Model of Investment Water Scheme of Drinking Water Supply System (SPAM) Development in Mapanget Sub District Manado City

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Abstract: Drinking water management by PT. Air Manado, PDAM (*Perusahaan Daerah Air Minum* / District Company for Drinking Water Affairs) Manado and UPTD AM (*Unit Pelaksana Teknis Dinas Air minum*) *or* technical service unit for drinking water, to the average community is still relatively low. This can be seen from the coverage percentage of the area services from the three managers of drinking water supply is still low. The service coverage of PT Air Manado on the range is still 27.52% to Manado City population. The coverage of PDAM and UPTD AM in Mapanget sub district is only 12.03% from 54,640 people, which is only 6,573 people. From these percentages, SPAM (*Sistem Penyediaan Air Minum* / Drinking Water Supply System) service is still very small from the MDGs (Millennium Development Goals) target for urban population. This study aims to calculate the feasibility of investing SPAM development in Manado City, especially in Mapanget sub district. Method of analysis of feasibility factors with data acquisition in field data is analyzed further using economic investment feasibility calculation. The calculation methods are Benefit Cost Ratio (BCR), Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP). The results shown in terms of technical factors that make up SPAM distribution planning system consists of raw water from Kuwil Reservoir by IPA (*Instalasi Pengolahan Air*) or Installation of Water Treatment and pump. The social factors of the water needs estimated about 19,741.23 m^3 in 2025 and 2036 plans1

1 INTRODUCTION

The availability of drinking water greatly affects the survival of humans in the world because it is a basic human need. Drinking water needs have increased in line with the increasing population growth in the world. The target of the MDGs (Millennium Development Goals) is the achievement of 80% service coverage for the urban population and 60% for the rural population.

Infrastructure development investments such as drinking water supply are considered as one of the policy instruments for economic development which is characterized by the development of industries, settlements, expansion of city / district areas and the increasing drinking water need. Therefore, it is necessary to consider the investment as an active strategy which in its development can invite participation not only the government but also private investors.

In the national medium-term investment development plan, the estimated investment to achieve the target of service coverage for drinking water is 274.80 trillion Rupiah where the central government allocates funds of the state budget of 90.70 trillion Rupiah. The difference in investment requirements is expected to come from local government funds of 98.90 trillion rupiah, excluding the regional government and the state budget amounting to Rp. 175.90 Trillion Rupiah. Based on the deviation in budget value needed to achieve development targets outside government funds, it is still very high, making other financing sources absolutely necessary to support the achievement of the target service coverage that has been set.

Based on the Government Regulation of the Republic of Indonesia number 16 of 2005 about the development of drinking water supply systems (SPAM) chapter I clause I verse 9 states that the Implementation of the development of Drinking Water Supply Systems (SPAM) hereinafter referred to as "The operator is BUMN (*Badan Usaha Milik Negara*) or state owned enterprises / BUMD (*Badan Usaha Milik Daerah)* or Regional Owned

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Enterprises, *koperasi*, private enterprises, and / or community groups that carry out the development of drinking water supply systems ". The Verse 10 states that "Organizers are individuals, community groups, or institutions that obtain drinking water services from the operator", so that to archieve the target of drinking water supply based on the deviation between the state budget and regional budget with RPIJMN is through cooperation between the government and the private sectors, such as; bank loans, Obligations, Corporate Social Responsibility (CSR), Government Investment Centers (GIC) and others. So that with this alternative financing is expected to accelerate the achievement of the target of the development of drinking water supply in an area specifically.

SPAM in Manado City is currently managed mostly by PT. Air Manado, some region in Malalayang sub-districts are managed by UPTD AM, while Mapanget sub-district is managed by PDAM Manado and UPTD AM.

So far in drinking water management by PT. Air Manado, PDAM Manado and UPTD AM, the level of service to the public is still relatively low. This can be seen from the coverage percentage of the area services from the three managers of drinking water supply is still low. The service coverage of PT Air Manado on the range is still 27.52% to Manado City population. The coverage of PDAM and UPTD AM in Mapanget sub district is only 12.03% from 54,640 people, which is only 6,573 people. Based on these percentages, SPAM services are still very small from the MDGs target for urban residents. According in the Manado City Spatial Plan in 2017 where Mapanget sub district development has changed for its designation, which is to become the central development area of Manado City. The consequences of that development are the many additional office buildings, housing and commerce that certainly accompanied by population growth which greatly affects the level of drinking water needs.

Based on the above description in Mapanget sub-district, it is necessary to develop a drinking water supply system that is expected to achieve the needs of drinking water both in terms of quality and quantity.

2 RESEARCH METHODOLOGY

The Methodology was started by collecting data, both primary and secondary data through literature studying, surveying, interview and filling out the questionnaires. Furthermore, identification of the determine feasibility factors of the SPAM is carried out.

The next step is data analysis. The Both of data is analyzed based on the feasibility factors. The indicators of technical factor are source water and the transmission system. The indicators of social factors are service area, population development, total usage, desire to subscribe of drinking water. The indicator of institutional factor is organization of SPAM. The output of this stage is the feasibility of drinking water supply systems technically, socially and institutionally.

The last Stage is economical and financial analysis based on technical, social and institution factor. The indicators are the all of cost, the benefit and price of drinking water. The feasibility investment determined IRR, NPV, BCR, and PP.

3 RESULTS AND DISSCUSION

3.1 Identification and Analysis of Technical Feasibility Factors

Analysis of water source in Mapanget sub district based on SPAM Manado and SPAM Bimantara Master Plan consists 3 water sources that are Paniki river, Tondano river and Kuwil reservoir. Paniki river have used for some region in Mapanget sub district but did not supply all the need. So the focus of the raw water source on Tondano river also used for electric source and Kuwil reservoir.

Table 1 shown that Kuwil reservoir is the best choice for water source where is the water flow system is the highest point to be used as a reference in determining alternative water sources because it is easier to operate and maintain.

SPAM Distribution System Planning consists of raw water sources, Kuwil Reservoir. Production units in the form of IPA and pumps. IPA will be planned has capacity amount 50 L/s in 2025 and 3600 L/s in 2036 Two intake pump and one distribution needed. Reservoir unit consist container reservoirs, Bengkol reservoirs and Paniki Atas reservoirs with capacity will be reaching 3000 m^3.

The unit of pipeline consists transmission pipe amount 6000 m and distribution pipe amount 5775 m.

3.2 Identification and Analysis of Social Feasibility Factors

The population of Mapanget sub district amount 53,716 people. The growth rate of the Mapanget sub district population from 2011 to 2016 can be seen in Table 2. According to Table 2, the growth percentage

Table 1: Utilization of the water sources.

No	Contents	Kuwil Reservoir	Tondano River
1	Lokasi	Kuwil,North Minahasa	Minahasa
2	Elevation	+87 masl	+680 masl
3	Coordinate	1º26'44.14" N 125º56'17.77" E	1º17"13.78" N 124º54"48.81" E
4	Min. debit availability (L/s)	4300	3300
5	Max. debit utilized (L/s)	2000	3226
6	Taking raw water	Pump	Pump
7	Water flow system	Gravitation	Pump
8	Water source quality a. Rainy season b. Dry season	 Stable Stable	 Stable Stable
9	Continuous flow	Yes	Yes
10	Technical recommendation	Ok	Studying

is 2.56 %. The Population projection in 2025 and 2036 can be predicted using arithmetic formula that is 59,699 in 2025 and 95,521 in 2036.

Table 2: Mapanget population data.

Year	Population	Population Increase	
		(people)	(%)
2011	44,773		
2012	50,146	5373	10.71
2013	51,174	1028	2.01
2014	51,631	457	0.89
2015	52,223	592	1.13
2016	53,716	1493	2.78
Mean		1490.5	2.92

Based on mayor decision in 2017, Mapanget is prepared to be a new city. So, we used the term from Ministry of Public Work for determine the total usage of water drinking need. Survey Sampling using 165 respondents who did not serve by PDAM and UPTD AM. The total usage is 19,120 L/day/family with 119.16 L/day/person. Data analysis for total water usage using term from Public Work Department in the *Pelita* Plan V what is adjusted by regional classification and total population. The result shown on the Table 3.

The capacity of the existing installed system for Mapanget served by PDAM and UPTD AM is 65 L/s. Based on water demand at peak hours in 2025 that is 145.67 L/s, there is a system shortage of 80.67 L/s, while for 2036 it is 228.49 L/s, there is a system shortage of 163.49 L/s.

Questionnaire forms that have been carried out for the calculation of the water needs analysis. Questionnaire are also used to determine the willingness and ability of communities in Mapanget to subscribe to clean water. The results of the questionnaire obtained in knowing the number of people who want to subscribe drinking water that is 51 % want to subscribe and 46.7% did not said yes or no. The people who want to subscribe has the ability to pay in 100,000 – 500,000 rupiah amount 88%.

Table 3: Water drinking usage projection in Mapanget.

Year	Domestic (L/s)	Non-domestic (L/s)	Water Depri-ation	Water usage in hour peak (m^3/day)
2017	7.34	1.45	1.74	1,556.48
2025	58.64	11.73	14.07	12,585.91
2036	91.98	18.40	22.08	19,741.23

3.3 Identification and Analysis of Institutional Feasibility Factors

The plan for developing the SPAM in Mapanget, by building IPA and the main distribution network. The investment needed in the development of SPAM is quite large. These costs can be obtained from several sources, such as from the central government, provincial governments, private enterprise or cooperation between the provincial government and the district /city government, or cooperation with the private sector. Based on Act No. 7 of 2004 about water resource, the provincial government takes responsibility of the management drinking water. So, they must arrange the scheme and the plan for the management. They management by government if all financing is borne entirely by the provincial government.

Based on the review of the SPAM organizing institution and by considering the authority and responsibility of the SPAM manager in accordance

with Government Regulation no. 122 of 2015, the organizer for the development of SPAM in Mapanget is the North Sulawesi Provincial Government in this case the Public Works Agency and the one handling it is the UPTD AM. The organizational structure must be able to describe the main activities in the management system, clear work patterns and have the functions of planning, implementation and control, and supervision by describing their duties, authorities and responsibilities.

3.4 Identification and Analysis of Economic Feasibility Factors

3.4.1 Job fee

Cost components calculated for economic analysis include three components, namely the cost of the SID (*Survey Investigasi dan Desain*) or Investigation and Design Survey, construction costs, operating and maintenance costs.

Table 4: SID costs, construction cost, maintenance and operations (financial).

Year	Job stage	Total Cost (in milion Rupiah)	
		Year 2025	year 2036
1	SID	550.00	550.00
2	Construction	37,025.00	58,050.00
3	Operational and maintenance	740.50	1,161.00
4		740.50	1,161.00
5		740.50	1,161.00
6		740.50	1,161.00
7		740.50	1,161.00
8		740.50	1,161.00
9		740.50	1,161.00
10		740.50	1,161.00
11		740.50	1,161.00
12		740.50	1,161.00
13		1,110.75	1,741.50
14		1,110.75	1,741.50
15		1,110.75	1,741.50
16		1,110.75	1,741.50
17		1,110.75	1,741.50
18		1,110.75	1,741.50
19		1,110.75	1,741.50
20		1,110.75	1,741.50

Construction costs in accordance with the Budget Plan are calculated based on the current work unit price. For raw water sources, only 1 (one) alternative location is used that is Kuwil Reservoir. In the economic analysis, it is assumed that the construction of this raw water supply system will be built in stages over two periods, namely in 2025 to 2036 for the Intake of Kuwil Reservoir. The results of the calculation of the budget plan for the construction of the system in Mapanget Subdistrict, the results of the approach were obtained. For 2025, the construction costs amounting to Rp. 37,025,000,000.00 and construction costs for 2036 amounting to Rp. 58,050,000,000.00.

Based on the proportion of the planned construction costs, then the assumption of SID and managerial costs for 2025 and 2036 is calculated as a result of Rp. 550,000,000.00. Based on the proportion of the assumed construction cost assumptions, it is assumed that operating and maintenance costs are made. Based on the system, the planned annual operating and maintenance costs are estimated to range between 1 - 3% of construction costs. For the calculation of economic analysis, it is assumed that OP costs are an average of 1% for the first 10 years and 1.5% for the time after that. Based on these assumptions it can be calculated the amount of OP costs each year (Table 4).

3.4.2 Cost of Economic Benefits

The value of the work cost is calculated as a financial cost (based on market prices). For the purposes of analyzing the cost of economic benefits, the amount of the costs (economy) is needed based on adjusted market prices. If the financial costs based on market prices have been calculated, then the economic costs can be calculated or approached with a 'conversion factor'.

The traded components are given a conversion factor of 1.06 while those not traded are divided into casual laborers of 0.80 and local materials of 1.0. Whereas for operation and maintenance, the average conversion factor is 1.015.

In calculating the economic costs, the conversion factors are modified into a conversion factor. The conversion factor is calculated by giving the value to each component by calculating the planned system. Financial costs are then multiplied by the appropriate conversion factors producing economic costs shown in Table 5.

3.4.3 The Determination of the Benefit

Based on the SPAM investment feasibility guidelines, the average direct benefit is around 30% of the total cost of work both for SID work, construction and operation and maintenance, and this amount is used in calculating the amount of direct benefits. In calculating the amount of indirect benefits, several assumptions and approaches are

Table 5: SID costs, construction cost, maintenance and operations (economical).

Year	Job stage	Total Cost (in milion Rupiah)	
		Year 2025	year 2036
1	SID Construction Operational and maintenance	550.00	550.00
2		37,025.00	58,050.00
3		740.50	1,161.00
4		740.50	1,161.00
5		740.50	1,161.00
6		740.50	1,161.00
7		740.50	1,161.00
8		740.50	1,161.00
9		740.50	1,161.00
10		740.50	1,161.00
11		740.50	1,161.00
12		740.50	1,161.00
13		1,110.75	1,741.50
14		1,110.75	1,741.50
15		1,110.75	1,741.50
16		1,110.75	1,741.50
17		1,110.75	1,741.50
18		1,110.75	1,741.50
19		1,110.75	1,741.50
20		1,110.75	1,741.50
Total		55,383.05	86,506.78

Table 6: Total benefit value (direct and indirect).

Year	Total cost (Million Rupiah)	
	Year 2025	Year 2036
1	1,466.96	1,926.49
2	21,863.82	29,684.10
3	6,833.09	9,259.55
4	9,422.49	12,768.00
5	13,306.59	18,030.68
6	13,306.59	18,030.68
7	13,306.59	18,030.68
8	13,306.59	18,030.68
9	13,306.59	18,030.68
10	13,306.59	18,030.68
11	13,306.59	18,030.68
12	13,306.59	18,030.68
13	13,486.39	18,274.89
14	13,486.39	18,274.89
15	13,486.39	18,274.89
16	13,486.39	18,274.89
17	13,486.39	18,274.89
18	13,486.39	18,274.89
19	13,486.39	18,274.89
20	13,486.39	18,274.89
Total	253,930.26	344,082.71

used by considering the condition of the area and the location of the work. In Mapanget, the benefits is assumed derived from the development of SPAM that are benefits for public health, community productivity, community economic growth, community resilience and property assets.

In this case each benefit for each aspect is given a scale of 1, 2 or 3 where the smaller the number indicates the higher or the greater the benefits raised. For the benefit of economic growth and property assets given a scale of 1 while the health, productivity and resilience of the community are given a scale of 2. Furthermore, in calculating the amount of indirect benefits, it is assumed that the amount of benefits generated every year is at a maximum of 5% of the economic costs of SID work and construction. The direct and indirect benefits shown in Table 6.

4 IDENTIFICATION AND ANALYSIS OF ECONOMIC FEASIBILITY FACTORS

4.1 BCR, NPV and IRR Analysis

After all costs and benefits are obtained in the year price, the economic feasibility criteria of a project (BCR, NPV and IRR) can be calculated. Price values for both costs and benefits must be converted with a 'discount factor', which is (1 + i) -n, to get the current price in the same year. The "i" means Rate Return.

The Rate of Return used for the analysis of economic costs is 5%, 10%, 15%, 20% and 25%. Calculation results to get the BCR, NPV,and IRR using 5% interest rates. For the calculation of the next interest rate are used10%, 15%, 20% and 25%. All the data Shown in Table 7-10. From the above, The values for i = 5%, it can be concluded:

- BCR : 2.26%> 1.00 Eligible
- NPV 2025 : Rp. 59,426.44> 0 Eligible
- NPV 2036 : 92,632,18> 0 Eligible
- IRR 2025 : 26,833%> 5% Eligible
- IRR 2036 : 26,86463%> 5% Eligible

4.2 Water Prices and PP Analysis

From each year the plan analyzed for each interest rate level can be illustrated that the economic analysis carried out is feasible, this can be seen from the BCR value of more than 1, the NPV is positive, the IRR value is greater than the interest value used and the Payback Period for interest rates of 5% - 20% less than 15 years. But for interest rates of 25%, the payback period obtained is greater than 15 years so it is not feasible to invest.

Table 7: Calculation of BCR and NPV for the Construction Period of 2025.

Year		Dis,F (I = 5%)	Cost	Benefit	PV Cost	PV Benefit	Ratio Net (B/C)
			(Milllion Rupiah)				
1		2	3	4	5 = 2 X 3	6 = 2 X 4	7 = 6 : 5
	0	1.0000	574.20	998.91	574.20	998.91	
	1	0.9524	38,061.70	13,898.46	36,249.24	13,236.63	
	2	0.9070	761.23	4,361.62	690.46	3,956.12	
	3	0.8638	761.23	6,014.92	657.58	5,195.91	
	4	0.8227	761.23	8,494.87	626.27	6,988.75	
	5	0.7835	761.23	8,494.87	596.45	6,655.95	
	6	0.7462	761.23	8,494.87	568.04	6,339.00	
	7	0.7107	761.23	8,494.87	540.99	6,037.15	
	8	0.6768	761.23	8,494.87	515.23	5,749.66	
	9	0.6446	761.23	8,494.87	490.70	5,475.87	
	10	0.6139	761.23	8,494.87	467.33	5,215.11	
	11	0.5847	761.23	8,494.87	445.08	4,966.77	
	12	0.5568	1,141.85	8,609.06	635.83	4,793.84	
	13	0.5303	1,141.85	8,609.06	605.55	4,565.57	
	14	0.5051	1,141.85	8,609.06	576.71	4,348.16	
	15	0.4810	1,141.85	8,609.06	549.25	4,141.10	
	16	0.4581	1,141.85	8,609.06	523.10	3,943.91	
	17	0.4363	1,141.85	8,609.06	498.19	3,756.10	
	18	0.4155	1,141.85	8,609.06	474.46	3,577.24	
	19	0.3957	1,141.85	8,609.06	451.87	3,406.90	
	20	0.3769	1,141.85	8,609.06	430.35	3,244.66	
Total			56,524.90	170,714.37	47,166.88	106,593.32	2.2599
Ratio Net B/C							2.26
NPV						59,426.44	

Table 8: Calculation of BCR and NPV for the Construction Period of 2036.

Year		Dis,F (I = 5%)	Cost	Benefit	PV Cost	PV Benefit	Ratio Net (B/C)
			(Million Rupiah)				
1		2	3	4	5 = 2 X 3	6 = 2 X 4	7 = 6 : 5
	0	1.0000	574.20	1,461.46	574.20	1,461.46	
	1	0.9524	59,675.40	21,770.22	56,833.71	20,733.54	
	2	0.9070	1,193.51	6,804.05	1,082.55	6,171.48	
	3	0.8638	1,193.51	9,382.45	1,031.00	8,104.92	
	4	0.8227	1,193.51	13,250.05	981.90	10,900.85	
	5	0.7835	1,193.51	13,250.05	935.14	10,381.76	
	6	0.7462	1,193.51	13,250.05	890.61	9,887.39	
	7	0.7107	1,193.51	13,250.05	848.20	9,416.56	
	8	0.6768	1,193.51	13,250.05	807.81	8,968.16	
	9	0.6446	1,193.51	13,250.05	769.35	8,541.10	
	10	0.6139	1,193.51	13,250.05	732.71	8,134.38	
	11	0.5847	1,193.51	13,250.05	697.82	7,747.03	
	12	0.5568	1,790.26	13,429.08	996.88	7,477.81	
	13	0.5303	1,790.26	13,429.08	949.41	7,121.73	
	14	0.5051	1,790.26	13,429.08	904.20	6,782.60	
	15	0.4810	1,790.26	13,429.08	861.15	6,459.62	
	16	0.4581	1,790.26	13,429.08	820.14	6,152.02	
	17	0.4363	1,790.26	13,429.08	781.09	5,859.06	
	18	0.4155	1,790.26	13,429.08	743.89	5,580.06	
	19	0.3957	1,790.26	13,429.08	708.47	5,314.34	
	20	0.3769	1,790.26	13,429.08	674.73	5,061.28	
Total			88,297.04	266,280.31	73,624.98	166,257.15	2.2582
Ratio Net B/C							2.26
NPV						92,632.18	

Table 9: Calculation of IRR for the Construction Period of 2025.

Year	Dis,F (I = 5%)	Cost	Benefit	PV Cost	PV Benefit	Ratio Net (B/C)
		(Million Rupiah)				
1	2	3	4	5 = 2 X 3	6 = 2 X 4	7 = 6 : 5
0	1.0000	574.20	998.91	574.20	998.91	
1	0.7884	38,061.70	13,898.46	30,009.30	10,958.08	
2	0.6216	761.23	4,361.62	473.21	2,711.34	
3	0.4901	761.23	6,014.92	373.10	2,948.04	
4	0.3864	761.23	8,494.87	294.16	3,282.67	
5	0.3047	761.23	8,494.87	231.93	2,588.19	
6	0.2402	761.23	8,494.87	182.86	2,040.62	
7	0.1894	761.23	8,494.87	144.18	1,608.91	
8	0.1493	761.23	8,494.87	113.67	1,268.52	
9	0.1177	761.23	8,494.87	89.62	1,000.15	
10	0.0928	761.23	8,494.87	70.66	788.56	
11	0.0732	761.23	8,494.87	55.71	621.73	
12	0.0577	1,141.85	8,609.06	65.89	496.78	
13	0.0455	1,141.85	8,609.06	51.95	391.68	
14	0.0359	1,141.85	8,609.06	40.96	308.82	
15	0.0283	1,141.85	8,609.06	32.29	243.48	
16	0.0223	1,141.85	8,609.06	25.46	191.97	
17	0.0176	1,141.85	8,609.06	20.08	151.36	
18	0.0139	1,141.85	8,609.06	15.83	119.34	
19	0.0109	1,141.85	8,609.06	12.48	94.09	
20	0.0086	1,141.85	8,609.06	9.84	74.18	
Total		56,524.90	170,714.37	32,887.40	32,887.43	1.0000
Ratio Net B/C						1.00
NPV					0.04	

Table 10: Calculation of IRR for the Construction Period of 2036.

Year	Dis,F (I = 5%)	Cost	Benefit	PV Cost	PV Benefit	Ratio Net (B/C)
		(Million Rupiah)				
1	2	3	4	5 = 2 X 3	6 = 2 X 4	7 = 6 : 5
0	1.0000	574.20	1,461.46	574.20	1,461.46	
1	0.7882	59,675.40	21,770.22	47,038.64	17,160.20	
2	0.6213	1,193.51	6,804.05	741.56	4,227.53	
3	0.4898	1,193.51	9,382.45	584.53	4,595.10	
4	0.3860	1,193.51	13,250.05	460.75	5,115.11	
5	0.3043	1,193.51	13,250.05	363.18	4,031.95	
6	0.2399	1,193.51	13,250.05	286.27	3,178.15	
7	0.1891	1,193.51	13,250.05	225.65	2,505.15	
8	0.1490	1,193.51	13,250.05	177.87	1,974.66	
9	0.1175	1,193.51	13,250.05	140.20	1,556.51	
10	0.0926	1,193.51	13,250.05	110.51	1,226.91	
11	0.0730	1,193.51	13,250.05	87.11	967.10	
12	0.0575	1,790.26	13,429.08	103.00	772.61	
13	0.0453	1,790.26	13,429.08	81.19	609.00	
14	0.0357	1,790.26	13,429.08	64.00	480.04	
15	0.0282	1,790.26	13,429.08	50.44	378.39	
16	0.0222	1,790.26	13,429.08	39.76	298.26	
17	0.0175	1,790.26	13,429.08	31.34	235.10	
18	0.0138	1,790.26	13,429.08	24.71	185.32	
19	0.0109	1,790.26	13,429.08	19.47	146.07	
20	0.0086	1,790.26	13,429.08	15.35	115.14	
Total		88,297.04	266,280.31	51,219.74	51,219.77	1.0000
Ratio Net B/C						1.00
NPV					0.03	

Table 10: The effect of interest rates on BCR, NPV, IRR, selling price and PP of 2025.

Interest Rate (i)	Current cost	Benefit cist	BCR	NPV	IRR	Selling price	PP
%	(Rp, Million)	(Rp, Million)		(Rp, Million)		(Rp,)	(Year)
5	47,166.88	106,593.32	2.26	59,426.44	26.8330	2,559.71	13.83
10	41,732.81	73,184.23	1.75	31,451.43	26.8330	2,109.61	13.18
15	38,164.57	54,231.06	1.42	16,066.49	26.8330	1,734.42	13.47
20	35,571.30	42,624.83	1.20	7,053.52	26.8330	1,419.17	14.55
25	33,537.63	35,028.46	1.04	1,490.83	26.8330	1,152.36	16.44

Table 11: The effect of interest rates on BCR. NPV. IRR. selling price and PP of 2036.

Interest Rate (i)	Current cost	Benefit cist	BCR	NPV	IRR	Selling price	PP
%	(Rp, Million)	(Rp, Million)		(Rp, Million)		(Rp,)	(Year)
5	73,624.98	166,257.15	2.26	92,632.18	26.8646	2,564.83	13.72
10	65,105.11	114,140.54	1.75	49,035.43	26.8646	2,114.74	13.07
15	59,510.62	84,573.27	1.42	25,062.65	26.8646	1,739.54	13.35
20	55,444.74	66,466.33	1.20	11,021.59	26.8646	1,424.29	14.41
25	52,256.23	54,614.36	1.05	2,358.13	26.8646	1,157.48	16.28

5 CONCLUSION

In developing the SPAM in Mapanget, the factors that determine the feasibility of this project are technical factors from the aspect of raw water sources and piping network systems; social factors from the aspect of population, regional development, water usage and desire to subscribe; institutional factors from aspects of institutional and SPAM management organizations; economic factors from aspects of SID costs, construction costs, operating and maintenance costs and benefit costs.

Based on the results of the analysis of these factors, it was found that the development of SPAM in Mapanget was feasible to be carried out using raw water sources in the Kuwil reservoir. The results of the investment feasibility calculation for the planned year 2025 and 2036 assuming an interest rate of 25%, the payback period obtained is greater than 15 years so the project is not feasible to be carried out. While the Payback Period for interest rates of 5% - 20% is obtained less than 15 years with a BCR value of more than 1, the NPV is positive, the IRR value is greater than the interest rate used so that the project is declared feasible to carry out.

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