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Analysis of Availability and Water Demand: A Case Study in Sumberejo Village Tanggamus Regency

Anwar[1*], ElzaNovilyanza[1], Kemas Muhammat Abdul Fatah[1]

[1]Faculty of Engineering, University Sang Bumi Ruwa Jurai, Lampung Indonesia

Corresponding email: minakshaka2013@gmail.com

Abstract. Clean water is a basic need for humans so that it is normal if clean water gets priority in handling and fulfilling it. The spring in Sumberejo Village, Sumberejo Subdistrict, Tanggamus District Is needed to facilitate. The purpose of this study is to identify the potential sources of raw water (clean water) in Sumberejo Village. The EPANET 2.0 program was implemented by calculative the number of people to be served as well as the need for clean water, reservoir capacity, and planning for distribution network. The methods used in water availability include measurement of discharge, topographic data, and water quality and for water requirements are projections of population, total water requirements and pipeline network pressure. The results of the analysis and projections of the number of villagers up to 2030 with a total of 2443 people, total water needs of 2842 liters/second, the availability debit in Sumberejo water eyes was 2,979 liters/second, the discharge was still sufficient for water needs until 2030. Hydraulic analysis using EPANET 2.0 obtained pressure at the highest location is 24.75 meters and the lowest is 2.95 meters. The study indicates that availability and water demand is sufficient until 2030

1. Introduction

Water is one of the most important needs for human life and other living things. So far, human needs for water are very large. When viewed in terms of its use, water has never been separated from all aspects of humans. Nature has provided quite a lot of water, but with population growth and increased activity so that the use of water needs increases. Clean water has a very important role in improving environmental health or the community, which has a role in reducing the number of people with diseases, especially those related to water and plays a role in improving the level or quality of life of the community [1-2]. In Indonesia until now the provision of clean water for the community is still faced with a number of quite complex problems and still cannot be fully addressed [3-5].

Sumberejo Village has a water source in the form of springs which have sufficient head potential but are not well distributed. At present the distribution of clean water still uses simple technology, namely by using temporary shelters that are distributed by hoses to the homes of residents. In clean water services to the community, the availability of clean water is a very important part. The main function of the distribution pipeline network is to deliver clean water to all villagers while taking into account the quality, quantity and water pressure factors. The condition desired by the whole community is continuous water availability [6-8].

In this case the author tries to plan a large capacity reservoir to store water so that the distribution can be carried out continuously or continuously, and the water distribution system used will use a gravity system, because the location of Sumberejo Village is at a lower elevation than the raw water source will be used.

With consideration of the above problems, it is necessary to have a study on "Analysis of Availability and Need for Clean Water in Sumberejo Village, Sumberejo District, Tanggamus Regency". The analysis is expected to meet domestic and non-domestic needs that meet the requirements standards.

2. Research Methodology

In carrying out research on the availability of analysis and the need for clean water in Sumberejo Village, Tanggamus Regency, a systematic stage of research planning is needed. This stage of analysis consists of several stages, which include area observation or area identification, evaluation of existing clean water network systems, population size, analysis of water availability, population growth and population needs.

This research was conducted in Sumberejo Village Sumberejo District, Tanggamus Regency. Sumberejo Village is one of 13 villages in the Sumberejo District area. Sumberejo Village is located in a highland area. Geographically the village borders on north side, Pulau Panggung sub-district, east side, Sidomulyo Village, south side, Sumber Mulyo Village and west side, Argopeni Village

Sumberejo Village is located in Sumberejo District, Tanggamus Regency which consists of 4 hamlets. The area of Sumberejo Village is 367.64 km^2, accessibility to Sumberejo Village from the subdistrict capital is 3 km and from the district capital which is about 36 km. The population is 2162 in 2016. In Figure 1, it is a map of village administration.

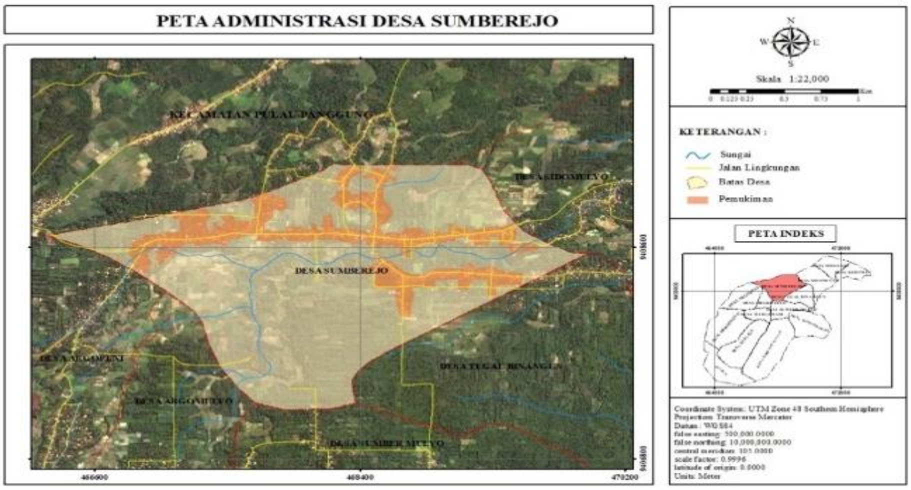

Figure 1. Map of Village Administration.

In this study, the progress of data collection can be grouped into two; primary data, are data obtained from field observations, laboratory tests and interviews. Field observations include potential discharge and potential energy potential (altitude / topography). For laboratory tests carried out is a test of physical and chemical quality of water to be carried out at the Lampung State Polytechnic Laboratory. Secondary data is the data needed to do calculations and analysis. This secondary data is in the form of data including population data and maps of Sumberejo Village, Sumberejo District, Tanggamus Regency.

The analysis was carried out using data that had been obtained, both in the field and in the laboratory, then adjusted to the literature and the results of previous related studies. This water quality analysis was carried out at the Lampung State Polytechnic Laboratory. The method and parameters of the water being analyzed refer to the provisions / requirements for the quality of clean water and drinking water based on RI Minister of Health Regulation No. 416 / MENKES / Per / IX / 1990. Furthermore, water feasibility

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is carried out by comparing the parameters of water samples with the quality standards of clean water and drinking water based on Minister of Health Decree No. 416 of 1990.

Population analysis is carried out to determine the number, density, and population growth of Sumberejo Village, which is geographically possible to be served by springs. The amount of water needs of the rural population refers to the 2001 drinking water SK-SNI, which is 60 liters per person per day. For water needs for public facilities refer to Lampung Province P3P of 20% of domestic water needs. Water losses caused by leakage of piping systems and such are estimated at 20% of total production and referring to Lampung Province P3P data. Fluctuations in water demand for maximum day factor values are 1.5 and the water service system is carried out through public faucets (KU) or public hydrants (HU), so that the population's water needs can be known per year.

In the drainage in the pipe there is friction along the pipe and due to the bend of the pipe so that head loss occurs in the pipe. Energy losses (head losses) due to friction along the pipe (hf) in water distribution are calculated using the formula. Calculation of the amount of energy loss in pipe narrowing (hf1) in water distribution. Jetting energy analysis is carried out to simulate an adequate pipe size / diameter by using EPANET software, so that it is known to what extent the source of the spring can flow its service area.

3. Results and Discussion

3.1. Total population

In 2016 the population of Sumberejo Village Sumberejo Subdistrict was 2,612 people with a ratio of 1,101 men and women of 1,061 people, as shown in Table 1, and Table 2 shown the population and growth rate of Sumbererjo Village.

Table 1 Total Population Based on Gender Ratio in Sumberejo Village [1]

Age	Gender		Total
	Male	Female	
0-4	55	55	112
5-9	69	67	136
10-14	70	68	138
15-19	114	110	224
20-24	163	158	321
25-29	69	67	136
30-34	78	75	153
35-39	130	126	256
40-44	136	132	268
45-49	147	142	289
50-54	78	75	153
55-59	74	71	145
60-64	76	73	149
65+	67	65	132
Total	1328	1284	2612

Table 2. Population and Growth Rate of Sumberejo Village [1]

No	Year	Total Population	Population Growth Rate (%)
1	2010	2043	0.95
2	2011	2078	0.95
3	2012	2095	0.95
4	2013	2112	0.95

5	2014	2129	0.95
6	2015	2146	0.95
7	2016	2163	0.95

3.2. Projected Population Amount

Population increase due to birth, loss due to death, increase and decrease due to migration and increased merging. Each of these elements is influenced by economic and social factors in the community. Other factors such as war, natural disasters, and industrial and commercial activities also influence. These elements, especially industry and commerce can produce sharp, slow growth, stable conditions or population decline.

Calculation of population projections can be done using 3 methods, namely arithmetic methods, geometric methods and least square methods. After knowing the results of the calculation of each method and also determined the value of the standard deviation of each method, determine which method will be used to calculate the projections of water requirements.

3.2.1. Arithmetic Method

Formula of the arithmetic method are:

$$Pn = Po_1 + n(Pr) \tag{1}$$

$$Pr = \frac{Pn_1 - Po_1}{n_1} \tag{2}$$

Where:
Pn : Total population in the nth year projection
Pr : Ratio of population
Po_1 : Total population at the beginning of the data
Pn_1 : Total population at the end of the data
n : Number of years to come
n_1 : Data collection year / final year minus the initial year

$$Pr = \frac{2163 - 2043}{2016 - 2010} = 20$$

$$P_{2030} = Po_1 + n(Pr)$$

$$P_{2030} = 2163 + (14 \times 20)$$

$$P_{2030} = 2443$$

Table 3. Projected Population Growth Using Arithmetic Method

No	Year	Total Population
1	2016	2163
2	2017	2183
3	2018	2203
4	2019	2223
5	2020	2243
6	2021	2263
7	2022	2283
8	2023	2303
9	2024	2323

10	2025	2343
11	2026	2363
12	2027	2383
13	2028	2403
14	2029	2423
15	2030	2443

From the calculation of the standard deviation or standard deviation above in the projected number of populations using the arithmetic method, the standard deviation value is 121.37, as shown in Table 4.

$$s^2 = \frac{(21)x\,(106148594) - (2222933904)}{(21)x(20)}$$

$$s^2 = 14729.928$$

$$s = \sqrt{14729.928}$$

$$s = 121.37$$

Table 4. Standard Deviation in Arithmetic Method

No	Year	Projected Population (xi)	xi^2
1	2010	2043	4173849
2	2011	2078	4318084
3	2012	2095	4389025
4	2013	2112	4460544
5	2014	2129	4532641
6	2015	2146	4605316
7	2016	2163	4678569
8	2017	2183	4765489
9	2018	2203	4853209
10	2019	2223	4941729
11	2020	2243	5031049
12	2021	2263	5121169
13	2022	2283	5212089
14	2023	2303	5303809
15	2024	2323	5396329
16	2025	2343	5489649
17	2026	2363	5583769
18	2027	2383	5678689
19	2028	2403	5774409
20	2029	2423	5870929
21	2030	2443	5968249
	∑	47148	106148594
	$(\sum xi)^2$	2222933904	

3.2.2. Geometric Method

Formula of the geometric method are:

$$Pn = Po_1(1+r)^n \tag{3}$$

$$r = \left(\frac{Pn_1}{Po}\right)^{\frac{1}{(n_1-o_1)}-1} \tag{4}$$

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Where:
Pn : Amount in the coming year
Po : Total population at the beginning of the estimate
Pn_1 : Total population at the end of the data
Po_1 : Total population at the beginning of the data
r : Average percentage of population increase
n : Duration of production year from the initial year of calculation
n_1 : Data end year
o_1 : Data start year

$$r = \left(\frac{2163}{2043}\right)^{\frac{1}{(7-1)}-1}$$

$$r = 0.0095$$

$$P_{2030} = 2163(1 + 0.0095)^{14}$$

$$P_{2030} = 2471$$

Table 5. Projected Population Growth Using Geometric Methods

No	Year	Total Population
1	2016	2163
2	2017	2184
3	208	2205
4	2019	2226
5	2020	2247
6	2021	2268
7	2022	2290
8	2023	2312
9	2024	2334
10	2025	2356
11	2026	2379
12	2027	2402
13	2028	2425
14	2029	2448
15	2030	2471

Table 6. Standard Deviation in Geometric Methods

No	Year	Projected Population (xi)	xi^2
1	2010	2043	4173849
2	2011	2078	4318084
3	2012	2095	4389025
4	2013	2112	4460544
5	2014	2129	4532641
6	2015	2146	4605316
7	2016	2163	4678569
8	2017	2184	4768434
9	2018	2205	4860025
10	2019	2226	4953375
11	2020	2247	5048518
12	2021	2268	5145489
13	2022	2290	5244322

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14	2023	2312	5345054
15	2024	2334	5447720
16	2025	2356	5552358
17	2026	2379	5659007
18	2027	2402	5767704
19	2028	2425	5878488
20	2029	2448	5991401
21	2030	2471	6106482
	∑	47311	106926403
	$(\sum xi)^2$	2238364345	

From the calculation of the standard deviation or standard deviation above in the projected number of populations using the geometric method, the standard deviation value is 121.37, as shown in Table 4.

$$s^2 = \frac{(21)x\,(87650829) - (1840667409)}{(21)x(20)}$$

$$s^2 = 1688124$$

$$s = \sqrt{1688124}$$

$$s = 1299.28$$

3.2.3. Least Square Method

Formula of the arithmetic method are:

$$\mathrm{y = a + bX} \tag{5}$$

$$\mathrm{a} = \frac{\mathrm{N} \sum \mathrm{y} \sum \mathrm{x}^2 - \sum \mathrm{x} \sum \mathrm{y}}{\mathrm{N} \sum \mathrm{x}^2 - (\sum \mathrm{x})^2} \tag{6}$$

$$\mathrm{b} = \frac{\sum \mathrm{x}^2 \sum \mathrm{y} - \sum \mathrm{x} \sum \mathrm{xy}}{\mathrm{N} \sum \mathrm{x}^2 - \sum \mathrm{x} \sum \mathrm{x}} \tag{7}$$

Where:
y : Total population for the year expected
x : Number of years or years calculated from the base year
a : constant
b : linear regression coefficient

Table 7. Calculations Determine Value A and B Method of Least Square

No	Year	Total Population (y)	x	y^2	x^2	yx
1	2010	2043	-3	4173849	9	-6129
2	2011	2078	-2	4318084	4	-4156
3	2012	2095	-1	4389025	1	-2095
4	2013	2112	0	4460544	0	0
5	2014	2129	1	4532641	1	2129
6	2015	2146	2	4605316	4	4292
7	2016	2163	3	4678569	9	6489
	∑	14766	0	31158028	28	530

$$a = \frac{(7 \text{ x } 530) - (0 \text{ x } 14766)}{(7 \text{ x } 28) - 0}$$

$$a = 18.928$$

$$b = \frac{(28 \text{ x } 14766) - (0 \text{ x } 530)}{(7 \text{ x } 28) - (0 \text{ x } 0)}$$

$$b = 2109.429$$

$$s^2 = \frac{(21)x\ (110800771) - (2317507740)}{(21)x(20)}$$

$$s^2 = 22162.98$$

$$s = \sqrt{22162.98}$$

$$s = 148.872$$

Table 8. Projected Population Growth Using Least Method

No	Year	Total Population
1	2016	2163
2	2017	2261
3	208	2280
4	2019	2299
5	2020	2318
6	2021	2337
7	2022	2356
8	2023	2374
9	2024	2393
10	2025	2412
11	2026	2431
12	2027	2450
13	2028	2469
14	2029	2488
15	2030	2507

Table 9. Standard Deviation in Least Method

No	Year	Projected Population (xi)	xi^2
1	2010	2043	4173849
2	2011	2078	4318084
3	2012	2095	4389025
4	2013	2112	4460544
5	2014	2129	4532641
6	2015	2146	4605316
7	2016	2163	4678569
8	2017	2261	5111475
9	2018	2280	5197423
10	2019	2299	5284087
11	2020	2318	5371468
12	2021	2337	5459566
13	2022	2356	5548380
14	2023	2374	5637911
15	2024	2393	5728158

16	2025	2412	5819122
17	2026	2431	5910803
18	2027	2450	6003200
19	2028	2469	6096314
20	2029	2488	6190144
21	2030	2507	6284691
	∑	48141	110800771
	$(\sum xi)^2$	2317507740	

The results of the 3 (three) population projection methods above and by considering the standard deviation value, it can be concluded that the Arithmetic Method is approaching reality. The reason for choosing this method is because the value of the standard deviation is smaller than the other methods.

3.3. Water Quality

The source of raw water used as a source of raw water in Sumberejo Village is a spring. The Sumberejo Springs are in the coordinates of 5 ° 21 '08.74 "S - 104 ° 42' 06.52" E while for the Springs of the Workspace are at coordinates 5 ° 21 '06.78 "S - 104 ° 42' 44.18" E. The results of the discharge measurement are obtained debit of 3.00 liters / second for Sumberejo Springs and 0.35 liters / second for Sumber Spring works. The results of testing the quality of clean water that has been sampled are as follows.

Table 10.1 Water Quality of Sumberejo Village.

No	Parameter	Maximum Limit Allowed	Test Result	Unit
1	Smell and Taste	No smell/ tasteless	No smell/ tasteless	-
2	Color	Colorless	Colourless	-
3	Temperature	±3°C	27	˚C
4	TDS	1	75	mg/ litre
5	Turdibity	5	3,6	FAU
6	Salinity	0	0	-
7	pH	6,5-9,0	7,3	-

Table 11. Water Quality of Sumberkarya

No	Parameter	Maximum Limit Allowed	Test Result	Unit
1	Smell and Taste	No smell/ tasteless	No smell/ tasteless	-
2	Color	Colorless	Colourless	-
3	Temperature	±3°C	26	˚C
4	TDS	1	75	mg/ litre
5	Turdibity	5	3,6	FAU
6	Salinity	0	0	-
7	pH	6,5-9,0	7,0	-

Based on the results of measurements and laboratory tests of samples from springs it can be seen that all parameters can be said to meet the requirements to be used as raw water. Clear water flowing with turbidity levels that only ranges from 3.6 FAU because there is no rain, but according to information if the day before the rain occurs it appears that the spring is cloudy, it must be anticipated by using a slow sand filter.

3.4. Topographic Data

Based on the topographical data of Sumberejo Village, the location of the elevation of the spring is located at an elevation of ± 490 m asl and the water service area ranges from ± 488 m asl to ± 380 m asl. So that clean water services do not use pumps and can be done by means of gravitational flow because service areas are in lower elevations than raw water sources. Existing topographic images can be seen in Figure 2, and Figure 3.

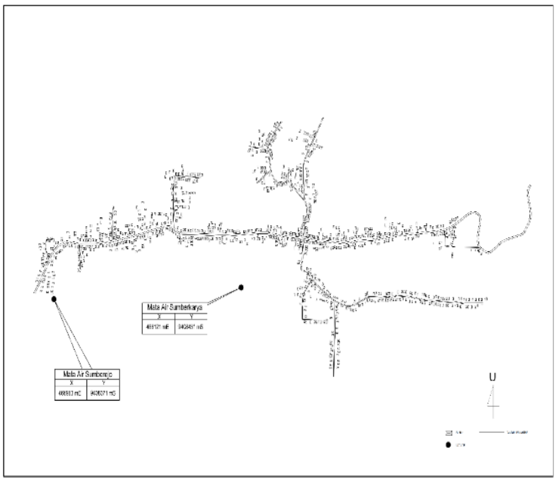

Figure 2. Topographic Sumberejo.

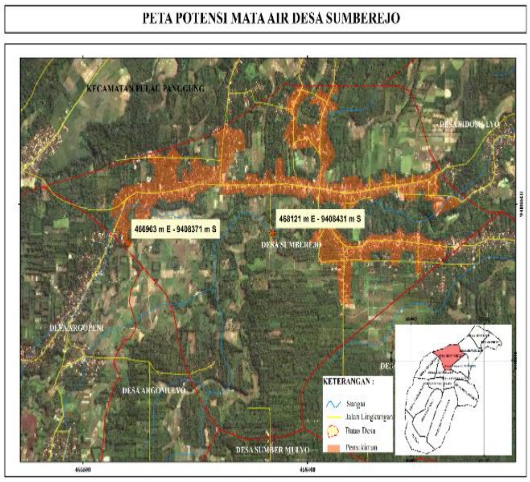

Figure 3. Springs Potential Map.

3.5. Projection of Water Needs

Sumberejo Village already has a clean water supply system, but the supply of clean water still uses simple technology and the clean water obtained now comes from springs.

Table 12. Water Needs in Total Sumberejo Village

No	Year	Total Population	Debit Domestic Water Needs (Qd)	Debit Non- Domestic Water Needs (Qn)	Water Losses (Qa)	Total Water Needs (Qt) in ℓ/s
1	2016	2163	1.590	0.318	0.286	2.194
2	2017	2183	1.592	0.318	0.287	2.197
3	208	2203	1.653	0.331	0.298	2.282
4	2019	2223	1.692	0.338	0.306	2.336
5	2020	2243	1.732	0.346	0.312	2.390
6	2021	2263	1.749	0.350	.0315	2.413
7	2022	2283	1.789	0.358	0.322	2.469
8	2023	2303	1.806	0.361	0.325	2.493
9	2024	2323	1.848	0.370	0.33	2.550
10	2025	2343	1.866	0.373	0.336	2.574
11	2026	2363	1.908	0.382	0.343	2.633
12	2027	2383	1.926	0.385	0.347	2.658
13	2028	2403	1.970	0.394	0.355	2.719
14	2029	2423	2.040	0.408	0.367	2.815
15	2030	2443	2.059	0.412	0.371	2.842

3.6. EPANET 2.0 Piping Network

The clean water distribution pipeline network that will be planned uses pipes with a diameter of 12.5 - 100 mm with the type of planned pipe, namely using PVC pipes. The formula used in calculating Head Loss on a distribution pipeline is to use the Hazen Williams formula.

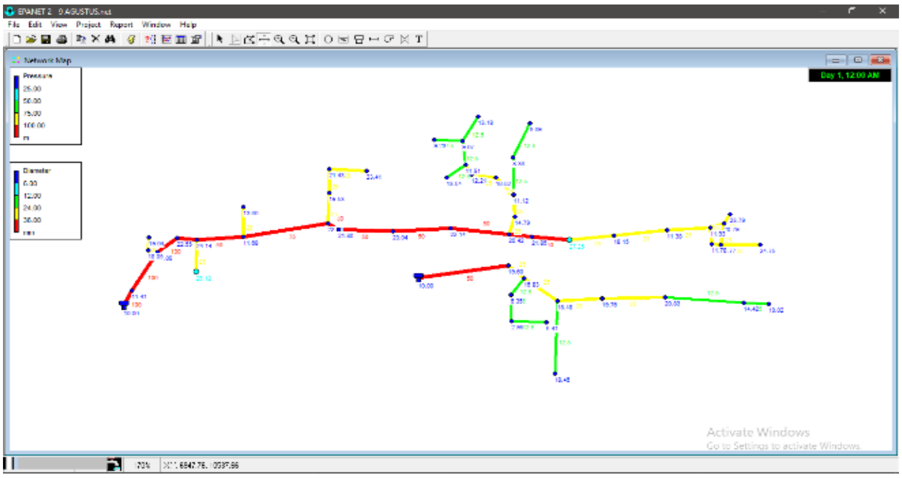

Figure 4. Scheme of Piping Network Using EPANET 2.0 Program.

To analyze the clean water distribution network system using the EPANET 2.0 program, it can be done in 2 ways, namely by Single Period and Extended Period Simulation. In the single period the process of analyzing the distribution of clean water needs is considered the same every hour and the flow is steady, while in the extended period simulation analysis of the distribution of clean water needs varies at each time. In this planning analysis an extended period simulation system is used.

The work steps taken to begin the analysis with the EPANET 2.0 program are as follows:

a. Making a new project.
b. Program settings.
c. Depiction of the scheme of clean water distribution network.
d. Input data on clean water distribution network components.
e. Input water pattern data.
f. Program simulation.
g. Interpretation of simulation results

After the program is run, then see the simulation results. The simulation results can be accessed in the form of tables, graphs, and hourly parameter maps. The flow pressure of each pipe can be seen in the table below.

Table 13. Pressure at Every Point in the EPANET 2.0 Program

Node ID (Junc)	Elevation (m)	Base Demand LPS	Demand LPS	Head (m)	Pressure (m)
2	488	0.229	0.23	499.41	11.41
3	483	0.222	0.22	498.09	15.09
4	480	0.014	0.01	498.05	180.05
5	479	0.007	0.07	498.04	19.04
6	475	0.208	0.21	497.55	22.55
7	472	0.201	0.2	496.14	24.14
8	471	0.007	0.01	496.12	25.12
9	465	0.188	0.19	476.68	11.68
10	463	0.007	0.01	476.66	13.66
11	450	0.174	0.17	472.8	22.8
12	447	0.021	0.02	466.53	19.53
13	445	0.014	0.01	466.43	21.43
14	443	0.007	0.01	466.41	23.41
15	448	0.153	0.15	469.86	21.86
16	437	0.146	0.15	460.04	23.04
17	430	0.139	0.14	452.14	22.14

18	426	0.132	0.13	446.42	20.42
19	423	0.062	0.06	442.6	19.6
20	420	0.056	0.06	436.83	16.83
21	421	0.021	0.02	427.35	6.35
22	421	0.014	0.01	423.95	2.95
23	418	0.007	0.01	423.41	5.41
24	415	0.035	0.03	433.48	18.48
25	415	0.00	0	433.46	18.46
26	412	0.028	0.03	431.76	19.76
27	410	0.021	0.02	430.83	20.83
28	407	0.014	0.01	421.42	14.42
29	402	0.007	0.01	421.02	19.02
30	395	0.007	0.01	419.75	24.75
31	402	0.014	0.01	419.77	17.77
32	399	0.014	0.01	419.79	20.79
33	408	0.021	0.02	419.93	11.93
34	408	0.021	0.02	419.78	11.78
35	396	0.007	0.01	419.79	23.79
36	412	0.049	0.05	423.38	11.38
37	414	0.056	0.06	432.15	18.15
38	418	0.063	0.06	445.25	27.25
39	424	0.069	0.07	445.85	14.79
40	424	0.056	0.06	438.79	14.79

The results of EPANET 2.0 data above the highest elevation point are at 488 m with a pressure of 11.41 m and the lowest elevation is at an altitude of 395 m with a pressure of 24.75 m.

From the results of the below data it can be concluded that the highest head loss is in pipe 18 at 29.13 m / km and pipe 36 at 27.16 m / km and for the lowest head loss in pipe 15 and pipe 53 because it has the same value i.e. 0.04 m / km.

Table 14.2 Speed and Head Loss in Pipes

Link ID (Pipe)	Length (m)	Diameter (mm)	Roughness	Flow LPS	Velocity (m/s)	Unit Head loss (m/km)	Friction Factor
2	299.04	25	100	0.2	0.41	19.3	0.056
3	585.16	25	100	0.1	0.21	5.73	0.062
4	644.96	25	100	0.07	0.14	2.67	0.065
5	893.77	25	100	0.04	0.08	1.04	0.071
6	1121.49	12.5	100	0.02	0.17	8.4	0.072
7	357.32	12.5	100	0.01	0.06	1.1	0.084
8	312.55	25	100	0.04	0.08	1.04	0.071
9	404.94	12.5	100	0.02	0.17	8.4	0.072
10	495.02	12.5	100	0.01	0.06	1.1	0.084
11	1113.51	12.5	100	0	0.01	0.02	0.118
13	690.43	100	100	2.22	0.28	1.91	0.047
14	131.73	25	100	0.02	0.04	0.29	0.078
15	199.62	25	100	0.01	0.01	0.04	0.092
16	350.76	100	100	1.98	0.25	1.54	0.048
17	277.15	75	100	1.77	0.4	5.1	0.047
18	667.98	50	100	1.56	0.8	29.13	0.045
19	483.46	25	100	0.0	0.01	0.04	0.092
20	1229	75	100	1.37	0.31	3.16	0.049
21	176.96	50	100	1.15	0.59	16.58	0.047
22	770.56	50	100	1	0.51	12.74	0.048
23	830.28	50	100	0.85	0.44	9.52	0.049
24	834.55	50	100	0.72	0.36	6.85	0.051

25	327.74	50	100	0.34	0.17	1.73	0.057
26	533.31	50	100	0.27	0.14	1.13	0.059
27	641.51	25	100	0.21	0.42	20.42	0.056
28	763.17	25	100	0.15	0.31	11.49	0.058
29	610.78	25	100	0.1	0.21	5.66	0.062
30	212.49	25	100	0.03	0.06	0.62	0.074
31	165.34	25	100	0.01	0.01	0.04	0.092
32	337.83	25	100	0.01	0.02	0.08	0.086
33	248.09	25	100	0.03	0.06	0.6	0.074
34	132.83	25	100	0.01	0.02	0.8	0.087
35	562.08	25	100	0.01	0.01	0.04	0.092
36	281.04	25	100	0.24	0.5	27.16	0.054
37	337.54	25	100	0.19	0.38	16.8	0.057
38	570.68	12.5	100	0.02	0.17	8.4	0.072
39	578.28	12.5	100	0.01	0.06	1.1	0.084
40	363.8	25	100	0.12	0.24	7.13	0.061

4. Conclusion

Based on the results of the analysis carried out in the previous chapter, conclusions can be taken as follows:

I. Based on the results of the survey at the site there are 2 springs in Sumberejo Village, namely the Sumberejo Springs and Sumber Karya Water Spring. The potential discharge from the two springs is 3.00 liters / second and 0.35 liters / second.

II. From the data and results of the calculation of the projection of the residents of Sumberejo Village by using the arithmetic method for 2030, there are 2443 people.

III. Based on the survey results in the study locations, the population's basic needs were 60 liters / day / capita, so the population was 2443 people for domestic clean water needs of 2.059 liters/ second. As well as non-domestic needs, because there are public facilities around 0.412 liters / day. So that the total water needs of Sumberejo Village are 2.842 liters / second and the available spring discharge is 3.35 liters / second, so that the need for clean water is sufficient until 2030.

IV. Based on the calculation of fluctuations in the need for clean water, the reservoir volume for the Sumberejo Spring is found to be 50 m3 and for the Source Spring 6 m3.

V. From the results of the EPANET 2.0 program simulation, the distribution network design criteria have met until 2030. The planned water distribution network uses PVC pipes with a diameter of 12.5 mm - 100 mm, the total length of pipes needed is 4,916 meters. The results of hydraulic analysis using EPANET obtained the highest pressure (pressure) at 24.75 meters and the lowest 2.95 meters.

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