Determination of Critical Points for Water and Soil through Geoelectrical Methods and Potential Natural Resources in Clean Water Management in Flood Prone Areas

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***Abstract*-**Water is a basic human need covering 50-70%. According to WHO, each person needs between 60-120 liters of water/day, Indonesian people use a lot of water with poor quality or not meeting health standards. Astambul sub-district in five villages as many as 8568 people with poor, vulnerable and disabled people of 2796 people is one of the areas in Banjar Regency that has a clean water crisis, both rainy and dry seasons and coupled with floods every year even every time it rains which causes water quality becomes cloudy and does not meet the physical, chemical and bacteriological quality. The method in community empowerment activities is that filtration and adsorption techniques can use natural materials that grow such as water hyacinth and Moringa and waste left over from community activities around the community such as rice straw, husks, coconut fibers, coconut shells, market charcoal. Each has advantages in improving water quality, such as Moringa leaves (Moringa oleifera) can be used to purify water because they contain nine amino acids, sucrose, D-glucose, alkaloids, wax, quercetin and kaempferate are also rich in potassium and calcium. . Moringa leaves contain vitamins, carotenoids, polyphenols, phenolic acids, flavonoids, alkaloids, glucosinolates, isothiocyanates, tannins, saponins, and oxalates.

***Index Terms*-** Critical points for water and soil, Geoelectricity, GIS, Community Empowerment using natural resources (plants and waste from community activities)

I. INTRODUCTION

Water is the main need in life so that the earth's surface consists of about 75% water. Most of the human body weight is water covering 50-70%. According to WHO, each person needs between 60-120 liters of water/day, while in developing countries, including Indonesia, each person needs between 30-60 liters of water/day (1).

Astambul sub-district in five villages as many as 8568 people with poor, vulnerable and disabled people of 2796 people is one of the areas in Banjar Regency that has a clean water crisis, both rainy and dry seasons and coupled with floods every year even every time it rains which causes water quality becomes cloudy and does not meet the physical, chemical and bacteriological quality. This is confirmed based on the results of research by Syamsul A et al, 2021; Laily K et al, 2021; Waskito, 2021 in September 2021 in 6 areas with an average depth of > 75 meters and a resistivity of 89.58 m and the quality of ground water looks cloudy and the condition of well water also does not meet the requirements, namely still cloudy, although with a depth of 5-10 meters main. (2).

Data on the results of river water quality inspections in 2020 in Banjar district that of 8 parameters exceeding the allowable threshold value, namely MPN coli 35000/100 ml of water from the standard of 100 ml/water, TSS of 846 mg/L from 50 mg/L, BOD 398 mg/L from 3 mg/L, COD 189.3 mg/L from 25 mg/L, DO 6 mg/L from 4 mg/L, pH 6-7 from 6-9. The data for 2021 are as follows: turbidity number 57.55, TDS 343.3, Ph 6.69, dissolved oxygen 15.13. This is in line with the results of the research by Waskito et al. In 2021, there are still many people in the Astambul sub-district who have not fulfilled clean water sources that meet health requirements as many as 10,453 people (86%) both from dug wells, drilled wells, river water with details of the Ulu Expansion of 847 people. (52.4%), Middle Kelampian 532 people (36.8%), Limamar 535 people (28.4%), Lok Gabang 780 people (52%), Kaliukan 1744 people (93.1%), Sei Alat 1305 people (63.1%) with an average population of 1742 people per village with the fulfillment of clean water by buying or using water that is not yet suitable as clean water for its physical, chemical and bacteriological quality, namely turbidity well water in Kaliukan Village 336 NTU (standard 25 NTU), Fe 0.371 mg/l in the village of Kelampapan ulu and Tengah (standard 1.0 mg/l), Fe 0.087 mg/l Kaliukan, Fe 0.371 mg/l in Lok Gabang village, Fe 0.371 mg/l in Sungai Sungai Tool, Mn 27.09 mg/l (0.5 mg/l)

in the village of Kelampapan ulu, Desa Kelampapan Tengah, Mn 28.98 mg/L, Mn 12.60 mg/L Kaliukan, Mn 19.53 mg/L, Lok Gabang, Mn 14.49 mg/l Sungai Alat, pH 6 (standard 6.5 -9.5), MPN Coli > 1600 /100 ml. Groundwater (Lok Gabang) Mn 0.036, (Lok Gabang) Fe 1.77, (Lok Gabang) turbidity 18.67, (Lok Gabang) pH 7.6, MPN Coli > 1600 /100 ml. Kaliukan Kekruhan Village River Water 22.43 NTU, pH 7.2,

If the water is used by the community for their daily needs. Health impacts that may arise in the long term due to poor quality water are bone loss, tooth corrosion, anemia, and kidney damage. This happens because the water is contaminated with heavy metals which are usually toxic and precipitate in the kidneys (1). Water quality will decrease in addition to pollution as well as natural conditions/disasters such as floods. Data from disaster risk studies in 2016-2020 in Banjar Regency, a sub-district that has a high class hazard, one of which is Astambul District. Astambul sub-district was hit by floods in 2021 with a total of 9 villages with 35313 people with a population density per km2 of 163 people with a flood height of 1-2,5 m.

and community empowerment activities in the health sector in clean water treatment obtained from combining threats, vulnerabilities and capacities in each risk component, which can then be used as a reference for decision making in planning and management of flood and water-prone disasters and community empowerment (3, 4 , 5). The method in community empowerment activities is filtration and adsorption techniques can use natural materials that grow such as water hyacinth and moringa and waste left over from community activities around the community such as rice straw, husks, coconut fibers, coconut shells, market charcoal. Each of them has advantages in improving water quality, such as Moringa leaves (Moringa oleifera) can be used to purify water because they contain nine amino acids, sucrose, D-glucose, alkaloids, wax, quercetin and kaempferate are also rich in potassium and calcium. Moringa leaves contain vitamins, carotenoids, polyphenols, phenolic acids, flavonoids, alkaloids, glucosinolates, isothiocyanates, tannins, saponins, and oxalates.

II. RESEARCH METHODS

This study uses a quantitative research design with a cross-sectional method, namely to look at factors related to mapping clean water sources in flood and mining areas based on seasonal trends and community empowerment using geoelectrical and GIS methods. In this study, the research sample will be water and soil in Astambul District which are homogenized with the Purposive Sampling technique.

1. Independent variable (independent variable)
   The independent variables in this study are water sources (depth, discharge and potential)
2. Dependent variable (dependent variable)
   The dependent variable in this study is the availability of clean water which is included in the map of clean water sources using the GIS method

III. WRITE DOWN YOUR STUDIESANDFINDINGS

Ulu Expansion, Lok Gabang, Alat River and Kaliukan)

No	Sample	Soil				
		Organic Carbon (%)	Organic Ingredients (%)	Mn-soluble (PPM)	Fe-soluble (PPM)	Permeability (cm/hour)
Middle Kelampian Village						
1	1 point	2.09	3.6	14	57.38	7.64
2	Point 2	1.38	2.41	3.91	12.68	3.36
3	3 point	1.25	2.17	4.48	13.61	2.3
4	4 point	0.69	1.2	3.62	22.45	2.64
5	5 point	0.88	1.54	3.57	8.75	1.92
Average		**1.26**	**2.18**	**5.92**	**22.97**	**3.57**
Lok Gabang Village						
6	1 point	2.01	3.46	15.4	32.29	4.84
7	Point 2	1.3	2.26	2.91	5.77	2.33
8	3 point	0.41	0.72	2.78	15	1.94
9	4 point	0.63	1.1	2.78	6.41	2.3
10	5 point	1.23	2.13	2.27	5.63	1.97
11	6 point	1.33	2.32	2.91	7.64	2.34
Average		**1.15**	**2.00**	**4.84**	**12,12**	**2.62**

No	Sample	Soil				
		Organic Carbon (%)	Organic Ingredients (%)	Mn-soluble (PPM)	Fe-soluble (PPM)	Permeability (cm/hour)
Tool River Village						
12	1 point	1.54	2.66	42	66.12	1.02
13	Point 2	0.21	0.36	3.94	12.78	4.52
14	3 point	1.59	2.77	2.76	29.59	2.66
15	4 point	1.13	1.97	3.05	7.03	2.8
16	5 point	0.65	1.13	3.79	31.9	2.44
17	6 point	0.88	1.54	49.14	1217.94	2.57
18	7 point	0.94	1.63	3.94	10.08	2.67
Average		**0.99**	**1.72**	**15.52**	**196.49**	**2.67**
Kaliukan Village						
19	1 point	0.14	0.25	62.3	36.36	2.8
20	Point 2	0.48	0.84	2.28	10.62	1.86
21	3 point	0.73	1.27	2.37	5.87	2.32
22	4 point	1.12	1.94	2.71	7.89	2.09
23	5 point	1.59	2.77	3.06	6.06	2.25
24	6 point	0.84	1.45	2.76	19.82	2.57
Average		**0.82**	**1.42**	**12.58**	**14.44**	**2.32**
Ulu						
25	1 point	2.21	3.82	23.8	48.84	4.08
26	Point 2	1.26	2.2	3.12	15.61	2.67
27	3 point	1.55	2.7	3.68	13.78	2.66
28	4 point	2.14	3.73	3.13	17.46	2.34
29	5 point	1.66	2.9	2.89	3.88	2.67
30	6 point	1.29	2.24	3.67	12.92	1.94
Average		**1.69**	**2.93**	**6.72**	**18.75**	**2.73**
Overall Land Average		**1.18**	**2.05**	**9.11**	**52.95**	**2.78**

Soil sample testing in 5 villages of Astambul District was seen based on 6 indicators, namely organic carbon, organic matter, water content, soluble Mn, soluble Fe and permeability. The average value of soil organic carbon from all sampling points is 1.09%. The highest value is at point 3 in Kelampapan Ulu Village at 2.14% and the lowest at point 2 in Lok Gabang Village at 0.41%. The average value of organic matter for all points of collection was 1.9%. The village with the highest average score is Kelampapan Ulu Village at 2.75% and the highest point is at point 3 Kelampapan Ulu Village at 3.73%. The water content in the soil for all points has an average of 21.03%. Kaliukan Village has the highest average water content of 26.85% and the point with the highest water content is also found in Kaliukan Village at point 1 of 34.56%. The average soluble Mn content for all points was 4.73ppm. Villages with the highest average soluble Mn content were found in Sungai Alat Village at 11.10 ppm and the point with soluble Mn levels was at point 5 in Sungai Alat Village at 49.14 ppm. The average soluble Fe content for all points was 52.69ppm. The village with the highest soluble Fe content was found in Sungai Alat Village at 218.22 ppm and the point with the highest soluble Fe content was also found in Sungai Alat village point 5 at 1217.94 ppm. The average soil permeability from all points is 2.47cm/hour. The village with the highest average level of soil permeability is in Sungai Alat Village of 2.94cm/hour and the highest point of soil permeability is at point 1 in Sungai Alat Village of 4.54 cm/hour. Villages with the highest average soluble Mn content were found in Sungai Alat Village at 11.10 ppm and the point with soluble Mn levels was at point 5 in Sungai Alat Village at 49.14 ppm. The average soluble Fe content for all points was 52.69ppm. The village with the highest soluble Fe content was found in Sungai Alat Village at 218.22 ppm and the point with the highest soluble Fe content was also found in Sungai Alat village point 5 at 1217.94 ppm. The average soil permeability from all points is 2.47cm/hour. The village with the highest average level of soil permeability is in Sungai Alat Village of 2.94cm/hour and the highest point of soil permeability is at point 1 in Sungai Alat Village of 4.54 cm/hour. Villages with the highest average soluble Mn content were found in Sungai Alat Village at 11.10 ppm and the point with soluble Mn levels was at point 5 in Sungai Alat Village

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Soil organic carbon (C) is a fundamental component in the global carbon cycle to support the sustainability of terrestrial ecosystems (Agus 2013; Siringoringo 2014). Soil C-organic is formed through several stages of organic matter decomposition. Soil C-organic status is influenced by various external factors such as soil type, rainfall, temperature, input of organic matter from above-ground biomass, anthropogenic processes, soil management activities, and CO2 content in the atmosphere (Hairiah et al. 2001; Hairiah et al. 2011; Yulnafatmawita et al. 2011 in Farrasati, 2019). Changes in the C-organic status of the soil through the process of decomposition and mineralization of soil organic matter are reported to have a relationship with soil properties such as texture, pH, metal cations in the soil, CEC (cation exchange capacity), and nitrogen content (6).

Organic matter can be defined as all materials derived from plant and animal tissues, both living and dead. Soil organic matter is a complex and dynamic material, derived from the remains of plants and animals in the soil and undergoing continuous degradation. Soil organic matter is formed from living soil organisms consisting of flora and fauna, living and dead plant roots, which are decomposed and modified as well as new synthesis products derived from plants and animals. Soil organic matter plays an important role in determining the physical, chemical, and biological activities in the soil that determine the carrying capacity and productivity of the land. Organic matter is generally found on the soil surface in the amount of only about 3-5% (7).

Organic matter is a complex and dynamic system, sourced from plant or animal residues found in the soil that continuously changes shape, because it is influenced by physical, biological, and chemical factors. Reintjes et al., (1992 in Nangaro) suggested that the function of soil organic matter, among others, is to store nutrients which are slowly released into the groundwater solution and made available to plants. Organic matter in or above the soil also protects and helps regulate soil temperature and humidity. Organic matter can also increase soil support (7).

The results showed that degraded paddy fields were one of the indications due to low organic matter and potassium. Organic matter has an important role in determining the ability of the soil to support plants, so that if the level of soil organic matter decreases, the ability of the soil to support plant productivity also decreases (8).

The C-Organic content of the soil can be low because the absence of the use of organic fertilizers in a field is the main factor in the low C-organic content of the soil. The land only uses inorganic fertilizers to increase soil fertility (9).

Soil water content is the ability of the soil to bind water which is influenced by matrix, osmotic and capillary binding forces. These forces are caused by the attraction between soil particles to one another and is also influenced by the electrostatic charge density of the soil particles. The disturbance and changes in volume weight, soil pore volume and pore size distribution cause variations in water content in the soil. The value of water content can be obtained by gravimetric method, namely the weight of the initial wet soil with the weight of the oven dry soil (10).

Table 3. Results of inspection of the physical quality of clean water in Astambul District in 5 villages (Kelampian Tengah, Kelampapan Ulu, Lok Gabang, Sungai Alat and Kaliukan)

No	Sample	Physique							
		Temperature (Maximum Level=Air Temperature ±3)		DO (Minimum Level 6)		TDS (Maximum Level=1000)		Turbidity (Maximum Level=25)	
Middle Kelampian Village									
1	1 point	35.5	it is not in accordance with	7.5	in accordance	181	in accordance	7.44	in accordance
2	Point 2	28	in	4	it is not in	131	in	4.74	in

No	Sample	Physique							
		Temperature (Maximum Level=Air Temperature ±3)		DO (Minimum Level 6)		TDS (Maximum Level=1000)		Turbidity (Maximum Level=25)	
			accordance		accordance with		accordance		accordance
3	3 point	27	in accordance	3.5	it is not in accordance with	188	in accordance	8.3	in accordance
4	4 point	28	in accordance	2.2	it is not in accordance with	251	in accordance	3.52	in accordance
5	5 point	27	in accordance	8.1	in accordance	112	in accordance	14.97	in accordance
Average		**29.10**	**in accordance**	**5.06**	**it is not in accordance with**	**172.6**	**in accordance**	**7.79**	**in accordance**
Lok Gabang Village									
6	1 point	31.5	in accordance	1.8	it is not in accordance with	287	in accordance	48.25	it is not in accordance with
7	Point 2	27	in accordance	5.6	it is not in accordance with	178	in accordance	17.46	in accordance
8	3 point	27	in accordance	20	in accordance	127	in accordance	11.62	in accordance
9	4 point	28	in accordance	14.4	in accordance	95	in accordance	11.4	in accordance
10	5 point	28	in accordance	3.8	it is not in accordance with	148	in accordance	34.55	it is not in accordance with
11	6 point	27	in accordance	4.8	it is not in accordance with	185	in accordance	27.3	it is not in accordance with
Average		**28.08**	**in accordance**	**8.40**	**in accordance**	**170**	**in accordance**	**25,10**	**it is not in accordance with**
Tool River Village									
12	1 point	30.3	in accordance	1.4	it is not in accordance with	162	in accordance	6	in accordance
13	Point 2	28	in accordance	5.5	it is not in accordance with	159	in accordance	30.77	it is not in accordance with
14	3 point	27	in accordance	6.1	in accordance	158	in accordance	49.56	it is not in accordance with
15	4 point	27	in accordance	6.2	in accordance	231	in accordance	20.78	in accordance
16	5 point	27	in accordance	6.7	in accordance	105	in accordance	6.43	in accordance
17	6 point	27	in accordance	32.1	in accordance	258	in accordance	33.09	it is not in accordance with
18	7 point	29	in accordance	2.6	it is not in accordance	86	in accordance	5.16	in accordance

No	Sample	Physique							
		Temperature (Maximum Level=Air Temperature ±3)		DO (Minimum Level 6)		TDS (Maximum Level=1000)		Turbidity (Maximum Level=25)	
Average		**27.90**	**in accordance**	**8.66**	**in accordance** with	**165.57**	**in accordance**	**21.68**	**in accordance**
Kaliukan Village									
19	1 point	35.9	it is not in accordance with	5.3	it is not in accordance with	339	in accordance	6.08	in accordance
20	Point 2	28	in accordance	31	in accordance	119	in accordance	30,19	it is not in accordance with
21	3 point	27	in accordance	8.4	in accordance	177	in accordance	23.35	in accordance
22	4 point	28	in accordance	4.3	it is not in accordance with	87	in accordance	4.31	in accordance
23	5 point	27	in accordance	8.1	in accordance	71	in accordance	17.01	in accordance
24	6 point	27	in accordance	19.2	in accordance	93	in accordance	21.82	in accordance
Average		**28.82**	**in accordance**	**12.72**	**in accordance**	**147.67**	**in accordance**	**17.13**	**in accordance**
Ulu Kelampapan Village									
25	1 point	34.3	it is not in accordance with	3.1	it is not in accordance with	261	in accordance	10.42	in accordance
26	Point 2	29	in accordance	3.3	it is not in accordance with	296	in accordance	2.22	in accordance
27	3 point	27	in accordance	5.4	it is not in accordance with	276	in accordance	12.66	in accordance
28	4 point	27	in accordance	4.4	it is not in accordance with	223	in accordance	41.95	it is not in accordance with
29	5 point	26	it is not in accordance with	8.8	in accordance	223	in accordance	14.21	in accordance
30	6 point	27	in accordance	6.9	in accordance	164	in accordance	5.38	in accordance
Average		**28.38**	**it is not in accordance with**	**5.32**	**it is not in accordance with**	**240,50**	**in accordance**	**14.47**	**in accordance**
Overall Physical Average		**28.46**	**in accordance**	**8.03**	**in accordance**	**179.27**	**in accordance**	**17.23**	**in accordance**

Source: Primary Data 2022

a) Temperature

The results of testing water samples at 30 points spread across Astambul District found that the water temperature was suitable for sanitation hygiene purposes according to the Minister of Health Regulation Number 32 of 2017. However, there were 4 points (13.33%) which had water temperatures below the standard of the regulations in the village. Kelampapan Tengah, Kaliukan Village and Kelampapan Ulu Village.

The temperature of the water is very dependent on the place where the water is located. The increase in water temperature in water bodies, waterways, rivers, lakes and so on will have consequences in the form of 1) The amount of dissolved oxygen in the water decreases; 2) The speed of chemical reactions increases; 3) The life of fish and other aquatic animals is disturbed (11). Water temperature that exceeds normal limits indicates that there are dissolved chemicals in large enough quantities (eg phenol or sulfur) or that the process of decomposition of organic matter by microorganisms is taking place. If the condition of the water is like this, then the water is said to be unfit for drinking and can interfere with health (12).

b) DO (Dissolved Oxygen)

Dissolved Oxygen (DO) testing on water samples in Astambul District obtained an average of 8.03 mg/l and is in accordance with the water used for sanitation hygiene needs. At some points, the number of DO is still below the standard, namely 16 points (53.3%) and spread over 6 villages (Kelampian Tengah, Kelampapan Ulu, Lok Gabang, Sungai Alat, and Kaliukan).

Dissolved Oxygen (DO) is the amount of oxygen dissolved in a certain volume of water at a certain temperature and pressure. DO in water is needed to support the life of the organisms in it (Saksena et al., 2008). The main source of DO is photosynthesis, besides river characteristics also affect the presence of DO. The characteristic of the river which is relatively flat shows a flow pattern that is relatively calm and there is no turbulence which will reduce the process of re-aeration of air into the water so that the process of diffusion of oxygen into the river water is not optimal (13).

c) TDS (Total Dissolved Solid)

The average value of Total Dissolved Solid (TDS) obtained is 179.27 mg/l and is in accordance with the water requirements used for sanitation hygiene needs according to the Minister of Health Regulation No. 32 of 2017. There were no sampling points that had the amount of TDS exceeding the maximum threshold.

Total Dissolved Solids (TDS) are dissolved materials (10-6mm diameter) and colloids (10-6mm-10-3mm diameter) in the form of chemical compounds and other materials that are not filtered on filter paper. diameter 0.45 m (14).

d) Turbidity

The results of the turbidity level test obtained an average of 17.23NTU. This figure is below the maximum threshold for water used as sanitation hygiene so that in terms of turbidity it still meets the standard. However, there are 8 points (26.67%) which have a high level of turbidity or above 25NTU so that it does not meet the feasibility of water used for sanitation hygiene according to Minister of Health Regulation No. 32 of 2017.

The turbidity value indicates that the river water is not suitable for consumption. The turbidity of river water is caused by the amount of material suspended in the river water, such as soil, mud and other organic materials. Suspended sediment from land is carried by surface runoff when it rains (15).

1) Chemical testing

Sampling of water for chemical testing at 30 points spread over 5 villages in the Astambul District, the results can be seen in the following table.

Table1The results of the chemical quality inspection of clean water in Astambul District in 5 villages (Kelampian Tengah, Kelampapan Ulu, Lok Gabang, Sungai Alat and Kaliukan)

No	Sample	Chemical							
		pH (Recommended Level=6.5-8.5)		Iron (Maximum Level=1mg/l)		Manganese (Maximum Level=0.5mg/l)		Lead (Maximum Level=0.05mg/l)	
Middle Kelampian Village									
1	1 point	6.4	it is not in accordance with	0.756	in accordance	18.4	it is not in accordance with	32.447pg/l	in accordance
2	Point 2	6.3	it is not in accordance with	1.03	it is not in accordance with	21.2	it is not in accordance with	31,596pg/l	in accordance
3	3 point	6.3	it is not in accordance with	1.054	it is not in accordance with	21.8	it is not in accordance with	38,511pg/l	in accordance
4	4 point	6.7	in accordance	0.982	in accordance	25	it is not in accordance with		
5	5 point	6	it is not in accordance with	0.371	in accordance	28.98	it is not in accordance with		

No	Sample	Chemical							
		pH (Recommended Level=6.5-8.5)		Iron (Maximum Level=1mg/l)		Manganese (Maximum Level=0.5mg/l)		Lead (Maximum Level=0.05mg/l)	
Average		**6.34**	**it is not in accordance with**	**0.84**	**in accordance**	**23.08**	**it is not in accordance with**	**34.18**	**in accordance**
Lok Gabang Village									
6	1 point	6.4	it is not in accordance with	0.621	in accordance	20.6	it is not in accordance with	21.17pg/l	in accordance
7	Point 2	6.2	it is not in accordance with	0.809	in accordance	25	it is not in accordance with		
8	3 point	6.3	it is not in accordance with	0.352	in accordance	21.8	it is not in accordance with	25,213pg/l	in accordance
9	4 point	6.3	it is not in accordance with	0.558	in accordance	13.2	it is not in accordance with		
10	5 point	6.4	it is not in accordance with	0.732	in accordance	23	it is not in accordance with	25.532pg/l	in accordance
11	6 point	6.10	it is not in accordance with	0.371	in accordance	19.53	it is not in accordance with		
Average		**6.28**	**it is not in accordance with**	**0.57**	**in accordance**	**20.52**	**it is not in accordance with**	**23.97**	**in accordance**
Tool River Village									
12	1 point	5.2	it is not in accordance with	0.549	in accordance	24.4	it is not in accordance with	40.957pg/l	in accordance
13	Point 2	5.9	it is not in accordance with	0.799	in accordance	22.8	it is not in accordance with		
14	3 point	5.4	it is not in accordance with	1.395	it is not in accordance with	10.6	it is not in accordance with	48.085pg/l	in accordance
15	4 point	6.7	in accordance	0.943	in accordance	12.8	it is not in accordance with		
16	5 point	6.4	it is not in accordance with	0.684	in accordance	24.4	it is not in accordance with		
17	6 point	6.3	it is not in accordance with	0.491	in accordance	19.6	it is not in accordance with	49,681pg/l	in accordance
18		8.35	in accordance	0.116	in accordance	14.49	it is not in accordance with		
Average		**6.32**	**it is not in accordance with**	**0.71**	**in accordance**	**18.44**	**it is not in accordance with**	**46.24**	**in accordance**
Kaliukan Village									
19	1 point	6.4	it is not in accordance with	0.698	In accordance	25	it is not in accordance with	32,021pg/l	in accordance

No	Sample	Chemical							
		pH (Recommended Level=6.5-8.5)		Iron (Maximum Level=1mg/l)		Manganese (Maximum Level=0.5mg/l)		Lead (Maximum Level=0.05mg/l)	
20	Point 2	6.9	in accordance	0.905	In accordance	24.4	it is not in accordance with		
21	3 point	6.2	it is not in accordance with	0.943	In accordance	24.2	it is not in accordance with	38,511pg/l	in accordance
22	4 point	6.4	it is not in accordance with	0.785	In accordance	24.6	it is not in accordance with		
23	5 point	6.4	it is not in accordance with	0.496	In accordance	20.6	it is not in accordance with	44,255pg/l	in accordance
24	6 point	8.27	in accordance	0.087	in accordance	12.6	it is not in accordance with		
Average		**6.76**	**in accordance**	**0.65**	**in accordance**	**21.90**	**it is not in accordance with**	**38.26**	**in accordance**
Ulu Kelampapan Village									
25	1 point	6.9	in accordance	0.4	In accordance	12.8	it is not in accordance with	61,277pg/l	in accordance
26	Point 2	6.2	it is not in accordance with	0.809	In accordance	25	it is not in accordance with		
27	3 point	6.3	it is not in accordance with	1.063	it is not in accordance with	19.6	it is not in accordance with		
28	4 point	6.4	it is not in accordance with	0.669	In accordance	25	it is not in accordance with	53,936pg/l	in accordance
29	5 point	6.7	in accordance	0.472	In accordance	17.4	it is not in accordance with	60.532pg/l	in accordance
30	6 point	6.6	in accordance	0.371	in accordance	27.09	it is not in accordance with		
Average		**6.52**	**in accordance**	**0.63**	**in accordance**	**21.15**	**it is not in accordance with**	**58.58**	**in accordance**
Overall Chemistry Average		**6.44**	**it is not in accordance with**	**0.68**	**in accordance**	**21.02**	**it is not in accordance with**	**40.25**	**in accordance**

Source: Primary Data 2022

a) pH level

The value of the degree of acidity or pH of the test results from 30 points spread across Astambul District is an average of 6.44 mg/l so that most of the water sources in Astambul District are acidic. This figure is below the standard of water used for sanitation hygiene purposes.

The pH value is an important factor in waters because the pH value in the water will determine the nature of the water being acidic or alkaline which will affect the biological life in the water (13). According to the Minister of Health Regulation Number 32 of 2017 which states that the standard pH or acidity degree for water used as sanitation hygiene is in the range of 6.5-8.5.

b) Iron

The content of iron (Fe) in the water as a result of testing at 30 points in Astambul District obtained an average of 0.68mg/l. The content of this amount is still below the maximum threshold for water used as a means of sanitation and hygiene. However, there are 4 points (13.33%) where the iron content is higher than the standard.

High levels of Fe metal have an impact on the color of groundwater, where for groundwater samples with the highest Fe metal content it has a brownish color, while water samples with the lowest Fe metal content have a yellowish color. In general, rainwater that falls to the ground and undergoes infiltration into the soil containing FeO will react with H2O and CO2 in the soil and form Fe(HCO3)2 where the deeper the water that seeps into the soil, the higher the solubility of iron carbonate. in that water. Groundwater that contains a lot of Fe will turn yellow and cause a metallic taste of Fe in the water and corrode metal objects. The presence of Fe in the water can cause the water to turn yellowish red and cause an unpleasant odor (16).

c) Manganese

The results of testing water samples to see the manganese or Mn content in the water obtained an average of 21.02 mg/l. Very far beyond the maximum threshold set for water used as sanitation hygiene by the community. There is no point that has Mn content according to the standard.

Water containing excess Manganese (Mn) causes taste, color (brown/purple/black), and turbidity (Fauziah, 2010 in Febrina, 2015). Manganese toxicity is relatively visible at low concentrations. The Mn content allowed in the waters for sanitation hygiene is a maximum of 0.05 mg/l based on the Minister of Health of the Republic of Indonesia No. 32 of 2017. Water originating from acid mining sources may contain dissolved Mn with a concentration of ±1 mg/l. At a rather high pH and aerobic conditions, insoluble Mn is formed such as MnO2, Mn3O4 or MnCO3, although the oxidation of Mn2+ is relatively slow.

d) Lead

The level of lead (Pb) in the waters from the test results obtained an average of 40.25 pg/l. This amount is very low compared to the maximum limit set for sanitation hygiene needs. There is no point where the Pb content exceeds the maximum threshold.

Heavy metals in waters that are difficult to degrade will be absorbed in the body of organisms so that heavy metals such as Fe, Mn and Pb are classified as dangerous heavy metals and can enter the body through the respiratory and digestive tracts (Darmono, 2001 in Koniyo, 2020). . Heavy metals can cause acute and chronic poisoning. Acute lead poisoning is characterized by a burning sensation in the mouth, irritation in the gastrointestinal tract accompanied by diarrhea and symptoms of chronic poisoning are characterized by nausea, anemia, pain around the stomach and can cause paralysis (11).

2) Water biology testing

Sampling of water to be tested for total coliform at 30 points spread over 5 villages in the Astambul District, the results can be seen in table 5 below.

Table2The results of the inspection of the biological quality of clean water in Astambul District in 5 villages (Kelampian Tengah, Kelampapan Ulu, Lok Gabang, Sungai Alat and Kaliukan)

No	Sample	Total Coliform (Maximum Level=50CFU/100ml)	
Middle Kelampian Village			
1	1 point	1600	it is not in accordance with
2	Point 2	1600	it is not in accordance with
3	3 point	1600	it is not in accordance with
4	4 point	1600	it is not in accordance with
5	5 point	1.6	in accordance
Average		**1280,32**	**it is not in accordance with**
Lok Gabang Village			
6	1 point	1600	it is not in accordance with
7	Point 2	1600	it is not in accordance with
8	3 point	1600	it is not in accordance with
9	4 point	1600	it is not in accordance with

No	Sample	Total Coliform (Maximum Level=50CFU/100ml)	
10	5 point	1600	it is not in accordance with
11	6 point	1600	it is not in accordance with
Average		**1600**	**it is not in accordance with**
Tool River Village			
12	1 point	1600	it is not in accordance with
13	Point 2	1600	it is not in accordance with
14	3 point	1600	it is not in accordance with
15	4 point	1600	it is not in accordance with
16	5 point	1600	it is not in accordance with
17	6 point	1600	it is not in accordance with
18	7 point	1600	it is not in accordance with
Average		**1600**	**it is not in accordance with**
Kaliukan Village			
19	1 point	1600	it is not in accordance with
20	Point 2	1600	it is not in accordance with
21	3 point	1600	it is not in accordance with
22	4 point	1600	it is not in accordance with
23	5 point	1600	it is not in accordance with
24	6 point	1600	it is not in accordance with
Average		**1600**	**it is not in accordance with**
Ulu Kelampapan Village			
25	1 point	1600	it is not in accordance with
26	Point 2	1600	it is not in accordance with
27	3 point	1600	it is not in accordance with
28	4 point	1600	it is not in accordance with
29	5 point	1600	it is not in accordance with
30	6 point	350	it is not in accordance with
Average		**1391.67**	**it is not in accordance with**

No	Sample	Total Coliform (Maximum Level=50CFU/100ml)	
Overall Biology Average		**1494.4**	**it is not in accordance with**

Source: Primary Data 2022

The results of testing water samples for the number of coliforms per 100ml from all points obtained an average of 1494.4CFU/100ml, this exceeds the maximum limit required for water used for sanitation hygiene purposes, which is 50CFU/100ml. There is only 1 point (3.33%) which has a total coliform value below 50CFU/100ml.

One of the parameters that must be met and has a direct effect on health is microbiological parameters, where one of the indicators is total coliform. In drinking water, the total coliform allowed is very small (50CFU/100ml). If the total coliform content in drinking water exceeds the maximum threshold, then the water is unsafe/unfit for consumption. Unsafe drinking water can certainly have a negative impact on health, especially for vulnerable groups such as toddlers, people with low immunity, and the elderly. One of the health problems that can arise from consuming unsafe water is waterborne disease, where diarrhea is one of the diseases most often associated with improper water consumption (17).

Total coliform is a group of bacteria that includes aerobic and facultative anaerobic bacteria, which are gram-negative bacteria. Most of the total coliform bacteria are heterotrophic and can increase in number in water and soil. Total coliforms can also survive and multiply in water distribution systems, especially if conditions permit. The presence of total coliforms can come from human or animal feces and can also occur naturally in water. Total coliform is only an indicator used to indicate that there could be other microbes in the water, for example pathogenic microbes such as Giardia, Cryptosporidium, E.coli, and others (Arsyina, 2019). Based on the regulations contained in the Regulation of the Minister of Health of the Republic of Indonesia No.

Total coliform in Astambul District is known to have a very high value. This is because the rivers there are still used as a place for local residents to defecate. This activity is very large which causes a large number of bacteria in a waters. The river is still used by residents for various kinds of daily activities, from bathing to consumption.

IV. CONCLUSION

The availability of clean water in Astambul District based on physical parameters is still feasible and according to standards, where the average measurement results for temperature, DO, TDS and turbidity are according to standards. Based on chemical parameters, water quality in Astambul District is not suitable for consumption and needs to be treated. The results obtained are that the pH and Manganese content are not in accordance with the regulations set by the government. Biological parameter testing obtained a high average total coliform value and the water is not fit for consumption. Astambul sub-district is mostly covered by agricultural land. In addition, there are many swampy areas so that many water hyacinth plants are found and the land area is overgrown with coconut trees. These three plants can be used to help provide clean water by making activated charcoal and absorbing harmful substances in the water. Sources of water in the form of wells without a dividing wall are one of the causes of the problem of the low quality of the water obtained.

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