

Study of Clean Water Needs Balikpapan, East Kalimantan, Indonesia

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Abstract. Clean water in human life has a very important function. The Human need for clean water is directly proportional to the population growth. In Balikpapan, which is the capital city of East Kalimantan Province has population 735,850 people by 2015, which represents 22% of total population of East Kalimantan. The results obtained for needs of clean water have not been sufficient and the water quality data has qualified the water requirements Class I. In the calculation of clean water needs of Balikpapan City above, the percentage of non-domestic with domestic demand is 50.30% its mean Balikpapan City have a lot of facility especially office and international company. Balikpapan City needs to immediately add the capacity of Intake because in 2017, is unable to meet the needs of clean water in Balikpapan City. Tirta Manggar PDAM has almost reached 80% service coverage, but loss of water equal to 36.92%.

Keywords: Balikpapan, clean water need, PDAM.

1 Introduction

Clean water in human life has a very important function. The trend that is happening now is reduced availability of natural water resources that can be used directly from day to day. This is due to influence of increasing development progress, population growth increase so that the capture of water by the soil as a source of ground water is reduced and industrial waste pollution in rivers as one source of clean water on the surface (1–3). In Balikpapan, East Kalimantan, water supply from PDAM is also still unable to fulfilled the needs of clean water in quality and quantity. In fact, Balikpapan has population 735,850 people in 2015, which is 22% of the total population of East Kalimantan. In rainy season, Balikpapan was often flooding. In addition to the overflowing of rivers, the floods are also caused by the narrowing of the river due to the waste accumulation.

Clean water is water that is used for everyday purposes and its quality fulfills the requirements of clean water health, according to applicable legislation and can be drunk after cooked.

Water Supply System Components :

1. Rain Water

Rain water is sublimation of cloud / vapor into pure water. to make rain water as a source of drinking water should be at the time to accommodate rain water do not start when the rain starts to fall, because it still contains a lot of dirt

2. Surface Water

Surface water is the rain that flows on the surface of the earth, the quality of surface water needs to get close attention if the surface water will be used as a clean water.

3. Ground Water

Groundwater is a very important source of water supply especially in areas experiencing drought or long drought causing the cessation of river water flow. (4,5)

There are several methods that can be used to analysis future population growth, namely: Arithmetic, geometric, linear regression, exponential, logarithmic. Influence factors of projected water needs are:

1. The number of people growing every year
2. Level of service
3. Water need for instalation and organization needs
4. Water lose factor. (6)

Domestic water needs is water used for daily activities. To estimate the current and future amount of domestic water demand can be calculated based on population size, population growth rate, and per capita water requirement. The units used are L / person / day (7,8). The basic need for non-domestic water is the water requirement for residents outside the residential area. The need for non-domestic water is often also called urban water needs or municipal (9).

Clean Water Criteria are Class 1, water used and requires the same water quality as that usefulness. Class 2, water used for facilities / infrastructure of water recreation activities, cultivation of freshwater fish, livestock, water to irrigate agriculture and / or other requirements requiring the same water quality as those uses. Class 3, water that can be used for the cultivation of freshwater fish, to irrigate crops and other things requires the same water quality as those uses. Class 4, water which can be used to irrigate crops and or other designations that require the same water quality as those uses (10,11).

Previous research are :

1. Fitriati, U. (2014). STUDI KUANTITAS DAN KUALITAS AIR UNTUK SUMBER AIR PDAM INTAN BANJAR. *Prosiding Seminar Ilmiah Nasional X IATPI-Unibraw ISSN: 2088-4818, Buku 2*, 249–258. Retrieved from <http://www.lingkungan-tropis.org/daftar-isi-penelitian-masalah-lingkungan-di-indonesia-2014-buku-2%0A>.
2. Fitriati, U., Novitasari, N., & Eriyane, E. (2015). *a Study on Water Quality of Raw Water Sources of Pdam (Munipical Water Company) Bandarmasih*. 1(1). Retrieved from <http://twj.unlam.ac.id/index.php/twj/article/view/6/7>.
3. Fitriati, U., & Ma'ruf, M. A. (2017). *A study of urban water demand in south kalimantan province*. 3(1), 23–30. Retrieved from <http://twj.unlam.ac.id/index.php/twj/article/view/49/56>.
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5. Fitriati, Ulfa; Novitasari, Novitasari; Ma'ruf, Muhammad Afief; Kurdi, H. (2019). The Water Quality in PDAM Intake in South Kalimantan Province The Water Quality in PDAM Intake in South Kalimantan Province. *IOP Conference Series: Earth and Environmental Science*, 366(012028), 1–6. <https://doi.org/10.1088/1755-1315/366/1/012028>.

Therefore the author wants to examine how much water needs and water quality in the city of Balikpapan, East Kalimantan Province.

2 Methods

In this study, starting with literature study that is collecting, reading and studying literature books related to the problem of raw water sources and matters associated with it. Then proceed to the formulation of the problem that is calculated needs clean water required by the city of Balikpapan, East Kalimantan. After that proceed with the data collection phase

The data obtained in the form of primary data and secondary data.

a. Primary data is data obtained directly from the source, include interviews, water quality, and field reviews.

b. Secondary data are data collected by researchers indirectly or using other sources. This data is in the form of location image, last year's public facilities data, 5 years population data from Balikpapan City Statistic, 5 years water loss data, and last year service data backup.

3 Results and Discussions

After analyzed using Arithmetic method, geometric, linear regression, exponential, and logarithmic then sorted and made graph comparison of existing population growth and population growth according to projection of all method got method that fulfill criteria requirement is Arithmetic method, because it is proportional to straight and almost approaching line existing residents (12). Projection of clean water needs must be in accordance with planning requirements with consideration of the following factors, namely domestic water requirements, non-domestic water demand, average water leakage rates of 20% -50% T and maximum day and peak hour factors.

a. Domestic Water Needs

The average water consumption level to be achieved by 2016 is 150 ltr / people / day for home connections and beyond until 2035 (13,14).

b. Non Domestic Water Requirement

a large domestic need especially when the city is a central government district office whose water needs for offices or government agencies can reach 40% of the total domestic water needs. However, in this plan, water demand for non-domestic needs is 14.70% of the total domestic demand for water, in accordance with the calculation of non-domestic needs in 2016 (8,15).

Balikpapan is the largest port and industrial city on the island of Borneo, so it has many international corporate offices. Facility data available in Balikpapan City can be seen in table 1.

Table 1. Public Facilities Data

No	Data	Total	Unit	Standard	Unit
1	School	190637	People	20	Liter/People/Day
2	Hospital	1030	Bed	400	Liter/Bed/Day
3	<i>Puskesmas</i>	27	Unit	1000	Liter/Day
4	<i>Puskesmas</i> Assistant	13	Unit	800	Liter/Day

5	<i>Posyandu</i>	3	Unit	800	Liter/Day
6	<i>Kelurahan/Desa Office</i>	34	People	10	Liter/People/Day
7	<i>Kecamatan Office</i>	6	People	10	Liter/People/Day
8	<i>Kabupaten Office</i>	1	People	10	Liter/People/Day
9	Mosque	422	Unit	1500	Liter/Day
10	<i>Musholla</i>	419	Unit	750	Liter/Day
11	Chruch	172	Unit	400	Liter/Day
12	Temple	10	Unit	400	Liter/Day
13	Market	10	Unit	3000	Liter/Day
14	Cooperation	0	Unit	800	Liter/Day
15	Restaurant	4120	Sit	40	Liter/Sit/Day
16	Bank	184	Unit	1200	Liter/Day
17	Medium Industries	69000	Unit	25	Liter/Day
18	Hotel	7185	Bed	100	Liter/Bed/Day

Data of water loss can be obtained from BPS data of Balikpapan Municipality, for 2016 Balikpapan Municipal PDAM distributes clean water equal to 32,710,965m³ water and experiencing shrinkage equal to 9,779,738 m³ water, or loss of water equal to 36,92% (16,17).

In the calculation of clean water needs of Balikpapan City above, the percentage of non-domestic demand for domestic is 50.30%. From the projection calculation of population growth, until the year 2036 the city of Balikpapan is still in the middle of the city with a population of 141,114 people, according to the standards of the creative works, the water needs per capita (direct line) is 150, and the general faucet 30. Here is the result of the calculation total water supply planning for Balikpapan in table 2.

PDAM Balikpapan has an existing intake of 1281 L/Sec. According to the figure 1, the need for clean water for Balikpapan City in 2017 has passed the existing line of intake or amounted to 2259,385 L/Sec, it can be said for 2017 the need for clean water has not been met. Therefore, PDAM Kota Balikpapan should immediately plan to increase production capacity / intake as soon as possible so that the need of clean water is always fulfilled

Table 2. Projected Water Need

No.	Year	Projected Water Need	
		L/day	L/second
1	2017	195210862.978	2259.385
2	2018	205372459.638	2376.996
3	2019	215776308.661	2497.411
4	2020	226422410.048	2620.630
5	2021	237310763.797	2746.652

6	2022	248441369.909	2875.479
7	2023	259814228.384	3007.109
8	2024	271429339.222	3141.543
9	2025	283286702.423	3278.781
10	2026	295386317.987	3418.823
11	2027	307728185.913	3561.669
12	2028	319036161.556	3692.548
13	2029	326606547.897	3780.168
14	2030	334176934.238	3867.789
15	2031	341747320.579	3955.409
16	2032	349317706.919	4043.029
17	2033	356888093.260	4130.649
18	2034	364458479.601	4218.269
19	2035	372028865.941	4305.890
20	2036	379599252.282	4393.510

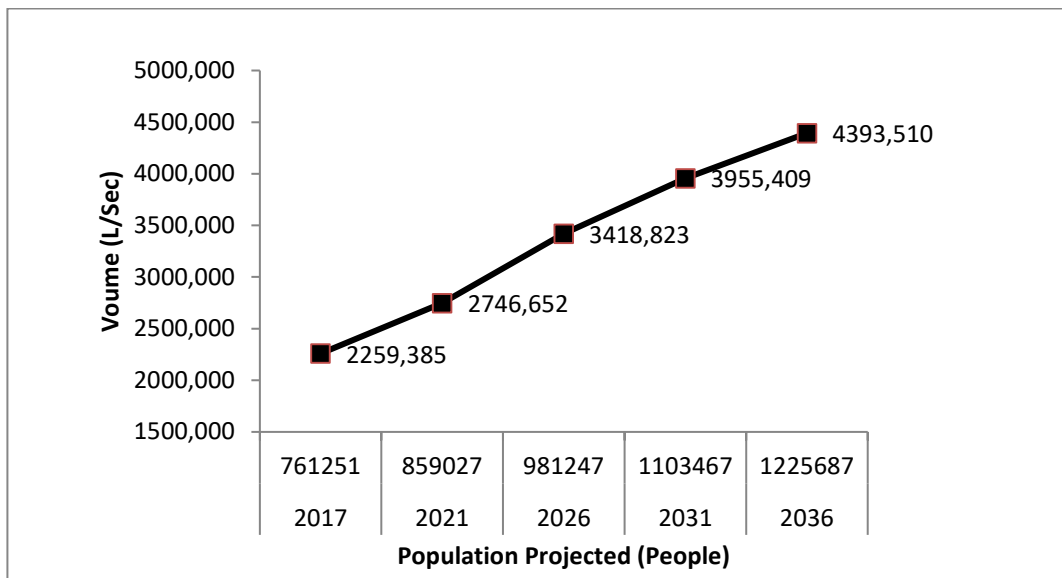


Figure 1. Clean Water Need Projected 2017-2036

Table 3. Result of Water Sampling Test of PDAM Tirta Manggar

No.	Parameter	Unit	Field Test Results		Requirement	Remark
			Before Processing	After Processing		
1.	Temperature	°C	30	30	(±3) °C	Fulfilled
2.	pH	pH	6.8	6.7	6.5-8.5	Fulfilled
3.	Electrical Conductivity	mS/cm	0.03	0.119	-	-
4.	Turbidity	NTU	9	1	5	Fulfilled
5.	Dissolved Oxygen	mg/L DO	4		-	-
6.	Amount Of Dissolved Solids	g/L TDS	0.015	0.058	0.5	Fulfilled

The water quality data of the distribution in Table 3 obtained from the test results of PDAM Tirta Manggar water sample has qualified for Class I water.

4 Conclusions

The population of Balikpapan City is obtained with the following results as follows: 2017; 2021; 2026; 2031; 2036 of 761,251 people; 859,027 people; 981,247 people; 1,103,467 people; 1,225,687 people. Calculation of clean water needs of Balikpapan City with the following results as follows 2017; 2021; 2026; 2031; 2036 equal to 2259.385 L/Sec, 2746.652 L/Sec, 3418.823 L/Sec, 3955.409 L/Sec, 4393.510 L/Sec. Tirta Manggar PDAM has an Intake capacity of 1281 L/Sec according to the calculation of projected clean water demand for the city of Balikpapan in 2017 amounted to 2259.385 L/Sec, it can be said for 2017 the need for clean water have not been sufficient. The water quality data of the distribution obtained from the test results of PDAM Tirta Manggar water sample has qualified for Class I water.

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