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ANALYSIS OF CLEAN WATER NEEDS IN WEST BANJARMASIN DISTRICT

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ABSTRACT

In order to meet the need for clean water, PDAM Bandarmasih continues to make service improvements by increasing the quality of water delivered, increasing the amount of production capacity and also through improvements to the distribution network system. Increasing the need for clean water for PDAM Bandarmasih customers, the best way is to conduct an assessment / recalculation of clean water needs for the present and future city of Banjarmasin so that the public's desire to get clean water distribution services from PDAM Bandarmasih can be fulfilled.

The purpose of this final assignment is to determine the needs of clean water for PDAM Bandarmasih customers in the district of West Banjarmasin and to know the increase in the number of customers and how much the need is, so that PDAM Bandarmasih can serve the community at this time and in the future in an even distribution, so that the community can get clean water smoothly.

From the results of the analysis with needs, it is obtained that the clean water needs of PDAM Bandarmasih customers in West Banjarmasin District in 2021 are equal to Q = 16590.32 m3 / day. Service coverage in West Banjarmasin District is in zone 129.

Keywords: Need for Clean Water, service coverage, West Banjarmasin District

CHAPTER I INTRODUCTION

1.1 Background

Bandarmasih PDAM network system is expected to be able to distribute clean water evenly and in balance to all network locations according to their respective needs. Clean water from these sources is distributed directly to customers. In the city of Banjarmasin there are water sources consisting of original water sources in the form of springs and deep wells. This source is a potential water source that can meet the water needs of the surrounding community, so that the distribution

of clean water can meet the national standard water needs of 80%. According to data from PDAM Bandarmasih, the public's desire to get clean water services is very high. With the increasing need for clean water for PDAM Bandarmasih customers,

1.2 Problem Formulation

1. How much water needs to be provided by PDAM Bandarmasih in West Banjarmasin area
2. How much water needs to be provided by PDAM Bandarmasih in the future West Banjarmasin area.

1.3 Research Objectives

1. Knowing the amount of water needs that must be distributed to customers of PDAM Bandarmasih in the District of West Banjarmasin.
2. Knowing the need for clean water for the District of West Banjarmasin in the future.

1.4 Research Benefits

Knowing how much PDAM Bandarmasih water needs for the West Banjarmasin District area up to and knowing the capacity of water source discharge to meet the needs of PDAM Bandarmasih customers until 2021. This research is also useful for gaining insight in the field of Water Resources Engineering.

1.5 Problem Limits

1. The research is located in the city of Banjarmasin, precisely in the district of West Banjarmasin, which gets water from the PDAM Bandarmasih springs.
2. The calculation of the amount of clean water needs which includes social, commercial, non-commercial, industrial, special needs and the percentage of water loss, in order to obtain the amount of water demand that must be available for all types of customers so that the total water needs that must be available for all types of customers are obtained.
3. Data analysis is based on secondary data obtained at PDAM Bandarmasih, Banjarmasin City from 2015 to 2018.

CHAPTER II LITERATURE REVIEW

2.1.1 Definition of Water

Water is a natural resource that is absolutely used for human life and life and in an environmental system, water is an element of the environment. Human needs for water needs always increase from time to time, not only because of the increasing number of people who need

water, but also because of the increasing intensity and variety of water needs (M. Daud Silalahi, 2002).

2.1.2 Water Requirements

Water needs are the amount of water that is reasonably needed for human (domestic) basic needs and other activities that require water. Water requirements determine the system size and are determined based on water consumption. (PERPAPSI, 1994).

Table 2. 1 Domestic Water Needs

No.	Uraian	Kategori Kota Berdasarkan Jumlah Penduduk (jiwa)				
		>1.000.000 Metro	500.000 s/d 1.000.000 Besar	100.000 s/d 500.000 Sedang	20.000 s/d 100.000 Kecil	<20.000 Desa
1	Konsumsi unit sambungan rumah (liter/hari)	190	170	150	130	30
2	Konsumsi unit hidran umum (liter/hari)	30	30	30	30	30
3	Konsumsi unit non domestik (%)	20-30	20-30	20-30	20-30	20-30
4	Kehilangan air (%)	20-30	20-30	20-30	20-30	20
5	Faktor maksimum day	1,1	1,1	1,1	1,1	1,1
6	Faktor pick hour	1,5	1,5	1,5	1,5	1,5
7	Jumlah jiwa per SR	5	5	6	6	10
8	Jumlah jiwa per HU	100	100	100	100-200	200
9	Sisa tekan jaringan distribusi (mka)	10	10	10	10	10
10	Jam operasi	24	24	24	24	24
11	Volume resevoir (%)	20	20	20	20	20
12	SR:HU	50:50 s/d 70:30	50:50 s/d 80:20	80:20	70	30
13	Cakupan pelayanan*)	90**)	90**)	90**)	90**)	70***)
*) : tergantung survei sosial ekonomi **) : 60% perpipaan, 30% non perpipaan ***) : 25% perpipaan, 45% non perpipaan						

Source: DPU Director General of Human Settlements, 1996

2.1.3 Clean Water Distribution System

a. Reservoir

b. Distribution piping system

2.1.4 Fluid Flow

Flow can be classified in many ways such as turbulent, laminar, ideal, reversible, non-reversible, steady, unstable, uniform, non-uniform, rotational, non-rotational.

2.1.5 Hydraulic Network

To begin with, the discussion starts with the series piping system. The basic concept applied to this simple system is to determine the flow rate in pipes and the head pressure at the nodes which are further developed throughout the network.

2.1.6 Simple Piping System

Simple piping system provides an initial overview for understanding the piping network system. The variation in the total head through a network can be seen in the series of pipes

arranged in series. The analysis of pipes arranged in parallel is the first application of the conservation of mass at the junction and the conservation of energy in the loop circuit.

2.1.7 Loss of Water

2.2 Basic Theory

2.2.1 Need for Clean Water

1. Classification of PDAM Bandarmasih Customers

Based on the Decree of the Managing Director of PDAM Bandarmasih

Number: PDAM.137 / KPTS / XI / 2013 Date: 01 November 2013

1. Social Needs
    a. General Social
    b. Special Social 1
    c. Special Social 2
2. Non Commercial
    1. Non-Commercial Classification Using Parameters & Measured Data

Table 2. 2 Non-Commercial Classification Parameters Using Measured Parameters And Data

2. Analysis of Clean Water Needs of Bandarmasih PDAM

Requirement = Number of Customers * Actual Usage ..... (2.1)

By: necessity = Usage (m^3/year)

Number of Customers = User (person)

Actual Use = Realization Need (m^3/ plg / month)

2.2.2 Flow Discharge

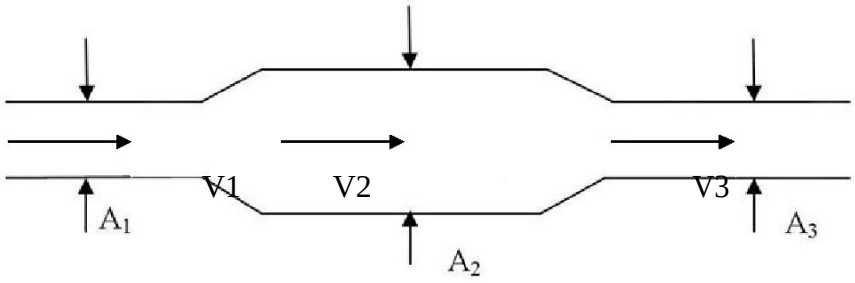
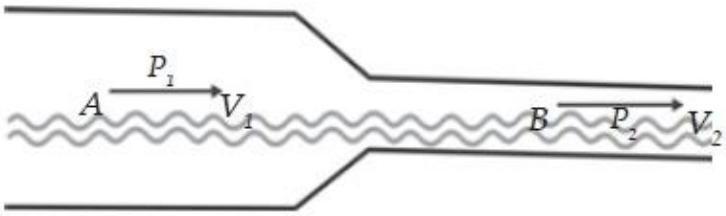


Figure 2. 1 Pipe Flow Discharge

By using the formula above, the velocity and flow rate can be calculated.

2.2.3 Bernoulli's Law



2.2.5 Pipeline

Figure 2. 2 Example of a Pipe Network System

CHAPTER III RESEARCH METHOD

3.1 Types of Research

This type of research is a quantitative descriptive study to determine the water needs of Bandarmasih PDAM, West Banjarmasin District, and to review the discharge capacity of the spring.

3.2 Data Sources

1. Production discharge from springs.
2. Customer consumption debit.
3. The number of active customers of Bandarmasih PDAM.
4. Distribution pipe dimensions.

3.3 Data Collection Techniques

3.3.1 Preparation stage

3.3.2 Data Collection

1. Data on the amount of water used by PDAM Bandarmasih
2. Data on the number of each type of active customer of PDAM Bandarmasih

3.4 Data Analysis

Figure 3. 1 Flowchart of Calculation of Water Requirements

Figure 3. 2 Pipe Capacity Calculation Flow Chart

CHAPTER IV ANALYSIS AND DISCUSSION

4.1 Analysis of Clean Water Needs

4.1.1 Domestic Sector Analysis

4.1.2 Scope of Service

Figure 4. 1 Service Coverage Map with Google Map Satellite

Figure 4. 2 Service Coverage Map with Google Map Map

Figure 4.3 Pipe Network Map

4.1.3 Projection of the Number of Active Customers for PDAM Bandarmasih

Year	Realization of Needs (m³ / year)
2015	225,750.0
2016	237,376.7
2017	230,732.1
2018	231,072.2

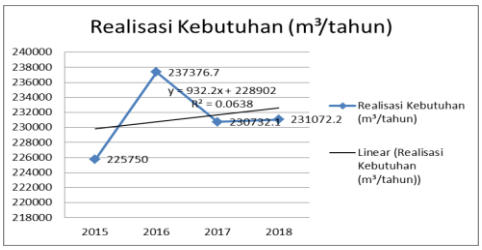


Figure 4. 3 Needs Realization Graph

Table 4. 1 Calculation of water requirements by means of actual use

No.	X	Y	XY	X2
1	2015	225,750.0	454,434,701,7	4052169
2	2016	237,376.7	478,076,625.5	4056196
3	2017	230,732.1	464,925,092.8	4060225
4	2018	231,072.2	465,841,474.6	4064256
AMOUNT			1,863,277,895	16232846

Calculation using linear regression method

$$A = \frac{\sum Y - B\sum X}{n} = 228{,}902$$

$$B = \frac{n \sum XY - \sum X.\sum Y}{n\sum X2 - (\sum X)\,2} = 932.2$$

$Y = A + (B * x)$

$Y = 228{,}902 + (932.2 * x)$

$Y\ 2021 = 228{,}902 + (932.2 * 2021)$

$= 237{,}291.97\ m^3/year$

$= 0.007629\ m^3/\ second$

$= 7.62\ liters / second$

4.1.3 Total Clean Water Needs of Bandarmasih PDAM, West Banjarmasin District

1. Calculation of water needs in West Banjarmasin District

Water needs in West Banjarmasin District:

$Yt = Yi + (Yi\ x\%\ lost)$

$= 237{,}291.97 + (237{,}291.97 \times 20\%)$

$= 284{,}750.37\ m^3/year$

2. Calculation of needs according to each type of customer

Table 4. 2 Average Percentage of Needs in 2021

No.	Type of Customer	Year 2013 (%)	Year 2014 (%)	2015 (%)	2016 (%)	Average (%)
1	Household A1-1	19.73	2.05	2.44	2.38	6.65
2	Household A1-2	2.27	19.99	22.76	23.87	17.23
3	Household A2-1	61.98	29.57	37.45	35.40	41.10
4	Household A2-2	2.56	23.60	28.14	31.17	21.37
5	Household A2-3	0.29	2.37	2.44	2.50	1.90
6	Household A3	6.45	15.41	16.20	17.53	13.90

7	Household A4	0.35	2.51	2.50	2.54	1.98

Table 4.7 Average Percentage of Needs in 2021 (continued)

No.	Type of Customer	Year 2013 (%)	Year 2014 (%)	2015 (%)	2016 (%)	Average (%)
8	Household A5	0.10	0.30	0.30	0.29	0.24
9	Big Industry	0.20	0.10	0.20	0.07	0.14
10	Small Industry 1	0.10	0.10	0.10	0.30	0.15
11	Government agencies	0.23	0.24	0.27	0.28	0.26
12	Educational institutions	0.10	0.10	0.10	0.10	0.10
13	Big Commerce 1	0.19	0.10	0.16	0.17	0.16
14	Big Commerce 2	0.13	0.20	0.14	0.13	0.15
15	Small Commerce 1	1.79	0.14	1.98	2.16	1.52
16	Small Commerce 2	0.65	1.48	1.06	1.30	1.12
17	Intermediate Commerce 1	0.53	0.92	0.59	0.67	0.68
18	Intermediate Commerce 2	0.68	0.53	1.13	1.35	0.92

Yt = Yi x% requirement

= 284,750.37 x 6.65%

= 18,939.39 m^3/year

For the calculation of each next type of customer can be seen in Table 4.8.

Table 4. 3 Need for Clean Water for Each Type of Customer in 2021
Table 4. 8 Clean Water Needs of Each Type of Customer in 2021 (connection)

4.2 Analysis of Additional Distribution Capacity

4.2.1 Number of Customers in 2021

Table 4. 4 Number of Each Type of Customer in 2021

Table 4. 9 Number of Each Type of Customer in 2021 (connection)

1.2.2 The Need for Clean Water of Bandarmasih PDAM, West Banjarmasin District, in 2021

According to the DPU, the Director General of Work, the City of Banjarmasin is in category II, so the water need per person per day is 170 liters.

1 SR = 5 Souls,

1402 x 170 x 5 = 1,191,700 l / day

West Banjar uses a 160 mm diameter pipe with a discharge of 13.79 liters / second.

13.79 lt / sec = 1,191,700 l / day = 1,191.7 m3 / day

From the calculation of the total needs in 2021 the Kec. West Banjar are:

284,750.37 m3 / year = 659,144 liters / day = 659 m3 / day.

4.2.3 Regional Water Needs of West Banjarmasin District in 2021

Water supply per day = number of customers x amount of water available

= 1,402 x 0.85 = 1,191.7 m3 / day

So the amount of reserve volume for 2021 Kec. West Banjar is

Inventory - Requirement = 1,191.7 m3 / day - 659 m3 / day = 532.7 m3 / day

532.7 m3 / day - (20% water loss) = 426.16 m^3/day

= 153,417.6 m^3/year

= 0.0049 m^3/ sec

4.2.4 Additional Distribution in 2021

Table 4. 5 Total volume added per customer in 2021

No.	Type of Customer	Average (%) Customers	Addition of Each Customer m^3 / Year
1	Household A1-1	6.65	1181.14
2	Household A1-2	17.23	7207.91
3	Household A2-1	41.10	34087.11
4	Household A2-2	21.37	10711.70
5	Household A2-3	1.90	100.94

Table 4. 10 Total volume of addition per subscriber in 2021 (connection)
Table 4. 6 Table of the number of subscribers that can be added in 2021
Table 4. 11 Table of the number of subscribers that can be added in 2021 (connection)

4.2.5 Review of the Dimensions of Installed Distribution Pipes in the Kec. West Banjarmasin

Table 4. 7 Pipe Length, Dimensions and Roughness Data
Table 4. 8 Vertex Point Elevation
Table 4. 9 Distribution Debit of S. Parman Booster in December 2018

Example of Calculating the Bernaoulli Equation

Pipe No. 66 and Pipe No. 65

d1 = 400 mm = 40 cm

d2 = 300 mm = 30 cm

p1 = 3.35 Bar = 33.5 x 10^4 kg / m2

= 0.078 m / s

= 113,603 cm + 210,889 cm = 324,493 cm

A1 x = A2 x

= x = 0.139 m / s

P1 + = P2 +

P2 = P1 + -

P2 = P1 + ()

P2 = 33.5 x 104 + 324,493 ()

P2 = 33.5 x 104+ (- 2,132.6)

P2 = 33.3 x 104 Pa

4.3 Discussion

By using the Realization of Needs method, the demand for clean water from PDAM Bandarmasih, Kec. West Banjar for 2021 is 7.62 liters / second. The total amount of clean water

needs for customers of PDAM Bandarmasih Kec. West Banjar after adding the percentage of water loss of 9.15 liters / second.

In the analysis of pipe capacity in 2021 for the Kec. West Banjarmasin with MS excel software, pipe dimensions that are still able to drain water from Booster S. Parman.

Table 4. 10The pipe that carries water from Booster S. Parman to Kec. West Banjar
Table 4. 15 Pipes that drain water from Booster S. Parman to Kec. West Banjar (continued)
Table 4. 11 Pipe calculation uses the Bernaoulli equation on the existing pipe.

Table 4. 12 Pipe calculation using the Bernaoulli equation on the existing pipe per 10 m
Table 4. 13 Pipe calculations use the Bernaoulli Equation for the new pipe
Table 4. 14 Pipe calculations using the Bernaoulli equation for new pipes reviewed per 10.

CHAPTER V CONCLUSIONS AND SUGGESTIONS

5.1 Conclusion

Based on the results of the analysis and discussion that have been described in previous chapters, the following conclusions are obtained:

1. Water availability in 2015 = 225,750 m3, 2016 = 237,376.7 m3, 2017 = 230,732.1 m3, year 2018 = 231,072.2 m3
2. Prediction of water demand in 2021 is 284,750.37 m3
3. The need for clean water for 2021 PDAM Bandarmasih in the Kec. West Banjarmasin has experienced a large increase. So that there are no complaints to customers

5.2 Suggestions

Based on the results of the analysis and discussion, the following suggestions can be submitted:

1. For additional clean water distribution customers, PDAM Bandarmasih in the region Kec. West Banjarmasin In 2021, it is necessary to take steps to recalculate a new distribution pipe network that is able to flow water from the booster to the customer.

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