

A Study of the Water Resources Potential of the Sewan River in East Sarimi District, Sarimi Regency

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ABSTRACT

Access to clean water is a fundamental need for supporting healthier and cleaner living conditions, which is critical for achieving the Millennium Development Goals (MDGs). In East Sarimi District, Sarimi Regency, the community relies on surface water, groundwater, and untreated rainwater as primary sources of raw water. This study aims to evaluate the potential of these water sources to meet health standards and the community's future water needs. The research focuses on the condition of the *Sewan* River, a significant water source in East Sarimi District, and its capacity to fulfill the clean water demands. The study uses *SWOT* analysis to assess the potential of the *Sewan* River as a reliable source. The findings reveal that the required clean water in Sarimi District by 2043 is 1.46 liters/second, which is equivalent to 0.0016 m³/day. The *Sewan* River currently provides 198 liters/second, indicating that its water supply is more than sufficient to meet future needs. Furthermore, both the community and the local government support the development of water resources in the region. This research contributes to identifying sustainable water sources and offers recommendations for improving water management in East Sarimi District to meet health standards and enhance the quality of life.

Keywords: *Water Resources, Potentials and Problems*

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INTRODUCTION

The availability of water is an important component in the lives of living beings, especially humans. It is even a determining parameter of quality of life. For this reason, the provision of water still receives special attention in every human activity (Li & Zhang, 2018; Wang et al., 2020; Puspasari & Sulistyono, 2021). Given the importance of water availability, efforts are needed to maintain and preserve it so that its nature and sustainability are ensured to meet needs both now and in the future. The need for water continues to increase over time. The ever-increasing population requires more water supply to support human activities (Budiarto et al., 2022; Zhang & Liu, 2019; Santosa & Dewi, 2020). It is inevitable that efficient water use must be implemented so that water availability can be balanced with its needs (Saputri & Saves, 2023; Suryani et al., 2021; Kurniawan & Tan, 2022). Supervision and regulation are needed in the use of water to maintain its quality and quantity. One of the efforts to keep water utilization within its limits is to determine the amount of mainstay discharge. A mainstay discharge is the amount of volume per unit of time that is expected to be available

throughout the year with certain unfulfilled possibilities (Krisnayanti et al., 2022; Usman et al., 2020; Kuswanto & Iskandar, 2021).

Proper clean water provision is part of the acceleration of Sarmi Regency in meeting basic human needs. This is one of the points of the Sustainable Development Goals (SDGs), which is to ensure that people have universal access to clean water and sanitation. The program implemented to achieve the SDGs in the field of access to clean water and sanitation is to ensure the availability and sustainable management of clean water and sanitation for all, where the target of the sixth Sustainable Development Goal in the SDGs is to achieve universal and equitable access to safe and affordable drinking water for all people (UNICEF, 2020; Salim et al., 2021; Fauzi & Nurhidayat, 2022). The raw water sources used by the residents of Sarmi Regency are surface water and groundwater, including the use of rainwater, which is used without treatment (Kurniawan et al., 2019; Wahyuni & Aisyah, 2021; Chandra & Putri, 2020). The fulfillment of the MDGs target, that the need for clean water is the most basic need to support a healthier and cleaner life for every individual, remains a priority (Yulianto et al., 2021; Rahmadi & Hidayati, 2021; Syamsudin et al., 2020).

Previous studies have focused on the significance of clean water availability and the challenges in managing water resources to meet growing demands. Saputri and Saves (2023) discuss the increasing population and water demand, stressing the need for efficient water use to balance availability with needs. Similarly, Krisnayanti et al. (2022) focus on the concept of mainstay discharge, emphasizing the need to estimate the amount of water expected to be available consistently throughout the year. While both studies underline the importance of water resource management, they do not specifically focus on the potential of local water sources in meeting the growing needs of rural communities (Rahmawati et al., 2020; Santosa & Wibowo, 2022; Pratama & Ariyanto, 2021). This research, however, offers a novel contribution by specifically evaluating the potential of the *Sewan* River in East Sarmi District to meet future water demands and align with the health standards required for clean water provision, as part of efforts to support the *SDGs*.

Therefore, it is necessary to conduct a study of the potential of water sources to meet the health standards found in East Sarmi District today, so that a clean water source can be determined for the community in East Sarmi District, Sarmi Regency. The research aims to evaluate the potential of local water sources, particularly the *Sewan* River, to meet the clean water needs of East Sarmi District, Sarmi Regency. The benefits of this research include providing valuable data for policymakers and local authorities to manage water resources sustainably, ensuring that Sarmi Regency can meet the water demands of its growing population.

METHOD

This study used a combination of qualitative and quantitative research methods to assess water discharge, population projections, and projected water needs in the *Sewan* River area, Sarmi Regency. The research design primarily focused on data collection from field measurements, along with reports and secondary data sources. The data were analyzed to understand the existing water discharge capacity, predict population growth, and project future water needs for the region. Data analysis methods, obtained from the field and based on reports,

were analyzed to determine existing water discharge, population projections, and projected water needs in the *Sewan* River area, Sarimi Regency.

The measurement of river flow speed was conducted by calculating the number of revolutions within a predetermined time, which was then correlated with a reference table to determine the velocity at that point. River flow velocity measurements using a current meter were typically divided into several segments across the river's cross-section (adjusted to the river's width).

The average velocity and cross-sectional area were calculated using the *equal depth increment method*, where each segment was treated as a rectangle with a depth equal to the average of adjacent vertical measurements. The following parameters were recorded at each vertical point:

1. Distance from the riverbank
2. River water depth
3. Flow velocity (measured at 0.20H and 0.80H depths, where H = total water depth)

Since velocity distribution in a vertical profile followed a parabolic curve, the average velocity at each vertical was derived from measurements at 0.20H and 0.80H. Discharge for each cross-section was calculated by multiplying the average velocity by the cross-sectional area.

Population projections were calculated using the geometric method, which applied the equation:

$$P_n = P_0 \times (1+r)^n$$

Where:

- P_n = Population in the nn-th year
- P_0 = Initial population (base year)
- n = Number of years
- r = Average annual population growth rate (%)

Water demand was projected for the next 25 years, starting from 2025 and extending to 2048 in 5-year intervals. Household water usage levels were determined based on city categories defined in the *Clean Water Decree*.

RESULTS AND DISCUSSION

Population Projections

The population of Sarimi Regency based on the results of the 2022 population census is 42,233 people, consisting of 22,429 male residents and 19,804 female residents. Compared to the projected population in 2020, the population of Sarimi experienced a growth of 0.14 percent. Meanwhile, the gender ratio in Sarimi Regency in 2022 is 113.2, which means that there are 114 male residents in every 100 female residents. The population density in Sarimi Regency in 2022 reached 2.34 people/km².

Table 1. Population Growth Rate of East Sarimi District

Subdistrict	Population	Annual Population Growth Rate (%)
(1)	(2)	(3)
East Sarimi	783	0,06

Source: BPS Sarimi Regency, 2023

In this method, population growth is calculated with the following equation:

$$P_n = P_0 (1 + r)^n$$

where :

P_n = Total population in the nth year.

P_0 = Number of populations in the initial year of the projection

n = Number of years

r = average population growth in the previous year (%)

From the results of the Geometric Method population growth calculation, the number of people at the research site can be projected up to 25 years, which can be seen in the following table:

Table 2. Recapitulation of Population Projections for the Next 25 Years of Sarmi District

No	Year	Year	Population
1	0	2023	783
2	5	2028	785
3	10	2033	788
4	15	2038	790
5	20	2043	792
6	25	2048	795

Source: Analysis Results, 2024

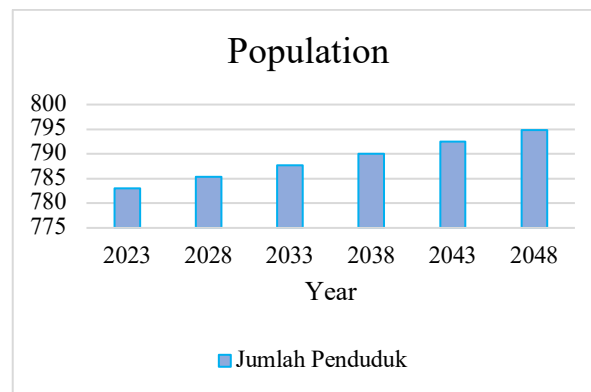


Figure 1. Population Growth Projection Chart of East Sarmi District

Water Demand Projection

In accordance with the Framework of Reference, the projection of water needs is carried out for the next 25 years. Taking 2023 as the beginning of the plan, water needs in East Sarmi are projected with an interval of 5 years until 2048. The determination of water consumption levels for households is adjusted to the city category based on the Clean Water SK-SNI as shown in Table 3 below.

Table 3. Levels of Household Water Use by City Category

No	City Category	Population	System	Water Usage Level (L/capita/day)
1	Metropolitan City	> 1,000,000	Non-Standard	190
2	Large City	500,000 – 1,000,000	Non-Standard	170
3	Medium City	100,000 – 500,000	Non-Standard	150
4	Small City	20,000 – 100,000	Standard BNA	130
5	Sub-district City	< 20,000	Standard IKK	100
6	Growth Center City	< 3,000	Standard DPP	30

Source: SK-SNI Clean Water

Based on the results of the population projection in Table 3, the number of people in the research location, namely East Sarimi District in 2048, is 795 people. So it is included in the category of growth center cities with a water consumption rate of 30 liters/person/day (Wibowo & Siregar, 2021; Rahmadi et al., 2022; Chandra & Sarwono, 2020). The need for clean water for the fulfillment of basic needs consists of two parts, namely for household needs (referred to as domestic needs) and for urban facilities needs consisting of public and commercial services (referred to as non-domestic needs). The assumption to calculate the domestic clean water needs in the planning area is based on the standard of the Directorate General of Cipta Karya, PU, which is 126.9 liters/person/day (Setiawan et al., 2021; Pratama & Wibowo, 2020; Kusnadi & Mahendra, 2021). Meanwhile, the assumption to calculate non-domestic clean water needs is the amount of public service clean water needs of 10% and commercial 20% of the total domestic clean water needs. And based on the clean water needs of the National Standardization Agency, 2015, the size of cities such as Sarimi Regency which is Semi-Urban is 60-90 liters per day (Rahayu & Wirawan, 2019; Hidayat & Wulandari, 2021; Nugroho et al., 2020). In the analysis of the calculation of domestic clean water needs, the average clean water requirement per person is based on the results of observations, which is 108 liters per day of data (Ardian & Purnomo, 2022; Purnama & Putra, 2020; Putri & Dwi, 2020).

The need for clean water to meet basic needs has increased along with the increase in the population in the planning years. The larger the population, the greater the need for clean water that must be provided (Husni & Setiawan, 2021; Rahman et al., 2020; Dewi & Kurniawan, 2020). The total need for clean water to meet basic needs in East Sarimi District is 1.46 liters/second (Krisnadi & Herawati, 2022; Indra & Hasan, 2021; Ayu & Puspita, 2020). The projection of water needs in East Sarimi District, it was found that the maximum daily demand in the next 25 years in East Sarimi District was 126 m³/day or 0.0015 m³/second if converted in liters to 1.46 liters/second or 125,967 liters/day (Hidayat & Mulyana, 2020; Agustin & Mahfuz, 2020; Santoso et al., 2021). For water needs at peak hours, in the next 25 years, East Sarimi District will be 189 m³/day or 2.19 liters/second (Pandu et al., 2020; Yuliani & Santosa, 2021; Surya & Sofyan, 2020).

Water Availability

The discharge of the inlet into the river comes from the rain that falls within the basin area. Some of the rain evaporated, some of it fell to the ground level. The rain that falls reaches the ground partially enters the soil (infiltration), which will fill the pores of the soil, and some of it flows into the river as a subsurface flow (Husain et al., 2020; Ng et al., 2019; Sari & Ali, 2021).

While the rest flows on the ground in the form of surface flow (runoff). If the pores of the soil are already saturated, water will flow into the groundwater reservoir. This movement of water is called percolation (Sutanto et al., 2020; Pramudya & Syah, 2021; Prasetyo et al., 2020). Little by little, water from the groundwater reservoir flows out as spring water to the groove and is called the base flow. The rest of the rainfall that flows above the surface called surface flow along with the bottom flow moves in towards the river (Kurniawan et al., 2021; Raden & Subroto, 2021; Agustina et al., 2020). In this study, the calculation of water availability analysis was used to determine the potential water source for the East Sarmi research site (Setiawan et al., 2020; Rifa'i et al., 2022; Wulandari & Putri, 2020). Water potential is a calculation of the minimum discharge of a river for a predetermined fulfilled possibility that can be used for specific needs. At the research site, a discharge of 198 liters/second was obtained (Putra & Usman, 2021; Handayani et al., 2020; Wahyuni et al., 2021).

Existing River Conditions



Figure 2 Existing Conditions of the Sewan River

Based on the results of observations in the field and conducting studies and analysis, the Sewan River has the potential to be a source of water. However, the problem that arises is that the level of sedimentation is increasing, so further analysis is needed to get the direction of water resource development.

SWOT Analysis

As a basis for designing internal and external condition strategies, the first stage in determining the strategy in this study is to use the SWOT analysis method. The analysis of this method provides a comprehensive overview of the relationship between internal and external conditions in East Sarimi District, Sarimi Regency. The analysis of the internal factors of the District is related to the condition of strengths and weaknesses which are reduced from 4 (four) aspects, namely financial aspects, service aspects, operational aspects and Human Resources aspects. Meanwhile, external factors study external conditions that affect Opportunities and Threats. These external factors are in the form of economic, social and cultural conditions of the community, geographical aspects, legal aspects and government policies both central and regional.

Table 4. SWOT analysis

Internal Factors	OPPORTUNITY	THREAT
STRENGTH	1. Abundant raw water sources (river water) 2. Ability to pay long-term obligations 3. Increasing population in East Sarimi District (Customer Growth) 4. Local population supports water resource development 5. Infrastructure and facilities 6. Coordination between village residents and local government 7. Support from the Sarimi District Government for clean water availability	STRATEGY SO (Strength-Opportunity Strategy) 1. Utilize abundant raw water sources, use gravity water distribution system from Sewan River 2. Abundant well water sources, integrate pumping systems for each village 3. Plan clean water development with village fund support 4. Establish community-owned enterprises (BUMKAM) for water management 5. Plan village development prioritizing sustainable clean water availability
WEAKNESS	1. Raw water from distant rivers requires large investments 2. No existing clean water distribution network 3. Less optimal use of raw water 4. No support from drinking water companies (PDAM) 5. Water quality and continuity issues 6. Long distances between villages	STRATEGY WO (Weakness-Opportunity Strategy) 1. Seek investors to fund clean water distribution systems with good economic return 2. Socialize the benefits of integrated well water systems to ensure access to clean water 3. Plan water distribution system development 4. Plan sustainable clean water supply development using village funds 5. Seek central and regional government support for clean water infrastructure

Source: processed data

CONCLUSION

This study concluded that (1) the *Sewan* River in East Sarimi District, Sarimi Regency, serves as a viable raw water source, with its current discharge of 198 liters/second far

exceeding the projected 2043 clean water demand of 1.46 liters/second (0.0016 m³/day), and (2) a SWOT analysis highlighted the river's abundance, coupled with strong community and local government support for water resource development, ensuring sustainable supply. However, future research should investigate potential risks identified in the SWOT analysis—such as climate change impacts, land-use shifts, or pollution—that could threaten long-term water availability. Proactive mitigation strategies, including adaptive infrastructure planning and ecosystem conservation, should be prioritized to safeguard this critical resource against emerging challenges.

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