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Feasibility Analysis of the Bonto River, Tomon 1 Village, Dekai District, Yahukimo Regency as a Source of Raw Water

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ABSTRACT

Rivers are one of the sources of water for the life of living things. Rivers are often used in various ways by humans. The Bonto River is one of the rivers in Yahukimo Regency that is used as raw water for drinking water. In order to meet the need for clean water, it is necessary to analyze the water quality of the Bonto River. Determining the source of raw water in an area is the first step in determining the location or place as a raw water supplier for clean water treatment purposes. The purpose of this study is to identify the water quality of the Bonto river and evaluate the condition of the Bonto river water with the water quality standards that have been set to be used as an alternative source of raw water for clean water treatment. Water sampling in this study was carried out by observation and measurement directly in the field, and laboratory tests. Raw water quality data is compared to the current raw water and drinking water quality standards. The water quality standards used are the Decree of the Minister of Health of the Republic of Indonesia Number: 492/MENKES/SK/IV/2010, dated April 19, 2010 concerning the Terms and Conditions and Supervision of Drinking Water Quality, and in accordance with the water quality requirements. Each sample of water and sediment is examined in the laboratory to be analyzed according to its needs, namely regarding water quality. Testing of water quality samples was carried out at the Papua Regional Health Laboratory Center.

Introduction

Water is a natural resource that has a very important function for human life and other living things, as well as basic capital in development. With the increase in the number of population, the need for water resources to meet the needs of daily life is also higher (Mahyudin et al., 2015; Mashadi et al., 2018). To meet the needs of drinking water and clean water, residents in Dekai District, Yahukimo Regency use river water more. The potential for clean water sources in Dekai City is quite a lot and one of the ones used as clean water is the Bonto River (Djana, 2023; Nanda et al., 2023). However, the increasing number of population and the rate of growth, the more the rate of utilization of water sources will also increase. As time goes by, the development of civilization and

the increase in population will add to life activities that add impurities or water pollution. One of the water pollution around the Bonto river is that people who live around the river free wild livestock such as pigs. Livestock liquid waste around the river area will cause water pollution that affects the quality of river water (Widiatmoko, 2012; Xu et al., 2022; Zimmerman, 2022). The purpose of this study is to identify the water quality in the Bonto river, Dekai District, Yahukimo Regency as a source of raw water with water quality standards that have been set and make recommendations for water quality treatment and management in Yahukimo Regency.

This research was carried out by testing basic parameters to meet clean water standards, which include physical/field, chemical/inorganic examination, chemical/ organic examination, disinfectant, and water microbiology. parameter evaluation is carried out by comparing the results of water quality parameter tests from the Bonto Distri Dekai River with the standard water quality parameters that have been stipulated in the Decree of the Minister of Health of the Republic of Indonesia Number: 492/MENKES/SK/IV/2010, dated April 19, 2010 concerning Drinking Water Quality Conditions and Supervision.

The novelty of this study is the holistic approach used to evaluate water quality, including physical, chemical, and microbiological parameters in an integrated manner. This approach not only provides a comprehensive picture of the water quality conditions of the Bonto River, but also offers specific data-driven solutions to improve water quality through appropriate treatment.

This research uses water pollution theory and water resource management as a basis to understand the existing problems. In this context, water pollution theory highlights how human activities can affect the physical, chemical, and biological parameters of water, while water resources management theory emphasizes the importance of planning and implementing treatment measures to ensure the sustainability of water resources.

Against this background, this research is expected to make a real contribution to clean water management in Yahukimo Regency, both in terms of scientific understanding and practical implications for local policies.

Research Methods

The location of the research is in the Bonto River, Dekai District, Yahukimo Regency. The location of the study is shown in Figure 1.

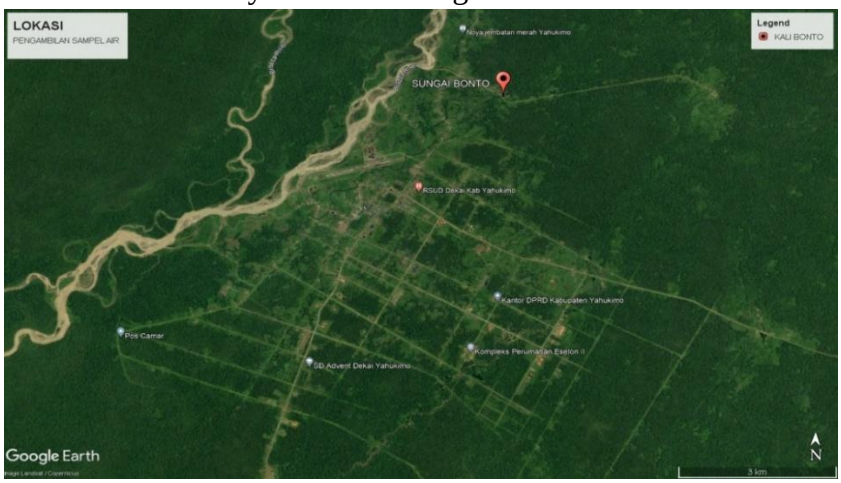

Figure 1. Research Location

The Bonto River Analysis Research as a source of raw water began with an initial survey of the research location and sampling of the Bonto water field for laboratory testing. Primary data collection for research is carried out in the following way:

1. Observation

The location of sampling of Bonto river water was identified. Water sampling is carried out at the location of the water source used. The aim is to find out the river flow affected by community activities.

2. Laboratory Tests

River water quality testing was carried out with physical, chemical, and biological parameters of Bonto river waters. Water quality testing serves to provide factual information about the current condition (status) of water quality.

Secondary data in the form of data to support the data processing process such as applicable regulations: Decree of the Minister of Health of the Republic of Indonesia Number: 492/MENKES/SK/IV/2010, dated April 19, 2010 concerning Conditions and Supervision of Drinking Water Quality.

Results and Discussion

Calculation of Population Projection

The projection of the population is used as a basis for calculating the clean water services received by the community. In 2022, the population in Yahukimo Regency is 17963 people with a growth ratio of 1.85% (Ariyani et al., 2020; Palippui, 2022). The number of people in a clean water service area is very important. This is related to the capacity of clean water that will be distributed to the community. To find out the clean water needs of the population, a projection of the population must first be carried out

(Rosyidah, 2017). After obtaining a projection of the number of population, it can be known the projected need for clean water. Based on the calculation results that have been obtained from the geometric method, it can be seen in Table 1.

Table 1. Recapitulation of Population Projections for the Next 25 Years of Yahukimo Regency

Year	n	Total Population (Soul)
2020	0	17316
2025	5	18978
2030	10	20800
2035	15	22796
2040	20	24984
2045	15	27383

Analysis of Water Availability in the Bonto River

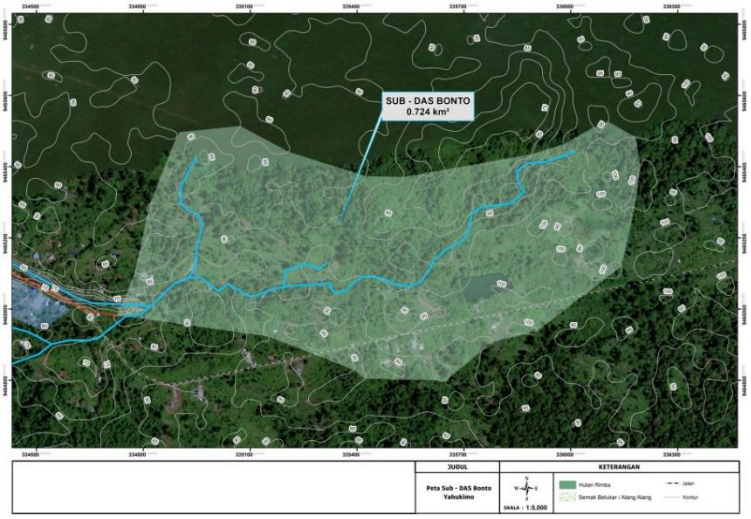

Figure 2. Bonto River Catchment Boundary Map

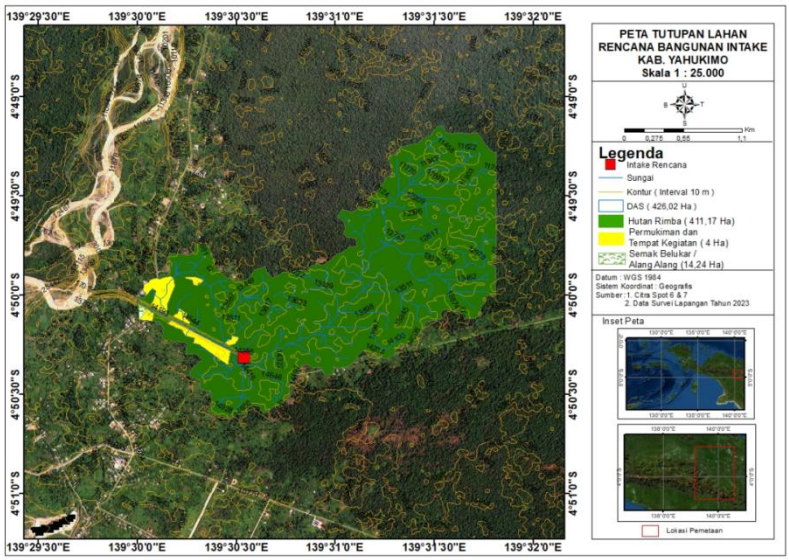

Figure 3. Bonto Watershed Land Cover Map

Reliable discharge analysis is carried out with the following procedure: (Paat et al., 2018)

a. Debit data sorted from largest to smallest
b. The probability is calculated by the equation P = (m/(N+1))*100%, where m is the number of data and N is the amount of data.
c. Reliable discharge is calculated by means of interpolation based on the expected probability/reliability.

The results of the calculation of the discharge with 80% reliability (Q_{80}) on the Bonto river look like Figure 4.

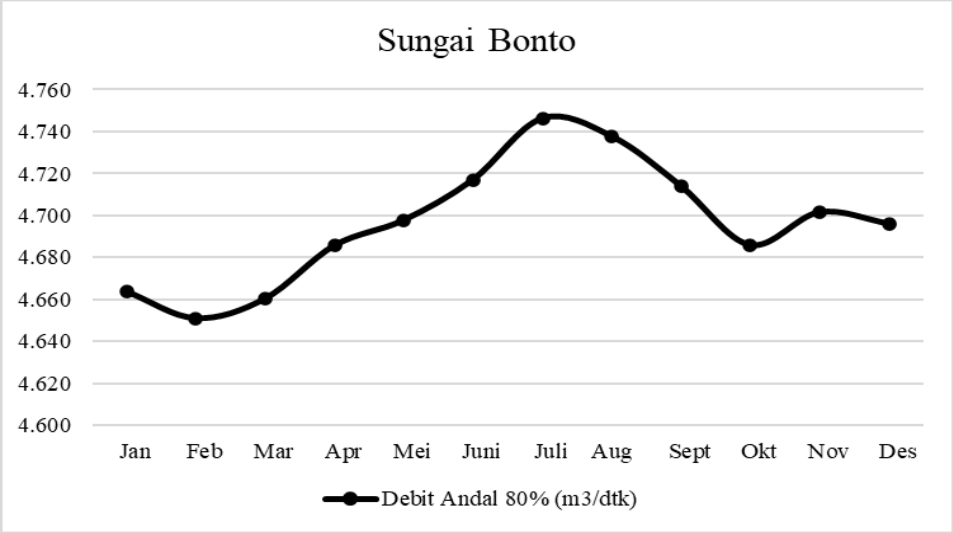

Figure 4. Reliable Discharge (Q80) of Bonto River

The results of the water demand projection show that the water demand for Yahukimo is shown a comparison between water demand and water availability.

Table 2. Results of Yahukimo's reliable discharge analysis

No	Moon	Water Availability, Q80 (m3/s)	Water Requirement (m3/s)	Surplus (m3/s)
		S. Wasi		
1	January	4.6639	0.0301	12.4480
2	February	4.6511	0.0301	12.4302
3	March	4.6604	0.0301	12.4432
4	April	4.6857	0.0301	12.4786
5	May	4.6978	0.0301	12.4955
6	June	4.7171	0.0301	12.5225
7	July	4.7463	0.0301	12.5633
8	August	4.7378	0.0301	12.5514
9	September	4.7141	0.0301	12.5183
10	October	4.6860	0.0301	12.4790
11	November	4.7016	0.0301	12.5008
12	December	4.6962	0.0301	12.4932

Source : 2024 analysis results

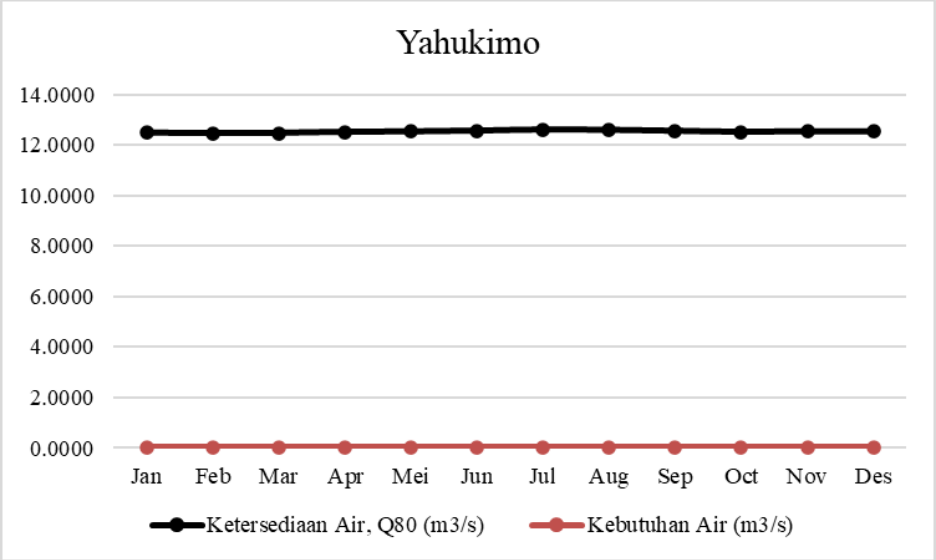

Figure 5. Comparison of Water Availability and Yahukimo Water Needs

River Water Quality Analysis

Based on this comparison, parameters that exceed the quality standard mean that they require processing so that the concentration drops in accordance with the standard (Duda et al., 2018; Taheri & Razban, 2021). The parameters tested in the laboratory are as follows: 1). Physics/Field Inspection; 2) Chemical/Inorganic Examination; 3) Chemical/Organic Inspection; 4) Disinfectants and 5) Water Microbiology.

With the results of the Drinking Water Quality Test and Environmental Sanitation Test on the Bonto River as follows: (Mayada, 2020)

Table 3. Water Quality Test Results

No	PARAMETER	SATUAN	BAKU MUTU	HASIL UJI LABORATORIUM	
				KABUPATEN YAHUKIMO Sungai Bonto Kampung Tomon 1 Distrik Dekai	SPESIFIKASI METODE
A	Pemeriksaan FISIKA/Lapangan				
1	Bau	-	Tidak Berbau	Tidak Berbau	
2	Rasa	-	Tidak Berasa	Tidak Berasa	
3	Suhu	°C	Suhu Udara ± 3	17	
4	Warna	tcu	15	15,0	SNI 6989.80:2011
5	Kekeruhan	ntu	5	4,90	SNI 06-6989.25-2005
6	Zat Padat Terlarut (TDS)	mg/L	500	196,0	SNI 06-2413-1991
B.	Pemeriksaan Kimia Anorganik				
7	PH	-	6.5 - 8.5	4,70	
8	Ammonia Sebagai (NH3-N)	mg/L	1,5	0,26	USEPA Method 8038
9	Chlorida (Cl)	mg/L	250	4,97	SNI 6989.19:2009
10	Cyanide (CN)	mg/L	0,07	-	
11	Flourida (F)	mg/L	1,5	0,20	USEPA Method 8029
12	Kesadahan Total (CaCO3)	mg/L	500	158,0	Standard Method 2012, Section 2340.C
13	Nitrat sebagai (NO3-N)	mg/L	50	1,40	Standard Method 2012, Section 4500-NO3.E
14	Nitrit sebagai (NO2-N)	mg/L	3	0,005	Standard Method 2012, Section 4500-NO2.B
15	Sulfat (SO4)	mg/L	250	4,0	USEPA Method 8051
16	Aluminium (Al)	mg/L	0,2	0,024	USEPA Method 8326
17	Arsen (As)	mg/L	0,01	-	
18	Besi (Fe)	mg/L	0,3	0,071	Standard Method 2012, section 3500-Fe.B
19	Cadmium (Cd)	mg/L	0,003	-	
20	Chromium (Cr Valensi 6)	mg/L	0,05	0,062	Standard Method 2012, section 3500-Cr.B
21	Mangan (Mn)	mg/L	0,4	0,02	USEPA Method 8149
22	Mercury (Hg)	mg/L	0,001	-	
23	Selenium (Se)	mg/L	0,01	-	
24	Timbal (Pb)	mg/L	0,01	0,004	SNI 6989.8.2009
25	Tembaga (Cu)	mg/L	2	0,051	USEPA Method 8143
26	Zinc (Zn)	mg/L	3	0,034	USEPA Method 8009
C.	Pemeriksaan Kimia Organik				
27	Zat Organik (KMnO4)	mg/L	10	0,09	SNI 06-6989.22-2004
28	Detergen Sebagai MBAS	mg/L	0,05	-	
D.	Desinfektan				
29	Chlorine	mg/L	5	0,08	USEPA Method 8021
E.	Mikrobiologi Air				
30	Fecal Coliform	MPN/100 mL	0		
31	Total Coliform	MPN/100 mL	0		
1	Coli Tinja	MPN/100 mL	0		PK/BLKDP-8.01 (Tabung Ganda)
2	Coliform	MPN/100 mL	0		PK/BLKDP-8.01 (Tabung Ganda)

Conclusion

The water quality in the Bonto River, Dekai District, Yahukimo Regency was obtained as follows: 1) Parameters that meet quality standards are: Construction, Taste, Temperature, Color, Turbidity, Dissolved Solids (TDS), Ammonia (NH3-N), Chlorida (CL), Flourida (F), Total Hardness (CaCO3), Nitrat (NO3-N), Nitrit (NO2-N), Sulfate (SO4), Aluminium (Al), Iron (Fe), Chromium (Cr Valensi 6), Mangan (Mn), Lead (Pb), Copper (Cu), Zine (Zn), Zat Organik (KMnO4), Chlorine

Parameters that do not meet quality standards are: pH: 4.70, the test results have not met the quality standard of 6.5 – 8.5.

Recommendations for the treatment and management of water quality in the Bonto river, Yahukimo Regency are the need for treatment and addition of additives (Soda Ash, Potassium Hydroxide) to balance the pH of the water, and it is necessary to further water treatment in the form of filtration (filtration) using sand filter media, pumice stone and activated carbon.

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