

Study of Identification Water Losses in Water Supply Company of Mojokerto City

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ABSTRACT

Water supply system becomes particular concern to every urban area in Indonesia including Mojokerto City. In water distribution system, water losses is one of serious problem to be overcome. The first step in reducing water losses is by developing an understanding of the big concept about water system including the preparation of a water balance. This process helps to understand the quantity, source and charge of water losses. The water balance calculation in this study uses the *WB-EasyCalc* program version 4.05. Based on the analysis, the percentage of water losses is 47 % with the composition of real losses 44,6 % and apparent losses of 2,4 %. Distribution data components of water losses used in determining the disadvantages in water supply company of Mojokerto City. The results of this water balance analysis are used to analyze disadvantages of water losses.

KEYWORDS: Water Losses, *WB-EasyCalc* version 4.05, Water Supply Company

1. INTRODUCTION

Drinking water is a basic need that can't be separated from human life. Drinking water services are a very important component of public services. The provision of drinking water is of particular concern to every urban area in Indonesia is no exception in Mojokerto City. The population of Mojokerto is 112.547 people with an area of 1.646,5 hectares. The need for the clear water is an important effort for the development of the city, so that the readiness of the clear water facilities is very supportive for business development in the center of the city [1]. The service of Mojokerto Drinking Water Regional Companies (PDAM) have not met the needs of clear water throughout Mojokerto so that some people use well bore water (Underground Water). The water loss rate of PDAM Mojokerto up to September 2017 amounted to 53.73% with the price of the water is Rp 3,168.20, that caused the PDAM Mojokerto to suffer a lot of losses. In water distribution system, water losses is one of serious problem to be overcome. This results is significant losses for company income [2]. Non revenue water is the difference between the amount of water supplied with the water consumed [3]. In fact, the water losses in a drinking water distribution system will always be present. This water loss can be technical, such as water losses on the pipe itself, while non-technical for example illegal consumer [4]. The results obtained from the water balance in this study were 47% water loss. The percentage of water loss volume is dominated by 44.6% of physical water loss of 68756 m³, and 2.4% of non-physical water loss of 3723 m³ [5]. Ministry of public work has set maximum limits of water losses as 20%, water supply company of Mojokerto City not meet the standards [6]. To reduce water losses in distribution system is must be aware the cause of the water losses, one of them by using the water balance. International Water Association (IWA) has developed a structure and standard terminology for international water balance which has been adopted by national associations in many countries [7]. Water balance calculation in this study using the program *WB-EasyCalc* version 4.05. This software is very helpful in preparing the water balance and can show the level of accuracy of non revenue water calculation. Water balance is very important to know components of water losses in order to analyze disadvantages in water supply company of Mojokerto City.

2. METHODS

The location of this research is urban water distribution network in water supply company of Mojokerto City. In this research, research methods will be done by quantitative research method through survey and interview. Technical analysis in this study using descriptive analysis techniques to identify the distribution of the causes of water losses in water supply company of Mojokerto City. Required data to identify the components of the cause of water losses is annual system input volume, billed meteres consumption, billed unmetered consumption, unbilled metered consumption, unbilled unmetered consumption, unauthorised consumption, costumer meter inaccuracies and data handling errors, length of distribution and transmission pipe, service pipe,

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average pressure, intermittent supply data and financial data. The data is inputted to the *WB-EasyCalc version 4.05* program and analyzed the component of the cause of water losses in the water distribution system of water supply company of Mojokerto City [7]. After that determined to analyze disadvantages water losses based on the water balance.

3. RESULTS AND DISCUSSION

On January until June 2018 water supply company of Mojokerto City has distributed water as 153,980 m³/month, with water losses in distribution system as 72,479 m³ or 47 %. With the composition of real losses 68,756 m³ and apparent losses of 3,723 m³. Water balance calculation results in urban areas water supply company of Mojokerto City are shown in figure 1.

Water balance in water supply company of Mojokerto City can be described as:

1. Non revenue water as annual system input volume which is reduced by revenue water. So the calculation for non revenue water on January until June 2018 is $153,980 - 80,991 = 72,989$ m³/month.
2. Unbilled unmetered consumption is all official consumption which is not billed or not metered. This component is generally used for water supply company operations such as washing pipe, pipe test, road cleaning, etc. Calculation of unbilled unmetered consumption in 2018 as 510 m³/month.
3. Unauthorized consumption is an illegal water use, caused by illegal connection, bypass on the meter, unauthorized use of hydrants, etc. Unauthorized consumption in 2018 water supply company of Mojokerto City is 402 m³/month.

Home	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption 80.926 [m3]		Revenue Water	
		80.991 [m3]	Billed Unmetered Consumption 65 [m3]			80.991 [m3]
	System Input Volume	81.501 [m3] Error Margin [+/-]: 0,1%	Unbilled Authorised Consumption	Unbilled Metered Consumption		Non-Revenue Water
			510 [m3] Error Margin [+/-]: 15,9%	0 [m3]		
	153.980 [m3] Error Margin [+/-]: 2,0%	Water Losses	Apparent Losses	Unauthorised Consumption		
			3.723 [m3] Error Margin [+/-]: 24,9%	402 [m3] Error Margin [+/-]: 20,0%		
		Customer Meter Inaccuracies and Data Handling Errors		72.989 [m3] Error Margin [+/-]: 4,2%		
		Real Losses				
		68.756 [m3] Error Margin [+/-]: 4,7%				

Figure 1. Water Balance Water Supply Company of Mojokerto City

4. Customer metering inaccuracies and data handling errors is an apparent losses effect of costumer metering innacuracies and error in meter reading. In 2018 its value is 3,321 m³/month
 5. Commercials losses as unauthorised consumption plus costumer meter inaccuracies and data handling errors. So the calculation for commercial losses in 2018 as $402 + 3,321 = 3,723$ m³/month. When changed in percentage is 2.4 %.
 6. Physical losses is the volume of water losses through all types of leakage, pipeline explosion, overflow on pipes, reservoir, etc. So in 2018, the calculation for physical losses water supply company of Mojokerto City as 68,756 m³/month or 44.6 %.
- Based on data from the water balance analysis, percentage of water losses is 47 % with the composition of real losses 44.6 % and apparent losses of 2.4 %. The results of this water balance analysis are used to know the advantages of water losses.

The high of water losses can cause the advantages in Water Supply Company of Mojokerto City. Broadly speaking, the disadvantages of water losses can be grouped into 4, namely as follows:

1. Losses in terms of quantity (debit)

Water losses, the amount of water that can be used by customers is reduced. Because there are water that should flow to customers wasted due to the pipe leak during the distribution, and the presence of illegal connections, will cause the water that should be fully distributed to official customers to be divided and reduced.

2. Losses in terms of pressure

Water losses (especially due to leakage in distribution pipes and the existence of illegal connections) can reduce the pressure of water during distribution to consumers.

3. Losses in terms of water quality

If there is a water leak, when the pipe is not filled with water or there is negative pressure there is a possibility that dirt from outside the pipe will enter the pipe, so the water in the pipe is contaminated with dirt from outside the pipe.

4. Financial (Economic) losses

The result of water losses are financial losses for the Water Supply Company. Water losses production cost per cubic meter of water will increase and the income from the sale of water will decrease, so overall profits obtained by the Drinking Water Company will decrease.

4. CONCLUSION

High water losses rate 47 % is above the water losses level set by the government is 20%. This resulted in significant losses of water supply company income. From water balance calculations, composition of real losses as 44.6 % and apparent losses of 2.4 %. The disadvantages of water losses are quantity, pressure, water quality, and financial (economic).

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