
ANALYSIS OF THE PERFORMANCE OF THE CIPAGER DAM IRRIGATION NETWORK: CASE STUDY CIPAGER DAM, CIREBON REGENCY, INDONESIA

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ABSTRACT

The Cipager Dam, located in Cirebon Regency, Indonesia, serves as a crucial infrastructure for irrigation in the region, with an irrigation network covering over 1,600 hectares. Despite its importance, the dam faces issues related to maintenance, network conditions, and workforce shortages, affecting its performance and water distribution efficiency. This study aims to evaluate the performance of the Cipager Dam irrigation network by analyzing the condition of the main and secondary channels, assessing water availability against demand, and exploring the impact of operational deficiencies. The research adopts a descriptive-inductive approach using both primary and secondary data. Primary data were collected through direct field observation of the irrigation infrastructure, while secondary data were obtained from institutional records, rainfall data, and historical irrigation performance. The study found that the water discharge from Cipager River is adequate to meet irrigation needs. However, the irrigation network suffers from moderate to severe damage, and there is a shortage of management personnel. The operational and maintenance budget remains insufficient despite a slight increase in 2025. The study suggests that improving the irrigation network's maintenance, integrating advanced technologies like IoT, and enhancing workforce management could significantly improve the system's performance and sustainability. Future studies should explore these areas and compare other irrigation systems in Indonesia to identify best practices.

Keywords: Dam, Performance, Irrigation, Rainfall, Damage.

INTRODUCTION

A dam is a construction that is built transversely in a river with the aim of raising the water level, so that the river flow can be taken and channeled to the irrigation network by gravity. (WANGSA et al., 2023). The Indonesian region located in Cirebon Regency, West Java, especially in Talun District, is an agronomic area where the majority of the population makes a living as farmers. Agricultural land in this area is relatively fertile and supports agricultural activities. Therefore, the construction of supporting facilities and infrastructure is needed, one of which is the construction of the main building in the form of a permanent dam in Talun District, Cirebon Regency.

Cipager Dam irrigates an area of $\pm 1,636$ Ha, consisting of 1 Dam, 1 Deep Main Channel (B.DI) and 7 Secondary Channels (Sumber, Benda, Cirebon Girang, Pilang Sari, Kedung Pane, Palir and Cideng) Cipager Irrigation Canal Stretches 22.22 Km. Cipager Dam is a grouping of dams located in Cirebon Regency, West Java. (Mulyandari et al., 2022)

Based on its astronomical location, the Cipager Dam is located at the coordinates of 6°40'31" S and 108°36'45" E. Cipager Dam is located on Jalan Syekh Nurjati, Kubang Village, Talun District, Cirebon Regency. The distance from the city of Kuningan is approximately 35 km to the Southwest and approximately 25 km from the city of Cirebon to the Northwest (source: Uptd in the Cimanuk-Cisanggarung river area).

The decline in the performance, condition, and function of the irrigation network is caused by a lack of maintenance. This has an impact on the distribution of water to agricultural land that is not optimal, not in accordance with the availability of irrigation water. As a result, there is a decrease in agricultural production which can ultimately affect the income conditions of farmers.(Puro et al., 2020)

Referring to these problems, this study focuses on the performance of irrigation networks, especially main channels, by examining the condition of building aspects and structural functions. Some parts of the building, such as the primary and secondary channels, will be further analyzed physically and theoretically to formulate technical criteria for the primary and secondary channels. The ability of the irrigation system to function effectively is highly dependent on the management system as well as its capacity in facilitating the consumption and operation of irrigation water, the irrigation space supports the implementation of regional plant patterns. (Mus Mulyadi Retang et al., 2024)

The purpose of this study is to analyze the percentage of the performance of the Main Cipager Dam channel based on the level of damage, analyze the performance condition of the Secondary Cipager Dam channel through evaluation of the condition and function of each building component and obtain the weight of each component in the Primary and Secondary Cipager Dam channel which can be used as an indicator of channel performance based on the condition and function of its components (Bravikawati et al., 2022).

The current research provides a detailed analysis of the performance of the Cipager Dam irrigation network, focusing on the water discharge, the condition of the irrigation channels, and the operational and maintenance challenges. Compared to previous studies, such as those by Mulyandari et al. (2022) and Puro et al. (2020), which assessed irrigation systems' performance in different areas, the novelty of this research lies in its integrated use of rainfall data analysis through the Thiessen Polygon method and the water needs assessment for rice and palawija crops. The research also highlights the personnel shortage and insufficient maintenance budgeting, which are critical operational factors often overlooked in similar studies. Moreover, the recommendation to explore advanced technologies such as IoT and drones for irrigation network monitoring is a unique contribution to improving the operational efficiency and sustainability of the system, distinguishing it from existing research.

METHOD

The tools and materials used in this research are categorized into hardware and software. The hardware includes GPS devices, smartphones, laptops, and general office stationery (ATK), while the software utilized comprises Google Earth, Microsoft Excel, and

Microsoft Word (Noviyanto et al., 2015). The research took place in the Cipager Channel main dam irrigation area, located at Jl. Syekh Nurjati, Tonjong Hamlet, Kubang Village, Talun District, Cirebon Regency. This location features a primary irrigation canal and several secondary channels, such as the Sumber (2.31 km), Benda (3.02 km), Cirebon Girang (0.54 km), Pilang Sari (0.89 km), Palir (0.99 km), and Cideng (0.47 km) secondary channels. The irrigation water originates from the Cipager River, which is fed by the Cijontor, Cinotok, and Cireumbay Rivers from the Kuningan region. Data collection was conducted between January and March 2025 at the main dam in SUP Ciwaringin (source-cideng service unit). The research methodology plays a vital role in verifying, developing, and validating facts for scientific accuracy (Sugiwanto et al., 2019).

This study employs a qualitative method with a descriptive-inductive approach. The descriptive aspect aims to detail and explain the data and findings collected during fieldwork, while the inductive approach builds conclusions based on observed empirical facts (Review, 2022). The study utilizes both primary and secondary data. Primary data was gathered through direct field observation, examining the condition of tertiary plots, irrigation canals, and associated infrastructure. Secondary data was obtained from the Cipager Dam archives, including climatological data, rainfall records, irrigation network and building schemes, planting patterns, and institutional records such as AKNOP data (Ramdhani, 2020).

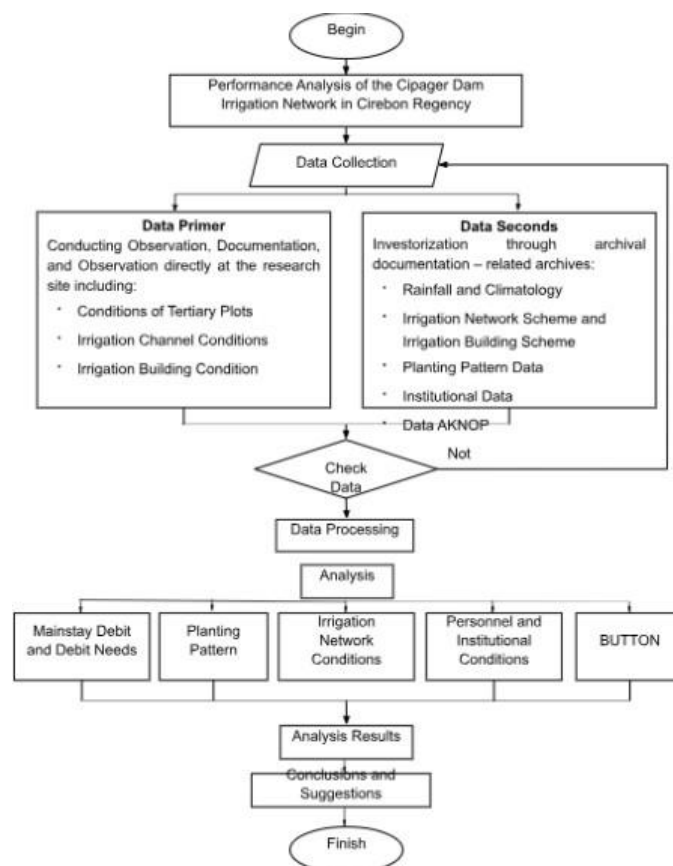


Figure 1 shows the results of the analysis using the Thiessen Polygon method, which is used to determine the area of influence of each rainfall station. Based on the analysis, the area for each station was obtained, with a total area of 268.0 km²

Polygon thiessen

A technique or step to calculate rainfall with the thiessen polygon equation is as follows:

$$P = \frac{A_1.p_1 + A_2.p_2 + A_3.p_3 + \dots + A_n.p_n}{A_1 + A_2 + A_3 + \dots + A_n} = \sum_{i=1}^n \frac{A_i \cdot p_i}{\sum_{i=1}^n A_i}$$

Where:

P = Rainfall Region (mm)

$A_1, A_2, A_3, \dots, A_n$ = Area of Influence of STA 1, 2, 3, ..., n

$p_1, p_2, p_3, \dots, p_n$ = High Rainfall STA 1, 2, 3, ..., n

Rainfall Analysis of Region Average Rainfall Using Thiessen Polygon (Nur et al., 2023)

Flagship Debit

Mainstay discharge is a discharge that is expected to always be available in a reservoir with certain opportunities that are used as a planning for water needs in rivers or dams as for the below including the value of mainstay discharge (Amin & Sulfanite, 2023)

$$Q_p = 0.00278 \cdot C \cdot I \cdot A$$

Where:

Q = Peak Discharge (m³/sec)

C = Flow Water Coefficient

I = Intensity of Rainfall (mm/h)

A = Watershed Area (km²)

0.00278 = (Condition)

Evaporation Potential (ETo) conditions are affected by the weather climate (Siarai et al., 2021)

$$E_{tc} = K_c \times E_{to}$$

Where:

E_{tc} = plant evaporation (mm/day)

E_{to} = plant evapotranspiration (mm/day),

K_c = plant coefficient

Water Needs in Rice Fields

$$KAS = "a" \times \text{Area}$$

KAS = Water needs in rice fields

"a" = irrigation water requirement

Area = planting area

RESULTS AND DISCUSSION

Polygon thiessen

In the Thiessen Polygon method, watersheds are divided into regions of influence based on their spatial proximity to rainfall stations, under the assumption that each point within a region experiences the same rainfall as the nearest station, meaning each polygon represents rainfall from a single rain station (Puspitasari & Nurhasanah, 2022). Based on the Watershed Map, rainfall data were collected from the Madirancan, Tukmuda, and Cangkol rain stations. To determine the rainfall contribution of each station and the total rainfall area, the Thiessen polygon method was applied.

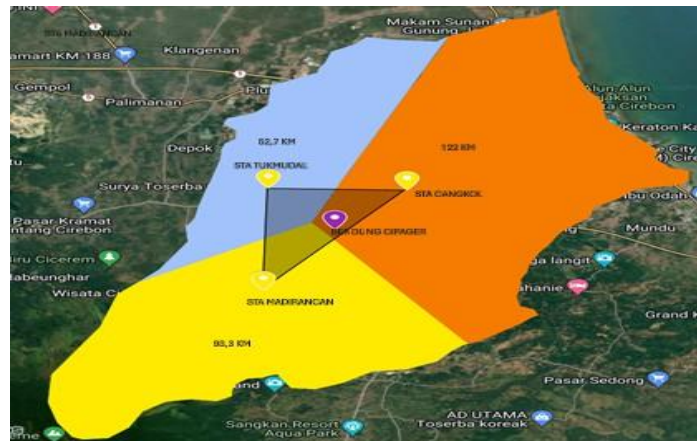


Figure 2. Polygon Thiessen Dam Cipager

From the results of the analysis using the Thiessen Polygon method, the area of rainfall at each station can be obtained, namely:

Table 1. Rain Station Area

Station	Polygon Thiessen Factor	
	Area (KM ²)	Percentage
Madirancan	93,3	27,57%
Tukmudal	52,7	41,58%
Cangkol	122	30,59%
Total	268,0	100%

Source: Calculation Results, 2025

Based on the results of Table 1, measurements were made using the Thiessen method to calculate regional rainfall. Each rain station within the calculation region is represented by a Thiessen polygon that describes the area of influence of each station. The results of the calculation of the average rainfall in the Cipager area are shown in the table. The Thiessen polygon method is considered to be effective especially in non-uniform field conditions, as it takes into account the extent of the influence of each rain station on the surrounding area.

Thus, this method provides a more representative estimate of the rainfall distribution in an area.(Ajr & Dwirani, 2019) The network of rain measuring stations needs to be used in determining the results of rainfall calculations in each region to provide the amount/amount of rain input that falls in the watershed, rainfall data has many benefits.

Hydrological Analysis

Table 2. Average Annual Rainfall 3 STA

YEAR	Rainfall Station (mm)		
	Tukmudal	Madirancan	Cangkol
2014	20,79	24,55	22,49
2015	17,30	22,59	21,29
2016	15,45	24,48	19,86
2017	19,52	23,50	20,16
2018	20,88	22,08	19,99
2019	17,92	9,43	21,79
2020	19,85	10,21	19,95
2021	16,13	17,87	22,95
2022	17,83	12,09	23,96
2023	17,44	7,36	23,66
Total	183,11	174,14	216,10
Average	18,31	17,41	21,61

Source: Calculation Results, 2025

Flagship Debit Analysis

Table 3. 80% monthly debit

Month	Massage								
	1	3	4	5	6	7	8	9	10
January	23,250	19,718	19,258	15,944	14,034	11,018	10,492	9,515	9,490
	25,539	23,371	16,158	15,295	14,225	13,301	12,020	10,057	9,968
February	31,282	18,025	17,360	16,579	14,033	13,249	12,067	10,272	9,984
	38,408	20,969	19,251	17,285	17,236	17,032	14,495	13,924	11,318
March	34,289	19,711	17,222	16,400	15,831	15,699	15,056	14,302	12,516
	31,887	18,636	16,816	16,120	15,877	15,131	14,837	13,570	13,164
April	25,727	18,497	17,138	16,647	14,823	13,603	11,503	10,324	10,202
	20,211	14,161	13,696	12,680	10,363	8,459	6,642	7,003	3,847
May	40,556	18,788	15,339	12,730	11,195	10,046	6,801	4,906	4,862
	21,671	16,774	16,620	15,146	15,001	9,579	8,957	8,085	7,291
June	14,841	14,170	13,961	13,081	11,691	10,592	10,448	8,991	8,316
	93,270	18,568	17,626	10,367	10,344	10,051	9,078	7,657	3,890
July	17,735	15,380	12,974	12,469	11,587	10,421	9,965	9,096	8,794
	23,265	16,482	15,424	14,086	12,722	11,299	8,856	6,297	5,771
August	15,833	14,000	13,149	11,898	10,408	9,828	9,294	5,457	3,293

	15,027	11,792	10,980	9,756	8,437	6,190	5,981	5,425	4,396
September	15,812	14,368	12,395	10,765	7,871	6,566	6,123	4,737	4,608
	15,569	10,652	10,165	8,842	8,709	8,466	7,594	6,541	5,082
October	17,708	15,812	15,226	13,996	13,609	12,874	12,096	10,769	10,692
	20,787	16,846	15,041	14,656	11,713	11,425	10,204	8,155	6,097
November	16,922	14,212	13,596	12,958	12,627	12,162	9,484	8,917	6,760
	20,752	18,407	15,225	13,941	13,833	13,449	11,685	10,969	8,384
December	21,026	15,680	14,450	13,949	11,846	11,659	8,573	8,032	5,698
	23,213	18,366	17,728	17,589	17,415	15,923	13,903	12,955	12,001

Source: Calculation Results, 2025

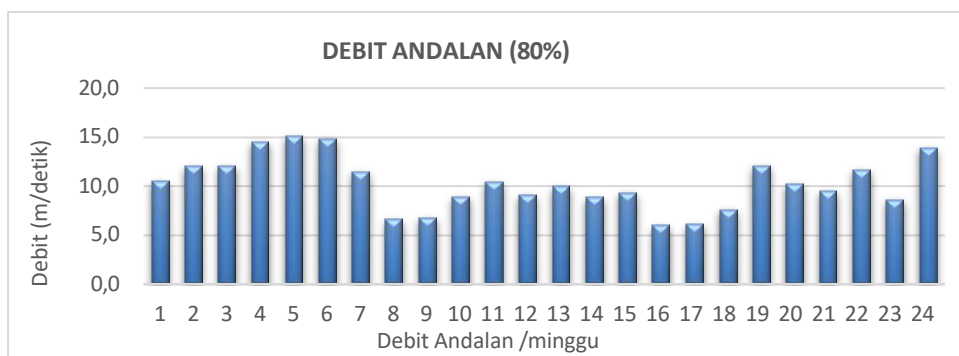


Figure 3. 80% Half-month discharge chart

Source: Data processed

Evaporation potential (Eto)

The quantities used in this calculation include evaporation rate, transpiration rate, and evapotranspiration rate, expressed in millimeters per day (mm/day). These data are very important to calculate the value of evapotranspiration in an area, especially in the irrigation area to be planned. Evapotranspiration itself is a combination of evaporation of water from the soil surface (evaporation) and the release of water vapor through plants (transpiration), so that it can reflect the overall water needs in the agricultural system. To determine the consumptive use of plant water, calculations are carried out using the following formula: (Muyassar et al., 2023)

$$\begin{aligned}
 \text{Eto (mm/day)} &= c \times \text{Eto} \\
 &= 1.10 \times 4.55 \\
 &= 5.01 \text{ mm/day}
 \end{aligned}$$

Table 4. Evaporation potential (Eto)

Month	Eto (mm/Day)
January	5,01
February	5,12
March	5,44
April	4,76
May	4,89
June	4,81

July	5,30
August	6,78
September	8,53
October	8,00
November	6,56
December	5,36

Source: Calculation Results, 2025

Water needs

Preparation of land needs for rice crops starting in November

Location taken = 2 mm/day

Land preparation time (T) = 15 days

Saturation = 250mm

The need for clean water in rice fields (NFR) for rice plants can be calculated:

$$\begin{aligned}
 \text{NFR} &= \text{ETc} + \text{P} + \text{WLR} + \text{Re} \\
 &= 6.56 + 2 + 0 + 0.69 \\
 &= 9.25 \text{ mm/day}
 \end{aligned}$$

The need for clean water for rice fields (NFR) for palawija plants can be calculated:

$$\begin{aligned}
 \text{NFR} &= \text{Etc} - \text{Re} \\
 &= 3.28 - 0.49 \\
 &= 2.8 \text{ mm/day}
 \end{aligned}$$

After the calculation of the NFR Max value per year. Furthermore, by using the total irrigation efficiency of 0.65 and the calculation is as follows: (Setiadi & Muhaemin, 2018)

$$\begin{aligned}
 \text{Irrigation water needs} &= \text{NFR} / (\text{Efficiency} \times 8.64) \\
 &= 10.77 / (0.65 \times 8.64) \\
 &= 1,918 \text{ lt/dt/ha}
 \end{aligned}$$

Table 7. Irrigation water needs

Category	Rice	0,65
I	10,77	1,92
II	10,77	1,92
Category	Palavija	0,65
I	10,77	1,92
II	10,77	1,92

Source: Calculation Results, 2025

For the calculation of each season, plants from 3 groups can be calculated as follows:

a. Rice Field Water Needs (Land Preparation)

$$\begin{aligned}
 \text{THAT} &= \text{"a"} (\text{Land Preparation}) \times \text{Area (ha)} \\
 &= 2,45 \times 298 \\
 &= 730.1 \text{ l/dt/ha}
 \end{aligned}$$

b. Rice Field Water Needs (Planting, Planting Period, and Cooking Period)

THAT = "a" x Area (ha)

= 1,92 x 298

= 572.16 l/dt/ha

Table 8. KAS Planting Season 3

Growing Season	Month		Discharge Requirement (m3/sec)	Availability Discharge (m3/sec)
MT I	November	II	731,50	11684,74
	December	I	1670,46	8573,24
		II	1670,46	10492,15
	January	I	1670,46	12019,68
		II	1670,46	12066,58
	February	I	1670,46	14494,85
		II	1670,46	15056,42
MT II	March	I	1590,74	14837,07
		II	1758,49	11503,32
	April	I	1733,75	6641,99
		II	1733,75	6800,73
	May	I	1733,75	8956,89
		II	1641,69	10447,80
	June	I	1733,75	9077,51
		II	1641,69	9965,26
MT III	July	I	2088,55	8855,51
		II	1821,97	9293,52
	August	I	1342,50	5980,94
		II	1342,50	6123,33
	September	I	1342,50	7593,58
		II	1342,50	12095,57
	October	I	1342,50	10203,86
		II	786,32	9484,31
	November	II	731,50	11684,74

Source: Calculation Results, 2025

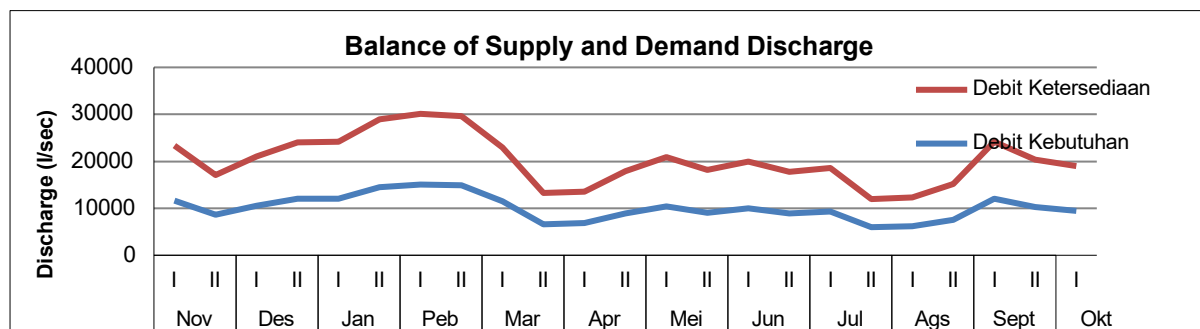


Figure 4. Water Balance Graph Needs and Availability

From the results of the analysis of the comparison of the discharge of needs with the mainstay discharge of the Cipager Irrigation Area, it can be concluded that the mainstay discharge of the river is greater than the discharge of needs. Thus, the water needs in the Cipager Dam Irrigation Area are almost entirely met.

First Plan Planting Pattern

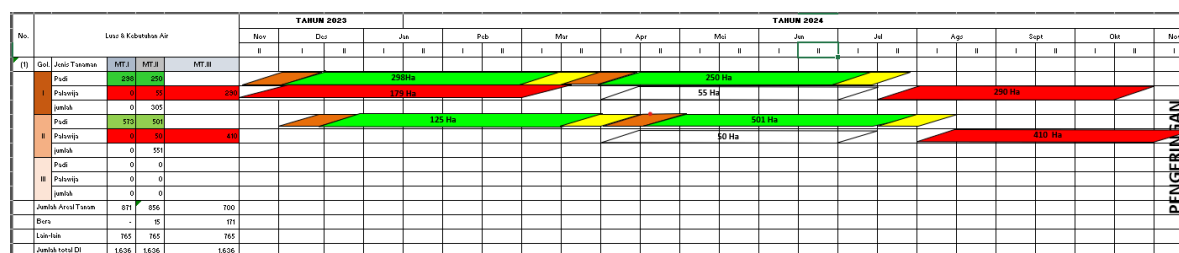


Figure 5. Planting Patterns of Cipager Dam Irrigation Areas

The Cipager Dam plays a strategic role in supporting food security and agricultural productivity in an area of 1,110 hectares. With topography varying from flat to light undulating, water flows can be channeled by gravity, but still require technical management to evenly distribute them to the tertiary network.

Cipager's water discharge exceeds the needs, the steps taken include reducing the opening of sluices, accommodating excess in ponds or ponds, draining water to sewers, and implementing a rotating distribution system. In addition, excess water can also be used for other purposes and supervised through regular discharge monitoring.

Irrigation Network Conditions

Table 9. Condition of the Channel DI Cipager

No	Description	Volume (km)	Condition (%)				Function			Information
			Good	Minor Damage	Moderately Damaged	Severely Damaged	Good	Keep	Broken	
1	Main Channel	6,06	3,6	1,83	0,57	0,1	59%	40%	2%	Good
2	Saluran Seconds									
	Secondary Sources	2,31	1,5	0,65	0,2	0,2	63%	37%	9%	Minor Damage
	Seconds Benda	3,02	1,9	0,73	0,26	0,3	64%	33%	9%	Minor Damage
	Seconds Cirebon Girang	0,54	0,3	0,16	0,09	0,1	46%	46%	17%	Minor Damage
	Secondary Kedung Pane	7,95	4,2	2,02	1,09	1,1	53%	39%	14%	Minor Damage
	Secondary Pollinator	0,89	0,5	0,2	0,16	0,2	56%	40%	18%	Minor Damage
	Seconds Palir	0,99	0,4	0,26	0,19	0,2	41%	45%	19%	Minor Damage
	Seconds Cideng	0,47	0,2	0,12	0,11	0,1	32%	49%	23%	Moderately Damaged
Sum		22,23	12	5,97	2,67	2,2	56%	39%	10%	Moderately Damaged
Flat - Flat			1,6	0,75	0,33	0,3	52%	41%	14%	Minor Damage

Table 10. Building Condition in Cipager

No	Description	Volume (km)	Condition (%)				Function			Information
			Good	Minor Damage	Moderately Damaged	Severely Damaged	Good	Keep	Broken	
1	Main Building									
	Weir	1			1		0%	100%	0%	Good
	Sluice Gate	7			7		0%	100%	0%	Good
	Mud Bags	1		1			0%	100%	0%	Good
	Mud Bag Door	1		1			0%	100%	0%	Good
2	Building Regulator									
	For	3			3		0%	100%	0%	Moderately Damaged
	For Tap	4			4		0%	100%	0%	Good
	Sadap	27			21	6	0%	78%	22%	Moderately Damaged
	Direct Interception	1	1				100%	0%	0%	Good
	Water Gate (fruit)	86	28	33	23	2	33%	65%	2%	Minor Damage

**Complementary
Buildings**

Survey Building	36			6	30	0%	17%	83%	Severely Damaged
Siphon	1	1				100%	0%	0%	Good
Carrier Plunge	29		1	21	7	0%	76%	24%	Good
Talent	6				6	0%	0%	100%	Good
Got Miring	11			9	2	0%	82%	18%	Good
Culvert	17			7	10	0%	41%	59%	Good
Crossword Puzzle	3			2	1	0%	67%	33%	Moderately damaged
Side Spill	21			16	5	0%	76%	24%	Moderately damaged
Drainer	1			1		0%	100%	0%	Good
Suplesi	5			3	2	0%	60%	40%	Moderately damaged
People Bridge	3			3		0%	100%	0%	Moderately damaged
Village Bridge	19		4	15	3	0%	100%	16%	Moderately damaged
Washing Stations	20			17	1	0%	85%	5%	Moderately damaged
Animal Baths	1				1	0%	0%	100%	Severely Damaged
Water Gate (fruit)	5	2	1	1	1	40%	40%	20%	Moderately damaged
Tunnel	1	1				100%	0%	0%	Good
Mud Bags	1	1				100%	0%	0%	Good
Sum	311	30	36	102	63				
Rata – Rata		10	9	10,2	9	18%	61%	21%	Moderately Damaged

Source: Calculation Results, 2025

Field Institutional Management Personnel

Table 12. Operational Personnel

Personnel Management Channels and Staff	Personnel			Percentage	
	Need	Not enough	Available	Available	Not Enough
S. Primary (6,06)					
Irrigator	1	0	1	43	57
EACH	0	0	1	100	0
PPA	11	7	4	100	0
S. Secondary (16.16)					
PPA	0	0	0	100	0
PPS	0	0	0	100	0

Source: Calculation Results, 2025

Actual Operational and Maintenance Requirements (AKNOP)

Table 13. Operational and Maintenance Costs of Cipager Dam

Year	2023	2024	2025
Operation	892.852.204	892.852.204	949.957.511
Self-Managing	Routine	680.325.828	680.325.828
	Periodic	571.152.453	571.152.453
Contractual	1.395.858.805	1.395.858.805	1.395.858.805
Rehabs	6.565.587.000	6.565.587.000	6.565.587.000
P3A Empowerment	25.560.000	25.560.000	25.560.000
Pembinaan	50.620.000	50.620.000	50.620.000
Disaster Reserve (15%)	531.028.394	531.028.394	546.351.502
Total	10.712.984.684	546.351.502	10.830.461.846

Source: UPTD CIMANUK-CISANGGARUNG Service Unit



Figure 6. Chart of Rill Operation and Maintenance Needs

CONCLUSION

The study concludes that the water discharge from the Cipager River is sufficient to meet the irrigation needs of the Cipager Dam Irrigation Area, based on rainfall analysis and discharge comparison. However, the irrigation network's condition is slightly damaged, with 51% in medium condition and 18% damaged, indicating a need for improvement. The area also faces a personnel shortage, with only 6 out of the required 14 staff members, affecting service quality. Additionally, the budgeting for operation and maintenance is still insufficient, despite an increase in 2025. Future research could focus on optimizing irrigation network maintenance, exploring advanced technologies like IoT or drones, improving workforce management, finding sustainable funding models, enhancing water management efficiency, and comparing other irrigation systems in Indonesia to identify best practices for improved operational performance and sustainability.

REFERENCES

- Adriana, I. (2016). The effect of self-efficacy and learning independence on mathematical problem-solving ability. *Proceedings of the National Panel Discussion on Mathematics Education*, 539-548. Jakarta: Mathematics Education Study Program, Indraprasta University PGRI.
- Ajr, E. Q., & Dwirani, F. (2019). Determining Rain and Rainfall Stations with the Thiessen Polygon Method in Lebak Regency. *Journal of Environment and Natural Resources*, 2(2), 139–146. <https://ejournal.lppm-unbaja.ac.id/index.php/jls/article/view/674/387>
- Amin, A. A., & Sulfanite, A. (2023). Kalola Irrigation, Anabanua Village, Wajo Regency. *Royal Journal of Engineering*, 3(1), 11–16.
- Bravikawati, M., Oktaviani, C. Z., & Fauzi, M. (2022). Performance of the operation and maintenance of the Keuliling Dam, Aceh Besar Regency. *Journal of Civil Engineering and Planning Archives*, 5(4), 337–345. <https://doi.org/10.24815/jarsp.v5i4.27608>.
- Darmawan, H. (2016). Constructivism-based learning uses animation media with the TPACK framework and learning styles on student learning achievement. *Journal of Educational Technology*, 6(1): 1-11. <http://dx.doi.org/10.30998/formatif.v6i1.747>
- Leonard. (2013). The role of lateral and positive thinking skills on educational evaluation learning achievement. *Horizon Education*, 32(1): 54-63. <http://dx.doi.org/10.21831/cp.v5i1.1259>
- Mulyandari, E., Handoyo, S., Ganara Mawandha, H., & Kesuma, L. M. (2022). *How to cite: Mulyandari, Erni et al.* 7(7), 11. <http://dx.doi.org/10.36418/syntax-literate.v6i6>.
- Mus Mulyadi Retang, Dian Noorvy Khaerudin, Suhudi, & Pamela Dinar Rahma. (2024). Analysis of Irrigation Network Performance in Plunturan Irrigation Areas of Ponorogo Regency. *Journal of Water Resources Technology and Engineering*, 4(02), 1428–1437. <https://doi.org/10.21776/ub.jtresda.2024.004.02.119>
- Muyassar, M., Badrun, B., & Yusuf, A. R. (2023). Weir Performance Analysis Based on Aspects and Functions of Building Structures. *Journal of Consolidated Civil Engineering Research*, 1(3), 179–184. <https://doi.org/10.56326/jptsk.v1i3.3026>
- Noviyanto, Q., Study, P., Civil, T., Engineering, F., Development, U. T., Jambon, K., Ponorogo, K., & Kanan, S. (2015). *Evaluation of the performance assessment of the right sungkur irrigation system, Ponorogo Regency, East Java Province*. 6(12).
- Nur, R., Rusli, H., Lutfi, M., & Djunur, H. (2023). *Planning of the Paenre Dam, Bantaeng Regency (Case Study)*. 2(September), 246–258.
- Puro, S., Mulyo, Y. S., & Balapadang, D. (2020). Performance of the Pamarayan Dam, Ciujung Irrigation Area, Serang Regency. *Journal of Civil Mechanical Construction Engineering (JRKMS)*, 3(1), 1–6. <https://doi.org/10.54367/jrkms.v3i1.697>
- Puspitasari, M., & Nurhasanah, A. (2022). *Analysis of the Availability of Water Availability of the Way Bulok Sukamara I Dam to Meet the Needs of Irrigation Water in Pekon Tanjung Russ, Pardasuka District, Regency* 41–49. <http://repository.ubl.ac.id/id/eprint/145>
- Ramdhani, M. Z. (2020). Evaluation of the Performance of the Cikahuripan Irrigation Area Dam. *Journal of Civil Engineering Students*, 2(2), 147–151.
- Review, C. S. (2022). Vol. 1 No.3 June 2022 <http://jurnal.ensiklopediaku.org> Encyclopedia Research and Community Service Review. *Analysis of voltage changes to light intensity in CFL lamps and LED lamps*, 1(3), 100–106.
- Siarai, H. A. K., Udiana, I. M., & Bunganaen, W. (2021). Planting pattern of the right irrigation area of the Benanain Dam in Malacca Regency. *Journal of Civil Engineering*, 10(1), 63–76. <https://ejournal.petra.ac.id/index.php/jurnal-teknik-sipil/article/view/23800>

- Sugiwanto, H., Purnomo, S. E., & Mulyono, H. (2019). Performance Analysis of the Pedati Dam Irrigation Network. *Journal of Construction Unswagati Cirebon*, 8(3), 662–673.
- WANGSA, A. A. R. R., SURYATMAJA, I. B., & ANDINI, A. A. M. P. (2023). The design hydrological analysis uses a rational method on drainage channels in Sumerta Kelod Village, Denpasar City. *Ganec Swara*, 17(2), 607. <https://doi.org/10.35327/gara.v17i2.463>



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