Clean Water Infrastructure Strategy for the Industrial Sector in Indramayu to Support the Rebana Area

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Abstract

Clean water infrastructure is essential for supporting the Rebana Industrial Area in Indramayu, where high industrial demand risks conflict with the crucial agricultural sector and exacerbates an existing water crisis. This study aims to develop an integrated strategy to boost water supply and service quality in Indramayu. Using a mixed method approach combining quantitative water balance (demand-supply) and qualitative SWOT analysis the main findings reveal a significant water deficit. The current supply of 79.448 l/sec fails to meet the demand of 157.740,7 l/sec, resulting in a −78.292,7 l/sec deficit in 2025, projected to remain −49.438,1 l/sec by 2045. Adding to the crisis, raw water quality in the two main rivers is classified as moderately to heavily polluted. The main conclusion emphasizes the urgent need for supply interventions. The recommended strategy focuses on two pillars: increasing raw water quantity by utilizing 3.600 l/sec from regional alternative sources and enhancing local reservoir capacity to enforce the groundwater ban, and improving services through the construction of new, high-tech Water Treatment Plants (WTPs) and expanding piping networks. This study provides vital policy recommendations for the local government to ensure sustainable water access and industrial growth in the Rebana Region.

Keywords: Clean Water Infrastructure, Industrial Sector, Rebana Area, Water Balance, Development Strategy

PENDAHULUAN

One of the fundamental principles that can have a multiplier effect on the economic growth of a region is infrastructure development (Tinambunan et al., 2020). Grigg and Fontane (2000) explain that land use systems are influenced by infrastructure management to support economic systems and social systems in communities. The availability of infrastructure can be a key means for Indonesia to become a more advanced and prosperous country and escape the developing country trap or “middle income trap” (Faculty of Economics and Business, UGM, 2023). The economic growth center of West Java Province was previously more concentrated in the western and central regions. However, with the development of the Rebana Region, which covers Subang Regency, Sumedang Regency, Indramayu Regency, Majalengka Regency, Cirebon Regency, Cirebon City, and Kuningan Regency, it is hoped that economic growth can spread to the eastern and northern regions. One of the missions of the Indramayu Regency Regional Activity Center (PKW) is to serve national-scale activities, namely as a food barn center and investment center in the industrial sector with the allocation of priority industrial areas such as KPI Cipali Indramayu, KPI Patrol, KPI Losarang, KPI Balongan, KPI Krangkeng, and KPI Tukdana covering an area of ±20,000 Ha (Presidential Regulation Number 87 of 2021). This potential for industrialization will naturally increase the demand for raw water significantly. However, Indramayu Regency also has serious problems, such as a clean water crisis for daily needs and conflicts over water resource use with the agricultural sector, which has become a characteristic of the region (Belva and Raspati, 2024).

There are several problems with clean water supply in Indramayu Regency, which is currently not optimal in supporting the industrial sector in the Rebana Area. Problems such as the suboptimal coverage of clean water services in both the domestic and non-domestic sectors (Natsir et al., 2025), high PDAM tariffs, and poor water quality make access to clean water increasingly difficult for low-income communities. Technically, the Cimanuk River, as the largest source of raw water in Indramayu Regency, has a quantity crisis in the dry season and a quality problem in the rainy season (Sutriati, 2011) due to the high volume of dissolved solids that can limit the water discharge produced by the Water Treatment Plant (WTP). Furthermore, the decrease in the quality of raw water sources is due to pollution from industrial waste and the accumulation of waste from upstream due to Indramayu's position downstream of the Cimanuk River Basin (Sulthonuddin, I., 2019). The demand for water supply will increase along with the rise in population and industrial development targets until 2030. However, cooperation between regions to integrate water supply systems is still lacking. Therefore, this research is important to develop strategies for providing sustainable and integrated clean water infrastructure so that the industrial sector can continue to operate smoothly while supporting the achievement of the Rebana Region's development goals.

There has been a lot of previous research discussing the urgency of water management in industrial areas. In a study by Arnandi, et al. (2012), it was stated that a reliable clean water treatment system through a Clean Water Treatment Plant (IPA) is very important to meet industrial standards in terms of quantity and quality. Another study conducted by Nguyen, et al. (2023) confirms that clean water supply systems are a major factor in investment decisions by the private sector in developing countries, thus requiring more proactive and sustainable water management strategies. Government Regulation No. 142 of 2015 requires industrial estate managers to provide clean water treatment plants (IPA) with raw water sources derived from surface water and prohibits the extraction of groundwater to preserve environmental carrying capacity.

Several of the above literature sources have confirmed the importance of providing clean water for industry, but no research has comprehensively discussed strategies for providing clean water infrastructure in terms of quantity and quality. Therefore, this study is expected to contribute strategic policy recommendations that can be used by the Indramayu Regency government and the Rebana area management agency to ensure a reliable supply of clean water for industry.

METHODS

This study uses a mixed method because it combines qualitative and quantitative analysis. Data collection was carried out through observation and unstructured interviews with Regional Apparatus Organizations. Table 1 details the data collection methods used in this study.

Table 1. Data Collection Methods (Afifah et al., 2025)

Data Type	Collection Technique	Data Source	Focus/Purpose
Primary	Semi-structured interviews	Relevant Regional Apparatus Organizations (OPD) (Indramayu Regency Natural Resources Management, Mining and Energy Agency, Indramayu Regency Cooperative, SME, Trade and Industry Agency, Indramayu Regency Development Planning Agency, and Indramayu Regency Public Works and Public Housing Agency) and PDAM Tirta Darma Ayu	To obtain in-depth information on clean water production through Water Treatment Plants (WTPs), policies related to clean water infrastructure that support industry, inter-regional cooperation, institutional strategies, and challenges in implementing the Rebana policy.
	Observation	Water Treatment Plant (WTP) facilities of PDAM Tirta Darma Ayu, Raw Water Source (Cimanuk River), and water supply in households	Quality of clean water for the community of Indramayu Regency, both from PDAM and groundwater (wells), and water treatment facilities at PDAM Tirta Darma Ayu
Secondary Data	Literature Studies, Documentation, and Statistical Data	Related Regional Government Agencies (OPD), PDAM Tirta Darma Ayu, and internet media	RTRW Documents, RPJMD, RISPAM, RDTR Indramayu Regency, and previous research on water quality

The methods of clean water supply analysis used to planning clean water infrastructure strategies in Indramayu Regency are quantitative descriptive analysis, qualitative descriptive analysis with SWOT, literature synthesis, and spatial analysis. The quantitative descriptive method is used to analyze the demand for clean water infrastructure by considering the population and non-domestic sector needs, mainly in the industrial sector, tourism sector, public and social facilities, and the agricultural sector in Indramayu Regency, the coverage of existing clean water services, and the analysis of the gap in clean water infrastructure needs. In addition, qualitative descriptive analysis with literature synthesis was conducted to identify the volume of surface water sources (raw water) in Indramayu Regency, clean water quality, and SWOT to formulate supply strategies and spatial analysis used to map the potential of raw water sources in Indramayu Regency.

RESULTS AND DISCUSSION

This section will explain several analysis results to support industrial development in Indramayu Regency, such as the analysis of clean water infrastructure supply, the analysis of clean water infrastructure demand, which includes the coverage of piped and non-piped clean water services as well as domestic and non-domestic clean water needs, clean water quality, infrastructure needs gap, and clean water infrastructure development strategies in terms of quantity and quality.

Clean Water Infrastructure Supply Analysis

As the main support for the industrial sector, the discharge of raw water sources from three rivers (surface water) in Indramayu Regency is 99,310 liters per second. The largest discharge comes from the Cimanuk River, which is 76,700 liters per second. This data is based on water discharge calculations downstream of the Rentang Dam (Center for Water Resources Research and Development, 2015). The second surface water source is the Cipunegara River with a flow rate of 14,610 liters per second, obtained from calculations of the speed and cross-sectional area of the river at the Salam Darma Dam (PT. Alocita Madiri, 2014). Furthermore, the third surface water source is the Cipanas River, which has a discharge of 8,000 liters per second, determined using the 50% exceedance probability method (normal conditions) from the Cipanas River flow duration curve (Luthfi and Sodiq., 2022). The use of surface water is the main focus due to the negative impacts and restrictions on groundwater exploitation. Although the total discharge from these three rivers is relatively large, its availability remains vulnerable during the dry season and when used concurrently with the agricultural sector. The following is a map of surface water sources in Indramayu Regency.

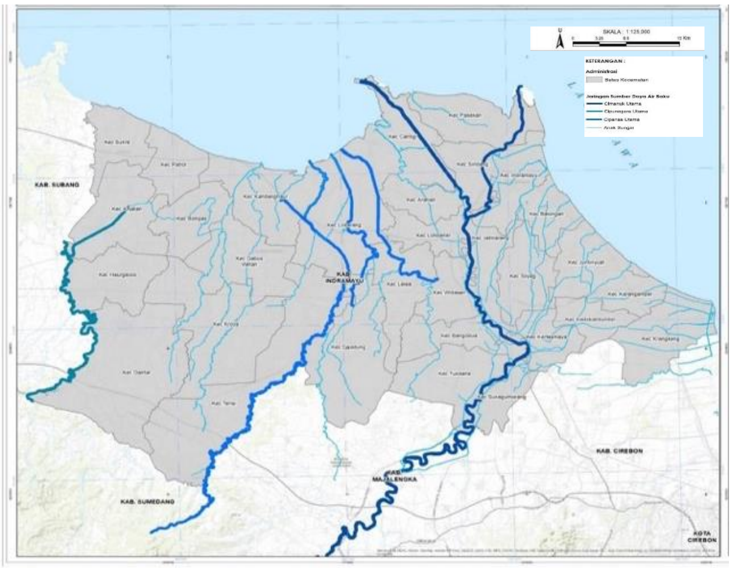

Figure 1. Map of Existing Surface Water Supply Sources in Indramayu Regency (Afifah et al., 2025)

Clean Water Infrastructure Demand Analysis

There are three outputs from this clean water infrastructure demand analysis, which is the coverage of existing piped and non-piped clean water services, as well as domestic and non-domestic clean water needs.

Piped and Non-Piped Clean Water Service Coverage

The coverage of clean water services for the PDAM Tirta Darma Ayu piped system is only around 28% with 157,000 customers (Humas Perumda Tirta Bhagasasi, 2025), which means that it does not yet cover the entire population of Indramayu Regency. Based on data from the 2018-2038 RISPAM document for Indramayu Regency, there are 12 Clean Water Treatment Plants (IPA) as shown in Table 2 and their locations in Figure 2 below.

Table 2. Water Sources, Production Capacity, and Areas Served by Water Treatment Plants (Water Supply System Master Plan (WSSMP) of Indramayu Regency 2018–2038)

No.	Water Treatment Plant	Water Source	Water Source Areas Served (Subdistricts)	Production Capacity (l/sec)
1	WTP Kepandean	Cimanuk River	Indramayu	160
2	WTP Jatibarang		Jatibarang, Sliyeg	69
3	WTP Regional		Indramayu, Sindang, Jatibarang, Sliyeg, Balongan,	291.63
4	WTP Kertasemaya		Kertasemaya, Sukagumiwang, Krangkeng, Kodokanbunder,	45,54
5	WTP Sindang		Pasekan, Indramayu	88
6	WTP Jatisawit		Jatibarang	19,44
7	WTP Pamayahan		Lohbener, Arahan, Cantigi	65
8	WTP Lohbener		Lele, Jatibarang	115,85
9	WTP Bangodua		Bangodua, Tukdana	33,82
10	WTP IKK Losarang	Cipanas Irrigation	Losarang	3,26
11	WTP Babakan Jaya	Wanguk Irrigation	Kandanghaur	49,95
12	WTP Salam Darma	Bugis Irrigation	Anjatan, Sukra, Patrol, Haurgeulis, Bongas,	95,36
Total Capacity (l/sec)				**1.036,85**
Number of People Served (People)				**860.112**
Number of Household Connections				**175.000**

Figure 2. Map of Piped Clean Water Service Coverage in Indramayu Regency (Afifah et al., 2025)

Approximately 72% of the population in Indramayu Regency still relies on non-piped clean water sources, compared to the coverage of the Tirta Darma Ayu Regional Water Company (PDAM), which is only 28%. The largest source of non-piped clean water is drilled wells with pumps, with a usage rate of around 44%, indicating a high level of community dependence on groundwater. Furthermore, dug wells with pumps account for around 16.9%, while protected dug wells account for around 10.8%. These sources are generally used in areas with shallow geological conditions. Other sources, such as water terminals (0.08%), protected springs (0.02%), and rainwater reservoirs (0.28%), have a very small role and only serve as a supplement in areas that experience water shortages during long dry seasons. These conditions indicate that the availability of clean water in Indramayu is highly dependent on the exploitation of shallow and deep groundwater. If this condition continues, it could lead to groundwater pollution, seawater intrusion, and environmental damage.

Domestic and Non-Domestic Clean Water Demand

The method for calculating domestic water demand in Indramayu Regency is based on the 1996 Clean Water Planning Criteria of the Directorate General of Public Works, the existing population (in 2025), and the projected population until 2045. The existing population is 1.9 million, and the projected population in 2045 will reach >2 million, meaning that Indramayu Regency can already be categorized as a metropolitan city. Domestic water demand can be calculated using the formula Q = Pn × q, where Pn is the population in year n and q is the standard daily water demand for the metropolitan category, which is 150 liters per person per day. Figure 3 below is a graph of domestic clean water demand in Indramayu Regency until 2045.

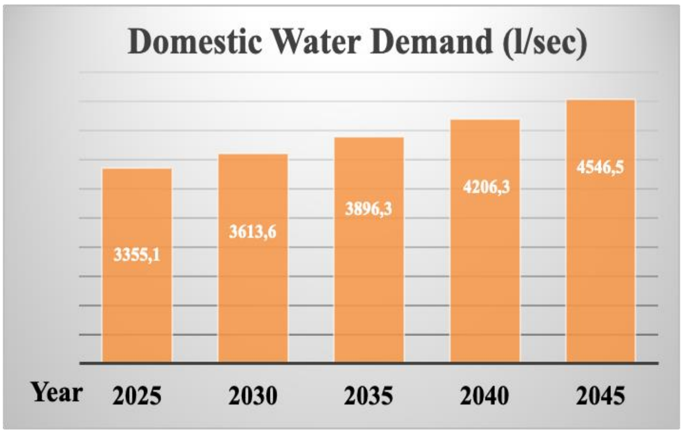

Figure 3. Existing and Projected Domestic Clean Water Demand (Afifah et al., 2025)

The calculation of non-domestic clean water requirements is divided into several types of activities, namely water requirements for the industrial, tourism, agricultural, public facilities, and social facilities sectors. The calculation of clean water needs for the industrial sector takes into account the existing industrial area in 2025, which is 1,300.41 hectares, as well as industrial development plans for 2030, which is 19,863.16 hectares in 6 Industrial Development Areas (KPI), such as KPI Losarang, KPI Patrol, KPI Cipali - Indramayu, KPI Tukdana, KPI Balongan, and KPI Krangkeng (West Java Governor Regulation No. 84 of 2020) and multiplying it by the standard water needs for the industrial sector, which is 0.2-0.8 liters/second/ha (Directorate General of Public Works, 1996). The clean water needs of the tourism sector are obtained by multiplying the existing area of the tourist area by the standard of 0.1-0.3 liters/second/ha. Then, to calculate the planned water needs for the next 20 years, the projected number of visitors to the tourist area is used. Agricultural or rice field water needs are calculated by multiplying the existing and planned land area by the standard water needs of 0.74-1.2 liters/second/ha (Patuh Rujhan et al., 2025). The planned agricultural land area has decreased due to KPI land development, especially in non-productive agricultural areas. Non-domestic water requirements for public and social facilities are calculated by multiplying domestic water needs by 15%. Table 3 explains water requirements in the non-domestic sector:

Table 3. Non-Domestic Sector Water Needs (Directorate General of Human Settlements, Ministry of Public Works (1996–2000); Spatial Plan for the Strategic Area of Tana Lili Industrial Zone (2019); modified by the author (2025))

Non-Domestic Sector	Standard	Land Area (Ha)	Clean Water Needs (liters/second)
Industry	0.8 liters/second/ha	1,300.41 (Existing)	1.040,328
	Based on land use (30% green space, 60% industrial area, 20% commercial area, and 20% residential area), labor, hydrant availability, and water loss rate	19,863.16 (Planned)	9981
Tourism	0.3 liters/second/ha	45 (Existing)	13,5
		143,05 (Planned)	42,9

Agriculture	1.2 liters/second/ha	126.393 (Existing)	151.671
		88.554,8 (Agricultural area spatial plan)	106.265,76
Fasilitas Umum dan Fasilitas Sosial	15% of domestic needs	-	1.660,77 (Existing)
		-	8.049,96 (Projected)

Clean Water Quality Analysis

Water quality in the Cimanuk River Basin in Indramayu Regency shows medium to heavy pollution, as found by two major studies. A study by Nurrohman et al. (2019) evaluated water quality downstream of the Cimanuk River Basin at the Rambatan Dam using a Pollution Index. They measured several parameters such as pH, TDS, TSS, nitrate, phosphate, BOD, and COD in accordance with the SNI 6989.57:2008 standard. Meanwhile, research by Sutriati A. (2011) in Widasari Village, Widasari District, used the STORET method to assess water quality. Both methods came to the same conclusion, namely that the water quality of the Cimanuk River was severely polluted.

Furthermore, research conducted by Herawati et al. (2019) discusses fish diversity in the downstream area of the Cipanas River, Indramayu Regency. In addition, this study also analyzes water quality at three sampling points, namely Santing, Tempalong, and Cemara villages. To measure water quality, in situ measurement methods were used to check temperature, dissolved oxygen (DO), pH, and light attenuation, as well as laboratory methods to determine Total Suspended Solids (TSS), Total Dissolved Solids (TDS), and Chemical Oxygen Demand (COD). The Cipanas River has a fairly high Pollution Index value (Pij ≥10, or 12.5), which indicates that the river water is heavily polluted and not suitable for use as drinking water or for other purposes that require clean water. This pollution index value indicates that the river water is classified as highly polluted.

Clean Water Demand Gap Analysis

Water balance analysis is used to identify the gap between the current availability (supply) of raw water and the demand for clean water from 2025 to 2045 if there are no new raw water sources added in Indramayu Regency. This analysis compares the availability of raw water, which is calculated with an 80% probability of availability from the total reliable discharge of three main rivers and the total discharge from IPA production, with the water demand from the existing domestic and non-domestic sectors in 2025 and the total water demand from the existing and planned/projected domestic and non-domestic sectors in 2045. The results of this analysis can be seen in Table 4 below.

Table 4. Water Balance in 2025 (Existing) and 2045 (Planned) (Afifah et al., 2025)

Year	Raw Water Supply (l/sec)	Water Treatment Plant Production (l/sec)	Demand (l/sec)	Raw Water Gap (l/sec)	Clean Water Production Gap (l/sec)
2025	79.448	1.036,85	154.386	-74.938	-153.349,2
2045	79.448	2.192	127.054,2	-47.606,2	-124.862,2

Based on Table 4, the results of the water balance analysis show a gap between water availability and water demand, both in 2025 and 2045. The analysis results show that there is currently a water shortage in Indramayu Regency of 74,938 liters per day. It is predicted that this deficit or shortage will continue until 2045. In 2025, the raw water supply will be 79,448 l/sec, while the water demand will be 154,386 l/sec. This will result in a raw water deficit of -74,938 l/sec. On the other hand, the production capacity of the Water Treatment Plant (IPA) is only 1,036.85 l/sec, which is much smaller than the water demand of −153,349.2 l/sec. This condition shows that the availability of raw water and water treatment capacity are very important in meeting the needs of the community. In addition, the quality of local river water is very low during the dry season, which exacerbates this deficit. Although water discharge increases significantly during the rainy season, the volume of water that can be produced through PDAM remains much lower due to the high level of dissolved solids in the water, indicating a decline in water quality. In 2045, even though IPA production capacity will increase to 2,192 l/sec and water demand will decrease to 127,054.2 l/sec, the gap will remain with a raw water deficit of around -47,606.2 l/sec and a water production deficit of around -124,862.2 l/sec. Overall, these results indicate that despite an increase in production capacity, the availability of raw water and the capacity of water treatment systems are still insufficient to meet demand. Therefore, strategies to increase production capacity, improve efficiency, and conserve water resources are needed to reduce the gap between supply and demand in the future.

Clean Water Infrastructure Development Strategy

The infrastructure planning strategy focuses on three main pillars to achieve the goal of optimizing integrated clean water supply services, thereby supporting industrial development in the Rebana Region. This includes increasing the amount of surface water resources to meet the needs of the community and industry, as well as maintaining the region's role as a food production center. In addition, this strategy also emphasizes improving the production, distribution, quality, and overall service of clean water. The presence of 12 water treatment plants, most of which are located in the eastern part of Indramayu Regency, as well as surface water sources from three main rivers, namely Cimanuk, Cipanas, and Cipunegara, are the main supporters of this strategy.

Table 5. Determination of Strategies Based on SWOT Analysis of the Clean Water Sector in Indramayu Regency (Afifah et al., 2025)

INTERNAL / EXTERNAL	**Strengths**	**Weakness**
	• **(S1)** There are 12 Water Treatment Plants (IPA) in Indramayu Regency, serving 27 subdistricts. • **(S2)** There is a directive from the Public Works and Public Housing Agency prohibiting KPI from using groundwater sources. • **(S3)** The existence of a Community-Based Water Supply program (Pamsimas) in the sub-districts of Gantar, Terisi, Patrol, Kandanghaur, Bongas, Gabusweta n, and Cikedung. • **(S4)** There are three surface water sources, namely the Cipanas River, Cimanuk River, and Cipunegara River.	• **(W1)** Insufficient quantity of surface water supply. • **(W2)** Decline in the quality of raw water sources due to pollution from industrial waste. • **(W3)** Suboptimal coverage of clean water services in both the domestic and non-domestic sectors. • **(W4)** Suboptimal accessibility to clean water services, especially for low-income communities. • **(W5)** High use of groundwater, especially in the domestic sector (72%). • **(W6)** Suboptimal cooperation between regio ns especially in the integration of raw water s upply systems. • **(W7)** Limited local government funding for clean water supply.
Opportunities • **(O1)** The existence of alternative raw water source plans for the Rebana Metropolitan Area from Sadawarna Dam, Jatigede SPAM, and Cipanas Dam (Source: West Java Provincial Regulation No. 84 of 2020). • **(O2)** The existence of plans for pipeline network development (Source: Indramayu Regency Spatial Plan 2021–2041). • **(O3)** The existence of plans to install new customer connections in sub-districts that are not yet served by clean water supply systems, namely Cikedung, Terisi, Bongas, and Gantar Sub-districts (Source: Indramayu Regency Spatial Plan 2021–2041). • **(O4)** The existence of plans to expand drinking water service coverage through the construction of Water Treatment Plants and distribution pipeline networks (Source: Indramayu Regency Spatial Plan 2021–2041). • **(O5)** The existence of plans for capacity enhancement and development of dams and reservoirs (Source: Indramayu Regency Spatial Plan 2021–2041)	**S-O Strategies** • **(S1, O2, O3, O4)** Maximize the performance of clean water management by developing pipeline networks in 12 existing Water Treatment Plants (WTPs) and accelerating the construction of new WTPs in areas not yet served by the piped clean water system. • **(S2, O1)** Accelerate the development of surface raw water sources to support the enforcement of the Groundwater Use Prohibition for Industrial Designation Areas (KPI) in Indramayu. • **(S2, O5)** Develop the capacity of dams and reservoirs to maximize the quantity of surface water sources in order to strengthen the prohibition of groundwater use in Indramayu Regency.	**W-O Strategies** • **(W1, W5, O1, O5)** Increase the quantity of surface water supply by utilizing alternative raw water sources and expanding the capacity of dams and reservoirs to reduce groundwater extraction. • **(W2, O4)** Improve the quality of clean water by constructing technologically advanced Water Treatment Plants capable of meeting safe water quality standards. • **(W3, W4, O3, O4)** Optimize piped clean water coverage by developing WTPs and distribution pipeline networks in sub-districts that are not yet served.
Threat • **(T1)** Limited quantity of raw water, threatening the sustainability of Indramayu Regency's agriculture as a national food barn. • **(T2)** Increasing demand for clean water in Indramayu Regency due to the demographic bonus and the influx of external labor.	**S-T Strategies** • **(S4, T1, T2)** Optimize the quantity of existing surface raw water sources to supply water for Indramayu Regency's agricultural sector as a national food barn and to meet the needs of population and labor growth in the future.	**W-T Strategies** • **(W6, W7, T1, T2)** Optimize inter-regional cooperation to support the provision and management of raw water for Indramayu Regency's agriculture as a national food barn, as well as to meet the increasing water demand in the future.

Based on the analysis in the table above, it is known that in 2045 there will be a raw water deficit of around -47,606.2 l/sec and a water production deficit of around -124,862.2 l/sec. Therefore, the strategy for optimizing clean water supply to support community needs and industrial activities in the Rebana Area is as follows:

A. Raw Water System:

- Promoting the acceleration of surface raw water supply for the implementation of the Ban on Groundwater Use for Industrial Areas (KPI) in Indramayu Regency.
- Develop local water storage capacity up to 90% as a new raw water source, namely reservoirs, lakes, swamps, and ponds (existing capacity 315.49 l/sec). to maximize the quantity of surface water sources through dredging and gradual embankment addition from 2030 to 2045 (the potential addition of new raw water discharge is 599.42 l/sec if developed by 90%, with 6-meter dredging and 3-meter embankment height addition).
- Increase the quantity of surface water supply by utilizing alternative regional raw water sources with a potential increase in raw water discharge of 3,600 l/sec from the Sadawarna Reservoir: 2,000 l/sec, Cipanas Reservoir: 850 l/sec, and Jatigede Dam: 750 l/sec, thereby strengthening the ban on groundwater use in Indramayu Regency.
- Optimizing the quantity of existing surface water sources to supply water for agriculture in Indramayu Regency as a national food granary, as well as to support future population growth and workforce development

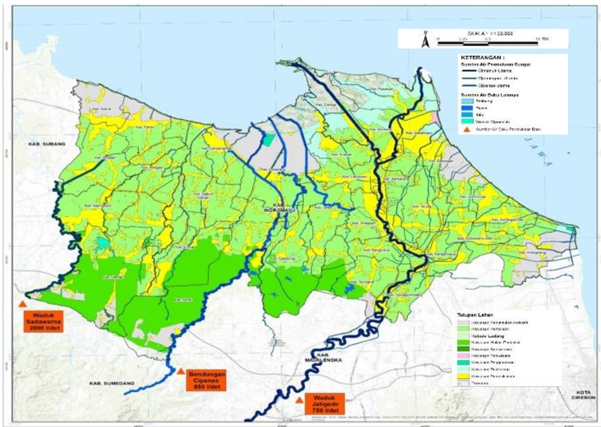

Figure 4. Map of Alternative New Raw Water Sources and the Development of Reservoirs, Lakes, Swamps, and Retention Ponds in Indramayu Regency in 2045 (Afifah et al., 2025)

B. Production, Distribution, and Service System:

- Maximize the performance of clean water management by developing a piped network in 12 existing Water Treatment Plants (WTPs) — increasing total production capacity to 2,192 l/sec — and accelerating the construction of new WTPs in areas currently not served by the piped clean water system, such as Gantar, Cikedung, and Terisi Subdistricts.
- Optimize the coverage of piped clean water services to reach all areas in Indramayu Regency through the construction of new WTPs and distribution pipelines for unserved subdistricts.
- Improve the quality of clean water services through modernization by applying advanced technologies. Water quality monitoring should no longer rely solely on manual inspections but be supported by technology such as the Real-Time Water Quality Information Service, a system that measures water quality parameters and publishes real-time data on a web platform to inform users about water conditions for usage and public safety. Real-time information is enabled by sensors that measure parameters such as pH, water temperature, turbidity, dissolved oxygen, nitrate, and others.

CONCLUSION

The study results indicate that efforts to develop clean water infrastructure in Indramayu Regency are currently in a critical phase. This is marked by two major issues: a significant water balance deficit (projected raw water deficit of approximately −47.606.2 l/sec and production deficit of −124.862.2 l/sec by 2045) and the degradation of main river raw water quality to a heavily polluted level. Despite the existence of 12 Water Treatment Plants (WTPs) supporting water supply, the treatment process has been hampered by issues in both the quantity and quality of raw water. Consequently, the community remains heavily dependent on groundwater, accounting for about 72% of total water use. Therefore, implementing an integrated strategy is crucial to ensure the sustainable development of the Rebana Industrial Area. The main recommendations include increasing the quantity of supply through the development of up to 90% of local storage capacity in reservoirs, lakes, swamps, and retention ponds (from an existing capacity of 315.49 l/sec to 599.42 l/sec), and utilizing regional raw water sources (adding a total of 3,600 l/sec). This represents an essential support for achieving the groundwater-use prohibition policy. To expand service coverage, this strategy must be complemented by the modernization of WTPs through real-time water quality information technology and the expansion of piped distribution networks. The study contributes by providing detailed policy recommendations for stakeholders, while recognizing that the projected water deficit is expected to persist through 2045, underscoring the need for more extensive interventions.

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