall (*HHMT*) data obtained from PT PLN *Nusantara Power UP Cirata*;
2. Watershed maps compiled using HEC-HMS software
3. Historical data on river discharge obtained from the *Citarum River Area Center* (*BBWS*); and
4. Spatial data and region mapping analyzed using ArcGIS software.

The data collection process is carried out through two main methods. First, hydrological data such as rainfall and river discharge are collected from official agencies such as *BMKG* and *BBWS Citarum*, which are then used as input for hydrological and hydraulic modeling. Second, a literature study is conducted to obtain relevant theoretical references and support the validity of the methods used in the analysis.

To support technical analysis, this research utilizes two main software applications. HEC-HMS (*Hydrologic Modeling System*) is used to simulate the hydrological response of the *Cimeta* watershed to rainfall by considering land characteristics, land use, and climatological conditions (Simanjuntak et al., 2023). This model produces output in the form of peak discharges for various return periods (*Q*2, *Q*5, *Q*10, *Q*25, *Q*50, and *Q*100), which are then used as inputs in hydraulic analysis.

Furthermore, HEC-RAS (*River Analysis System*) is used to analyze flows in open channels based on river geometry data and the discharge results from HEC-HMS (Bimantoro et al., 2024). This model provides information regarding the water level profile, river flow capacity, and potentially flooded areas. In addition to describing existing conditions, HEC-RAS is also used to simulate flood control scenarios, in order to evaluate the effectiveness of alternative treatments.

RESULTS AND DISCUSSION

Cimeta River Hydraulics Data

Hydraulic data is data obtained using HEC-HMS and HEC-RAS software analysis which includes hydrological conditions. The area of the watershed (watershed), and the length of the channel. The data from the measurement results of the Cimeta River is presented as follows.

- Area of the river basin (watershed) (A) = 24,813 km2
- River length (L) = 16.64 km2

Hydrometric Data

Hydrometric data is data obtained from PT PJB BPWC (Java Bali Power Plant-Cirata Reservoir Management Agency). In the form of maximum daily rainfall data for the last 15 years, starting from 2002-2016 which will be used as input data in the analysis of this study. The maximum daily rainfall can be seen in table 1.

Daily Climatology Information Services:

- Data : Annual Maximum Daily Rainfall (HHMT)
- Observation location : Cimeta Rainfall Post
- Coordinates : Lie 6°49'9.18"S – Long 107°19'55.19"E

Based on the daily maximum rainfall data obtained from PT PJB BPWC (Java Bali Plant - Cirata Reservoir Management Agency) which is contained in table 1 as follows:

Table 1. Annual Maximum Daily Rainfall Data Recapitulation

Year	Year	Annual Max
1	2002	81.0
2	2003	88.0
3	2004	133.5
4	2005	74.0
5	2006	83.5
6	2007	90.5
7	2008	95.0
8	2009	70.0
9	2010	86.0
10	2011	89.5
11	2012	94.5
12	2013	138.4
13	2014	81.0
14	2015	109.0

Year	Year	Annual Max
15	2016	104.0

Source: Cimeta Rainfall Post

Selection of Distribution Type
Determining the size of the statistics

Table 2. Statistical Big Calculation

Cs dan Ck (Metode Gumbel)						
No	Tahun	R (mm)	$(X_i - X_{rata-rata})$	$(X_i - X_{rata-rata})2$	$(X_i - X_{rata-rata})3$	$(X_i - X_{rata-rata})4$
1	2002	81	-13.53	182.97	-2474.9838	33478.2811
2	2003	88	-6.53	42.60	-278.0189	1814.5366
3	2004	134	38.97	1518.92	59197.4032	2307120.1266
4	2005	74	-20.53	421.34	-8648.7888	177530.8038
5	2006	84	-11.03	121.59	-1340.7035	14783.4904
6	2007	91	-4.03	16.21	-65.2886	262.8952
7	2008	95	0.47	0.22	0.1060	0.0502
8	2009	70	-24.53	601.56	-14754.1973	361871.2788
9	2010	86	-8.53	72.70	-619.9232	5285.8781
10	2011	90	-5.03	25.27	-127.0107	638.4404
11	2012	95	-0.03	0.00	0.0000	0.0000
12	2013	138	43.87	1924.87	84450.4358	3705122.1215
13	2014	81	-13.53	182.97	-2474.9838	33478.2811
14	2015	109	14.47	209.48	3031.8359	43880.7718
15	2016	104	9.47	89.74	850.1752	8053.9935
Jumlah, Σ		1418	0.0000	5410.4493	116746.0578	6693320.9492
Jumlah data, n		15				
Rata-Rata		94.53	Cs	1.266		
Standar Deviasi, S		19.66	Ck	0.308		

Source: Statistical analysis based on rainfall data from PT PJB BPWC (2002–2016)

Determining the type of Distribution to use:

Table 3. Calculation of Distribution Type Selection

Distribution Types	Condition	Cs	Ck	Conclusion
Usual	Cs = 0, Ck = 3	1.266	0.308	Not Compliant
Normal Logs	Cs = 3, Ck = 5.383	1.773	0.377	Not Compliant
Log Pearson III	C ≠ 0, Ck = 3.873	0.876	0.266	Not Compliant
Gumbel	Cs > 1.1396, Ck < 5.4002	1.266	0.308	Meet

Source: Distribution calculation results using the Gumbel method based on PT PJB BPWC rainfall data

Based on the table above, the method that can be used for the analysis of planned rainfall is the Gumbel Method because the Cs value > 1.1396 and the Ck value < 5.4002.

RAPS *Outlier*

RAPS outlier is used to see if the rainfall data from year to year is homogeneous or if there are abnormal values.

RAPS Concentration Test

The RAPS concentration test is used to see whether extreme rainfall accumulates in a given period or not.

Table 4. RAPS Consistency Test

No.	Year	Xi	Sk*	by2	Sk**
1	2002	81.0	-13.527	18.3	-0.86
2	2003	88.0	527	43	-0.41
3	2004	123.5	38.973	151.9	2.47

No.	Year	Xi	Sk*	by2	Sk**
4	2005	74.0	-20.527	42.1	-1.30
5	2006	33.5	-11.027	12.2	-0.70
6	2007	90.5	027	16	-0.26
7	2008	95.0	0.473	0.0	0.03
8	2009	70.0	-24.527	60.2	-1.56
9	2010	86.0	527	7.3	-0.54
10	2011	39.5	9.027	25	-0.32
11	2012	94.5	-0.027	0.0	0.00
12	2013	138.4	138400	1915.5	8.87
13	2014	81.0	81.000	656.1	5.14
14	2015	109.0	109.000	1188.1	6.91
15	2016	104.0	104.000	1081.6	6,60
Average		**94.53**	**2,47**	**5141.6**	
Sum		Q			
Dy	**15.76939**	R	4.03	**RAIN STATION MEETS TEST CONSISTENCY**	
Sk max**	2.47	a/n*0.5	0.64		
Sk min**	-156	R/n405	1.04		

Source: Data consistency testing using the RAPS (Rescaled Adjusted Partial Sums) method based on PT PJB BPWC rainfall data

Maximum Rain Data *Outlier* Test

The *maximum rain outlier* test is used to check whether there is a maximum rain value that is too extreme to be suitable for use in the analysis.

Table 5. Maximum Rain Data Outlier Test

No.	Year	LogX	LogX-logXr	$(LogX-logXr)^2$	$(LogX-logXr)^3$
1	2002	see	i908	1,908	3,642
2	2003	Sso	i944	1,944	3,781
3	2004	133.5	2,125	2,125	4,518
4	200s	740	i869	1,869	3,494
5	2006	835	1,922	1,922	3,693
6	2007	905	1,957	1,957	3,828
7	200s	950	i978	1,978	3,911
8	2009	700	is4s	1,845	3,404
9	2010	860	1,934	1,934	7,239
10	2011	Sos	1,952	1,952	7,436
11	2012	945	1,975	1,975	7,709
12	2013	1384	2,141	2,441	9,816
13	2014	see	i908	1,908	6.951
14	2015	109.0	2,037	2,037	8,458
15	2016	104.0	2,017	2,017	8,206
Average		=	195		
Standard Deviation (Stdev)		=	0.07		
Skew ness (Cs)		=	1.36		
n		=	11		
Kn		=	2.247	(table)	
STA CIMETA					
Upper limit (XH)		=	128,57	Upper Limit Accepted	
Lower limit (XL)		=	60,77	Lower Limit Accepted	

Source: Extreme rainfall data outlier analysis using statistically defined upper (XH) and lower bound (XL)

Re-Period
2-Year Anniversary Period

Table 1. 2-year Anniversary Period

Duration t (min)	Mononobe			
	2-Year Anniversary Period			
	R24	R24/24	(24/t)²/3	(mm/h)
2	91.862	3.828	80.332	307.478
5	91.862	3.828	43.611	166.925
10	91.862	3.828	27.473	105.156
15	91.862	3.828	20.966	80.249
20	91.862	3.828	17.307	66.244
25	91.862	3.828	14.915	57.088
30	91.862	3.828	13.208	50.554
35	91.862	3.828	11.918	45.617
40	91.862	3.828	10.903	41.731
45	91.862	3.828	10.079	38.580
50	91.862	3.828	9.396	35.963
55	91.862	3.828	8.817	33.749
60	91.862	3.828	8.320	31.847

Source: Simulation of rain re-period using the Mononobe method based on PT PJB BPWC rainfall data

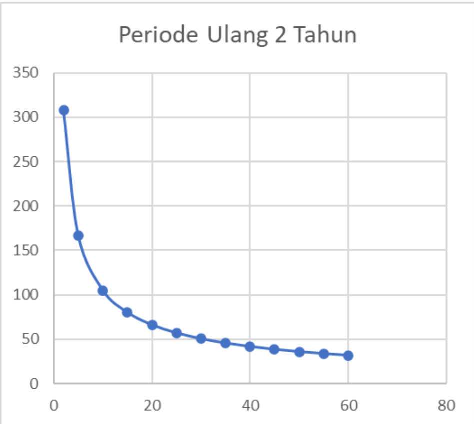

Figure 3. 2-Year Anniversary Period Chart

5-Year Anniversary Period

Table 7. 5-Year Anniversary Period

Duration t (minutes)	Mononobe			
	5-Year Anniversary Period			
	R24	R24/24	(24/t)²/3	(mm/h)
2	115.326	4.805	80.332	386.015
5	115.326	4.805	43.611	209.561
10	115.326	4.805	27.473	132.015
15	115.326	4.805	20.966	100.120
20	115.326	4.805	17.307	83.164
25	115.326	4.805	14.915	71.669
30	115.326	4.805	13.208	59.766
35	115.326	4.805	11.918	57.266
40	115.326	4.805	10.903	49.803
45	115.326	4.805	10.079	48.434
50	115.326	4.805	9.396	45.149
55	115.326	4.805	8.817	42.639
60	115.326	4.805	8.320	39.981

Source: Simulation of rain re-period using the Mononobe method based on PT PJB BPWC rainfall data

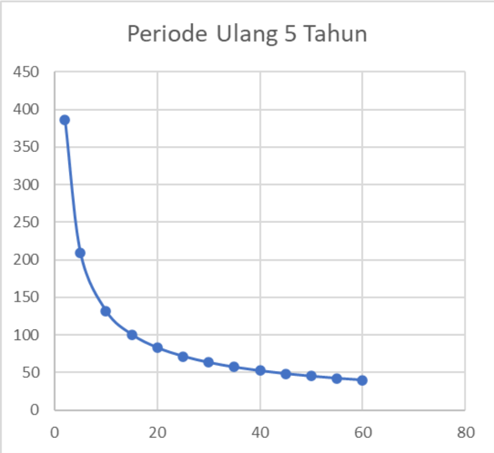

Figure 4. 5-Year Recurrence Period Chart

10-year Anniversary Period

Table 8. 10-Year Anniversary Period

Duration t (min)	Mononobe			
	10-Year Anniversary Period			
	R24	R24/24	(24/t)2/3	(mm/h)
2	130.859	5.452	80.332	438.005
5	130.859	5.452	43.611	237.786
10	130.859	5.452	27.473	149.796
15	130.859	5.452	20.966	114.316
20	130.859	5.452	17.307	94.366
25	130.859	5.452	14.915	81.322
30	130.859	5.452	13.208	71.167
35	130.859	5.452	12.018	64.948
40	130.859	5.452	11.023	59.444
45	130.859	5.452	10.079	54.957
50	130.859	5.452	9.396	51.229
55	130.859	5.452	8.817	48.076
60	130.859	5.452	8.320	45.366

Source: Simulation of rain re-period using the Mononobe method based on PT PJB BPWC rainfall data

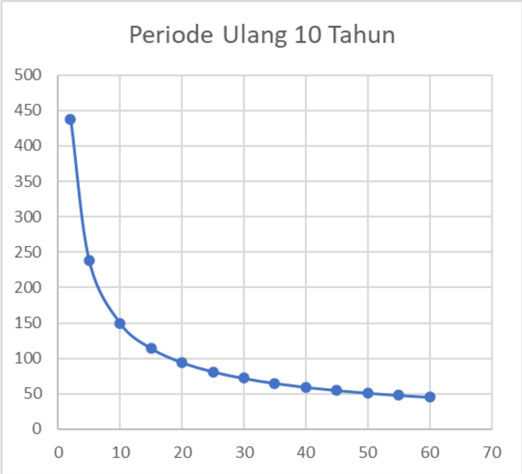

Figure 5. 10-Year Anniversary Period Chart

25-year anniversary period

Table 9. 25-year anniversary period

Duration t (min)	Mononobe			
	25-Year Anniversary Period			
	R24	R24/24	$(24/t)^{2/3}$	(mm/h)
2	145.565	6.065	80.332	487.231
5	145.565	6.065	43.611	264.510
10	145.565	6.065	27.473	166.631
15	145.565	6.065	20.966	127.163
20	145.565	6.065	17.307	104.971
25	145.565	6.065	14.915	90.961
30	145.565	6.065	13.208	80.106
35	145.565	6.065	12.027	72.728
40	145.565	6.065	10.903	66.127
45	145.565	6.065	10.079	61.134
50	145.565	6.065	9.396	56.279
55	145.565	6.065	8.817	53.479
60	145.565	6.065	8.320	50.465

Source: Simulation of rain re-period using the Mononobe method based on PT PJB BPWC rainfall data

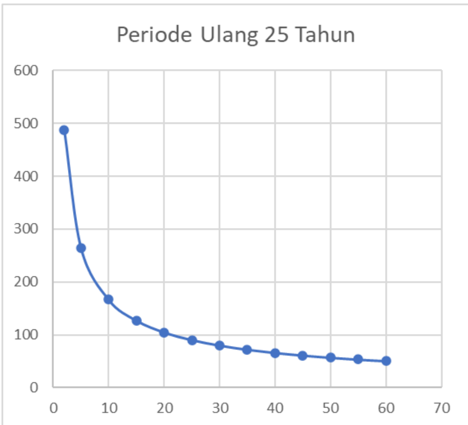

Figure 6. 25 Year Anniversary Period Chart

50-year anniversary period

Table 2. 50 Year Anniversary Period

Duration t (min)	Mononobe			
	50 Year Anniversary Period			
	R24	R24/24	$(24/t)^{2/3}$	(mm/h)
2	165.052	6.877	80.332	552.457
5	165.052	6.877	43.611	299.920
10	165.052	6.877	27.473	188.938
15	165.052	6.877	20.966	144.186
20	165.052	6.877	17.307	119.023
25	165.052	6.877	14.915	102.571
30	165.052	6.877	13.200	98.901
35	165.052	6.877	11.918	81.961
40	165.052	6.877	10.903	74.980
45	165.052	6.877	10.079	69.318
50	165.052	6.877	9.396	64.616
55	165.052	6.877	8.817	60.638
60	165.052	6.877	8.320	57.220

Source: Simulation of rain re-period using the Mononobe method based on PT PJB BPWC rainfall data

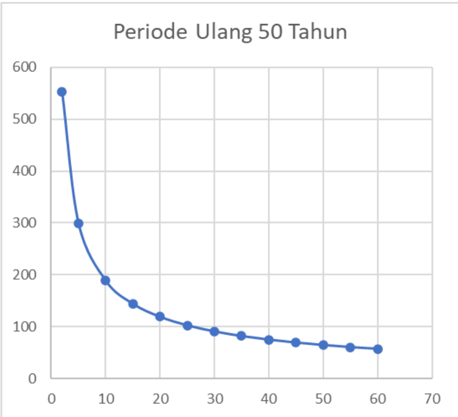

Figure 7. 50 Year Anniversary Period Chart

100-year anniversary period

Table 3. 100 Year Anniversary Period

Duration t (min)	Mononobe			
	100 Year Anniversary Period			
	R24	R24/24	$(24/t)^{2/3}$	(mm/h)
2	179.506	7.479	80.332	600.837
5	179.506	7.479	43.611	326.184
10	179.506	7.479	27.473	205.483
15	179.506	7.479	22.906	156.813
20	179.506	7.479	17.307	129.446
25	179.506	7.479	14.915	111.554
30	179.506	7.479	13.208	98.786
35	179.506	7.479	12.215	88.739
40	179.506	7.479	11.095	80.355
45	179.506	7.479	9.936	74.398
50	179.506	7.479	8.817	65.948
55	179.506	7.479	8.204	62.231
60	179.506	7.479	8.320	62.231

Source: Simulation of rain re-period using the Mononobe method based on PT PJB BPWC rainfall data

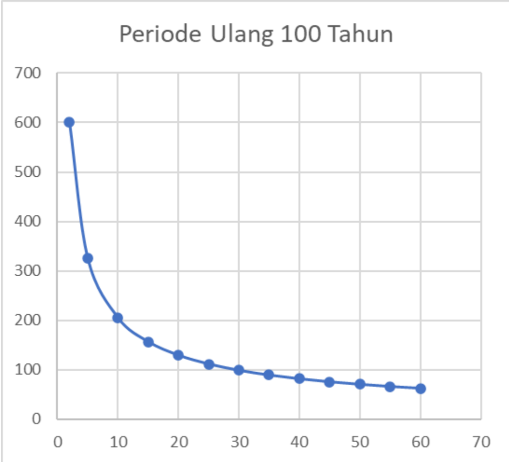

Figure 8. 100 Year Anniversary Period Chart

Flood Discharge Analysis

The calculation of the planned discharge on the Cimeta River was obtained using the SCS Curve Number (SCS-CN) method through the help of HEC-HMS software.

Table 4. Sub-Watershed Hydrology Parameters Used by HEC-HMS

No	Basin	Luas (km2)	L	L	C	S	S	Slope DAS,Y	tc	tl	tl	Initial	impervious
			km	ft		mm	in	%	(jam)	(jam)	(menit)	abstraction	
1	CIMETA 1	0,45540	3,08478	10120,67	67	125,1045	4,925373	0,25177	9,719894	5,831937	349,9162	25,02089552	5
2	CIMETA 2	2,70810	21,61120	70902,89	67	125,1045	4,925373	0,25817	45,55902	27,33541	1640,125	25,02089552	5
3	CIMETA 3	11,42800	11,36996	37303,02	67	125,1045	4,925373	0,19016	31,75644	19,05386	1143,232	25,02089552	5
4	CIMETA 4	10,22200	10,36558	34008	67	125,1045	4,925373	0,23137	26,73656	16,04194	962,5162	25,02089552	5

Source: Hydrological parameters are calculated using the SCS-CN (Soil Conservation Service Curve Number) method through HEC-HMS software

From the table above, the results of the HEC-HMS simulation with a C value of 67, S value is 125.104, initial abstraction is 25.0209, and impervious is 5.

Table 5. Average amount of discharge of SCS method re-period

Q2	Q5	Q10	Q25	Q50	Q100
88,8	109,9	123,9	141,7	155	168,1

Source: Results of planned flood discharge simulation using the Soil Conservation Service Curve Number (SCS-CN) method through HEC-HMS software,

Based on hydrological calculations using the established method (SCS), the peak discharge value for the 50-year re-period (Q50) was obtained of 155 m3/second.

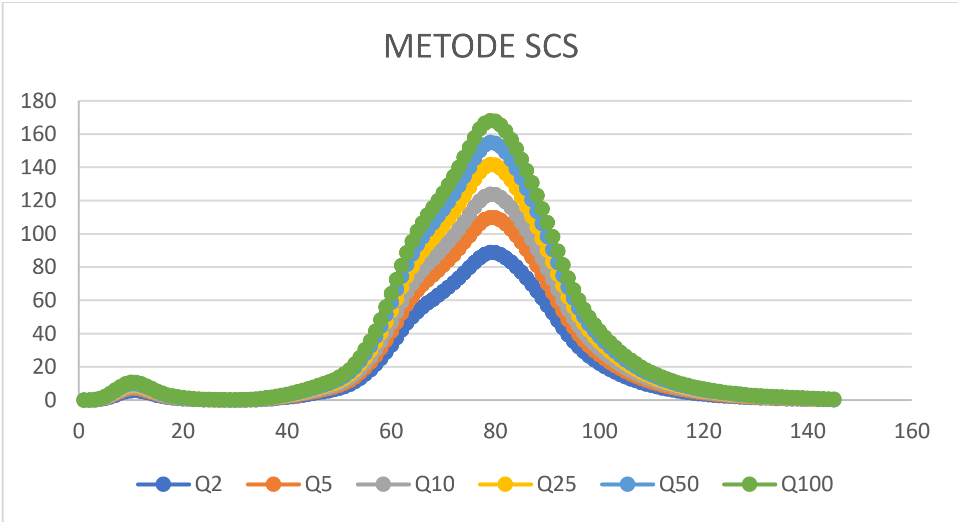

Figure 9. Hydrograph Watershed Cimeta
Source: Hydrographic simulation results using HEC-HMS based on rainfall data and Cimeta watershed parameters

Hydraulic Analysis Using HEC-RAS Modeling

Hydraulic analysis is needed to determine the capacity of river and channel channels under current conditions against planned flooding (Norman & Edijatno, 2017). In conducting this cross-sectional analysis, a calculation method was used using the HEC-RAS program.

HEC-RAS Simulation

The results of the simulation using HEC-RAS for the discharge of the 50-year plan can be seen in the following figure.

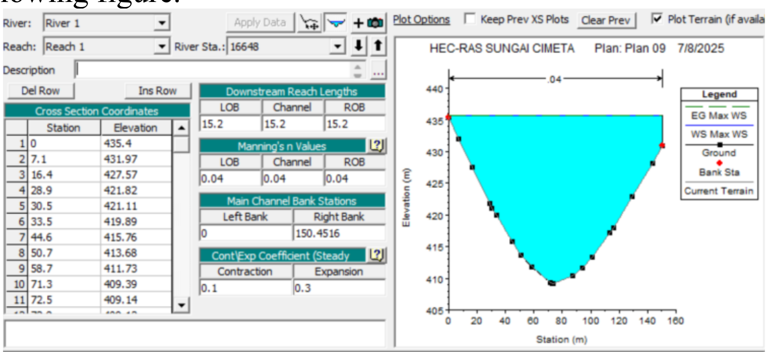

Figure 10. Existing Profile STA. 16+648 Q 50 Years
Source: River capacity simulation using HEC-RAS for discharge plan for the 50-year re-period (Q50) plan

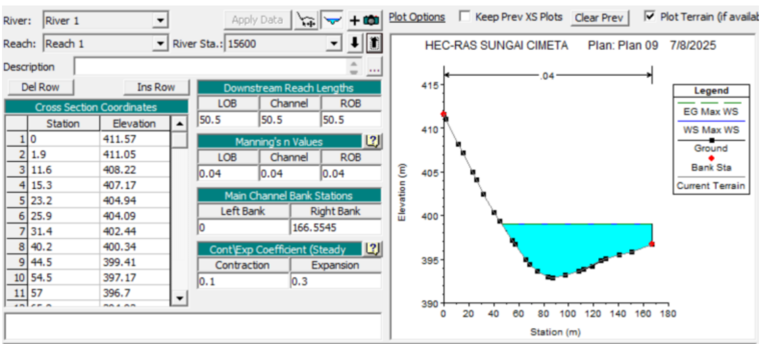

Figure 11. Existing Profile STA. 15+600 Q 50 Years
Source: River capacity simulation using HEC-RAS for discharge plan for the 50-year re-period (Q50) plan

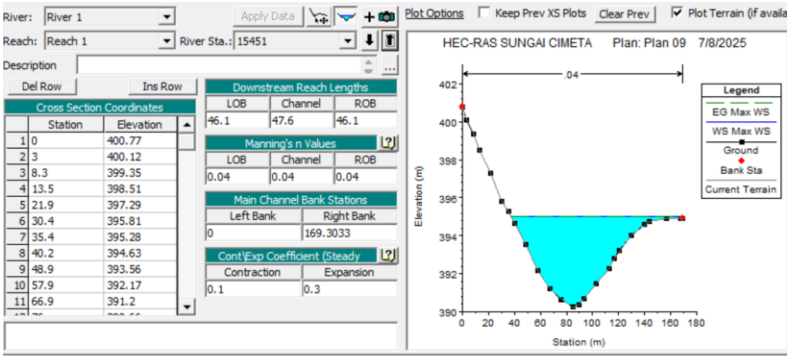

Figure 12. Existing STA Profile. 15+451 Q 50 Years

Source: River capacity simulation using HEC-RAS for discharge plan for the 50-year re-period (Q50) plan

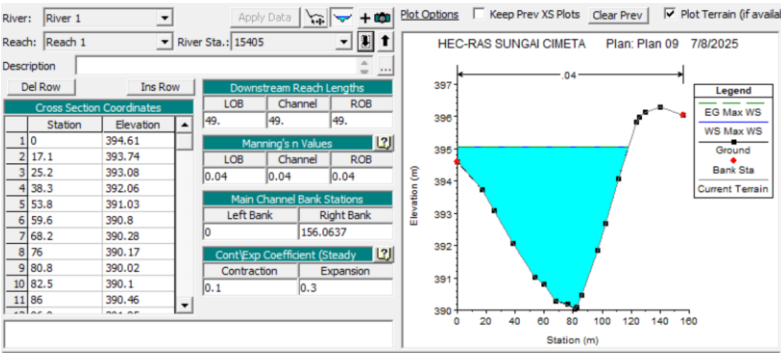

Figure 13. Existing STA Profile. 15+405 Q 50 Years

Source: River capacity simulation using HEC-RAS for discharge plan for the 50-year re-period (Q50) plan

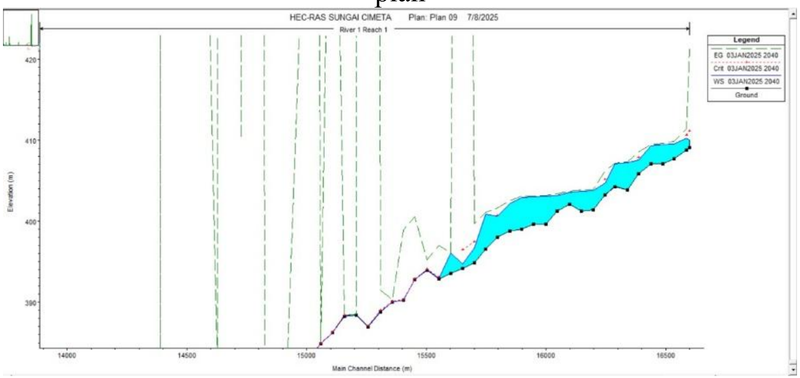

Figure 14. Cross Profile of the Cimeta River

Source: Cross-sectional analysis of the Cimeta river using field survey data and HEC-RAS

From the results of hydraulic analysis for the existing river cross-section, it was obtained that the elevation of the water level above the river mouth for the discharge period of 50 years was obtained, so that it can be concluded that the cross-section of the flood control plan was not able to drain the planned discharge.

Flood Conditions That Have Occurred Around the Cimeta River

Flooding around the Cimeta River often occurs due to heavy rains that cause the river to overflow. One of the significant events occurred in March 2025, when floods submerged dozens of houses and damaged infrastructure with water levels reaching 1.5 meters. A similar event was also recorded in 2019, showing a pattern of repeated flooding in the region.

Figure 15. The condition of the Cimeta River at the time of flooding
Source: https://www.detik.com/jabar/berita/d-7825051/luapan-air-sungai-cimeta-rendam-25-rumah-di-cipatat#google_vignette

Figure 16. Impact of the Cimeta River flood
Source: https://bandung.kompas.com/read/2025/03/16/115611578/2-kampung-di-bandung-barat-porak-poranda-akibat-banjir-luapan-sungai-cimeta

The flood in the Cimeta River occurred on Saturday afternoon, March 15, 2025, in Nyalindung Village, Cipatat District, West Bandung Regency. This event was triggered by high rainfall intensity exacerbated by the impact of climate change. Floods caused significant damage, including submerged homes, loss of property, and damage to infrastructure such as roads, bridges, and public facilities, which also disrupted the social and economic activities of the local community.

Discussion

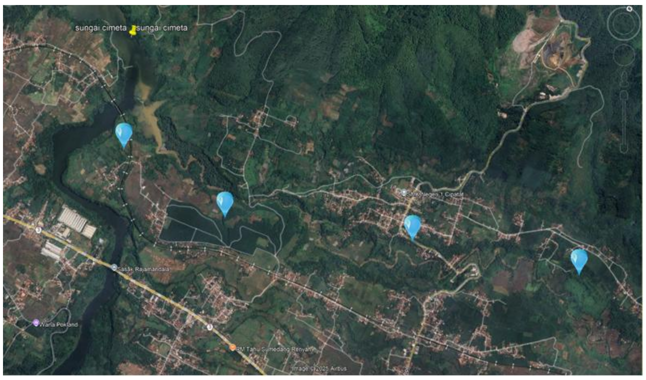

Figure 17. Flood-affected areas from the Cimeta River
Source: GoogleEarth

In figure 17 is the area that is often affected by the overflow of the Cimeta River. The results of the analysis show that the flooding that occurred in the Cimeta River area was the impact of several interrelated factors, such as limited river capacity, cliff erosion, and lack of an adequate flow control system. Therefore, integrated handling efforts are needed from upstream to downstream areas to reduce the risk of recurring floods.

One of the main steps that can be taken is the normalization of the river. This activity aims to increase the flow capacity of the Cimeta River by enlarging the cross-section of the river, both through widening and deepening the channel. In addition, the construction of additional channels such as flood channels, drainage, and carrier channels also needs to be considered to share the load of water discharge, especially during the rainy season with high rainfall. This strategy can be strengthened by the construction of retention ponds at strategic points around the river channel, which serve as a temporary reservoir for overflow and reduce the load of direct flow to the main river.

In addition to increasing flow capacity, strengthening river banks is also an important solution in flood control. Erosion that occurs on river banks, especially in segments with heavy flows, causes uncontrolled cross-section widening and decreases the morphological stability of the river. Therefore, the construction of a cliff safety structure is necessary to direct the flow of water to remain in a safe and stable path. With this arrangement of flows, it is hoped that the flood flow can flow faster and under control without causing damage around the river body.

In addition to reducing the risk of flooding, flow speed control is also important to support a balanced sedimentation process, so that sediment does not accumulate in certain areas that can clog river flows. Therefore, the flood management strategy in the Cimeta River must be carried out comprehensively and sustainably, involving technical interventions, border vegetation management, and land use supervision around water catchment areas.

CONCLUSION

Based on the results of the hydrological analysis using the SCS-CN method with HEC-HMS software, a peak discharge for the 50-year return period (*Q*50) of 155 m³/second was obtained. There are several points along the *Cimeta* River that experience high discharge flows, specifically at *STA 16 + 648*, *STA + 150 + 600*, *STA 15 + 451*, and *STA 15 + 405*. The results of hydraulic simulations with HEC-RAS indicate that the existing cross-section of the *Cimeta* River is currently unable to accommodate the planned discharge, as evidenced by water levels that exceed the riverbank in several segments. This condition explains the frequent overflows and flooding around the *Cimeta* River.

To address this, river normalization efforts are needed, such as dredging, widening, and elevating embankments to increase the capacity of the river channels. In addition, bank reinforcement should be implemented to reduce erosion and maintain the stability of the riverbanks. It is hoped that these measures will be carried out promptly so that the risk of flooding can be reduced, the function of the river can be improved, and the safety and sustainability of the environment around the *Cimeta* River can be better ensured.

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