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PROJECTED ANALYSIS OF FULFILLING PDAM CLEAN WATER NEEDS IN DOMESTIC CUSTOMERS OF WAGINOPO VILLAGE, WANGI-WANGI DISTRICT, WAKATOBI DISTRICT

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Abstract

Clean water is a very vital need for society, to meet the needs for drinking water, bathing, cooking, washing and including industrial needs. The existence of clean water in an area is very important considering the very dynamic activities of society. In its implementation, the drinking water supply system in Waginopo Village has not been able to run smoothly. In fact, according to a temporary survey that has been carried out, PDAM water only flows once every 2 days, once a week and the maximum flow time is only 12 hours. The aim of this research is to calculate the amount of clean water needed for the service area of Waginopo Village, Wangi-Wangi District, Wakatobi Regency until 2033. In this research, not only numerical data will be collected, but also information about what the community desires regarding the performance of the clean water distribution system, so this research study approach uses a combination of quantitative and qualitative approaches. From the results of the analysis it can be said that the total water demand of PDAM Wakatobi Regency for the Waginopo Village service area in 2033 is 867,894 m^3/year. Meanwhile, based on water demand in 2024, it is 592,737 m^3/year. So the calculation results from 2024 to 2033 have increased.

Keywords: Clean Water Needs, PDAM, Domestic Customers

INTRODUCTION

Clean water is a very vital need for society, to meet the needs for drinking water, bathing, cooking, washing and including industrial needs. The existence of clean water in an area is very important considering the very dynamic activities of society (Haasnoot et al., 2013; Hove et al., 2019; Johannessen & Wamsler, 2017; Sivapalan et al., 2012; Venohr et al., 2018). To meet the need for clean water, residents of an area can rely on water from direct water sources such as surface water and rain because these two water sources are easily accessible even though most of it is polluted either directly or indirectly from human activities themselves (Bwire et al., 2020; Huang et al., 2021; Mishra, 2023; Mukaromah, 2020; Richards et al., 2021).

Water is a very important need for human survival, without water there would be no life on earth. 65% of the human body consists of water (Drabińska et al., 2021; Madhav et al., 2020), and this earth contains a large amount of water, approximately 1.4 x 109 km^3, which consists of oceans, seas, rivers, icebergs, and so on (Duarte, 2024; Mocek-Plóciniak & Skowronska, 2021; Peccerillo, 2021). However, of all the water contained on earth, only 3% is fresh water found in rivers, lakes and groundwater (Klimaszyk & Gołdyn, 2020; Mishra, 2023; Musie & Gonfa, 2023). Because of the importance of the need for clean water, it is natural that the clean water sector gets top priority because it concerns the lives of many people.

Handling the need for clean water can be done in various ways, adapted to existing facilities and infrastructure. In urban areas, the clean water supply system is carried out using piped and non-piped systems. The piping system is managed by the Regional Drinking Water Company and the non-piping system is managed by the community, both individually and in groups.

Providing clean water infrastructure in a city is one of the government's very important responsibilities to ensure the availability of clean water for the residents (Bishoge, 2021; Neto & Camkin, 2020; Saikia et al., 2022; Torres et al., 2020). In this regard, the Regency/City government through the Regional Drinking Water Company is working to establish a water treatment installation, which can guarantee the availability of clean water for the community.

This also happens in the Wakatobi Regency area, namely Wangi-wangi District. The population of Wangi-Wangi District, especially Waginopo Village, is 739 people (Central Statistics Agency of Wakatobi Regency). Most of Wangi-Wangi District is on low land surrounded by mountains and high land. Hydrological conditions in Wangi-wangi District consist of underground water, surface water and sea where the condition of some water sources is very dependent on the intensity of rainfall and the level of forest destruction, namely for mountainous areas. So the water in Wangi-wangi District includes Wagehe Gehe Springs, Tee Huo Springs, Tee Bete Springs, Longa Springs and Tee Wahuo Springs. So for the research area that will be studied using the Wagehe Gehe Spring.

Residents in Wangi-Wangi District, Waginopo Village have varying economic levels and social status. From the differences in clean water supply systems used by the community in obtaining clean water, which is 90% percent from PDAM Wangi-Wangi District, the quality and quantity of clean water supply is different, because the performance of each system is greatly influenced by various things, both technical and non technical. In a piped clean water supply system, the quality of service depends on the condition of the water distribution pipe network and service performance. Meanwhile, the quality of service in non-piped clean water supply systems depends on the conditions of the surrounding natural environment. From the results of a preliminary survey directly at the PDAM service area in Wangi-wangi District, it was found that the flow rate was small (insufficient), the water pressure was low, the flow was not continuous or the flow hours were often erratic, which was very detrimental to residents.

In its implementation, the drinking water supply system in Waginopo Village has not been able to run smoothly. There are several problems that have arisen in the water supply process so far, namely the distribution system is not able to meet the water needs of all customers, which can be seen from the water supply not being available within 24 hours. In fact, according to a temporary survey that has been carried out, PDAM water only flows once every 2 days, once a week and the maximum flow time is only 12 hours.

Apart from the problems that arise in the drinking water supply system, PDAM also faces challenges to improve system performance in order to cope with increasing community water consumption. Water consumption will always increase along with population growth. Population growth will increase the amount of water demand in general due to increased water consumption. Seeing these conditions and realities, it is necessary to improve the PDAM Wakatobi Regency's drinking water supply system as a whole to increase the service's ability to meet the community's drinking water needs.

To find out more about Wakatobi Regency PDAM services and how the community actually faces this problem, it is necessary to conduct a study regarding the performance of clean water supply services. In this way, it is hoped that a real picture of the condition of clean water services will be known, including various problems and how to solve them. Apart from that, it can be seen the real picture of clean water insecurity that arises in the area that is the object of study so that this can be used as evaluation and input material for city planners, especially the PDAM and as learning material for the community.

Based on the background of this research, the issue of clean water supply service performance will be further studied, as well as the level of community satisfaction with the PDAM clean water service system in meeting the clean water needs of the Waginopo Village Community, as follows. How much clean water is needed for the service area of Waginopo

Village, Wangi-wangi District, Wakatobi Regency until 2033. Then the aim of this research is to calculate the amount of clean water needed for the service area of Waginopo Village, Wangi-Wangi District, Wakatobi Regency until 2033.

The aim of this research is to calculate the amount of clean water needed for the service area of Waginopo Village, Wangi-Wangi District, Wakatobi Regency until 2033. The research provides a calculation or estimation of the future demand for clean water in Waginopo Village, located in the Wangi-Wangi District of Wakatobi Regency, up until the year 2033. This contribution is valuable for planning and managing water resources to ensure sufficient clean water supply for the village's population in the coming years.

RESEARCH METHOD

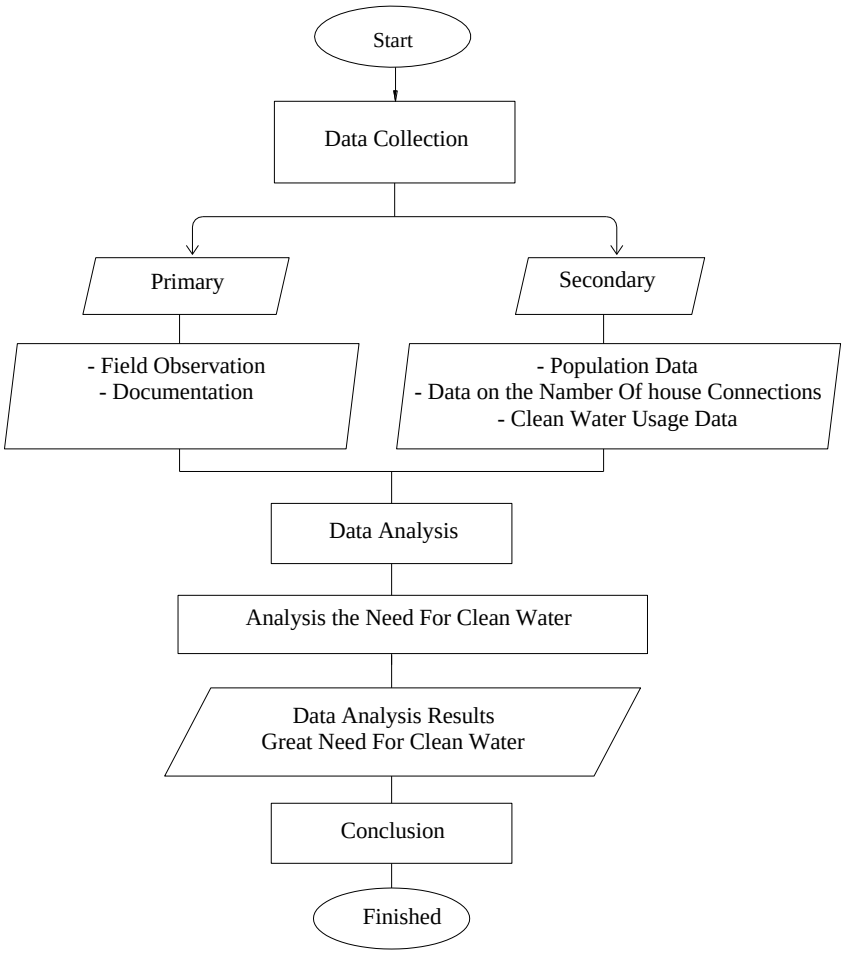

Figure 1. Research Flow

This research requires two types of data: secondary data from related agencies like PDAM Wakatobi, and primary data from field observations and questionnaires from clean water customers. Secondary data includes population, head of families, customers, daily clean water usage capacity, and clean water quality standards. Primary data comes directly from field observations and questionnaires from clean water customers, including house connections, quantity of clean water, continuity, service area, and clean water service.

Data collection techniques include field observation and literature review, with the aim of obtaining unwritten data about clean water distribution services. Data processing and presentation techniques help researchers process data and create targets. Descriptive data is separated from numerical data, while quantitative data is separated from quantitative data.

Data is presented in narrative data as qualitative data, which comes from answers or stories from clean water supply system managers and the community. Data tabulation is used for numerical data but does not exclude non-number data from clean water customers directly related to the distribution system.

The research methods include primary and secondary data, including water supply and production capacity, customer area boundary data, service area boundary data, and PDAM customer water usage data by customer category. Secondary data was obtained from PDAM data, while primary data was obtained from direct measurements in the field.

RESULT AND DISCUSSION

Calculation of Clean Water Needs for the Waginopo Village Service Area

To find out how much clean water will be needed for the Waginopo Village service area in the future, this can be done using the rate of increase in house connections and water usage data as the main basis at this calculation stage. Thus, the amount of clean water needed for Waginopo Village can be calculated in 2033. The table with data on house connections and water use is as follows.

Table 2. Number of Home Connections and Total Use of Clean Water from 2019 to 2023

Year	Home Connection	Water Usage (m^3/year)
2019	374	443.190
2020	396	469.260
2021	424	502.440
2022	438	519.030
2023	482	571.170

Source: Wakatobi Regency PDAM data, 2024

Based on table 2, it can be seen that the number of house connections and the amount of clean water usage has increased each year, namely in 2019 there were 374 home connections with a total of 443,190 m^3/year of clean water usage, while in 2023 the number of connections 482 home connections houses with total clean water usage of 571,170 m^3/year. So it can be calculated as follows:

House Connections (2019) = 374 home connections

Average water usage = Number of Uses : 12

= 443.190 : 12

= 36.933 m^3/month

Based on the table above, a table of water use per year can be made to make calculations easier, namely as follows:

Table 3. Calculation of Average Clean Water Needs

No	Year	A	B	C
		House Connections	***Water Usage (m^3/month)***	***Total usage Avg (m^3/year) (B) x 12***
1	2019	374	36.933	443.190
2	2020	396	39.105	469.260
3	2021	424	41.870	502.440
4	2022	438	43.253	519.030
5	2023	482	47.598	571.170

Source: Researcher Process, 2024

Based on table 3, it can be concluded that there is an increase in clean water use, namely the lowest clean water use in 2019 was 36,933 m^3/month and the highest clean water use was in 2023 at 47,598 m^3/month. This allows the use of clean water for future predictions to be carried out as follows:

Table 4. Calculation of Estimated Clean Water Needs

No	X	Y	XY	X^2
1	1	443.190	443.190	1
2	2	469.260	938.520	4
3	3	502.440	1.507.320	9
4	4	519.030	2.076.120	16
5	5	571.170	2.855.850	25
∑	15	2.505.090	7.821.000	55

Source: Researcher Process, 2024

Based on table 4, X is the years 2019, 2020, 2021, 2022 and 2023 and Y is the total need/use of clean water for each year 2019, 2020, 2021, 2022 and 2023, so the need can be calculated using the following formula:

$$B = \frac{n\Sigma XY - \Sigma X.\ \Sigma Y}{n\Sigma X^2 - (\Sigma X)^2}$$

$$B = \frac{5 \times 7.821.000 - 15 \times 2.505.090}{5 \times 55 - (15)^2}$$

$$= \frac{1.528.650}{50}$$

$$= 30.573$$

$$A = \frac{\Sigma Y}{n} - B\frac{\Sigma X}{n}$$

$$A = \frac{2.505.090}{5} - (30.575)\frac{15}{5}$$

$$= 501.018 - 91.719$$

$$= 409.299$$

$Y = A + (B \times X)$

The X value above is a projection for the reporting year calculated annually as follows:

For 2033

$Y = 409.299 + (30.573 \times 15)$

$Y = 867.894\ m^3$/year

For 2032

$Y = 409.299 + (30.573 \times 14)$

$Y = 837.321\ m^3$/year

Based on the estimated calculations above, the need for clean water will increase per year, here is the calculation table:

Table 5. Results of Estimated Average Water Needs and Increased Water Needs

No	Year	Average Water Requirements (m^3/year)	Increased Water Needs (%)
1	2024	592.737	8,12
2	2025	623.310	8,53
3	2026	653.883	8,95
4	2027	684.456	9,37
5	2028	715.029	9,79
6	2029	745.602	10,21
7	2030	776.175	10,63
8	2031	806.748	11,05
9	2032	837.321	11,47

10	2033	867.894	11,88
Total		7.303.155	100

Source: Researcher Process, 2024

Based on table 5, it can be seen that the lowest average water estimate results in 2024 are 592,737 m^3/year, and the highest average water estimate results in 2033 are 867,894 m^3/year. From table 5 a graph can be made as follows:

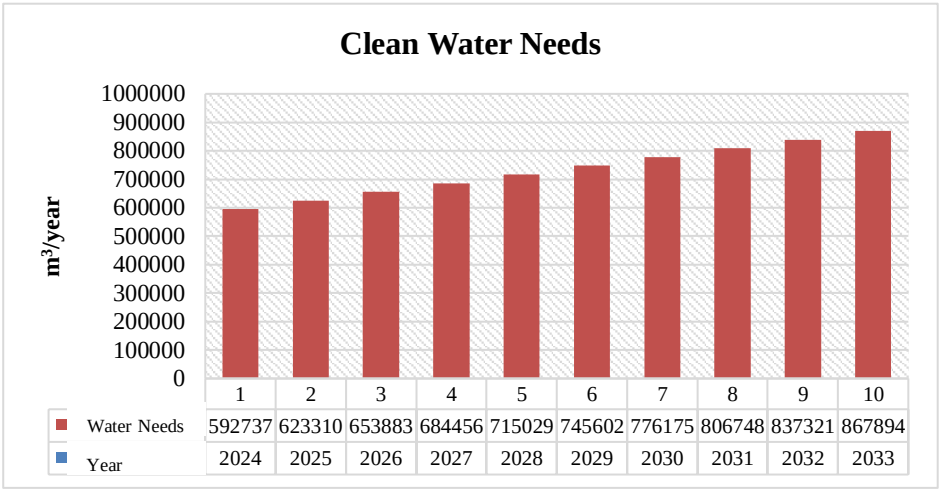

Figure 2a. Graph of Clean Water Needs
Source: Researcher Process, 2024

From Figure 2a, it can be seen that the results of the lowest average water demand estimate in 2024 are 592,737 m^3/year, as well as the results of the highest average water demand estimate in 2033 of 867,894 m^3/year.

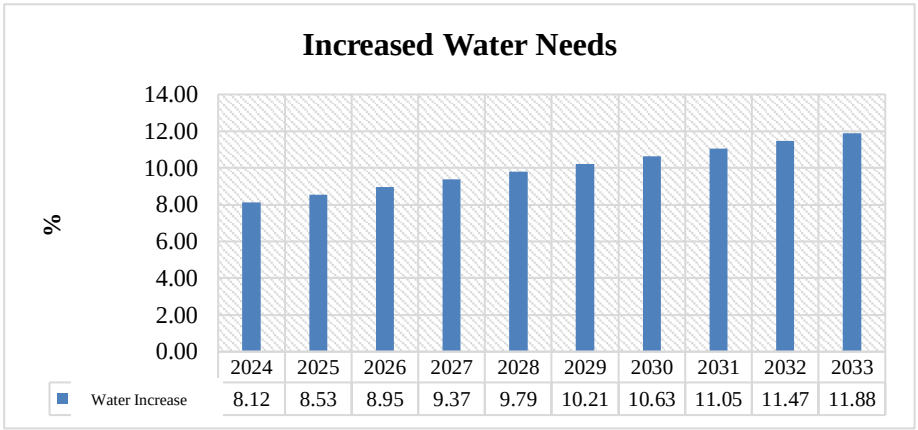

Figure 2b. Graph of Increase in Clean Water Needs
Source: Researcher Process, 2024

From Figure 2b, it can be seen that the results of the lowest average water demand estimate in 2024 are 8.12%, as well as the results of the highest average water demand estimate in 2033 of 11.88%.

CONCLUSION

From the results of the research carried out, several conclusions can be drawn from the Projected Analysis of Fulfillment of PDAM Clean Water Needs for Domestic Customers in

Waginopo Village, Wangi-Wangi District, Wakatobi Regency, namely that the total water needs of PDAM Wakatobi Regency for the Waginopo Village service area in 2033 will be 867,894 m^3/year. Meanwhile, based on water demand in 2024, it is 592,737 m^3/year. So the calculation results from 2024 to 2033 have increased, so that the need for clean water has met the needs of the community, especially the Waginopo Village service area.

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