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Study on Mamuju clear water supply infrastructures

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ABSTRACT

The study Is dedicated to describe the condition of water supply infrastructure in Mamuju and to investigate the fresh water supplied to the domestic customers, viewed from its quality, quantity, and continuity by Manakarra, Mamuju Regional Water Supply Company (PDAM), projecting requirement of five years later, then (the year 2006-2017)

The relevant data collected through observations on the water quality. The data are analyzed and described qualitatively using inferential statistics.

The result proves that the quantity, ad continuity variables have a significant influence on the availability of water supply infrastructure of Manakarra. The strongest influence comes from the quantity factor, and the continuity and quality respectively. The availability of standard water is important to increase the quantity, continuity of water supply and to improve the performance of the company in fulfilling the quality standard of water to the customers. The intake capacity in 2011 is 196,25 litre/second to meet the water demand of 37,95 litre/second.

I. Introduction

The needs of clean water for people in common, especially in the urban areas from time to time, have increased along with the increasing number of people who moved to live in the cities, the population density and the incidence of Spatial changes from the city.

After the West Sulawesi province formed under Act No. 26 dated October 10, 2004, where the Mamuju Regency as the capital Province specialized on two sub-districts, Mamuju and sub-central skip to the activities of the provincial government West Sulawesi, the Mamuju Regency government or have undergone many changes. Variety of facilities and being dighted in planning such as the construction of various government offices at the provincial level, new settlements, shopping center, The increase in activity in the port, hotels, small/large industry, and population increased with the encouragement of improved basic infrastructure needs such as clean water. The intrinsic and basic needs of clean water have increased along with the population increase, its modern life and the association's level of economic progress.

The higher the standard of living, there will be a more human necessity in the air (Suriawira, 1996 in Silaban RH, 2006). During this period the population residing in the capital of Mamuju Regency used good water, groundwater belongs to the taps directly as a source of clean water. However, water and groundwater wells are not necessarily as reliable as it has limitations as to quality or quantity (Supian, 2006). The provision of clean water in principle is designed and constructed in such a way that the construction can reach the goal, among others, that sufficient clean water is available in sufficient quantities according to the quality that meets the requirements of the clean water and the availability of water. Always or continuously, affordable by the general public as consumers (section PU, 1998)

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In general, clean water services in urban areas are dealt with by the regional drinking Water Company (Pdam) similarly in Mamuju, by taking the raw water sources in four sources in Danga (Springs) Installed Capacity (Bronkapmian) 5 lt/SEC, Rivers in the Baka with installed Capacity 30 lt/SEC. Sangkurio with a fixed capacity of 10 L/sec and ' LL ' with a fixed capacity of 20 lt/sec which is distributed to serve customers around the unit of 59,461 3137 inhabitants (numerically, Mamuju 2006). The population in both areas with total area 260.93 km^2 As the Mamuju Capital centre of the capital of the province of West Sulawesi which is a region of clean water services taps Mamuju, Manakarra with a service scope of approximately 31% (BPS Mamuju Regency, 2004) is still the low coverage of services and increasingly The increasing number of inhabitants with such rapid activities. It will be a challenge to the Takkarra taps in providing clean water, the ability of a limited range of good taps as well as the quality of its service. Even current state tapes Manakarra is only able to produce 29 litres/second of 65 litres/second set very influential in fulfilling the needs as well as clean water services in the community. Thus some residents still rely on water sources clean by using groundwater from shallow or well-bored wells. Although available groundwater is not necessarily of good quality and is worth eating. By looking at the conditions and problems resulting from clean water needs of being carried out and serviced by Manakarra tapes, research is needed to find and obtain an alternative proposal that would, of course, require the study in detail.

II. Literature Review

A. Understanding the infrastructure and clean water

Infrastructure (infrastructure), i.e., the minimum requirements needed to support the functions of housing/residential or urban use, such as road/bridge, drainage, water supply, waste management and sanitation, electric/energy power and Telecommunications (BPSDM DEP. Kimprashy, 2003). Defensive engineering also stated that the infrastructure was designed in a physical assets system, providing important public services (Kodoatie, 2005)

Clean water is the water used for everyday quality purposes of qualifying health and can be drunk when cooked, in academic terminology is the water produced from engineering results against dirty water coming from the Human and animal body as well as from an economic activity to be a worthy channelization back as surface water (Bhatas 2003).

The Lebanese Umar Munir (2003) (2006) Clean water is water that is safe to use for drinking water and other use because it has been clean of germs diseases, organic and inorganic chemical substances, as well as radioactive substances that can harm health. Clean water that meets health requirements does not contain as much water (clear or transparent), it does not change its flavor, its smell not changed, and it lacks organic substances or germs that interfere with health.

Clean water infrastructure based on NSPM Kimprashy 2002 include :

1. The influx of buildings, the construction of a building in the national awakening at a water source location, was used as a place to take the water to clean water provision
2. Water Treatment Installations (IPA) or *Treatment* Installation/building operating to process raw water into clean water.
3. Transfer of pipelines, which are the means of transport to bring the raw water to the unit of processing or providing clean water from the processing unit to the main distribution unit/fund dividers
4. A reservoir is a reservoir of water that has cultivated during the installation of a water treatment plant for a debit balance between the production and use of water varying during the 24 hours, which consists of two forms, namely an underground water reservoir *(Ground Reservoir)* and Water tower (*elevated tank).*
5. A distribution piping network is a network of pipelines that operate to organize and distribute clean water from the reservoir to the administration by the requirements of the water in the plan.

B. Clean Water Needs

The needs of clean water in question include the need for domestic use for the following purposes: homes and the public at home and non-office facilities such as trade and industry, social facilities, etc.

Kodoatie (2005) states that water needs largely determined by population and per capita consumption. Population trends and population history used as the basis of calculating dysmistik water needs especially in determining the trend rate of growth (*Growth Rate Trends).* This growth also relies on a spatial area development plan. The estimated population for the future is one of the main parameters in determining misgamik water needs. Daily per capita water needs – – adapted to standard and normal service criteria based on the city category.

Table 1. Category Area

Category Area	Population	Number of homes	Clean water
City Metropolitan	> 1.000.000	> 200.000	190
The big city	500.000-1.000.000	100.000-200.0000	170
Small city	100.000-500.000	20.00-100.000	150
Small town	10.000-100.000	2.000-20.000	130
Village	3.000-10.000	600-2.000	100

Source of NSPM Kimprashy, 2002 (Part 6 Vol: IV, V, VI, Municipal water supply, p. 21)

Domestic needs based on average non-domestic consumption at this time, where the size of the 20 – 30% of domestic needs, industry commerce not estimated on the large scale, so that the set of 20 – 30% of the needs Domestic (technical Guide/guide and manual for municipal drinking water, Depkimprashy, 2002)

Also, water needs are not always the same, but they will vary; generally water needs are divided into three groups:

1. The average daily requirement
2. Peak-time needs
3. Maximum Daily RequirementmTo

Based on technical guidance/guidance and manual for municipal drinking water Depkimprashy 2002, adjusting the average daily maximum and average using the following method for daily maximum needs = 1.15 – 1.20 time of daily needs Average requirement and peak hours = 1.65 – 1.75 times greater than the average daily requirement.

The loss of water can defined as the difference between the amount of water produced and the amount of water sold to consumers, according to the entry on the meter's customers, this may cause as (Kodoatie and R. Sharif, 2005):

1. Physical needs
   As a result of the leaking of pipes, a fire extinguisher and a connection not recorded
2. Administration is leaking
   Among others due to an error in the reading of the meter, the non-registration meter of water and the pollution, collusion and nepotism influence either directly or indirectly against the loss of water.
3. Development/Population projection

Population development is an important factor in the future needs of clean water planning. In this study, an analysis of the development of the population projection/is used to estimate the level of service received by the Clean Air Association. The estimated future population can be made using geometric means (NSPM

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depkimprashy 2002) with the following equation :

$$Pn = Po(1+r)^n$$

Description :

Pn = Total number of Population of In At the end Years to-N

Po = Reviewed population

r = Number Growth Population

n = Period Years Tthe Review

1. Clean water supply System

A clean water supply system is a system for supplying clean water that includes a raw water retrieval system, water transfer, a water treatment process and the water transportation system, and the distribution/piping systems that can be Operating. So much that there is always sufficient weight in all parts of the piping system and can use at any time without disruption (NSPM depkimprashy, 2002)

The provision of clean water in municipal public utilities is provided to ensure the life and daily activities of the community. Characteristics of the water supply in urban areas are the presence of a system that is organized to meet the needs of clean water on an ongoing basis (continued) Regarding quantity and quality.

Water supply efforts aimed at meeting the various needs, such as domestic needs in the area of housing, commercial office space, industry events, and other public facilities, so that clean water management efforts included in the category of service General (Djaja, 1995 in Supian, 2006).

On the system of delivery of clean water taps, there are three (3) main components associated with the system of providing clean water, i.e. water sources (*water resources),* The system of production and distribution system.

III. The results of the research

A. State of the Clean water provision infrastructure

The system of providing the clean water of Manakarra's tap when serving the community in the area and the subclass, Mamuju, Simkep usually consists of a The source of the raw water), b) production units and C) a distribution system.

1. Intake

   Of the 4 4, raw water consumption was currently a direct property of Manakarra, 1 of which was through brother and three direct intakes, i.e. :

   a. The influx with the Bronkapit form that uses Ffynnon with a runout that can enter the influx 3 – 5 lt/DT, built in 1973, Kondisiyang is now only as a backup if the other of the thesis II and IV has not been Jalan.
   b. An influx II Sangkurio shaped from wells with a depth of 8 metres and a diameter of 2.5 meters, only water at a depth of 5 meters from the spring, capturing the pipe of the raw water inlet by giving up to 12 long river meters planted at a depth of About 1 metre. The site of the accepted weft-lip on the Kali Mamuju River, using a 10 lt/SEC submersible pump to drain the raw water to process the Intaproar along 200 meters .
   c. Influx III in the Baka by using the Pangazeang River as a source of raw water intake, which is at heights and Berlembah about 70 metres from sea level at a distance of about 13000 metres from Intalasi Processing.

2. Intake installation IV Of In the Sodo, the harness times will be used to purchase raw water, which includes a pump using the Centrifugal pump No. Two. Each the Fruits capacity 20 lt/DT. Taking a raw water inlet pipe using a with along a 5 metre length and a diameter of 50 mm to the site of the intake located immediately on the Kali Bibi Mamuju River.

Concerning the maximum amount of raw water available for signature to each intake, since January – October 2006 it can be disliked from the following table :

Table 5 The capacity of the water entering the influx

No	Moon	INTAKE			
		I	II	III	IV
1	January	5	6	20	12
2	February	5	6	20	12
3	March	5	6	20	12
4	April	5	6	20	12
5	May	5	6	20	12
6	Juni	3	9	9	25
7	Juli	3	9	9	12
8	Agustus	3	9	9	12
9	September	3	9	9	12
10	October	3	9	91	12

Source: PDAM Manakarra, Mamuju

2. Transfer of pipelines

A transmission pipeline owned by Manakarr's Tap two, i.e. diameter of 150 mm and 200 mm of GIP. The following table is attached to the transmission pipeline following the installation of production units.

Table 6 Pipeline raw water transmission

No	Lokasi	Diameter Pipa (mm)	Panjang Meter Material	Tahun Pemasangan	Unit Instalasi
1	Danga	100	10/GIP	1973	Bronkaptering
2	Sangkurio	150	200/GIP	1982	IPA II
3	Padang Baka	200	1300/GIP	1997	IPA III
4	So'do	150	600/GIP	2003	IPA IV

Source: PDAM Manakarra, Mamuju

3. Installation of water management

Installing clean water Pengolhana owned by tapes Manakarra currently has 4 IE 3 units of complete Pencholhan, i.e. IPA II the factory was built in 1982 in Sangkurio with a capacity installed 10 Lt./dt, IPA III Padang Baka in Begun in 1997. For the first period With a capacity set 10lt/sec and the second phase in the year constructed 1999 with an installed capacities of 20 lt/sec, IPA IV was built in 2003 with a fixed capacity of 20 lt/sec and 1 Simple processing Unit (Bronkapian), which was built in 1973 by Capacity 5 LT/SEC.

4. Reservoir

Construction of a reservoir of water distribution in the next processing results for the service with the Gravitas system, owned by Manakarra, Mamuju, tapes can be seen in the table below

Table 7. Reservoir owns Mamuju

No	Reservoir Location	Reservoir Volume(m^3)	Build

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1	Danga	25	Concrete
2	Sangkurio	25	Concrete
3	Padang Baka	150	Concrete
4	So'do	25	Concrete

5. Distribution Pipe Network

Distribution pipes taps used to date have varied in diameter and material. The diameter of the pipeline starts from 50 mm up to 200 mm, while their material includes PVC and CHC. For the distribution of water to the service using a dual system. The following table of dimensions and lengths of pipe distribution used by tapes, Mamuju.

No	The function of the pipeline	Dimensions (mm)	The length of the (m)
1	Primer	200	1500
2		150	5000
3	Sekunder	100	3000
	Tarsier	75	5000
		50	5000
	Total pipeline length		19.500

Source: PDAM, Mamuju

B. Area service PDAM Mamuj

1. The scope of the servant and the number of customers

Based on the data of tapes Manakarra Mamuju that up to October 2006 total contacts 3,137 units with the largest number of customers in the subclass, Mamuju 2,841 and as many as 296 units in the Simkep area. Until October 2006 the number of residents who have been under-served ± 35% the area most subscribers in subclass Wards Binanga, Mamuju 2,429 units as much as it is due in the region are Permukinan and the Center Population activities.

Compared to customers living in the village with some 24-unit Rangas affiliates, on this region population development is still small and has just begun office plans developed after the provincial government of West Sulawesi good offices The governor or the department/Agency as well as the development of new settlements in the region. The number of customer units with more detail on each service area until October 2006 shown in table 9.

Table 9. The number of districts of Pelnaggan water based on districts

No	Region	Number of contacts
1	Sub-district, Mamuju :	
	a. Village Binanga	2429
	b. Village Mamunyu	412
2	Sub-district Simkep :	
	a. Village Simboro	272
	b. Village Rangas	24
	Total of number	3137

Source: PDAM Mamuju 2016

2. Types/Classes of customers

Based on the type of data from those Manakarra/tapes, the more customers are the household (non-commercial) connection with a total of as many as 2853 units, while there are as many as 212 trade relations units. More details as shown in the following tepee.

Table 10. Types/Classes of customers PDAM

No	Types/Classes of customers	Total
1	Social	52
2	Non-commercial	2853
3	Trade	212
4	Industry	5
5	Special	15
	Jumlah	3137

Source: Tapes Manakarra, Mamuju

3. Amount of water use and loss

Size of loss from a dozen Digynchkasi tapes Manakarra accounting Sedjak January – October 2006 average 22,304.76 m^3 or approximately 32.76% of water distributed to an average of 68,093.66 m^3, as shown in table 11 below:

Table 11 Production use and loss of water taps, Mamuju

No	Bulan	Distributed water (m3)	Water Sold (m3)	Water loss (M3)	Percentage (%)
1	Januari	59.702.00	44.475	15.227.00	25
2	Februari	60.408.00	46.149	14.259.00	23
3	Maret	67.039.20	44.596	22.443.20	33
4	April	65.563.20	42.604	22.959.20	35
5	Mei	71.200.80	46.530	24.670.00	34
6	Juni	78.174.00	46.355	31.363.00	40
7	Juli	71.247.20	47.883.50	23.363.70	32
8	Agustus	69.552.00	46.516	23.036	33
9	September	65.621.00	45.259	20.362	31
10	Oktober	72.428.40	47.621.50	24.806.90	34
	Rata-rata	38.093.66	45.788.90	22.304.76	32.76

Source: Monthly Engineering Report tapes Manakarra, Mamuju

C. Characteristics of respondents

These research on the Tapir Manakarra Sub-district server, Mamuju, which covers two up to the year 2006. To achieve the purpose of the research, then the research target is going to do to analyze and

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determine the magnitude of the level of community service that needs clean water so that there is a real amount of need for clean water.

The research conducted by interviewing some respondents using the questionnaire with as many as 200 respondents from each region in sub-areas 2 of Kecamatan as a percentage of the taps service on the population of Each region.

1. Number of family members

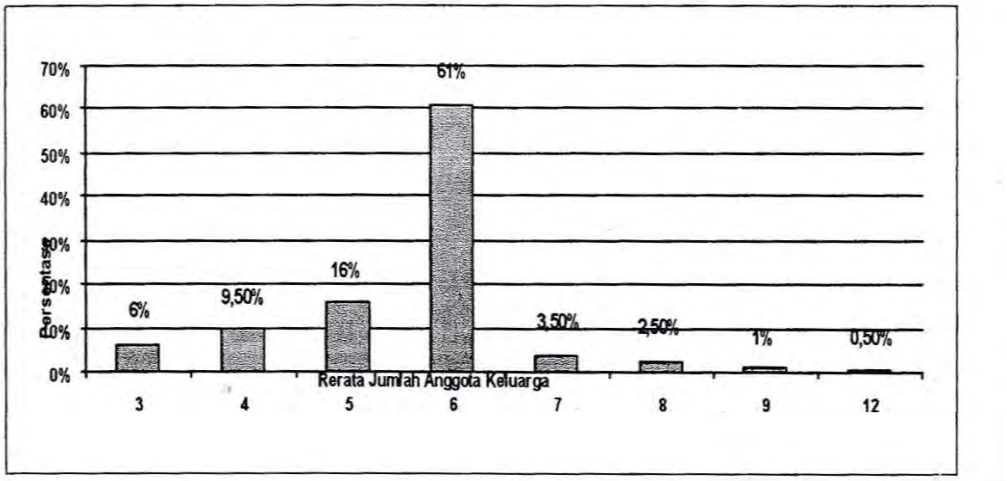


Figure 2. Grafik Number of family members (survey results, 2006)

On picture 2 above observed that the number of family members of respondents ranged between 3 persons up to 12 people, the largest percentage of households including six people reached 61% and households containing five persons reached 16%.

2. Type of work

The respondents in this study include 6 group work, i.e. private traders, civil servants, farmers, laborers, and Ain. Of the 200 respondents, the highest number worked as civil servants as many as 134 people (67%) and the latter worked as privately as many as 41 people (20.5%), as appears in the image below.

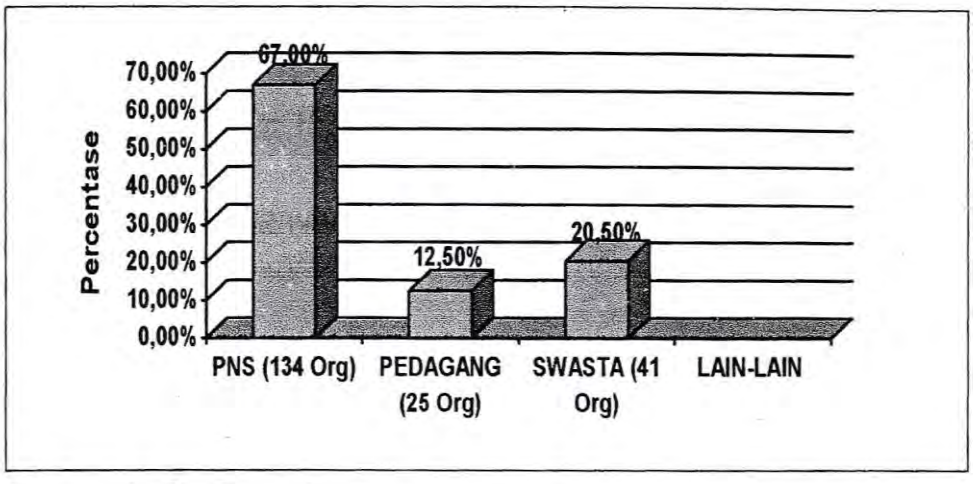
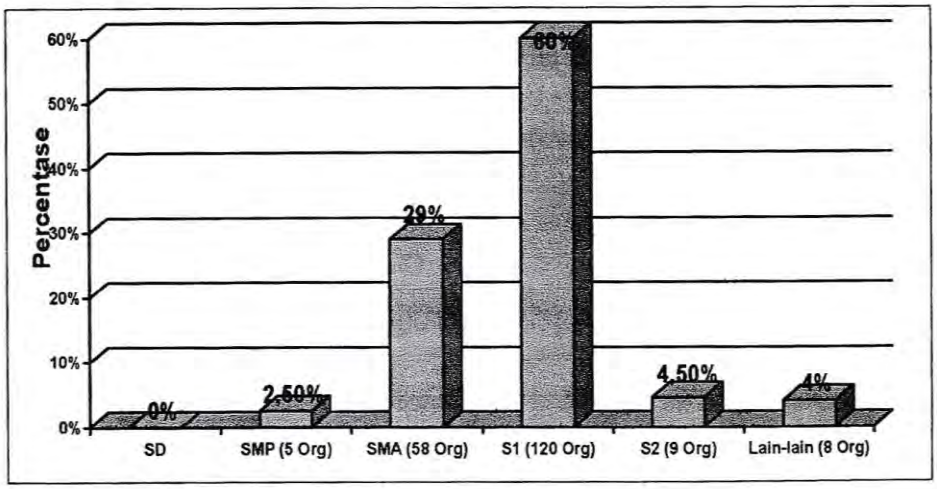


Figure 3. The graph for this type of work (survey results, 2006)

These are because in two subregions the central government and the province of Mamuju Regency of Western Sulawesi, while the sub-district located in two

infrastructures became a centre of the local community's. Economic activities as well as the Come to Mamuju, capital because it has become such open job opportunities for locals as well as for those seeking capital to venture in the SIB province as an entrepreneur as well as trade.



1. Level of education

According to Kusioner, the results of the respondents can see that the majority of respondents in the secondary school and later educated scholars, were to show that the average respondent had an adequate level of intelligence

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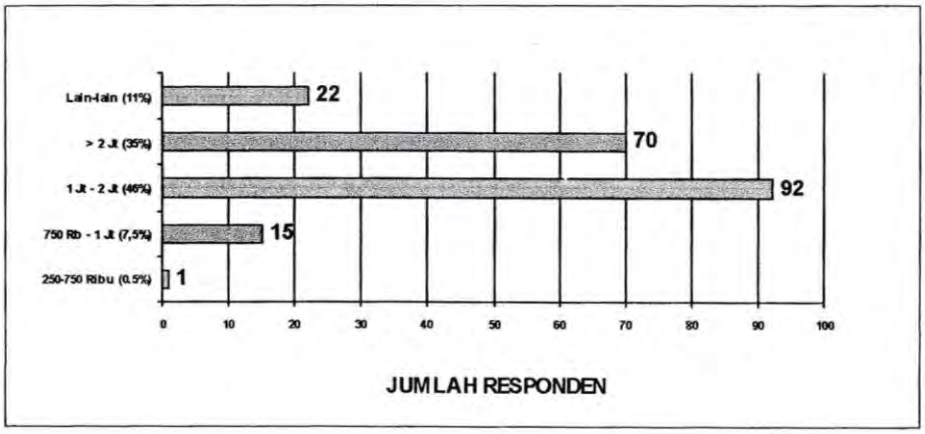

3. Monthly income

Research on the monthly income of respondents found that the income of most respondents ranged between 1000000-2000000 rupiah by as much as 46% earning more than 2 million by as much as 35% spread over four wards. Because the majority of respondents were civil servants and a private clerk with a sufficient level of education.

D. Characterization of clean water use for domestic

Research on the characteristics of clean water use aims to discover the magnitude of clean water needs and conditions used by the community regarding the size, quality, and duration of the stream.

1. Use of clean water every month

   The amount of clean water consumption per month that is intended to acquire the actual needs of the magnifiers when wearing any user. The results of the study of 200 respondents regarding the average amount of clean water consumption per month can be seen in Figure 6. Looking at the chart to see that 33% of respondents use a monthly average ranging between 10 – 15 m^3 and 23% wearing 15 – 20 m^3 Or can the average use of Desampulkan 82.93

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liters/person/day (Appendix 10). Low size and duration of piped water taps. In addition to most customers who still use other sources such as the Good morning, shallow wells and bottled water in another way of partial satisfaction

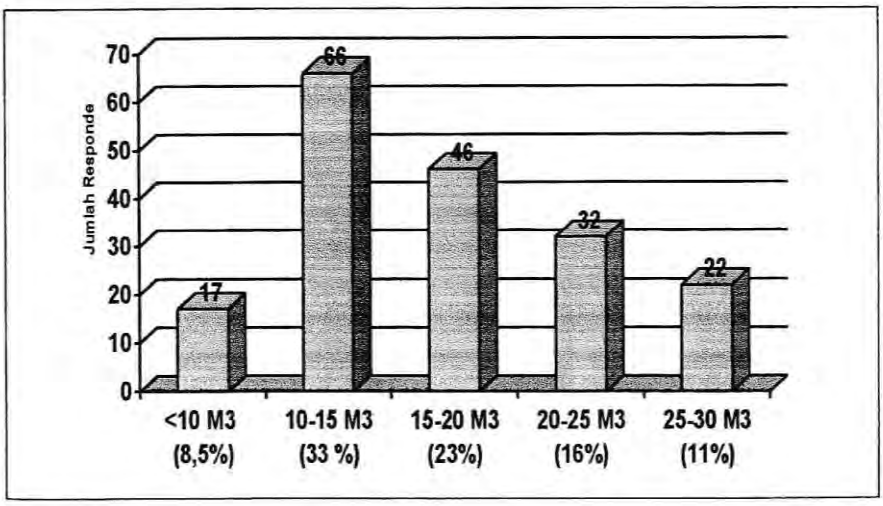
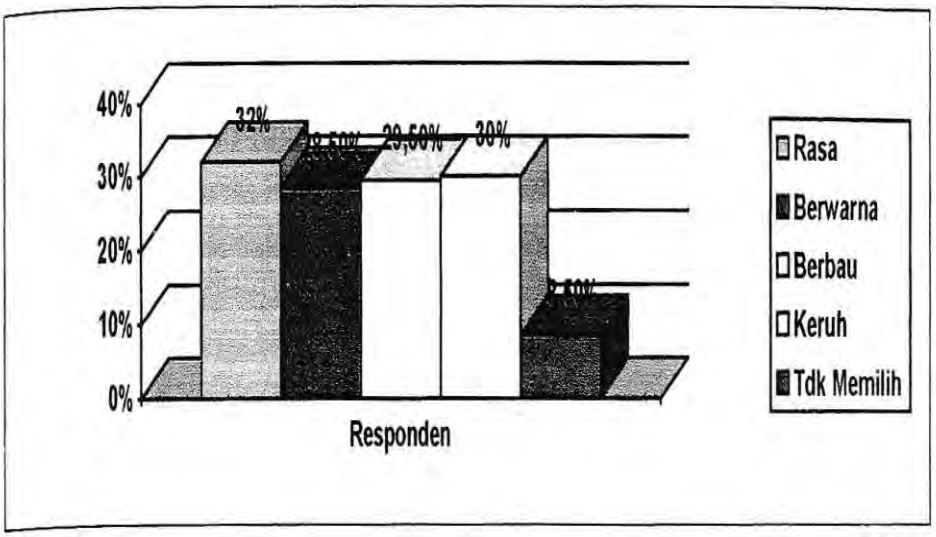


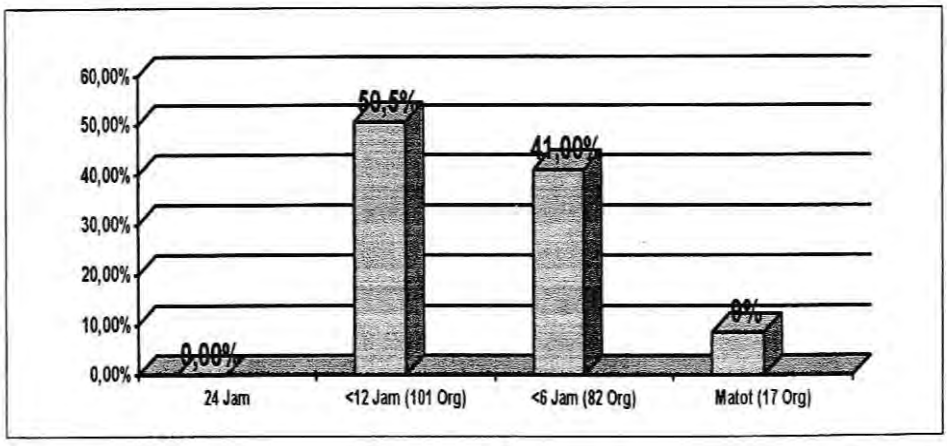
Figure 6. Perbula Clean Water Usage Chart



2. Water quality faucet In Physics

The respondents can classify clean water taps in physics, regarding flavor, smell, color, and Turbidity. The responses of the respondents regarding the clean water Quality in physics can found in Figure 7 above.

Of the respondents 32% (64 Respondents) report that clean water taps are derived, 28.5% (57 respondents) slightly browned color, 29.5% (59 respondents) smell, 30 ^ (60 respondents) high Kekeruhannya even 17 respondents (8.5%) did not vote because Water taps are not Gaussian, closer to home.



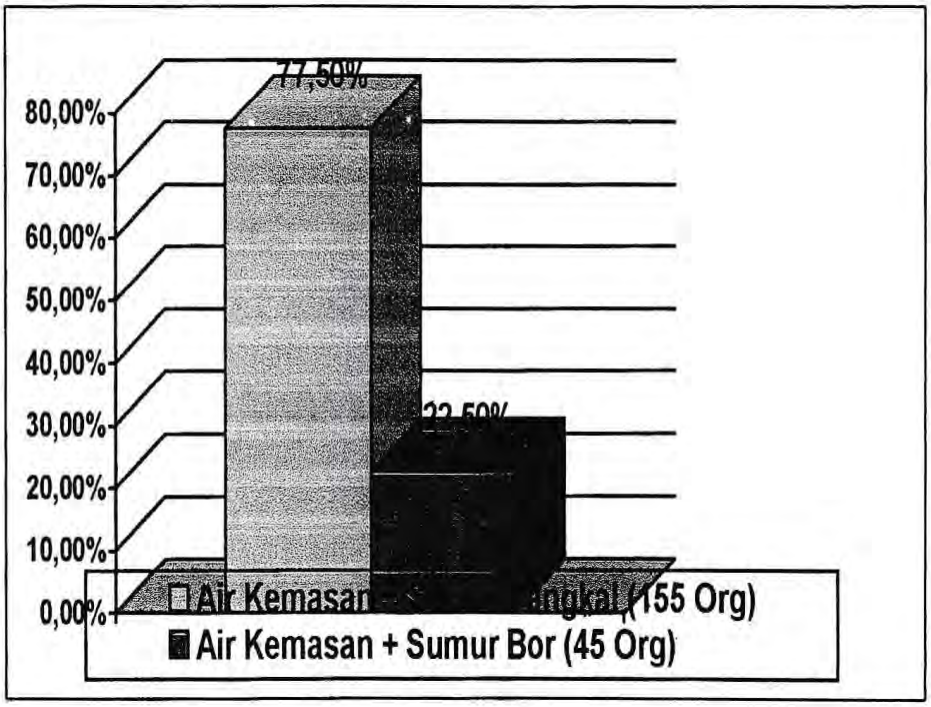
3. The continued flow of clean water

Figure 8. TAP Water of the graphite stream in a day (survey results 2006)

The graph above shows results that Mamuju tapes have not been able to obtain when supplying clean water to consumers on an ongoing basis, it can see from the successful respondents that janabin who streamed water into customers ' homes not continuously given For 24 hours. In Figure 8 above the 50.5% of the penicillin answered under 12 hours, 41% responded in under 6 hours of flow water receivable, and 8.5% replied that they did not receive at each stream water.

4. Other water sources

Of the 200 respondents, 100% still use other sources of water to meet daily life for eating/drinking, washing and washing, in the form of bottled water, shallow water fountains and good morning, moreover, it can be seen in the following image :



Pictures 9: Other water use chart

Look at the above picture wearing air packs + shallow wells There are 155 people or 77.55% and who use bottled water + Good morning as much as 45 people or 22.50%.

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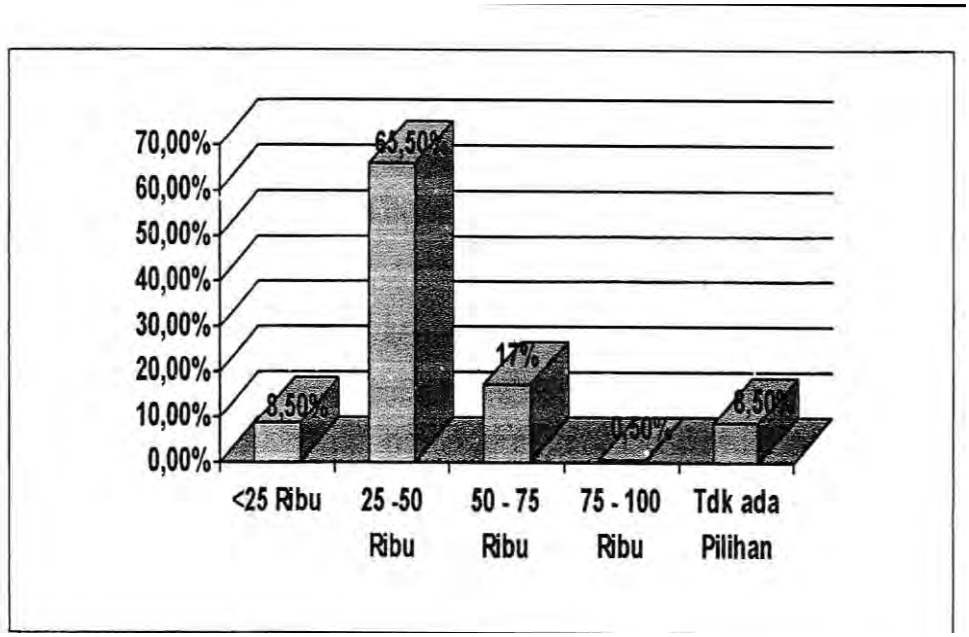
5. Clean water Cost

Research on the cost price of using clean water taps to determine the extent to which the community charge can consume clean water. Consumer expenses per month for the clean use of water can be seen in Appendix 4, 71% of its expenditures vary between IDR 25,000 to Rp. 50,000. And as much as 19.7% pay between IDR 50,000 to IDR 75,000.



Pictures 10. Clean water Cost

6. Water quality based on laboratory results

To find out the minimum level of water quality against Pemndsitribusian and where the water processed. Compared to the laboratory audit and regulatory results of INDONESIA's minister of Health. No. 907/Menkes/VII/2002, on the terms and supervision of water quality using the method :

1.	Organophilic	:	Physical tests using sensory perception
2.	Gravimetric	:	Filing using gravimetric analysis
3.	Turbidimeter	:	Presentation to see the Turpin level
4.	Spektrofotometri	:	Measurements using wavelength readings by spektro
5.	Membrane filter	:	The filing by using
6.	Expansion	:	Test through the thermometer
7.	DPD	:	Test using tablet

Laboratory test results indicate that there is still a proliferation of standard parameters that exist such as at the drought drinking water level there is an excess of 0.01 NTU and on dissolved oxygen of 4 mg. I, to the village level which still beyond the current standards, should be on the setting of an album the excess or lack of size is media and can predict concerning the deposition of Koangulan while oxygen dissolved due to the lying numbers of the oxygen adequacy of the ocean in water for life.

IV. Conclusion

The existing reception capacity which had not been able to meet the capacity of the installations owned by the Mamuju PDAM seen from the table. Three indicates that the tap has not been able to meet the needs of the maximum and minimum, it is affected by the leakage which is the reckless property of the raw water source, while technical influence causes the intake at any given time. It may not work because of such damage at the IV intake seen from a less secure intake site from raw water and the onset of the overflow-prone river as it is located at the River Bend site as shown in Figure 11.

These could cause damage to the inlet of the intake, even several works already being rehabilitated due to flooding from the river. Also, the situation of the intake also easily proves the pollution caused by external influences such as human pollution, the washing of the vehicle and the taking of stones, also by the Government of the West Sulawesi. Tourist attractions such as the Look at Figure 11, 64BA equipped with infrastructure worthy of natural attractions open at any time even on some days the place is very lively visiting people.

Observations field reservoir owned by Pdam Mamuju views regarding Perletakannya reservoir everything underground, as seen in the image below. A special fund for researchers has yet to see the consequences of putting chemicals on the water in the reservoir's capacity, such as needing to put chemicals in the reservoir or using the DACU pump as there has been no processing Crude reservoir on the other is synonymous.

Making the Reservoir since 1973 had passed the age of the technical section NSPM it was suggested in 2002 that for a job building a 30-year-old water reservoir. While Reservoir still looks nice.

Based on direct observation in the field as well as information obtained from the Engineering section of tapes Manakarra, Mamuju. There is no clear zoning until today for the distribution of water to the Pelanggang from any existing installation, therefore In a non-manageable archipelago if there are areas that do not have clean water distribution, including in the water received by customers at home Water becomes a murreable road even smelling. These are possible because of tissue damage. Its distribution pipeline, given that the geographical conditions on the ministership of the Ministry are pre-position, then the pipeline may be changed even to discharge, or because it is already over the technical limit age which is for 20 years (NSPM, III, and IV it is 260, 2002). There is still a distribution network that remains in use until now that its construction has built since the year 1973 and 1982.

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