



## RESEARCH REPORT

### **Preliminary Investigation of Land Cover/Use, Water Source, Coastal Environment and Socio-Economic Condition in Wangi-Wangi, WAKATOBI REGENCY, INDONESIA**

This report was prepared by a research team of Halu Oleo University (HOU), Indonesia based on a work contract signed between The National Institutes for the Humanities (NIHU), as the umbrella organization of The Research Institute for Humanity and Nature (RIHN) Japan, and HOU on June 28, 2022.

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## FOREWORD

In September 2021 an agreement was signed between The Research Institute for Humanity and Nature (RIHN) of the Inter-University Research Institute Corporation, National Institutes for the Humanities, Japan and Halu Oleo University (HOU), Indonesia, desiring to promote academic exchanges and international cooperation between both parties. The cooperation aims to establish long-term scientific and technical cooperative relationships including mutually beneficial academic collaborative research and the exchange of information, techniques, and publications. Such an agreement will last until March 31, 2027.

As a follow-up to this agreement, research collaboration is carried out between the two institutions with the title of **Adaptive governance of multiple resources based on land-sea linkages of the water cycle: application to coral reef island systems (LINKAGE project)**. The LINKAGE project aims to contribute to the realization of a resilient natural symbiotic relationship between society and coral reef island systems in the tropical and subtropical Western Pacific, in which people can respond to climate change and socioeconomic changes while sustainably using the limited resources of the islands, such as water, fishery, and forest resources. To that end, the purpose of this research is to strengthen the adaptive governance of multiple resources, connected by the water cycle in coral reef islands.

Wakatobi Archipelago (with a research base in Wangi-Wangi District) is one location for implementing the LINKAGE project for 6 years (2021-2026). This report is prepared as part of the research contract for 2022. The data obtained through this joint activity within the framework of this agreement is to be shared and used by both parties for the purpose. Parties shall not use the data for any other purpose outside the purpose or any other activities outside the joint activities and shall not disclose or provide such data to any third party without prior written consent from another party.

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Research team

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## Executive Summary

Wakatobi Regency is located in Southeast Sulawesi Province, Indonesia. It consists of Wangi-Wangi, Kaledupa, Tomia and Binongko Districts. Wangi-Wangi, also known as Wanci, is the capital of Wakatobi Regency. Wangi-Wangi, as an island, is categorized as a small island according to the Law of The Republic of Indonesia No. 27 of 2007 concerning the Management of Coastal Areas and Small Islands, hence it is vulnerable to degradation. Wangi-Wangi Island also belongs to the Wakatobi Marine National Park Area and of a karst island. It is predicted that many karst springs have not been explored or recorded, therefore, observation is necessary throughout Wangi-Wangi Island. This report contains the results of an investigation conducted in Wangi-Wangi associated with land cover/use and water sources, reef ecosystem and seagrass, as well as socio-economic condition. A portion of the mangrove ecosystem investigation at Kaledupa Island is also addressed.

A total of 69 points of water sources have been identified in Wangi-Wangi Island. Several water resources have been used either by the Municipal Waterworks Agency (*PDAM*) management or directly utilized by the community. However, the community traditionally uses about 30 points of water sources for bathing and washing. Consequently, they are identified to be contaminated by detergents. The community settlements in Wangi-Wangi Island are focused on resources. The settlements commonly surround water sources, with more than 50 water resources located near the people settlements. Although there is still local wisdom in the utilization of water resources, the presence of *E. coli* in the water body is recorded in most water resources. It has to be noted that there is no accurate data regarding the potential flow discharge and demand of water sources precisely in Wangi-Wangi Island. Determining the minimum standard for permitted groundwater utilization in Wangi-Wangi Island is essential. A new tool or method is required to measure or estimate the flow discharge and demand of cave water sources (springs).

The condition of the coral reef ecosystem on Wangi-Wangi Island was in the medium up to good category. Live coral cover ranged from 33.22 - 72.72%. The highest live coral cover was at Marine Protected Area (MPA) in Liya Togo and the lowest live coral cover was at the Non-MPA station around the seaweed cultivation area. In aggregate, no significant differences were found between coral cover in the 6 MPA areas and 4 Non-MPA areas since they have the average live coral cover of 54.9% and 53.9%, respectively. Despite the good category of reefs in Wangi-Wangi, several issues have to be challenged near future, including how environmental disturbances and stressors, as well as the effects of climate change on coastal habitat in relation to social-ecological resilience. Additionally, research is required also to determine how changes in water quality based on activities on the mainland may affect coastal ecosystems, particularly coral reef ecosystems. Further investigation on seawater intrusion into water sources is of interesting in Wangi-Wangi Island.

# LAND COVER/USE AND WATER SOURCES IN WANGI-WANGI

## Chapter 1

Geostrategically, Wakatobi Regency is important because of: (1) The sea waters are shipping connecting lanes of the East and West regions of Indonesia; (2) From a bioregion point of view, the geographical location of Wakatobi Regency is flanked by the Banda Sea and the Flores Sea which have large potential for marine and fishery biodiversity resources; and (3) Wakatobi Regency is located in the Coral Triangle Center of the World, which includes 6 countries, including Indonesia, Malaysia, the Philippines, Papua New Guinea, Solomon Island, and Timor Leste. Hence, the Wakatobi Regency position is at the Center of the World Coral Triangle.

The total area of Wakatobi Regency is  $\sim 19,200 \text{ km}^2$ , consisting of  $\pm 473.62 \text{ km}^2$  of land or only 2.47% and  $\pm 18,726.38 \text{ km}^2$  of seawater area which is 97.53% of the total Wakatobi Regency area. Based on these conditions, the fisheries and marine tourism sectors have become the main sector in Wakatobi Regency. Wakatobi Regency consists of 8 Districts: Wangi-Wangi, South Wangi-Wangi, Kaledupa, South Kaledupa, Tomia, East Tomia, Binongko, and Togo Binongko Districts, comprising of 75 villages, 25 sub-districts, 204 hamlets and 87 neighborhoods. The widest sub-district area is Wangi-Wangi, with an area of  $67.49 \text{ km}^2$  or 14.25% of total land. Meanwhile, the smallest area is the Kaledupa Subdistrict, with  $35.18 \text{ km}^2$  or 7.43 % of the total land area.

The development activities have had an impact (positive and negative) on the environment. Based on this situation, analysis of the condition of the area is an important aspect to be considered as a preventive measure to reduce the environmental damage caused by development activities in Wakatobi Regency. This is following statutory regulations and the commitment of the Wakatobi Regency Government to manage the environment properly so that the goals of sustainable development in the area can be implemented.

Geographically, Wakatobi Regency consists of four large islands, i.e., Wangi-Wangi, Kaledupa, Tomia, and Binongko Island. Wangi-Wangi Island is the largest island in Wakatobi Regency. Additionally, Wangi-Wangi Island is also the capital of the Wakatobi Regency. Therefore, this study is focused on Wangi-Wangi Island.

Wangi-Wangi Island is categorized as a small island according to the Law of The Republic of Indonesia No. 27 of 2007 concerning the Management of Coastal Areas and Small Islands, so it is vulnerable to degradation. Wangi-Wangi Island also belongs to the Wakatobi Marine National Park Area and of a karst island. It is predicted that many karst springs have not been explored or recorded, therefore, observation is necessary throughout Wangi-Wangi Island. This study is focused on soil characteristics, changes in land cover/use, the spatial distribution of springs (water sources), and the water quality of several water sources.

#### **A. Land**

Soil type is closely related to the level of development, fertility, the sensitivity of soil to erosion and the vegetation type that can grow, as well as land preparation procedure for agricultural and non-agricultural purposes. The soil structure of the northern Wakatobi Regency is about 90% rocky, while in the south is coral with sponges (90%). The type and condition of the soil in the planning area greatly influence the type of activity, both agricultural and non-agricultural activities.

The soil properties on Wangi-Wangi Island were analyzed by collecting soil samples and then analyzing them at the Soil Laboratory, Faculty of Agriculture, Halu Oleo University. Soil samples were taken based on land use/cover: Agroforestry, Settlements, Secondary Forests, Shrubs, Savanna, and Dryland Agriculture. The analyzed parameters are the texture of the three fractions, i.e., sand, silt, and clay, using the pipette method (gravimetry). Soil pH parameters were analyzed using the pH Meter method, while organic C and total N and P used the Spectrophotometry method. The total K parameter was analyzed using the AAS method, while the porosity parameter was examined by the Double Ring method. The laboratory results analysis of soil samples based on land cover/ use in Wangi-Wangi Island are tabulated in Appendix I.1.

The laboratory analysis of soil samples for each type of land use/cover showed that the textures of the soil were sand, silt, and clay. The soil texture analysis based on land use in Wangi-Wangi Island is presented in Figure 1.

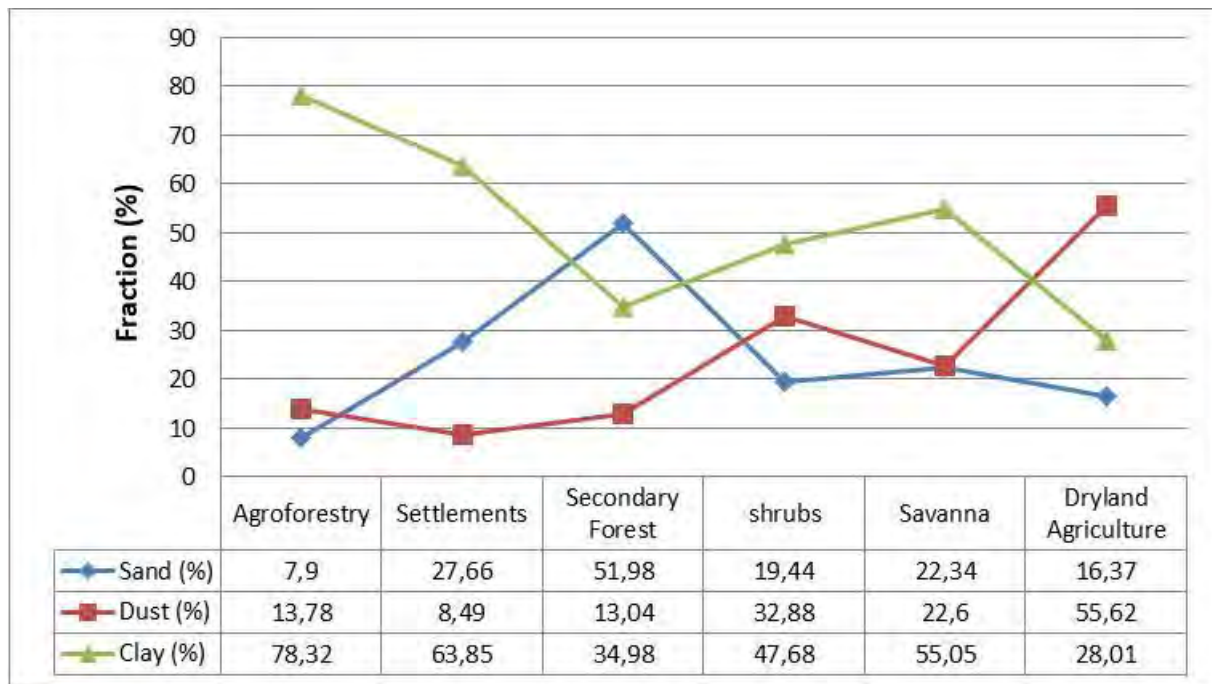


Figure 1. Soil texture level (sand, dust, and clay) for land use/cover in Wangi-wangi Island

Figure 1 presents a texture analysis of soil samples for various land cover /use types in Wangi-Wangi Island. It shows that the Clay type Fraction dominates the soil texture in Wangi-Wangi Island except for Secondary Forest land use and Dryland Agriculture. The dust type fraction is dominant in dryland agriculture with a proportion of 55.62%, while the sand fraction is dominant in secondary forest land with 51.98%.

Soil texture data for various land use types in Wangi-Wangi Island indicate that the soil texture is generally loamy. It indicates that the rate of soil infiltration is relatively slow. However, the soil's ability to hold water is higher than that of dust or sand textures (Ma et al., 2016; Akintoye et al., 2012; Li et al., 2020).

The soil texture affects surface runoff. Soils with sand-dominated textures have slower surface runoff because infiltration capacity is higher in sandy soils such as silt and clay than in finer soil textures. The soils with higher clay content, such as land used for agroforestry and settlements, will experience higher runoff due to lower soil infiltration rates. Therefore, the finer the soil texture, the higher the runoff rate (Mamedov and Levy, 2018; Jourgholami and Labelle; Belayneh, et al., 2020).

The acidity level of the soil (pH) for various types of cover/land use in Wangi-Wangi Island has neutral pH (7.0) acidity, except for the use of dry land agriculture with a pH value < 7.0 (data in Appendix I.1). The acidity level influences the nutrient content

of the soil. Soils with neutral pH have a higher fertility rate than acidic soil, pH ( $\text{pH} < 7.0$ ), or alkaline pH ( $\text{pH} > 7.0$ ).

The soil acidity is related to cation exchange capacity, nutrient availability, and the plants' ability to absorb nutrients. Generally, nutrients will be more available to plants within the neutral pH range (pH 6-8). Soils with a  $\text{pH} < 7.0$  are acidic, and require special treatment to increase the pH, and nutrient availability, such as liming. Soils with a  $\text{pH} > 7.0$  are alkaline and must be neutralized. Alkaline or acid soil can be neutralized using tea or coffee though it does not lower soil pH significantly. However, regular tea/coffee waste use may show permanent good results. Coffee or tea dregs/waste contains the nutrients and elements needed by a plant, such as Nitrogen, Magnesium, Potassium, Phosphorus, and Copper. The acidity level of various types of land cover in Wangi-Wangi Island is presented in Figure 2.

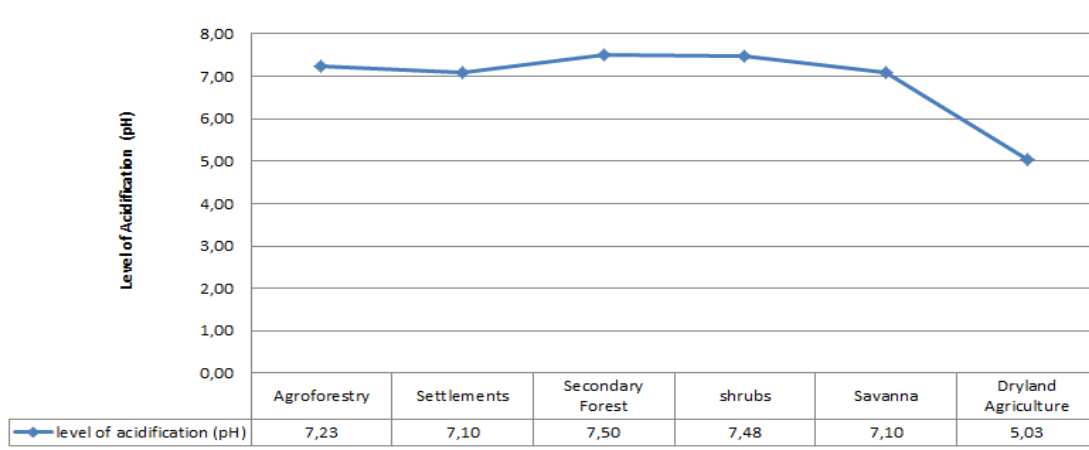


Figure 2. Soil acidity levels of various types of land use/cover in Wangi-Wangi Island

Another method to netralize soil pH is using Sulfur. Many types of Sulfur can be used for this purpose, but aluminum sulfate is the best because it melts directly into the soil. In addition, the pH of acid soils can be increased by soil liming. Several types of lime often used are Dolomite Lime ( $\text{CaCO}_3$ ) and  $\text{MgCO}_3$  (Rajani, 2019; Buckman and Brady, 1964; Ibrahim and Kasno, 2008; Soepardi, 1983).

Laboratory analysis results of soil samples (Appendix I.1) show that the C-Organic and N-Total content of each land cover/use type in Wangi-Wangi Island is varied. The analysis of the parameters are presented in Figure 3 below.



Figure 3. C-Organic and N-Total Content of Various Types of Land Use/Cover in Wangi-Wangi Island

Figure 3 presents data analysis of soil samples on various land cover types on Wangi-Wangi Island. The data shows that the C-Organic content of various types of land use in Wangi-Wangi Island ranged from 3.61% (Dryland Agriculture) to 7.22% (Savanna Fields). The C-organic content in each soil varies from less than 1% in sandy soils and more than 20% in muddy soils. Organic matter in the soil is a key factor in achieving success in agricultural cultivation.

Organic materials are materials or residues originating from plants, animals and humans found on the surface or within the soil with different levels of weathering (Hasibuan, 2006). Organic matter is a good soil aggregate stabilizer. Half of the Cation Exchange Capacity (CEC) is derived from organic matter (Hakim et al. 1986). Organic matter in the soil is one factor that plays a role in achieving success in plant cultivation. It is because of organic matter can increase the soil's chemical, physical and biological fertility. In this study, determining organic matter content is carried out based on the amount of C-Organic (Hasibuan, 2006). In addition, Kohnke (1968) stated that organic matters are: (i) a source of food and energy for microorganisms, (ii) helps plant nutrition through self-reorganization through its humus exchange capacity, (iii) provides substances that are needed in the formation of stabilizing soil aggregates, (iv) improving water binding capacity and passing water, (v) and assisting in controlling surface runoff and erosion.

Soil organic matter determines the soil ecosystem's interaction between abiotic and biotic components. Musthofa (2007) stated that the organic matter content in the form of C-organic in the soil must be maintained for not less than 2 percent to maintain the organic matter content decreasing in the soil due to the mineralization decomposition process. Therefore, the organic matter must be added during soil cultivation every year. Organic matters are closely related to CEC (Cation Exchange Capacity) and can increase soil CEC. Organic matter insufficiency may cause chemical, physical, and biological soil degradation.

Generally, carbon from soil organic matter consists of 10-20% carbohydrates, mainly from the biomass of microorganisms, 20% of nitrogen-containing compounds such as amino acids and amino sugars, 10-20% of aliphatic acids, alkanes, and the remainder is aromatic carbon. Therefore, it can be said that the most important factors affecting the productivity of both cultivated and uncultivated soils are the amount and thickness of soil organic matter (Paul and Clark, 1989).

Figure 3, moreover, presents that the N-Total for various types of land use in Wangi-Wangi Island ranges from 0.60% for Agroforestry to 5.71% for Dryland Agriculture. Bush and Savannah's N-Total values are only 0.85% and 0.86%, respectively.

Nitrogen (N) is one of the soil's main nutrients, which is essential in stimulating growth and giving the leaves a green color. Lack of nitrogen may affect plant growth, and plant yields decrease because chlorophyll forming in photosynthesis is disturbed. Plants need nitrogen to grow. It can be seen that farmers often use NPK fertilizers (Nitrogen, Phosphorus, and Potassium) for their plants. Nitrogen deficiency makes plant leaves turn yellow, the growth is stunted, and fruits and flowers grow small. Nitrogen is also required in DNA and RNA formation. DNA is the genetic information carrier to form a plant. Plants absorb nitrogen after the fixation process. Naturally, the fixation process changes nitrogen into other forms that plants can use and absorb.

The roles of nitrogen in plants are as follows: (1) Increasing plant growth, (2) Increasing levels of amino acids as well as protein in the soil, (3) Increasing the production of leaves so that they are very suitable for vegetable crops, (4) Increasing the activity of organisms in the soil, (5) Helps the process of synthesizing amino acids, and proteins in plants, (6) Helps plant vegetative growth, (7) Gives color to plants, (8)



Provides longevity to plants, (9) Helps process carbohydrates in plants, and (10) The nitrogen element can increase soil pH.

Plants with nitrogen deficiency experience: (1) Plant's growth is disrupted or stunted, (2) Leave's color turns to yellow and even wither, (3) Leave and fruit production decrease, (4) Growth phase is stunted, (5) Leave are short, narrow, even upright, (6) Fruit be small, fall off easily, die quickly, and cannot develop properly, (7) Roots on shoots are less sturdy or not sturdy at all, causing plants to fall and die easily, (8) Little seed production, (9) Fruit doesn't ripen easily or slow to ripen, (10) Fertilization become inefficient or ineffective because the plant's absorption ability reduce, and (11) Severe Nitrogen deficiency makes plant die (Leghari, et al., 2016; Youshaf, et al., 2021).

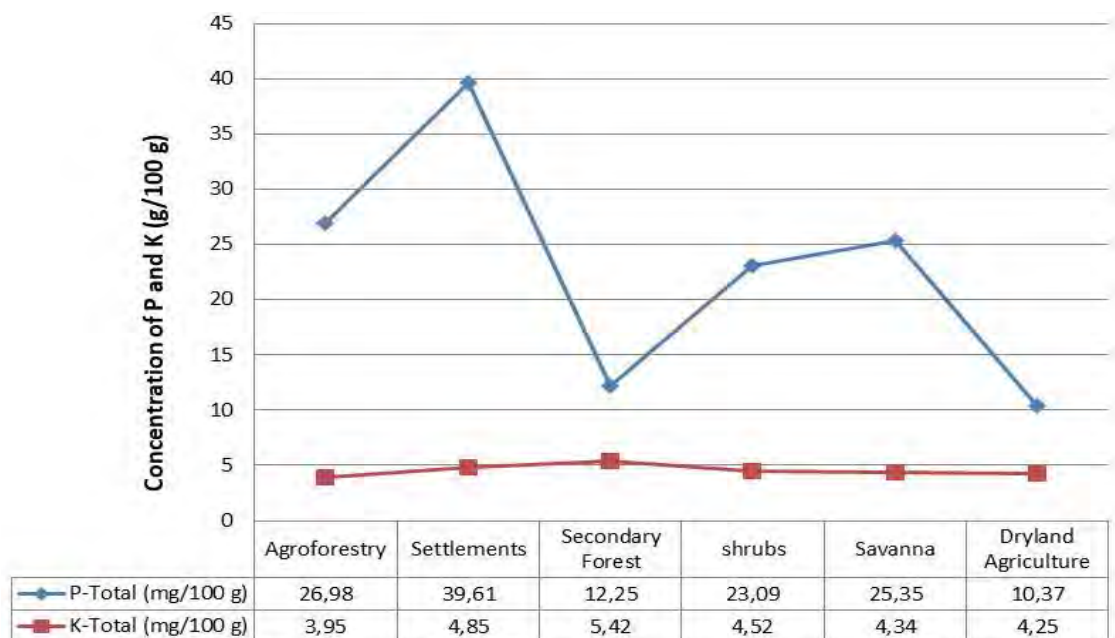


Figure 4. P-Total and K-Total Content Values of Various Types of Land Use/ Cover in Wangi-Wangi Island

Figure 4 presents the P-Total and K-Total content analysis of various land use/cover types in Wangi-Wangi Island. The P-total content of various types of land use ranges from 10.37 g/100g of soil for dry agricultural land use to 39.61 g/100g for residential land use. Phosphorus and Potassium are two important macronutrients for plant growth. Both of these nutrients are an indicator of the level of soil fertility. Phosphorus is one of the primary macronutrients for plants that are needed in large quantities to grow and produce. Plants take phosphor from the soil in  $\text{H}_2\text{PO}_4^-$  ions. The concentration of phosphor in plants ranges 0.1 - 0.5%, lower than N and K elements.



The presence of phosphorus serves as storage and energy transfer for all plants to support metabolic activities, and also will provide the following benefits for plants: (1) Stimulates root growth and forms a good root system, (2) Incentivizes the growth of plant tissues that form the growing point of plants, (3) Stimulating the formation of flowers and maturation of fruits/seeds, thus accelerating the harvest period, (4) Increasing the flowers possibility in forming a fruit, and (5) Compiling and stabilizing cell walls, thereby increasing plant resistance to pest attacks. (Malhotra, et al., 2018; Shen, et al., 2011; Lambers, 2022). In the mean time, lacking P nutrient will show the following symptoms: (1) growth becomes stunted, (2) Root system is underdeveloped, (3) Leaves are purplish, (4) Formation of flowers/fruits/seeds is hampered, resulting in late harvest, and (5) Flowers possibility to become fruit decreases due to imperfection in pollination (Shen, et al., 2011; Lambers, 2022; Chan et al., 2021).

Potassium contained in potassium fertilizer has many benefits for plants. Potassium functions for plants are to help the formation and transport of carbohydrates, catalyst in the formation of proteins, regulating the activities of various mineral elements and the movement of stomata, and promoting the growth of meristem tissue. Potassium is the element that has an important role for plants, and supports plant growth and development.

The various benefits of potassium are providing a positive impact on the plant's health. The roles of potassium for a plant (Prajapati and Modi, 2012; Johnson, et al., 2022) are: (1) Photosynthesis: Plants must carry out the photosynthesis process. All material produced by plants must be able to work properly, and photosynthesis is a determining process for the growth and development of a plant. Plants with sufficient potassium will be strongly helpful during photosynthesis and can make plants fertile. Photosynthesis has an impact on the next process carried out by a plant, and the better the process of photosynthesis is carried out, the better the resulting crop will be; (2) Water Efficiency: Potassium also has a function in making water use more efficient, and not be used too much water. Water is an essential component in nature that a plant can thrive. By having liquids, plants can grow well, and the effect of solar radiation on plants can be reduced by using water. Water is a natural resource that must be maintained for its naturalness; all living things can live healthily with sufficient water; (3) Forming Stems: One of the very important functions of potassium is to form strong plant stems, and with strong stems, plants can grow well. A brittle tree trunk can be caused by a lack

of potassium obtained, and it can be resolved by increasing potassium content. Many plants are suitable for wetlands, and one of the plants that can thrive in the wetland is rice; (4) Strengthens Stems and Roots: potassium has an important role in strengthening stems and roots so that the plant can grow stronger and longer. Plants with a long life may produce fruit every season, indicating that the plant has strong roots. The stronger the condition of the plants, the better the growth of these plants, and many plants can live in various conditions. By having potassium, plant roots will become strong and resistant to various conditions; (5) Increasing Disease Resistance: Rice plants are vulnerable to pests that may cause crop failure. The stronger the plants against a disease, the more yields. Potassium makes plant root become strong against various types of diseases. However, farmers use chemical fertilizers to eradicate plant diseases. Excessive chemical fertilizers have a negative impact on soil health. Hence, applying potassium to plants can make the plants more resistant to disease; (6) Improving Fruit Quality: The stem has an important function for plant; plant with strong stems can produce good fruit. Applying potassium make plant's structures become stronger. It is because a plant's growth is affected by external factors. Therefore, a plant must have strong stems, because stems influence fruit production. One may consider that stem structure has a less role, but structurally, the plant stems have a main role in plant productivity; and (7) Accelerating Plant Growth: Potassium content in plants can be observed by plants growing faster. Faster plant growth certainly results in faster harvests too. Chemical use is an alternative to fast plant growth. However, chemical use has an impact on soil damage and often ecosystems. Farmers no longer need to use chemical fertilizers by having potassium because potassium can accelerate plant growth and increase the abundance of yield/fruit.

Appendix I.1 further contains laboratory analysis of permeability parameters of soil samples for various types of land use/cover in Wangi-Wangi Island. Permeability values for various types of land use/cover in Wangi-Wangi Island are presented in Figure 5. Figure 5 shows that soil permeability for various types of land use/cover in Wangi-Wangi Island ranges from 25.47 cm/hour to 50.95 cm/hour. Agroforestry, Settlements, Secondary Forests, and Shrubs' permeability is higher than that of Savanna Fields and Dryland Agriculture.

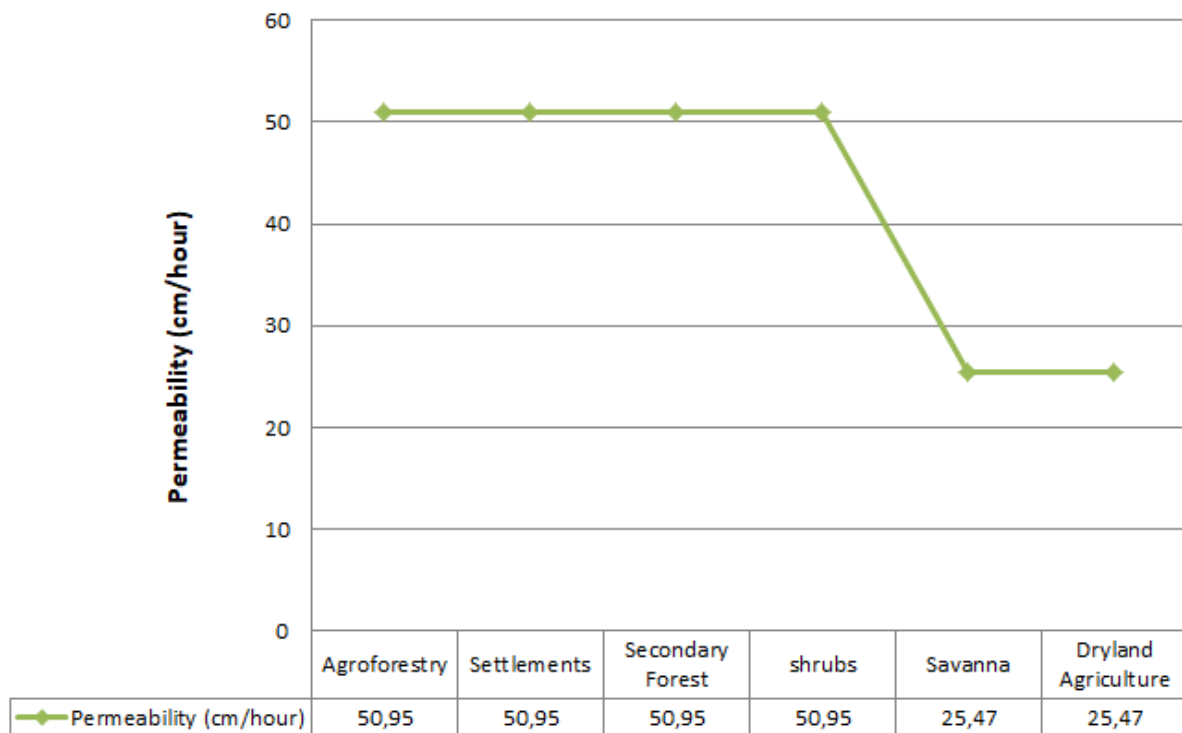


Figure 5. Soil Permeability for Various Types of Land Use/Coverage in Wangi-Wangi Island

Permeability is soil's ability to allow water to pass through. Permeability represents how quickly or slowly the water seeps into the soil through the horizontal and vertical pores. Soil permeability is affected by the soil's porosity and the soil aggregates' stability. The more water enters the soil, the more water is stored in the soil, fulfilling the plant's need for water and moistening the soil conditions. Moist soil triggers the presence of soil animals and microbial populations. Factors affecting soil permeability include soil texture, porosity, pore size distribution, and soil organic matter content. Vegetation will usually determine the pore size distribution of the soil. Plants with more roots donating a higher organic matter tend to increase macropores, thereby increasing soil permeability (Elhakim, 2016; Yulianti, et al., 2018).

## B. Land Cover/Use

Land cover/use alterations are the main factors affecting environmental health. Increasing space requirements due to population growth, human development, and economic activities affect land use/cover. Increasing demand for agriculture, settlements, and economic activities, such as mining and industry, significantly reduce the forest area, both natural and plantation forests.

A further impact of decreasing forest cover and non-forest vegetation area is an increase in the magnitude and frequency of floods, landslides, droughts, erosion, sedimentation, and the vulnerable land area. Additionally, it negatively impacts economic sectors due to soil productivity, water crisis, food crisis, floods, landslides, and even loss of human lives.

Land cover alteration by reducing the proportion of vegetation cover globally may trigger or increases greenhouse gas effects. Hence, deforestation must be prevented through international agenda with carbon trading schemes (*carbon trade*). The Kyoto Protocol has become a starting point for reducing deforestation area in the globe, especially in tropical countries such as Indonesia.

Investigation on land cover alteration in Wangi-Wangi Island has been carried out by satellite imagery analysis for the periods of 1997, 2002, 2007, 2012, 2017, and 2022. Land cover analysis in Wangi-Wangi Island for 1997-2022 is presented in Figures 6 - 11.

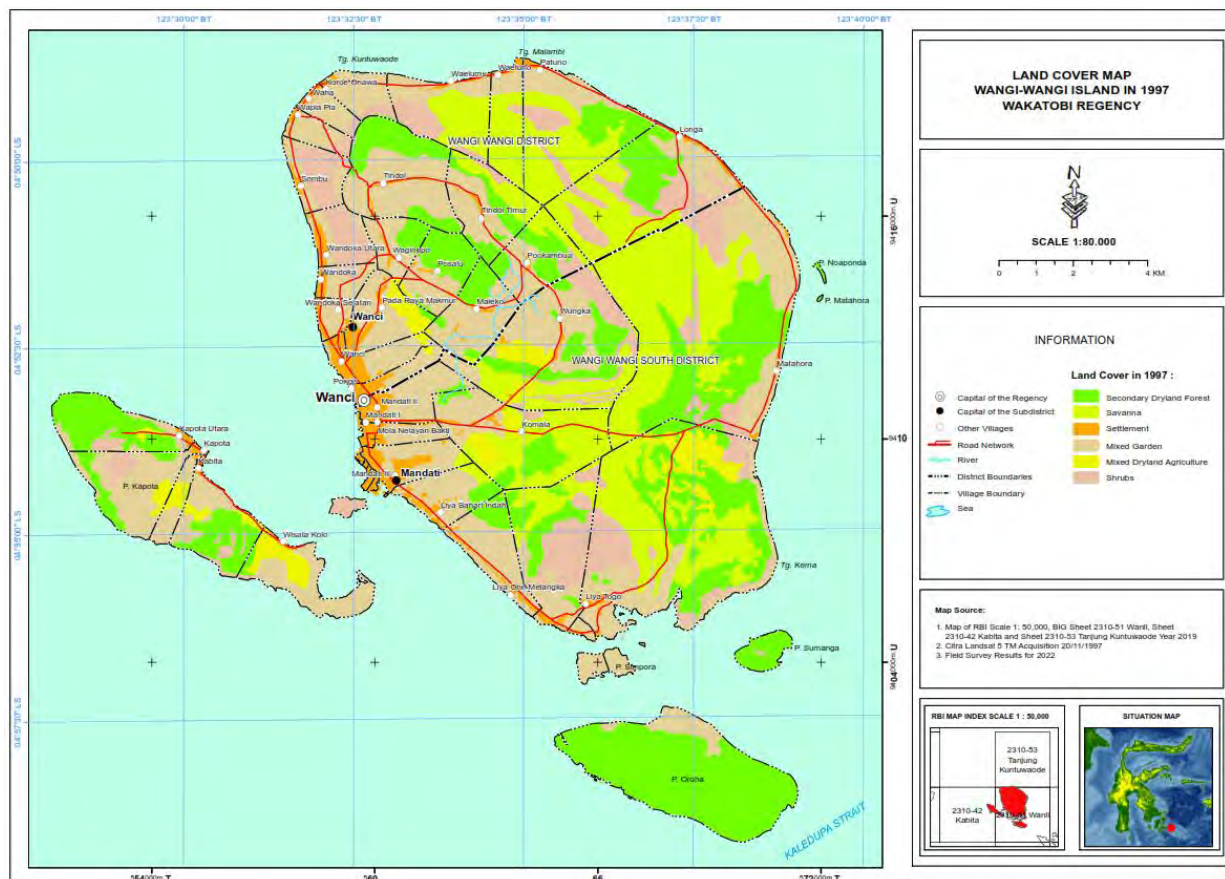


Figure 6. Land Cover Map of Wangi-Wangi Island in 1997

Figure 6 shows seven lands cover/use types analyzed: Secondary Forest, Mixed Gardens, Settlements, Mixed Dry Land Agriculture, Savanna Fields, Shrubs, and Airport Areas. A detail of the land cover/use area is presented in Table 1.

Table 1. Land Cover/Use area in Wangi-Wangi Island for 1997

No.	Land cover/use	Area (ha)	Fraction (%)
1	Secondary forest	4,997.9	26.41
2	Mixed garden	6,259.1	33.08
3	Settlement	811.0	4.29
4	Mixed Dryland agriculture	700.6	3.70
5	Savana	4,156.2	21.96
6	Shrub	1,998.7	10.56
7	Airport area		
<b>Total</b>		<b>18,923.5</b>	<b>100.00</b>

Figure 6 and Table 1 show land cover/use data for 1997. The total area of Wangi-Wangi Island was 18,923.5 hectares consisted of 4,997.9 hectares or 26.41% of Secondary Forest land cover/use and Mixed Gardens covered an area of 6,259.1 hectares or around 33.08% of the total area. The land cover/use of the Savanna Field was extensive, i.e., 4,156.2 hectares or 21.96%, while the area covered/used by the Bush Shrub was 1,998.7 hectares or around 10.56% of the total area of Wangi-Wangi Island.

The land cover/use of Wangi-Wangi Island in the following five years, i.e. 2002, relatively did not experience significant changes compared to land cover/use for the 1997 period. Land cover/use of Wangi-Wangi Island in 2002 is presented in Figure 7 and Table 2.

Table 2. Land Cover/Use area of Wangi-Wangi Island in 2002

No.	Land cover/use	Area (ha)	Fraction (%)
1	Secondary forest	4,981.5	26.32
2	Mixed garden	6,262.4	33.09
3	Settlement	814.2	4.30
4	Mixed Dryland agriculture	710.7	3.76
5	Savana	4,157.6	21.97
6	Shrub	1,997.1	10.55
7	Airport area		
<b>Total</b>		<b>18,923.5</b>	<b>100.00</b>

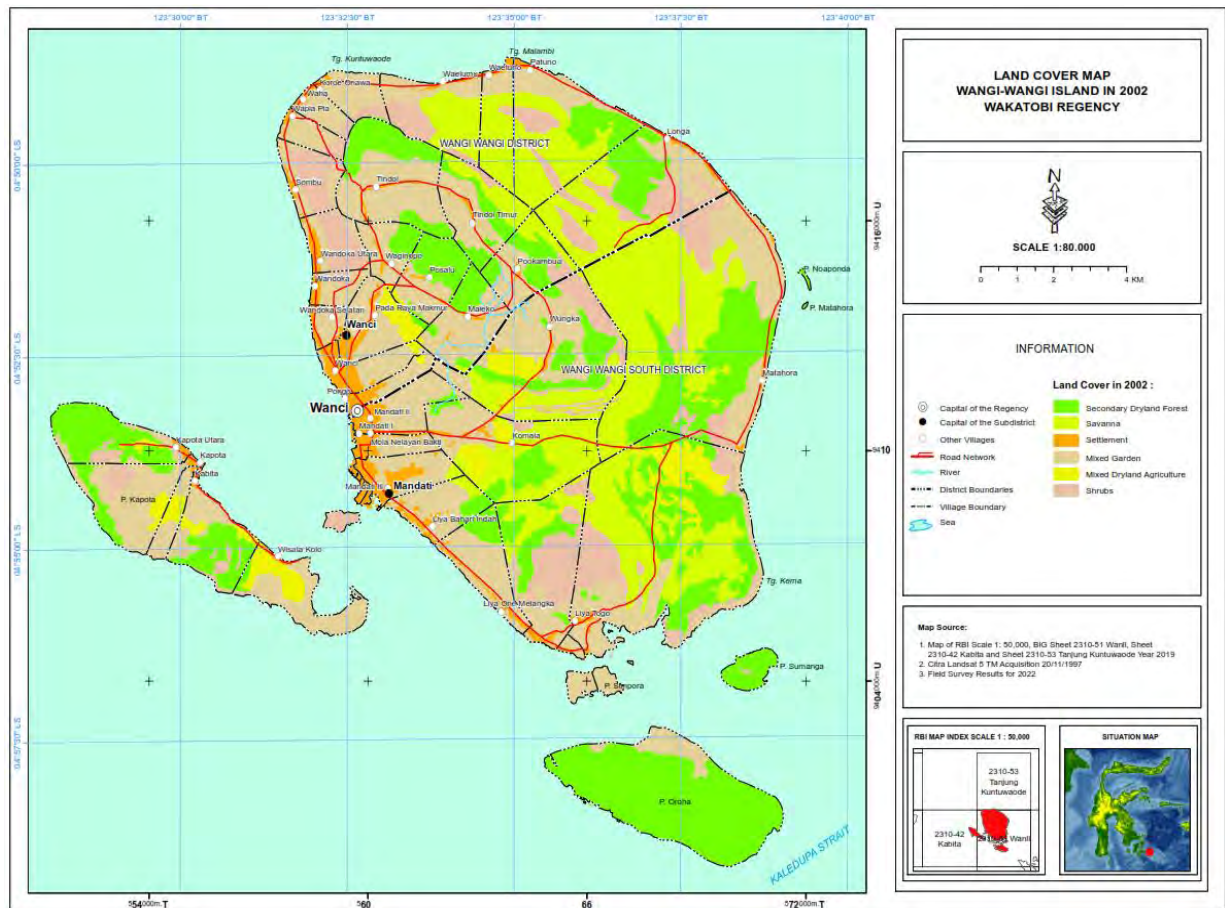


Figure 7. Land Cover Map of Wangi-Wangi Island in 2002

Figure 7 and Table 2 show Wangi-Wangi Island land cover/use data in 2002. In this period, the total land cover/use area of Wangi-Wangi Island was 18,923.5 hectares consisted of 4,981.5 hectares or 26.32% of Secondary Forest land cover/use; the Mixed Gardens area was 6,262.4 hectares or 33.09% of the total area of Wangi-Wangi Island. Savana area covered 4,157.6 hectares or 21.97%, while land cover/use of Shrubs was 1,997.1 hectares or 10.55% of the total area of Wangi-Wangi Island. Land cover/use of land on Wangi-Wangi Island for the next 10 years, i.e. for 2007 and 2012, are presented in Figures 8 and 9, and Table 3.



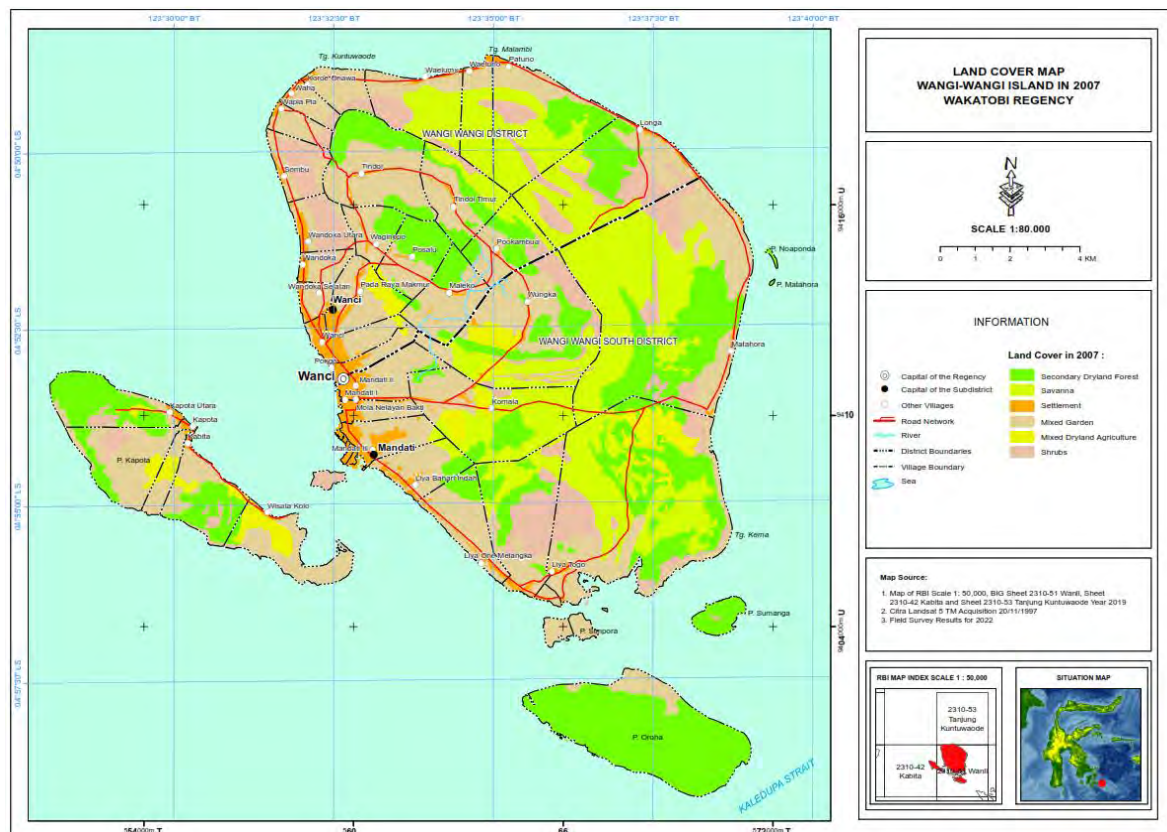


Figure 8. Land Cover Map of Wangi-Wangi Island in 2007

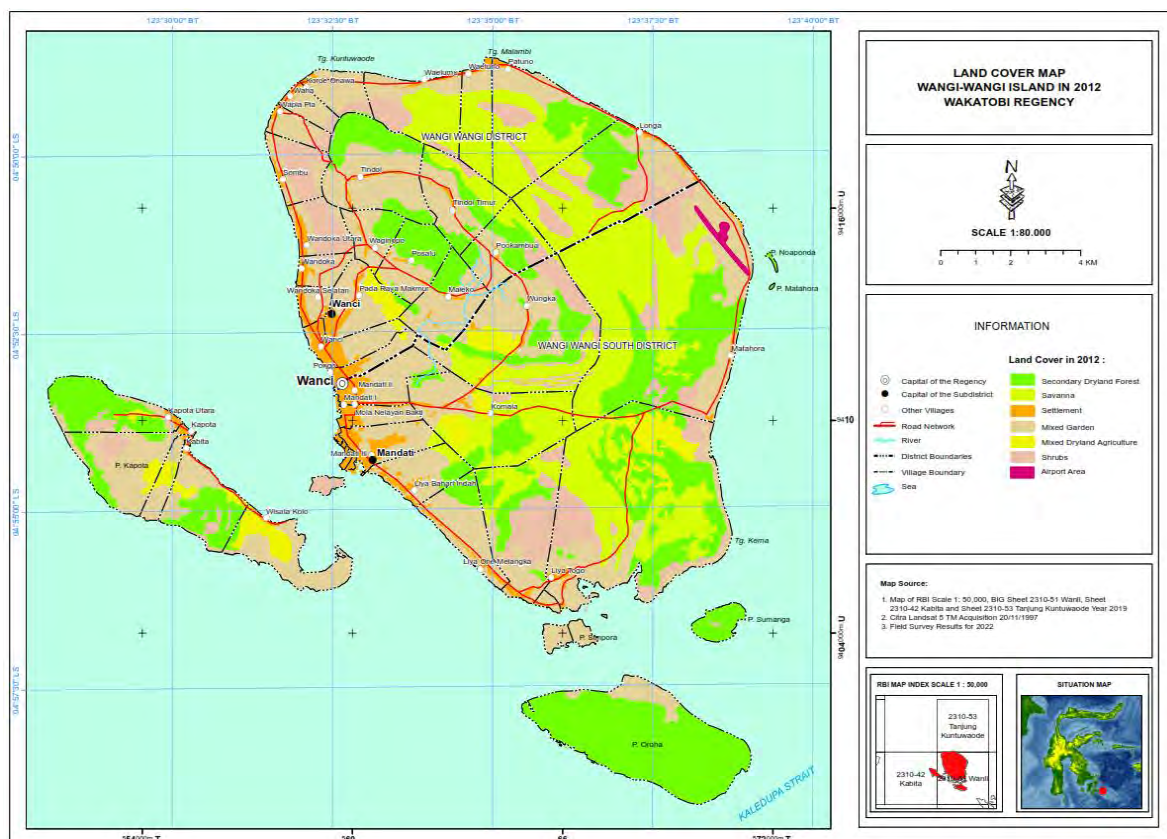


Figure 9. Land Cover Map of Wangi-Wangi Island in 2012

Table 3. Land cover/use alteration in Wangi-Wangi Island during 2007-2012

No.	Land cover/use	Area (ha) - 2007	Area (ha) - 2012	Alteration (ha)
1	Secondary forest	4,980.1	4,958.5	-21.6
2	Mixed garden	6,259.3	6,210.0	-49.3
3	Settlement	815.4	826.7	11.3
4	Mixed Dryland agriculture	708.2	716.7	8.5
5	Savana	4,179.0	4,177.5	-1.5
6	Shrub	1,981.6	1,983.4	1.8
7	Airport area		50.9	50.9
<b>Total</b>		<b>18,923.5</b>	<b>18,923.5</b>	<b>0.00</b>

Figures (8), (9), and Table (3) present land cover/use data in Wangi-Wangi Island from 2007 to 2012. It shows that several categories of land cover/use were decreasing. The secondary Forest category only covered 21.6 hectares, while Mixed Gardens decreased by 49.3 hectares in this period. However, the land use for settlements increased to 11.3 hectares; Mixed Dryland Agriculture also increased to 8.5 hectares, while the airport took an area of 50.9 hectares. Savana area decreased by 1.5 hectares, and Shrubs increased by 1.8 hectares from 2007-2012.

Additionally, the land cover/use of Wangi-Wangi Island during the 2012-2017 period underwent alteration. Land Cover/Use for 2017 and the 2012-2017 period are presented in Figure 10 and Table 4 as follows.

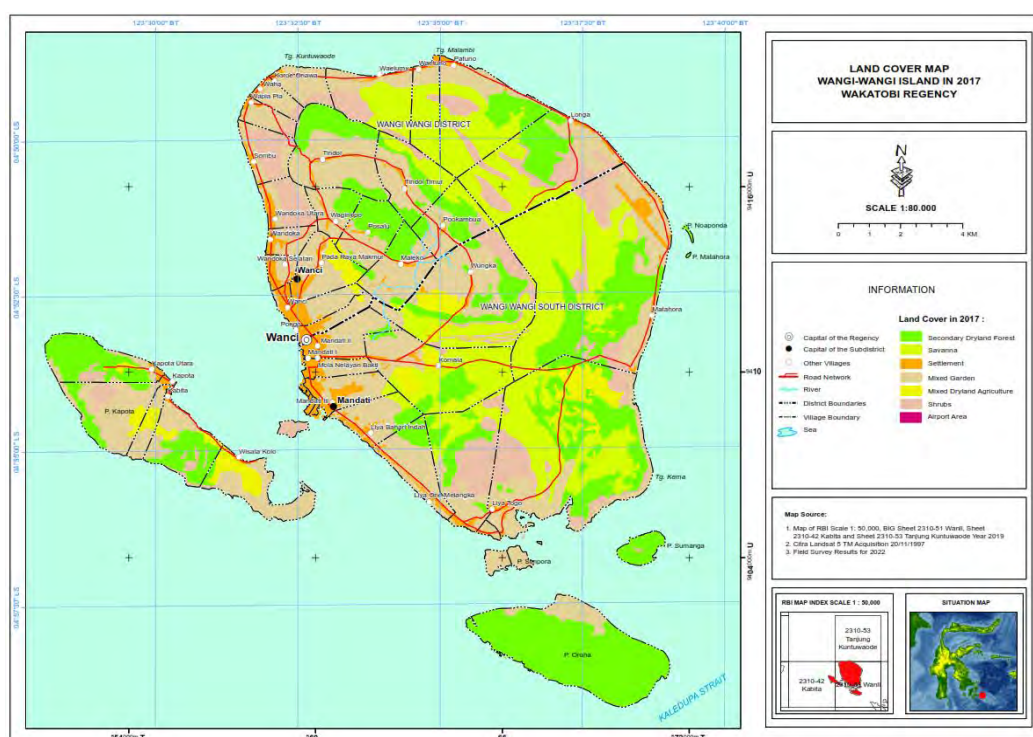


Figure 10. Land Cover Map of Wangi-Wangi Island in 2017



Table 4. Changes in Land Cover/Use on Wangi-Wangi Island for the 2012-2017 Period

No.	Land cover/use	Area (ha) in 2012	Area (ha) in 2017	Difference (%)
1	Secondary forest	4,958.5	4,906.6	-51.9
2	Mixed garden	6,210.0	6,227.1	17.1
3	Settlement	826.7	862.2	35.5
4	Mixed Dryland agriculture	716.7	721.0	4.3
5	Savana	4,177.5	4,162.3	-15.2
6	Shrub	1,983.4	1,994.4	11.0
7	Airport area	50.9	50.0	-0.9
<b>Total</b>		<b>18,923.5</b>	<b>18,923.5</b>	<b>0.00</b>

Source: Observation data (2022)

Figure 10 and Table 4 present data analysis of land cover/use changes in Wangi-Wangi Island for 2012-2017. They show that the secondary forest land cover/use decreased by 51.9 hectares, and the mixed garden increased by 17.1 hectares. Residential land increased by 35.5 hectares, while Mixed Dryland Agriculture also increased by 4.3 hectares. Savana's area decreased by 15.2 hectares, Bushes increased by 11.0 hectares, and the Airport Area decreased by 0.9 hectares.

Land cover/use in Wangi-Wangi Island for the 2017-2022 period is presented in Figure 11, while changes in land cover/use for that period are presented in Table 5.

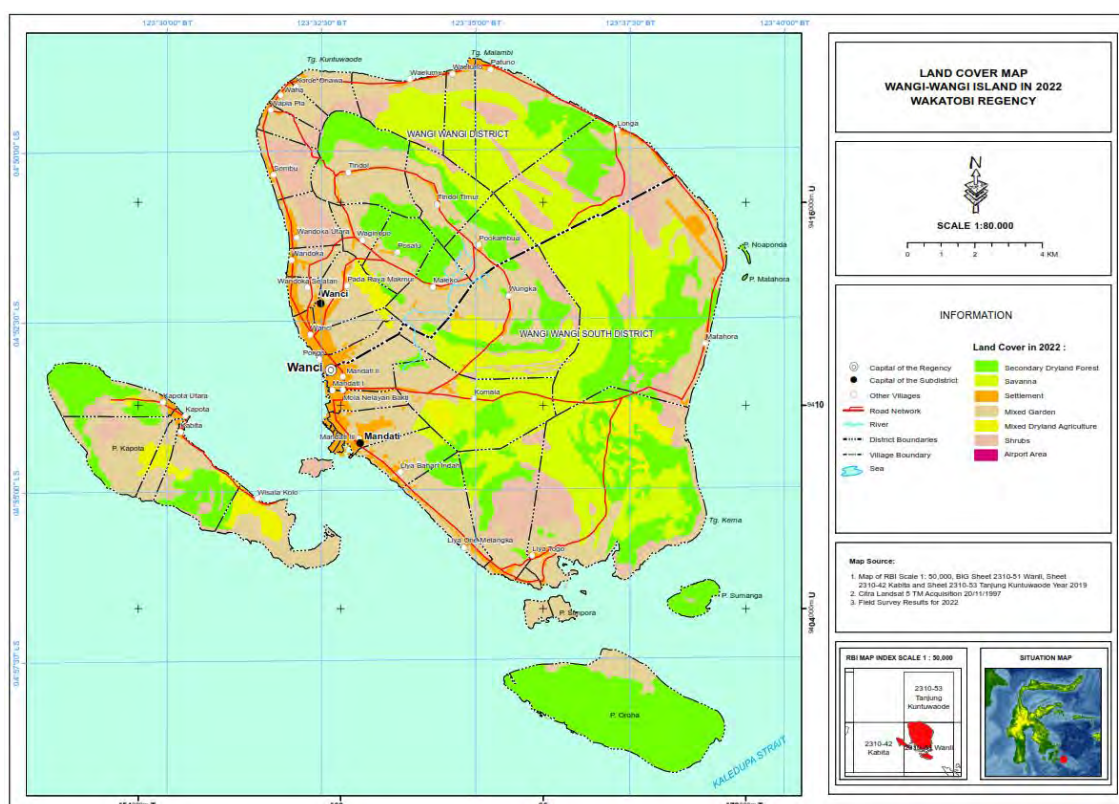


Figure 11. Land Cover Map of Wangi-Wangi Island in 2022

Table 5. Changes in Land Cover/Use on Wangi-Wangi Island for the 2017-2022 Period

No.	Land Cover/use	Area (ha) in 2012	Area (ha) in 2017	Difference (ha)
1	Secondary forest	4,906.6	4,819.4	-87.2
2	Mixed garden	6,227.1	6,288.8	61.8
3	Settlement	862.2	867.8	5.6
4	Mixed Dryland agriculture	721.0	723.4	2.4
5	Savana	4,162.3	4,246.6	84.3
6	Shrub	1,994.4	1,927.5	-66.9
7	Airport area	50.0	50.0	0.0
<b>Total</b>		<b>18,923.5</b>	<b>18,923.5</b>	<b>0.00</b>

Source: Observation data (2022)

Figure 11 and Table 5 contain observation data of land cover/use in Wangi-Wangi Island for 2017-2022. They show that the Secondary Forest land cover/use decreased by 87.2 hectares; the Mixed Garden increased by 61.8 hectares. Land use for residential also increased by 5.6 hectares; Mixed Dryland Agriculture increased by 2.4 hectares. Savana area increased by 84.3 hectares; the Bushes area decreased by 66.9 hectares; and the Airport Area area did not change during the period.

The total land cover/use change in Wangi-Wangi Island for the period 1997-2022 is presented in Table 6.

Table 6. Total Changes of Land Cover/Use in Wangi-Wangi Island for 1997-2022

Land cover/use	Land cover/use change (ha)				
	1997- 2002	2002- 2007	2007- 2012	2012- 2017	2017- 2022
Secondary forest	-16.32	-1.4	-21.6	-51.9	-87.2
Mixed garden	3.31	-3.1	-49.3	17.1	61.8
Settlement	3.21	1.2	11.3	35.5	5.6
Mixed Dryland agriculture	10.01	-2.5	8.5	4.3	2.4
Savana	1.39	21.3	-1.5	-15.2	84.3
Shrub	-1.61	-15.5	1.8	11.0	-66.9
Airport area	0.00	0.0	50.9	-0.9	0.0
<b>Total</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

Source: Data analysis (2022)

Table 6 is a data analysis on land cover/use change in Wangi-Wangi Island for 1997-2022. It shows that the secondary forest category's land cover/use decreased during 1997-2022; land cover/use seems to increase, except for the period of 2002-2007 and

2007-2012. Land cover/use due to Settlement increased during the period; land cover/use of Mixed Dryland Agriculture also increased, but it decreased by 2.5 hectares from 2002-2007.

### C. Water Source (Spring)

Water resources in Wakatobi Regency generally come from groundwater. The groundwater is flowed from hilly areas and is traditionally channeled to the residential area using iron pipes. Others water source is karst cave water which is called *Tofa*. However, those water sources are unfit for drinking water and are used only for bathing, washing, and toilets. Drinking water is taken from rainwater, which is traditionally collected in a tank. Groundwater levels in the Wakatobi Islands depend on sea level. Other water sources are well water, but only a few wells are for water sources.

The domestic water sources in Wangi-Wangi Island are *Wa Gehe-Gehe*, *Te'e Bete*, *Te'e Liya*, *Hu'u*, *Te'e Fo'ou*, etc. A detail of the water source capacity is presented in Table 7.

Table 7. Production capacity of water resources and service areas

No	Sources	Island	Water Capacity (lps)	Service area
1	Wa Gehe-Gehe	Wangi-Wangi	15	Wanci, Mandati, Wandoka, and Sombu
2	Te'e Bete	Wangi-Wangi	10	Numana and Mola
3	Longa	Wangi-Wangi	5	Longa
4	Te'e Liya	Wangi-Wangi	5	Liya area
5	Hu'u	Wangi-Wangi	10	Airport, Matahora dan Melai One area
6	Kampa (Kapota)	Wangi-Wangi	5	Kapota
7	Balande	Wangi-Wangi	25	South Wangi-wangi
8	Te'e Fo'ou	Wangi-Wangi	15	South Wangi-wangi
<b>Sub Total</b>			<b>90</b>	

Source: Wakatobi Regency Government (2021)

Table 7 presents production capacity data of several water sources in Wangi-Wangi Island, Wakatobi Regency. The data shows that *Wa Gehe-Gehe* water Source, with a 15 liters/second production capacity, is used to serve the water needs in Wanci, Mandati, Wandoka and Sombu area; *Te'e Bete* wate Source, with a production capacity of 10 litres/second serves Mola and Numana area. Longa Water Source, with a capacity of 5 litres/second serves the Longa area, while *Te'e Liya* Water Source, with a production

capacity of 5 litres/second serves the Liya area and its surroundings. *Hu'u* Water Source, with a production capacity of 10 litres/second, serves the community in the Matahora Melai One Airport area; while the *Kampa* Water Source (*Kapota*) serves the Kapota area by a production capacity of 5 litres/second. *Balande* water Source has a production capacity of 25 litres/second, and Te'e Fo'ou water Source has a capacity of 15 litres/second which serves the South Wangi-Wangi area.

Based on the observation of water sources in Wangi-Wangi Island, there are 69 water sources potentially to be used for domestic, industrial, and agricultural needs, including the trade (commercial) sector. Generally, these water sources are springs located in rock crevices or caves.

The water sources observations discovered 69 points of water sources (springs) by determining their coordinates using the Geodetic GPS. All water sources are documented (by manual photographs) and drone photographs. The spatial distribution of 69 water sources in Wangi-Wangi Island is presented in Figure 12, while a brief profile of the water sources is presented in Appendix I.2.

Observation data show that 30 water sources have been used by the people in Wangi-Wangi Island, including those used by *PDAM* Wakatobi (Municipal waterworks agency) as the water source. Traditionally, those water sources are used for bathing and washing, so it is likely contaminated by detergents and oil.

Additionally, observation data indicate that residential areas surround more than 80% of the total water sources. This is a common theory that settlement patterns tend to approach the resources. The settlement pattern in Wangi-Wangi Island is close to the resources, i.e., marine and water resources. Therefore settlements in Wangi-Wangi Island tend to approach water sources.

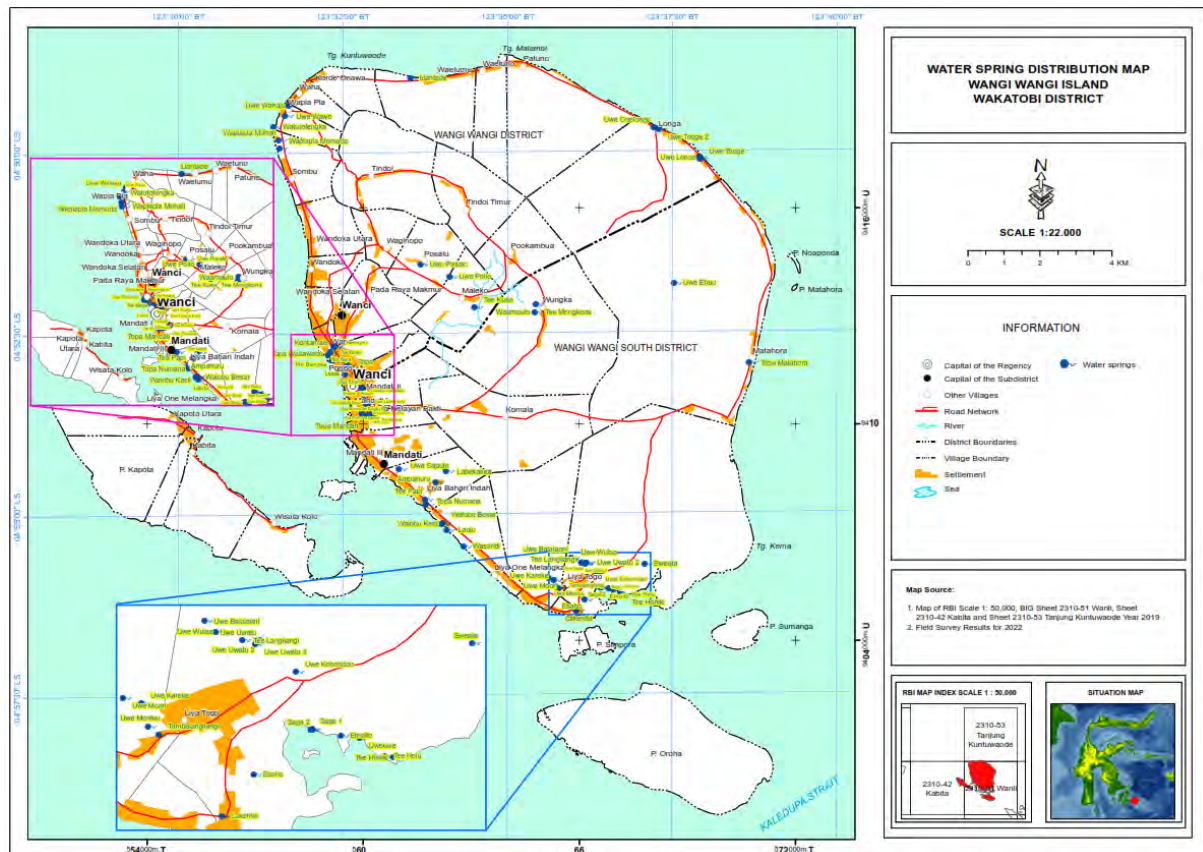


Figure 12. Spatial Distribution of Water Sources on Wangi-Wangi Island

Of the 69 water sources in Wangi-Wangi Island, the water quality has been partially reported by the last year Research Contract of HOU 2021. The remaining water sources quality test were analyzed by a composite of water samples analysis from neighboring water sources. Geologically, they are likely connected to each other. By having this method, 19 water samples' qualities were analyzed. The results of the water quality analysis of 19 water samples in Wangi-Wangi Island are tabulated in Appendix I.3.

## D. Conclusions

1. Soil texture in Wangi-Wangi Island is dominated by the clay fraction, except for Secondary Forest land cover/use, which is dominated by the sand fraction, and Dryland Agriculture is dominated by Dust fraction.
2. The soil acidity level for all categories of land cover/use in Wang-Wangi Island is generally neutral (7.0-8.0), however, Dry Land Agricultural land use is acidic pH (pH 7.0) soil type.

3. The C-Organic content for various types of land cover/land use in Wangi-Wangi Island is high (3.0-8.0%); meanwhile, the total N-Content is relatively low, i.e., less than 1.0%. The P-Total and K-Total content in the area is high; the soil permeability is also high, i.e., 25-51 cm/hour. It indicates that the soil's ability to pass water is high.
4. Changes in land cover/use of the Secondary Forests category decreased during 1997-2022, while the settlements category increased; the mixed dryland agriculture category increased, except for 2002-2007, which decreased by 2.5 hectares.
5. A total of 69 points of water sources have been identified in Wangi-Wangi Island. Several water resources have been used either by the Municipal Waterworks Agency (*PDAM*) management or directly utilized by the community. However, the community traditionally uses about 30 points of water sources for bathing and washing. Consequently, they are identified to be contaminated by detergents.
6. The community settlements in Wangi-Wangi Island are focused on resources. The settlements commonly surround water sources, with more than 50 water resources located near the people settlements. It is indicated by the presence of *E. coli* in water quality analysis.

## **E. Recommendations**

1. Detailed investigation on water sources quality is required, i.e., complete analysis in accordance with Indonesian Government regulation, PP No. 22 of 2021. A comprehensive water quality test is used to estimate the pattern of groundwater flow connectivity through a water quality similarity test from 69 water sources identified.
2. A new tool or method is required to measure or estimate the flow discharge of cave water sources (springs). It is noted that there is no accurate data regarding the potential flow discharge of water sources precisely in Wangi-Wangi Island. Determining the minimum standard for permitted groundwater utilization in Wangi-Wangi Island is essential.
3. Further investigation on seawater intrusion into water sources is required in Wangi-Wangi Island.



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## Appendix I.1. Laboratory analysis results for soil samples

<b>"EMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET DAN TEKNOLOGI</b> <b>UNIVERSITAS HALU OLEO</b> <b>FAKULTAS PERTANIAN</b> <b>LABORATORIUM PENGUJIAN JURUSAN ILMU TANAH</b> Kampus Istimu Bumi Teichamba, Anduonghu, Kendari Telp. (0910-) 3190214																							
<b>HASIL ANALISIS TANAH</b>																							
Nama : Proyek/Tamana : Pementa Analisa :		<b>RIO/UNZS-B.1.2/LL/2022</b> : : Dr. Ir. La Baco Sinda, M.Si.								: 20 November 2022 : 26 Desember 2022 : Pulau Wang-Wangi Kab. Wakarobi													
Kode Lapang	RIG LAB	TEKSTUR 3 FRAKSI			Eks. 1 : 2,5		Terhadap bahan kering 105°C										Porositas	Permeabilitas					
		PASIR	DEBU	LIAT	pH		C-organik	N total	SO	P-total	HO 25%		K Total	Eks HClO1 & HClOH									
					H <sub>2</sub> O	KO					P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O		Ca-d	Mg-d	K-d			Na-d	KTR	KB		
		Bipet (gramming)			pH Meter		Spektro-			Spektro		AAS		AAS		AAS				Spektro			
		%					%			mg/100g		mg/100g		mg/100g		ppm						%	(cm/jam)
Agriforestasi Haidini	Tns/22/167	7.90	11.76	26.32	7.21	-	7.16	0.60	-	26.96	-	-	3.95	-	-	-	-	-	-	-	0.72	50.95	
Proseduran Kaururuse	Tns/22/168	27.66	8.49	63.85	7.10	-	6.97	4.36	-	39.61	-	-	4.85	-	-	-	-	-	-	-	0.83	50.95	
Lutupan lahan hutan sekunder	Tns/22/169	51.98	13.04	24.98	7.59	-	4.21	3.74	-	12.25	-	-	5.41	-	-	-	-	-	-	-	0.82	50.95	
Semak belukar	Tns/22/170	19.44	32.88	47.68	7.48	-	7.06	0.85	-	23.09	-	-	4.52	-	-	-	-	-	-	-	0.87	50.95	
Padang sawah	Tnn/22/171	22.34	22.60	55.05	7.10	-	7.22	0.86	-	25.35	-	-	4.24	-	-	-	-	-	-	-	0.84	25.47	
Lutupan lahan Pertanian Kering	Tnn/22/172	16.37	55.67	28.01	5.03	-	3.61	5.71	-	10.17	-	-	4.25	-	-	-	-	-	-	-	0.76	25.47	

Dr. Ir. Hamid Hakim, M.P.  
 NIP.19650926 199103 1 008

Kendari, 26 Desember 2022  
 Yang bertandatangan,  
 Analis  
  
 Hachmad Anjani S.P., M.Si.  
 NIP.19650111 199103 1 001

### Appendix I.2. Water sources location

No	Name of Spring	Village	Subdistrict	Coordinate		Picture
				X	Y	
1	Ampanuru	Numana	Wangi Wangi Selatan	562082.00	9408387.00	
2	Emoito	Liya Togo	Wangi Wangi Selatan	566892.00	9405438.00	
3	Endapo	Kelurahan Mandati II	Wangi Wangi Selatan	559964.88	9411012.57	
4	Endapo Langilangi	Kelurahan Mandati II	Wangi Wangi Selatan	560050.00	9411009.00	

5	Esaho	Liya Togo	Wangi Wangi Selatan	566227.00	9405140.00	
6	Eweata	Liya Togo	Wangi Wangi Selatan	567891.00	9406138.00	
7	Kontamale	Kelurahan Wanci	Wangi-Wangi	559253.41	9412144.83	
8	Labekakea	Numana	Wangi Wangi Selatan	562374.00	9408687.00	
9	Lakentai	Liya Togo	Wangi Wangi Selatan	565983.00	9404824.00	

10	Laulu	Liya Onemaelangka	Wangi Wangi Selatan	562404.00	9407060.00	
11	Lesaa	Kelurahan Pongo	Wangi-Wangi	559562.00	9411379.00	
12	Liantade	Waelumu	Wangi-Wangi	561393.00	9419598.00	
13	Mowuta	Kelurahan Mandati II	Wangi Wangi Selatan	560091.00	9410662.00	
14	Saga 1	Liya Togo	Wangi Wangi Selatan	566660.00	9405486.00	



15	Saga 2	Liya Togo	Wangi Wangi Selatan	566677.00	9405480.00
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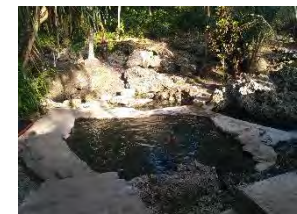
16	Tambalangilangi	Liya Mawi	Wangi Wangi Selatan	565500.00	9405446.00
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17	Tee a'a	Kelurahan Mandati I	Wangi Wangi Selatan	560034.00	9410318.00
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18	Tee Bangka	Kelurahan Wanci	Wangi-Wangi	559217.00	9411733.00
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19	Tee Bangka 2	Kelurahan Mandati I	Wangi Wangi Selatan	560240.00	9410251.00
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20	Tee Gholotu	Kelurahan Mandati I	Wangi Wangi Selatan	560362.00	9410382.00	
21	Tee Holu	Liya Togo	Wangi Wangi Selatan	567222.00	9405278.00	
22	Tee Honiki	Liya Togo	Wangi Wangi Selatan	567290.00	9405270.00	
23	Tee Kapa	Kelurahan Wanci	Wangi-Wangi	559613.38	9411603.55	
24	Tee Kosapi	Kelurahan Wanci	Wangi-Wangi	559161.89	9411995.53	

25	Tee Kuea	Maleko	Wangi-Wangi	563167.06	9413234.44	
26	Tee Langilangi	Liya Togo	Wangi Wangi Selatan	566136.33	9406164.47	
27	Tee Mentu'u	Kelurahan Mandati I	Wangi Wangi Selatan	560255.00	9410236.00	
28	Tee Mongkona	Wungka	Wangi Wangi Selatan	564875.00	9413320.00	
29	Tee Papi	Numana	Wangi Wangi Selatan	561800.00	9407914.00	



30	Tee Pehawa	Kelurahan Mandati I	Wangi Wangi Selatan	560346.00	9410312.00	
31	Tee Ponu	Kelurahan Mandati I	Wangi Wangi Selatan	560141.84	9410220.27	
32	Tee Ramuli	Kelurahan Mandati I	Wangi Wangi Selatan	560396.00	9410346.00	
33	Topa	Kelurahan Wanci	Wangi-Wangi	559642.00	9411628.00	
34	Topa Mandati	Kelurahan Mandati I	Wangi Wangi Selatan	560026.00	9410154.00	

35	Topa Matahora	Matahora	Wangi Wangi Selatan	570799.19	9411701.86	
36	Topa Numana	Numana	Wangi Wangi Selatan	561811.96	9407756.27	
37	Topa Wasawadu	Kelurahan Wanci	Wangi-Wangi	559105.98	9411918.98	
38	Uwe Balalaoni	Liya Togo	Wangi Wangi Selatan	565851.00	9406308.00	
39	Uwe Ehuu	Matahora	Wangi Wangi Selatan	568708.00	9413920.00	

40	Uwe Enunu	Kelurahan Pongo	Wangi-Wangi	560132.00	9411340.00	
41	Uwe Kareke	Liya Mawi	Wangi Wangi Selatan	565367.00	9405682.00	
42	Uwe Kohondao	Liya Togo	Wangi Wangi Selatan	566547.09	9405920.33	
43	Uwe Liabete Besar	Kelurahan Mandati II	Wangi Wangi Selatan	560169.00	9410529.00	
44	Uwe Liabete Kecil	Kelurahan Mandati II	Wangi Wangi Selatan	560173.00	9410558.00	

45	Uwe Lonso	Longa	Wangi-Wangi	569400.00	9417407.00	
46	Uwe Mentuu	Liya Mawi	Wangi Wangi Selatan	565419.00	9405508.00	
47	Uwe Moori	Liya Mawi	Wangi Wangi Selatan	565228.00	9405725.00	
48	Uwe Morondo	Kelurahan Mandati II	Wangi Wangi Selatan	560176.13	9410582.80	
49	Uwe Onelonge	Longa	Wangi-Wangi	568148.00	9418241.00	

50	Uwe Polio	Maleko	Wangi-Wangi	562486.00	9414095.00	
51	Uwe Pusalo	Posalu	Wangi-Wangi	561680.00	9414427.00	
52	Uwe Sapulo	Numana	Wangi Wangi Selatan	561077.00	9408761.00	
53	Uwe Tooge	Longa	Wangi-Wangi	569431.00	9417368.00	
54	Uwe Tooge 2	Longa	Wangi-Wangi	568282.00	9418183.00	



55	Uwe Uwatu	Liya Togo	Wangi Wangi Selatan	566268.67	9406164.34	
56	Uwe Uwatu 2	Liya Togo	Wangi Wangi Selatan	566253.27	9406152.07	
57	Uwe Uwatu 3	Liya Togo	Wangi Wangi Selatan	566234.78	9406133.67	
58	Uwe Wahaju	Wapia-pia	Wangi-Wangi	558006.00	9418822.00	
59	Uwe Wawo	Wapia-pia	Wangi-Wangi	557912.00	9418543.00	

60	Uwe Wulaa	Liya Togo	Wangi Wangi Selatan	565938.00	9406225.00	
61	Uweuwe	Liya Togo	Wangi Wangi Selatan	567035.00	9405422.00	
62	Waamaulo	Wungka	Wangi Wangi Selatan	564845.00	9413087.00	
63	Wagehegehe	Kelurahan Wanci	Wangi-Wangi	559295.00	9412170.17	
64	Walobu Besar	Liya Onemaelangka	Wangi Wangi Selatan	562279.00	9407266.00	





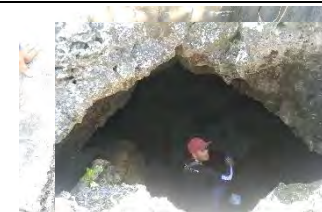
65	Walobu Kecil	Liya Onemaelangka	Wangi Wangi Selatan	562267.00	9407228.00
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66	Wapiapia Mohali	Sombu	Wangi-Wangi	557727.00	9417864.00
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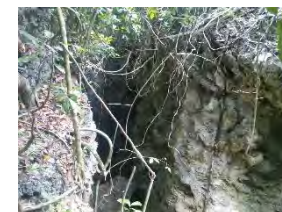
67	Wapiapia Momuda	Sombu	Wangi-Wangi	557760.00	9417632.00
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68	Wasaridi	Liya Onemaelangka	Wangi Wangi Selatan	562868.00	9406617.00
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69	Watutofengka	Wapia-pia	Wangi-Wangi	557594.09	9418231.79
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PEMERINTAH PROVINSI SULAWESI TENGGARA  
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UPTD BALAI LABORATORIUM KESEHATAN  
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Barrage Telp. (0401) 3197735  
email : labkes\_kendari@yahoo.co.id  
KENDARI 93116



### Appendix I.3. Laboratory analysis results of 19 water resources

LAPORAN HASIL UJI BAKTERIOLOGI  
No L.HU : 0705/110-11/XI/2022

No.FPPS	: 0705/PPS-11/XI/2022	No.Sampel	: 651 - AH
Project Id	: -	Jenis Sampel	: Mata Air 09
Nama Pelanggan	: Tn.Armid		Wapia Pia Momuda
Alamat	: Universitas Haluoleo		Des. Sumbu
Tlp/Fax	: 085397058000	Jumlah Sampel	: 250 ml
Personeel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Pemeriksaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	0	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diharuskan tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
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UPTD BALAI LABORATORIUM KESEHATAN  
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email : labkes\_kendari@yahoo.co.id  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No L.HU : 0704/L.HU-11/XI/2022

No.FPPS	: 0704/PPS-11/XI/2022	No.Sampel	: 650 - AB
Project Id	: -	Jenis Sampel	: Mata Air 08
Nama Pelanggan	: Tn.Armid		Ascho Lija Togo
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 250 ml
Tlp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personeel yang dihubungi	: Tn. Armid	Tgl Pemeriksaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	30	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diharuskan tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
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KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI  
No L.HU : 0701/LHU-B/XI/2022

No.FPPS	: 0701/FPPS-B/XI/2022	No.Sampel	: 649 - AB
Project Id	: -	Jenis Sampel	: Mata Air 07
Nama Pelanggan	: Tn.Armid		: Ewe Ata Liya Togo
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 250 MI
Tlp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personel yang dihubungi	: Tn. Armid	Tgl Penerimaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022


PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	22	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
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UPTD BALAI LABORATORIUM KESEHATAN  
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email : labkes\_kendari53@yahoo.co.id  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No L.HU : 0702/LHU-B/XI/2022

No.FPPS	: 0702/FPPS-B/XI/2022	No.Sampel	: 648 - AB
Project Id	: -	Jenis Sampel	: Mata Air 06
Nama Pelanggan	: Tn.Armid		: La Kentai Liya Togo
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 250 MI
Tlp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personel yang dihubungi	: Tn. Armid	Tgl Penerimaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022


PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	89 ✓	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



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DINAS KESEHATAN  
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email : labkes\_kendari53@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI  
No LHU : 0701/LHU-B/XI/2022

No.FPPS	: 0701/FPPS-B/XI/2022	No.Sampel	: 647 - AB
Project Id	: -	Jenis Sampel	: Mata Air 05
Nama Pelanggan	: Tn.Armid		La Rekaka
Alamat	: Universitas Haluoleo		Ds. Numama
Tlp/Fax	: 085397058000	Jumlah Sampel	: 250 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR					
No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	2	50 *	Tabung Ganda

\* Permenkes NO.32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LHU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



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LAPORAN HASIL UJI BAKTERIOLOGI  
No LHU : 07001/LHU-B/XI/2022

No.FPPS	: 07001/FPPS-B/XI/2022	No.Sampel	: 646 - AB
Project Id	: -	Jenis Sampel	: Mata Air 04
Nama Pelanggan	: Tn.Armid		Te Honik/Liya Togo
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 250 MI
Tlp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personel yang dihubungi	: Tn. Armid	Tgl Penerimaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR					
No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	0	50 *	Tabung Ganda

\* Permenkes NO.32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LHU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES





PEMERINTAH PROVINSI SULAWESI TENGGARA  
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UPTD BALAI LABORATORIUM KESEHATAN  
Jl. Kapten P. Tendean No. 50 Komp. RSU Bahteramas  
Baruga Telp. (0401) 3197735  
email : labkes\_kendari53@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI

No LRU : 0699/LRU-B/XI/2022

No.FPPS	: 0699/FPPS-B/XI/2022	No.Sampel	: 645 - AB
Project Id	: -	Jenis Sampel	: Mata Air 03
Nama Pelanggan	: Tn. Armid		: Emoito Liya Togo
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 250 MI
Tlp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personel yang dihubungi	: Tn. Armid	Tgl Penerimaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	0	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LRU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI

No LRU : 0698/LRU-B/XI/2022

No.FPPS	: 0698/FPPS-B/XI/2022	No.Sampel	: 644 - AB
Project Id	: -	Jenis Sampel	: Mata Air 02
Nama Pelanggan	: Tn. Armid		: Uwe-uwe, Jibir Pantai
Alamat	: Universitas Haluoleo		: Liya Togo
Tlp/Fax	: 085397058000	Jumlah Sampel	: 250 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	4	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LRU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No. L.HU : 0697/L.HU-B/XI/2022

No.FPPS	: 0697/FPPS-B/XI/2022	No.Sampel	: 643 - AB
Project Id	: -	Jenis Sampel	: 3 Mata Air 01
Nama Pelanggan	: Tn. Armid		Te' Bangka Meantu'u
Alamat	: Universitas Haluoleo		dan Ruku - Ruku
Tlp/Fax	: 085397058000	Jumlah Sampel	: 250 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	0	50 *	Tabung Ganda

\* Permeskes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 29 November 2022  
Kepala Seksi Mikrobiologi dan Immunologi

Fitri Dewi Yanti, SKM, MKes  
NIP.19780610 2008012 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI  
No. L.HU : 0715/L.HU-B/XI/2022

No.FPPS	: 0715/FPPS-B/XI/2022	No.Sampel	: 715 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 19
Nama Pelanggan	: Tn.Armid		Mata Air Ufe
Alamat	: Universitas Haluoleo		Bala-lami
Tlp/Fax	: 085397058000	Jumlah Sampel	: 300 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	8	50 *	Tabung Ganda

\* Permeskes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi

Fitri Dewi Yanti, SKM, MKes  
NIP.19780610 2008012 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No LHIU : 0714/LHIU-B/XI/2022

No.FPPS	: 0714/FPPS-B/XI/2022	No.Sampel	: 714 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 18
Nama Pelanggan	: Tn.Armid		: Mata Air Lauu Liya
Alamat	: Universitas Haluoleo		: Oneme Langka
Tlp/Fax	: 085397058000	Jumlah Sampel	: 300 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	45	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LHIU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
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F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No LHIU : 0713/LHIU-B/XI/2022

No.FPPS	: 0713/FPPS-B/XI/2022	No.Sampel	: 713 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 17
Nama Pelanggan	: Tn.Armid		: Mata Air Te'ekuea
Alamat	: Universitas Haluoleo		: Ds. Malako
Tlp/Fax	: 085397058000	Jumlah Sampel	: 300 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	2	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LHIU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES





PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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Boruga Telp. (0401) 3197735  
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KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI

No L.HU : 0712/L.HU-B /XI/2022

No.FPPS	: 0712/FPPS-B/XI/2022	No.Sampel	: 712 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 16
Nama Pelanggan	: Tn.Armid		Mata Air E'Huu
Alamat	: Universitas Haluoleo		Matahora
Tip/Fax	: 085397058000	Jumlah Sampel	: 300 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR					
No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	14	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SK.M.M.Kes  
NIP.19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI

No L.HU : 0711/L.HU-B /XI/2022

No.FPPS	: 0711/FPPS-B/XI/2022	No.Sampel	: 711 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 15
Nama Pelanggan	: Tn.Armid		Mata Air Liya
Alamat	: Universitas Haluoleo		Bete Besar
Tip/Fax	: 085397058000	Jumlah Sampel	: 300 MI
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR					
No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	2	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan L.HU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
  
Fitri Dewi Yanti, SK.M.M.Kes  
NIP.19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No LRU : 0710/LRU-B/XI/2022

No.FPPS	: 0710/FPPS-B/XI/2022	No.Sampel	: 710 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 14
Nama Pelanggan	: Tn.Armid	Mata Air Karke	
Alamat	: Universitas Haluoleo	Meantuu	
Tlp/Fax	: 085397058000	Jumlah Sampel	: 300 ML
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	0	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

- Hasil uji di atas hanya berlaku untuk sampel yang diuji.
- Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
- Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
- Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LRU.
- Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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email : labkes\_kendari@yahoo.co.id  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No LRU : 0709/LRU-B/XI/2022

No.FPPS	: 0709/FPPS-B/XI/2022	No.Sampel	: 709 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 13
Nama Pelanggan	: Tn.Armid	Mata Air Uwe Watu	
Alamat	: Universitas Haluoleo	Talang - Langi	
Tlp/Fax	: 085397058000	Jumlah Sampel	: 300 ML
Personel yang dihubungi	: Tn. Armid	Tgl Sampling	: 06/11/2022
Titik Koordinat	: -	Tgl Penerimaan	: 10/11/2022
		Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	0	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

- Hasil uji di atas hanya berlaku untuk sampel yang diuji.
- Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
- Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
- Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LRU.
- Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi  
  
Fitri Dewi Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No LHU : 0708/LHU-B /XI/2022

No.FPPS	: 0708/FPPS-B/XI/2022	No.Sampel	: 708 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 12
Nama Pelanggan	: Tn.Armid		Mata Air Uwe Morondo
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 300 MI
Tlp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personel yang dihubungi	: Tn. Armid	Tgl Penerimaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	0	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LHU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
Fitri Dewi Yanti, SKM,M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
UPTD BALAI LABORATORIUM KESEHATAN  
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Baruga Telp. (0401) 3197735  
email : labkes\_kendari53@yahoo.co.id  
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LAPORAN HASIL UJI BAKTERIOLOGI  
No LHU : 0707/LHU-B /XI/2022

No.FPPS	: 0707/FPPS-B/XI/2022	No.Sampel	: 707 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 11
Nama Pelanggan	: Tn.Armid		Mata Air Uwe Enunu
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 300 MI
Tlp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personel yang dihubungi	: Tn. Armid	Tgl Penerimaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/ 100 mL	2	50 *	Tabung Ganda

\* Permenkes NO. 32 Thn 2017 (Standar Baku Mutu Kesling dan Persyaratan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang Dan Permandian Umum )

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LHU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 5 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi /  
Fitri Dewi Yanti, SKM,M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES





PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
UPTD BALAI LABORATORIUM KESEHATAN  
Jl. Kapten P. Tendean No. 50 Komp. RSU Bahteramas  
Bungaya Telp. (0401) 3197735  
email : labkes\_kendari@pemprov-sultra.co.id  
KENDARI 93116



LAPORAN HASIL UJI BAKTERIOLOGI  
No LHU : 0706/LHU-B/XI/2022

No FPFS	: 0706/FPFS-B/XI/2022	No.Sampel	: 706 - AB
Project Id	: -	Jenis Sampel	: Air Bersih 10
Nama Pelanggan	: Tn.Armid		: Te'pehawa Mandari
Alamat	: Universitas Haluoleo	Jumlah Sampel	: 300 ML
Temp/Fax	: 085397058000	Tgl Sampling	: 06/11/2022
Personel yang dihubungi	: Tn. Armid	Tgl Penerimaan	: 10/11/2022
Titik Koordinat	: -	Tgl Pengujian	: 14 s/d 24/11/2022

PENGUJIAN BAKTERIOLOGI AIR

No	Parameter	Satuan	Hasil Pengujian	*Baku Mutu	*Spesifikasi Metode
1	Total Coliform	MPN/100 mL	0	50 *	Tabung Ganda

\* Permenkes NO. 32 Tahun 2017 (Standar Baku Mutu Kesling dan Penyehatan Kesehatan Untuk Keperluan Higienis Sanitasi, Kolam Renang dan Permandian Umum)

Catatan :

1. Hasil uji di atas hanya berlaku untuk sampel yang diuji.
2. Laporan Hasil Uji ini terdiri dari 1 (satu) halaman.
3. Laporan Hasil Uji ini tidak boleh digandakan, kecuali secara lengkap dan seijin tertulis dari UPTD Balai Laboratorium Kesehatan Provinsi Sulawesi Tenggara.
4. Laboratorium melayani complaint maksimum 1 (satu) minggu terhitung dari tanggal penyerahan LHU.
5. Pengambilan dan pengiriman sampel diluar tanggung jawab Balai LabKes Prov.SULTRA.

Kendari, 8 Desember 2022  
Kepala Seksi Mikrobiologi dan Immunologi  
  
Fitri Beni Yanti, SKM, M.Kes  
NIP. 19780610 200801 2 024

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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email : labkes\_kendari@pemprov-sultra.co.id  
KENDARI 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU	: 0837/LHU/KL-AB/LABKES/XI/2022	No. FPFS	: 0837/LHU/KL-AB/LABKES/XI/2022
Nama Pelanggan	: Armid	No. Sampel	: 019
Alamat	: Universitas Haluoleo	Jenis Sampel	: Muta Air Life Balaonisi Lya Togo
Personel Yang Dihubungi	: Armid	Tgl Sampling	: 06 - 11 - 2022
Temp/Fax	: 083397058000	Tgl Penerimaan	: 10 - 11 - 2022
Titik Koordinat	: -	Pengirim	: Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKTRIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	320	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	8,12	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	92,17	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,09	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	<0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	<0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	<0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	3,60	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	17,90	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	3,30	-	BOD Meter
12	Deterjen	mg/l	0,012	0,05	Spektrofotometrik
13	Fenol	mg/l	0,018	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	31	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

1. Hasil Uji diatas hanya berlaku untuk sampel yang diuji
2. Laporan Hasil Uji ini terdiri dari 1 Halaman
3. Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra
4. Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
5. Air yang siap dimasukkan kedalam kemasan/botol uji ulang diperika min. Sebulan sekali (Kepmenkes RI. No. 907/Menkes/SK/VII/2002)
6. Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel
7. \* Terakreditasi

Kendari, 14 November 2022  
Kepala Seksi Kimia dan Patologi  
  
Mubandil S.M.Kes  
Nip. 19661221 198703 1 090

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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e-mail : labkes.kendari53@yahoo.co.id  
KENDARE 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU : 0836/UHU/KL-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Titik Koordinat : -  
No. FPPS : 0836/UHU/KL-AB/LABKES/XI/2022  
No. Sampel : 018  
Jenis Sampel : Mata Air Laua Uya Onemelaneka  
Tgl Sampling : 06-11-2022  
Tgl Penyerimaan : 10-11-2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Asin	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	1530	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,48	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	1981,6	-	(SNI 06-2479-1991)
5	Amonia (NH <sub>3</sub> )	mg/l	0,16	0,0	(SNI 06-2480-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 19-1127-1989)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 6989.8:2009)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	3,80	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	12,10	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	1,50	-	BOD Meter
12	Deterjen	mg/l	< 0,01	0,05	Spektrofotometrik
13	Fenol	µg/l	< 0,001	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	80	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- Laporan Hasil Uji ini terdiri dari... 1 Halaman
- Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra
- Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
- Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebulan sekali (Kepmenkes RI No. 907/Menkes/SA/VI/2002)
- Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengembalian sampel dan pengiriman sampel
- \* Terakreditasi

Kendari, 28 November 2022  
Kepala Seksi Kimia dan Patologi  
Muhammad Sidiq M. Ken  
Nip. 19661231 198703 1 090

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
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e-mail : labkes.kendari53@yahoo.co.id  
KENDARE 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU : 0836/UHU/KL-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Titik Koordinat : -  
No. FPPS : 0836/UHU/KL-AB/LABKES/XI/2022  
No. Sampel : 017  
Jenis Sampel : Mata Air T'ekana Di Makko  
Tgl Sampling : 06-11-2022  
Tgl Penyerimaan : 10-11-2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	290	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,81	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	46,8	-	(SNI 06-2479-1991)
5	Amonia (NH <sub>3</sub> )	mg/l	0,06	0,0	(SNI 06-2480-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 19-1127-1989)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 6989.8:2009)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	4,10	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	21,40	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	4,60	-	BOD Meter
12	Deterjen	mg/l	0,032	0,05	Spektrofotometrik
13	Fenol	µg/l	0,026	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	116	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- Laporan Hasil Uji ini terdiri dari... 1 Halaman
- Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra
- Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
- Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebulan sekali (Kepmenkes RI No. 907/Menkes/SA/VI/2002)
- Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengembalian sampel dan pengiriman sampel
- \* Terakreditasi

Kendari, 28 November 2022  
Kepala Seksi Kimia dan Patologi  
Muhammad Sidiq M. Ken  
Nip. 19661231 198703 1 090

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
UPTD BALAI LABORATORIUM KESEHATAN  
Jl. Kapten Piere Tendean No. 50 Komplek RSUD Hutanmami Buraung Telp. (0401) 3197735  
e-mail : labkes\_kesra@510@yahoo.co.id  
KENDARI 93118



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LRU : 0833/LRU/KI-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Tik Koordinat : -  
No. FPPS : 0833/LRU/KI-AB/LABKES/XI/2022  
No. Sampel : 015  
Jenis Sampel : Muta Air Uya Bete Besar  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	850	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,38	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	460	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,06	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,01	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	3,30	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	17,19	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	3,60	-	BOD Meter
12	Deterjen	mg/l	< 0,01	0,05	Spektrofotometrik
13	Fenol	µg/l	< 0,001	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	30	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- Laporan Hasil Uji ini terdiri dari... Halaman
- Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra
- Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LRU
- Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebulan sekali (Kepmenkes RI No. 907/Menkes/SK/VII/2002)
- Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel
- \* Terakreditasi

Kendari, 28 November 2022  
Kepala Balai Labkes dan Stologi  
Muhammad S.M.Kes  
Nip. 19661231 198703 1 090

F-5.18.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
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e-mail : labkes\_kesra@510@yahoo.co.id  
KENDARI 93118



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LRU : 0812/LRU/KI-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Tik Koordinat : -  
No. FPPS : 0812/LRU/KI-AB/LABKES/XI/2022  
No. Sampel : 014  
Jenis Sampel : Muta Air Kerek - Mearatu'u  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	720	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,54	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	332,5	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,08	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	1,89	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	4,00	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	25,10	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	8,70	-	BOD Meter
12	Deterjen	mg/l	0,095	0,05	Spektrofotometrik
13	Fenol	µg/l	0,027	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	14	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- Laporan Hasil Uji ini terdiri dari... Halaman
- Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra
- Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LRU
- Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebulan sekali (Kepmenkes RI No. 907/Menkes/SK/VII/2002)
- Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel
- \* Terakreditasi

Kendari, 28 November 2022  
Kepala Balai Labkes dan Stologi  
Muhammad S.M.Kes  
Nip. 19661231 198703 1 090

F-5.18.4-LABKES





PEMERINTAH PROVINSI SULAWESI TENGGARA  
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Jln. Kapten Piere Tendean No. 50 Komplek RSJH Balarumahan Bontol Telp. (0401) 3197735  
e-mail : labkes\_kendari@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJIKIMIA LINGKUNGAN

No. UHU : 0831/UHU/KL-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 08539708000  
Titik Koordinat : -  
No. FPPS : 0831/UHU/KL-AB/LABKES/XI/2022  
No. Sampel : 013  
Jenis Sampel : Mata Air Uluw Wata, Telang Lang  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	200	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	8,11	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	184,3	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,1	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,03	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	4,20	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	16,70	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	2,10	-	BOD Meter
12	Deterjen	mg/l	< 0,01	0,05	Spektrofotometrik
13	Fenol	µg/l	< 0,001	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	24	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- 1 Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- 2 Laporan Hasil Uji ini terdiri dari... Halaman
- 3 Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra
- 4 Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan UHU
- 5 Air yang siap dimasukkan kedalam kemasan/botol isi ulang diproses min. Sebulan sekali (Kepmenkes RI No. 907/Menkes/SK/VII/2009)
- 6 Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap penyalahgunaan sampel dan pengiriman sampel
- 7 \* Terakreditasi

Kendari, 28 November 2022  
Kepala Balai Labkes dan Patologi  
Mulya H. S. M. R. S.  
Nip. 19661231 198703 1 090

F.5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
UPDT BALAI LABORATORIUM KESEHATAN  
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e-mail : labkes\_kendari@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJIKIMIA LINGKUNGAN

No. UHU : 0830/UHU/KL-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 08539708000  
Titik Koordinat : -  
No. FPPS : 0830/UHU/KL-AB/LABKES/XI/2022  
No. Sampel : 012  
Jenis Sampel : Mata Air Uluw Morondo  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	840	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	8,04	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	460	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,11	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	3,76	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	18,40	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	3,60	-	BOD Meter
12	Deterjen	mg/l	0,022	0,05	Spektrofotometrik
13	Fenol	µg/l	0,016	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	20	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- 1 Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- 2 Laporan Hasil Uji ini terdiri dari... Halaman
- 3 Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra
- 4 Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan UHU
- 5 Air yang siap dimasukkan kedalam kemasan/botol isi ulang diproses min. Sebulan sekali (Kepmenkes RI No. 907/Menkes/SK/VII/2009)
- 6 Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap penyalahgunaan sampel dan pengiriman sampel
- 7 \* Terakreditasi

Kendari, 28 November 2022  
Kepala Balai Labkes dan Patologi  
Mulya H. S. M. R. S.  
Nip. 19661231 198703 1 090

F.5.10.4-LABKES





PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
UPD BALAI LABORATORIUM KESEHATAN  
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e-mail : labkes\_kendari@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU : 0829/LHU/KI-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Titik Koordinat : -  
No. FPPS : 0829/LHU/KI-AB/LABKES/XI/2022  
No. Sampel : 011  
Jenis Sampel : Mata Air Uwe Emumu  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	570	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,59	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	332,5	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,08	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	3,80	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	18,90	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	4,70	-	BOD Meter
12	Deterjen	mg/l	0,018	0,05	Spektrofotometrik
13	Fenol	µg/l	0	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	102	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

- Catatan :
- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
  - Laporan Hasil Uji ini terdiri dari... Halaman
  - Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPD Balai Labkes Prov. Sultra
  - Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
  - Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebulan sekali (Kepmenkes RI. No. 907/Menkes/SA/VI/2003)
  - Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel
  - \* Terakreditasi

Kendari, 28 November 2022  
Kepala Balai Kimia dan Patologi  
  
NIP. 19661231 198703 1 090

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
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e-mail : labkes\_kendari@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU : 0828/LHU/KI-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Titik Koordinat : -  
No. FPPS : 0828/LHU/KI-AB/LABKES/XI/2022  
No. Sampel : 010  
Jenis Sampel : Mata Air Ter Epehawa Mandati (i  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	700	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,87	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	414,7	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,1	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	3,80	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	14,80	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	1,10	-	BOD Meter
12	Deterjen	mg/l	0,012	0,05	Spektrofotometrik
13	Fenol	µg/l	0	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	10	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

- Catatan :
- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
  - Laporan Hasil Uji ini terdiri dari... Halaman
  - Laporan Hasil Uji ini tidak boleh digandakan kecuali secara dan seijin tertulis UPD Balai Labkes Prov. Sultra
  - Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
  - Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebulan sekali (Kepmenkes RI. No. 907/Menkes/SA/VI/2003)
  - Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel
  - \* Terakreditasi

Kendari, 28 November 2022  
Kepala Balai Kimia dan Patologi  
  
NIP. 19661231 198703 1 090

F-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
UPTD BALAI LABORATORIUM KESEHATAN  
Jl. Kapten Piere Tendean No. 50 Komplek Balaikesehatan Baruga Telp. (0401) 3197735  
e-mail : balikes\_kendari@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU : 0827/LHU/KL-AB/LABKES/XI/2022 No. FPSP : 0827/LHU/KL-AB/LABKES/XI/2022  
Nama Pelanggan : Armid No. Sampel : 008  
Alamat : Universitas Haluoleo Jenis Sampel : Mata Air Waduga Pita, Marmuda Di Somba  
Personel Yang Dihubungi : Armid Tgl Sampling : 06 - 11 - 2022  
Telp/Fax : 085397058000 Tgl Penerimaan : 10 - 11 - 2022  
Tik Koordinat : - Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Asin	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	1540	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,57	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	4702	-	(SNI 06-2479-1991)
5	Amonia (NH <sub>3</sub> )	mg/l	0,02	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	<0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	<0,001	1	(SNI 19-1127-1989)
8	Timbal *	(Pb)	mg/l	<0,0004	0,05 (SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	4,45	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	20,20	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	3,10	-	BOD Meter
12	Deterjen	mg/l	<0,001	0,05	Spektrofotometri
13	Fenol	µg/l	<0,001	-	Spektrofotometri
14	Total Padatan Tersuspensi (TSS)	mg/l	22	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- Laporan Hasil Uji ini terdiri dari 1 Halaman
- Laporan Hasil Uji ini tidak boleh dipergunakan secara utuh dan sejin tertulis UPTD Balai Labkes Prov. Sultra
- Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
- Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebelas sekali (Kepmenkes RI No. 907/Menkes/SK/VII/2002)
- Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel
- \* Terakreditasi

Kendari, 28 November 2022

Kepala Balai Labkes

Mahyudin S. R. Kes

Nip. 39661231 198703 1 090

P-5.10.4-LABKES



PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
UPTD BALAI LABORATORIUM KESEHATAN  
Jl. Kapten Piere Tendean No. 50 Komplek Balaikesehatan Baruga Telp. (0401) 3197735  
e-mail : balikes\_kendari@yahoo.co.id  
KENDARI 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU : 0826/LHU/KL-AB/LABKES/XI/2022 No. FPSP : 0826/LHU/KL-AB/LABKES/XI/2022  
Nama Pelanggan : Armid No. Sampel : 008  
Alamat : Universitas Haluoleo Jenis Sampel : Mata Air Esabo Uya Togo  
Personel Yang Dihubungi : Armid Tgl Sampling : 06 - 11 - 2022  
Telp/Fax : 085397058000 Tgl Penerimaan : 10 - 11 - 2022  
Tik Koordinat : - Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Asin	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	1150	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,76	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	1013	-	(SNI 06-2479-1991)
5	Amonia (NH <sub>3</sub> )	mg/l	0,03	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	3,42	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	<0,001	1	(SNI 19-1127-1989)
8	Timbal *	(Pb)	mg/l	<0,0004	0,05 (SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	4,37	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	20,10	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	3,10	-	BOD Meter
12	Deterjen	mg/l	0,021	0,05	Spektrofotometri
13	Fenol	µg/l	0,022	-	Spektrofotometri
14	Total Padatan Tersuspensi (TSS)	mg/l	21	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air

Catatan :

- Hasil Uji diatas hanya berlaku untuk sampel yang diuji
- Laporan Hasil Uji ini terdiri dari 1 Halaman
- Laporan Hasil Uji ini tidak boleh dipergunakan secara utuh dan sejin tertulis UPTD Balai Labkes Prov. Sultra
- Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
- Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperiksa min. Sebelas sekali (Kepmenkes RI No. 907/Menkes/SK/VII/2002)
- Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel
- \* Terakreditasi

Kendari, 28 November 2022

Kepala Balai Labkes

Mahyudin S. R. Kes

Nip. 39661231 198703 1 090

P-5.10.4-LABKES

**PEMERINTAH PROVINSI SULAWESI TENGGARA**  
**DINAS KESEHATAN**  
**UPTD BALAI LABORATORIUM KESEHATAN**  
Jln. Kapten Here Tendean No. 50, Komp. RSJ Rahmatan Mangga Telp. (0401) 3197735  
e-mail : labkes.kendari@dyahpoko.co.id  
**KENDARI 93116**

**LAPORAN HASIL UJI KIMIA LINGKUNGAN**

No. LHU : 0825/LHU/AB/LABKES/KI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Titik Koordinat : -

No. FPPS : 0825/LHU/AB/LABKES/KI/2022  
No. Sampel : 007  
Jenis Sampel : Mata Air Ene Ata Uya Togo  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	690	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,87	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	460	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,02	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	4,78	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	12,70	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	0,90	-	BOD Meter
12	Deterjen	mg/l	< 0,001	0,05	Spektrofotometrik
13	Fenol	µg/l	< 0,001	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	24	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Penyerapan Kesehatan Air  
Catatan :  
1 Hasil Uji diatas hanya berlaku untuk sampel yang diuji  
2 Laporan Hasil Uji ini terdiri dari... Halaman  
3 Laporan Hasil Uji ini tidak boleh dipgandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra  
4 Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU  
5 Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperika min. Sebulan sekali  
(Kepmenkes RI. No. 907/Menkes/SA/VI/2002)  
6 Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel  
7 \* Terakreditasi

Kendari, 28 November 2022  
Kepala Seksi Patologi  
**Muhayyidul H. Khatib**  
Nip. 196612131987031090

F-5.10.4-LABKES

**PEMERINTAH PROVINSI SULAWESI TENGGARA**  
**DINAS KESEHATAN**  
**UPTD BALAI LABORATORIUM KESEHATAN**  
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e-mail : labkes.kendari@dyahpoko.co.id  
**KENDARI 93116**

**LAPORAN HASIL UJI KIMIA LINGKUNGAN**

No. LHU : 0825/LHU/AB/LABKES/KI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Haluoleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Titik Koordinat : -

No. FPPS : 0825/LHU/AB/LABKES/KI/2022  
No. Sampel : 006  
Jenis Sampel : Mata Air Labakal Uya Togo  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Ajin	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	1400	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,47	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	1474	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,02	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	2,56	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	4,31	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	12,70	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	1,90	-	BOD Meter
12	Deterjen	mg/l	< 0,001	0,05	Spektrofotometrik
13	Fenol	µg/l	< 0,001	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	26	-	Gravimetri

Permenkes No. 32 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan dan Penyerapan Kesehatan Air  
Catatan :  
1 Hasil Uji diatas hanya berlaku untuk sampel yang diuji  
2 Laporan Hasil Uji ini terdiri dari... Halaman  
3 Laporan Hasil Uji ini tidak boleh dipgandakan kecuali secara dan seijin tertulis UPTD Balai Labkes Prov. Sultra  
4 Balai Labkes Prov. Sultra melayani pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU  
5 Air yang siap dimasukkan kedalam kemasan/botol isi ulang diperika min. Sebulan sekali  
(Kepmenkes RI. No. 907/Menkes/SA/VI/2002)  
6 Balai Labkes Prov. Sultra tidak bertanggung jawab terhadap pengambilan sampel dan pengiriman sampel  
7 \* Terakreditasi

Kendari, 28 November 2022  
Kepala Seksi Patologi  
**Muhayyidul H. Khatib**  
Nip. 196612131987031090

F-5.10.4-LABKES





PEMERINTAH PROVINSI SULAWESI TENGGARA  
DINAS KESEHATAN  
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Jln. Kapten Piere Tendean No. 50 Komplek RSJ Bantaramas Baruga Telp. (0401) 3197725  
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KENDARI 93116



LAPORAN HASIL UJI KIMIA LINGKUNGAN

No. LHU : 0822/LHU/KI-AB/LABKES/XI/2022  
Nama Pelanggan : Armid  
Alamat : Universitas Halaaleo  
Personel Yang Dihubungi : Armid  
Telp/Fax : 085397058000  
Titik Koordinat : -  
No. FPPS : 0822/LHU/KI-AB/LABKES/XI/2022  
No. Sampel : 005  
Jenis Sampel : Mata Air Labekera Di Numana  
Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	1350	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,76	6,5 - 8,5	(SNI 06-6989-11-2004)
4	Klorida (Cl)	mg/l	559,5	-	-
5	Amonia (NH <sub>4</sub> )	mg/l	0,06	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	2,51	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	4,51	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	18,30	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	3,30	-	BOD Meter
12	Deterjen	mg/l	0,017	0,05	Spektrofotometrik
13	Fenol	µg/l	0,014	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	20	-	Gravimetri

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- 4 Balai Labkes Prov. Sultra meyakini pengaduan/complaint max. 1 (satu) minggu terhitung dari tanggal penyerahan LHU
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- 8 \* Terakreditasi

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No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	540	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,94	6,5 - 8,5	(SNI 06-6989-11-2004)
4	Klorida (Cl)	mg/l	553	-	-
5	Amonia (NH <sub>4</sub> )	mg/l	0,09	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8:2009)
9	Dissolved Oxygen (DO)	mg/l	4,95	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	18,20	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	2,60	-	BOD Meter
12	Deterjen	mg/l	0,018	0,05	Spektrofotometrik
13	Fenol	µg/l	0,011	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	22	-	Gravimetri

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Tgl Sampling : 06 - 11 - 2022  
Tgl Penerimaan : 06 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Asin	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	1380	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,86	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	1474	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,05	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	4,50	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	10,10	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	0,80	-	BOD Meter
12	Deterjen	mg/l	< 0,001	0,05	Spektrofotometrik
13	Fenol	µg/l	< 0,001	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	22	-	Gravimetri

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7 \* Terakreditasi

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Bibir Pantai Uya Togo  
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Tgl Penerimaan : 10 - 11 - 2022  
Pengirim : Armid

No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Asin	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	1260	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,85	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	1152	-	-
5	Amonia (NH <sub>3</sub> )	mg/l	0,010	0,0	(SNI 06-2479-1991)
6	Nitrat (NO <sub>3</sub> )	mg/l	< 0,02	10	(SNI 06-2480-1991)
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	4,15	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	15,70	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	1,40	-	BOD Meter
12	Deterjen	mg/l	< 0,01	0,05	Spektrofotometrik
13	Fenol	µg/l	< 0,001	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	10	-	Gravimetri

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Tgl Penyerahan : 10 - 11 - 2022  
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No	PARAMETER	SATUAN	HASIL	BAKU MUTU	SPEKIFIKASI METODE
1	Rasa	-	Tidak Berasa	Tidak Berasa	Organoleptis
2	Total Padatan Terlarut (TDS)	mg/l	800	1000	(SNI 06-2413-1991)
3	pH (Derajat Keasaman) *	-	7,58	6,5 - 8,5	(SNI 06-6989.11-2004)
4	Klorida (Cl)	mg/l	599,1	-	-
5	Amonia (NH <sub>4</sub> )	mg/l	0,09	0,0	(SNI 06-2479-1991)
6	Sulfat (SO <sub>4</sub> )	mg/l	< 0,02	400	Spektrofotometrik
7	Besi (Fe)	mg/l	< 0,001	1	(SNI 19-1127-1989)
8	Timbal *	mg/l	< 0,0004	0,05	(SNI 6989.8-2009)
9	Dissolved Oxygen (DO)	mg/l	4,20	-	Titrimetri
10	Chemical Oxygen Demand (COD)	mg/l	16,20	-	Titrimetri
11	Biological Oxygen Demand (BOD)	mg/l	2,20	-	BOD Meter
12	Desygen	mg/l	0,017	0,05	Spektrofotometrik
13	Fenol	ppb	0,006	-	Spektrofotometrik
14	Total Padatan Tersuspensi (TSS)	mg/l	53	-	Gravimetri

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# CORAL REEF ECOSYSTEM AND SEAGRASS IN WANGI-WANGI AS WELL AS MANGROVE CONDITION IN KALEDUPA

## Chapter 2

### A. Coral Reef Ecosystem Condition

Coral reef data was collected using the Underwater Photo Transect (UPT) method. Field data in photographs per frame were identified using the CPCe (Coral Point Count with excel extension) tool to classify coral lifeforms, coral cover, and others (Kohler & Gill, 2006). Photo analysis on the CPCe device was carried out in several stages, i.e., determining photo frames, determining frame boundaries, overlaying random points, identifying substrates at each random point, then storing and processing data in an excel spreadsheet (Kohler & Gill, 2006). The number of random points used in one photo frame is 30 random points. The number of random points is determined based on the area of the photo frame.

Determining coral lifeform types refers to LIPI (2006) and Jonker et al. (2008), as shown in Table 8.

Table 8. Group Code of coral lifeforms and coral benthic (biota and substrate)

Code	Description
HC	<i>Hard Coral</i> (HC = AC+NA)
- AC	<i>Acropora</i> : ACB, ACD, ACE, ACS, ACT
- NA	<i>Non Acropora</i> = CB, CE, CS, CF, CHL, CM, CME,CTU, CMR
DC	<i>Dead Coral</i>
DCA	<i>Dead Coral with Algae</i> = DCA + TA (TurfAlgae)
SC	<i>Soft Coral</i>
SP	<i>Sponge</i>
FS	<i>Fleshy Seaweed</i> = alga = MA (Macro Algae) + AA (Algae Assemblage)
OT	<i>Other Fauna</i> = fauna lain = CA (Coraline Algae) + HA (Halimeda) + ZO (Zoanthid) +OT
R	<i>Rubble</i>
S	<i>Sand</i>
SI	<i>Silt</i>
RK	<i>Rock</i>

The percentage of coral cover in each photo frame is calculated using the equation below.

$$\text{Coral cover (\%)} = \frac{\text{Points number of category}}{\text{Total Random points}} \times 100$$

The coral cover for each transect determines the condition category of coral reefs. The reference to the live coral cover area is based on the criteria stated in the attachment to the Decree of the Environmental Minister of Indonesia No. 4 (2001) as follows:

1. Damaged = 0.0 – 24.9 %
2. Medium = 25.0 – 49.9%
3. Good = 50.0 – 74.9%
4. Very good = 75.0 – 100%

This study conducted coral reef observations at 10 (ten) stations in Wangi-Wangi Island (Table 9)

Table 9. Observation location of coral reefs condition

Station	Coordinate Points		Description of Locations (name)
	East	South	
1	123°38'21.12"E	5°23'43.08"S	Marine Protected Area (MPA) Liya Togo
2	123°34'23.48"E	5°24'18.54"S	Non MPA: Seaweed culture area
3	123°30'8.73"E	5°20'5.36"S	Non MPA: Kapota Isle
4	123°31'38.74"E	5°19'14.11"S	Non MPA: Marina Beach
5	123°31'19.74"E	5°16'58.14"S	MPA Sombu
6	123°31'34.92"E	5°14'56.82"S	MPA Waha
7	123°34'47.28"E	5°14'41.34"S	MPA Longa
8	123°35'18.90"E	5°14'47.01"S	Non MPA Longa Village
9	123°36'34.02"E	5°15'30.48"S	MPA Patuno
10	123°38'59.64"E	5°18'17.22"S	MPA Matahora

### 1. Coral Reefs at Station 1 (MPA: Liya Togo)

Based on observations, Station 1, the Marine Protected Area, is Sumanga Island waters and the area of Liya Togo Village. This site is located at coordinates 05°23.954' S and 123°38.526' E. The percentage of live coral cover (hard and soft coral) at the observation site was 72.72%, where hard coral cover reached 13.47 % while soft coral reached 59.250%. Massive coral life was highly dominated by hard corals for 10.08%. The percentage for dead coral and abiotic (sand and rock) was 15.81% and 9.81%, respectively.

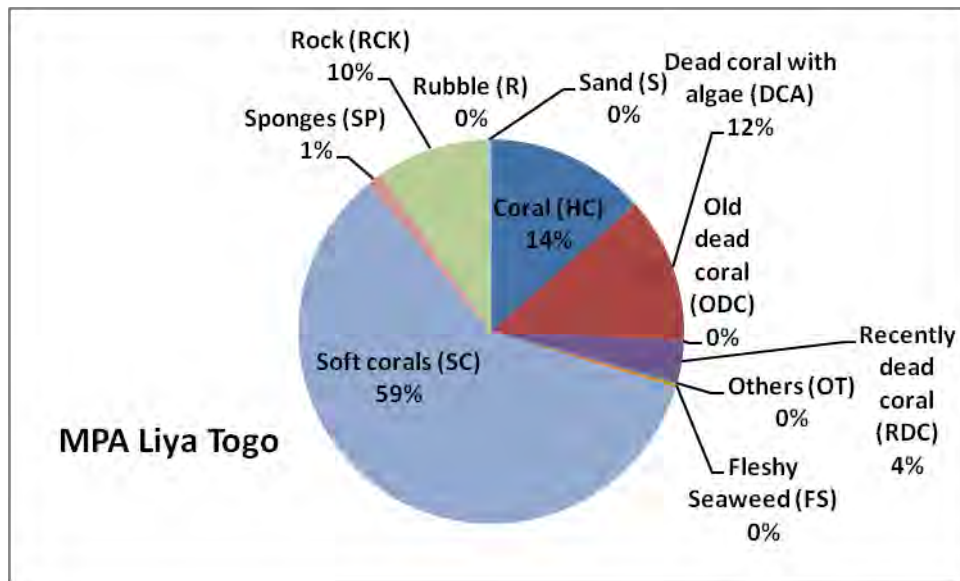


Figure 13. Coral cover distribution at the Liya Togo MPA observation site

Seven types of Hard Coral growth were found at the observation site of Station 1. They were *Acropora branching* (ACB), *coral massive* (CM), *submassive coral* (CSM), *Acropora submassive* (ACS), *Coral branching* (CB), *Coral encrusting* (CE), and *Coral heliopora* (CHL). Basic substrate constituent categories are grouped into 5 major groups, including hard coral, death coral, algae, other biotic, and abiotic.

The soft corals were mostly found at Station 1. Environmental factors are likely important factors affecting soft corals' distribution and abundance, which are the interaction of biological and physical factors. These animals often spread at depths below the lowest ebb to avoid the drying process. In shallow waters, wave motion is also a limiting factor for soft corals to colonize, while in deep waters, light availability is a limiting factor for soft corals to colonize (Tursch and Tursch, 1982). Additionally, competitive interactions with other coral organisms play an important role in determining the distribution of soft corals (Benayahu, 1985). Another factor affecting the distribution of soft corals in shallow waters is the type of substrate. Some soft coral colonies need a stable place and substrate for attachment. Soft corals are always abundant on dead coral and bedrock. It is considered that the substrate attachment of soft corals is the dead coral rock.

The high percentage of hard and soft coral cover indicates that the coral reef ecosystem at the station is still well-preserved and has not been affected by human activities. The observation area is far from residential areas and is not a traditional

shipping route. Based on the table of coral reef categories, the condition of coral reefs at Station 1 is good (Figure 14).

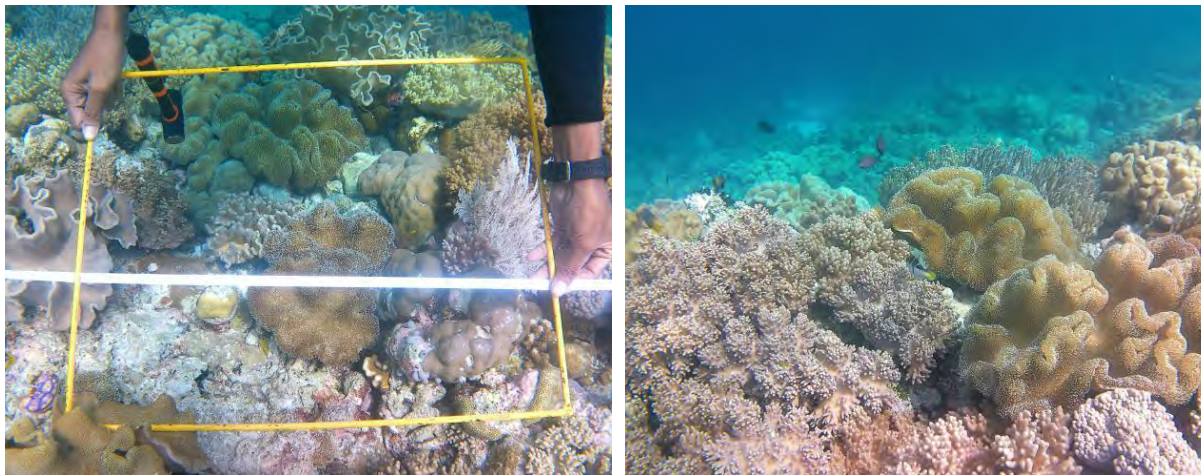


Figure 14. Coral reef health observations at Station 1

## 2. Coral Reefs at Station 2 (Non MPA: Seaweed Culture Area)

The Station 2 area administratively belongs to the Liya Togo Village area, located at the coordinates 05°24.192' S and 123°34.410' E. There are 11 types of hard coral growth forms found at station 2: *Acropora branching* (ACB), *Acropora Digitata* (ACD), *Acropora Submassive* (ACS), *Acropora Tabuate* (ACT), *Coral Branching* (CB), *Coral Encrusting* (CE), *Coral Foliose* (CF), *Coral Massive* (CM), *Coral Millepora* (CME), *Coral Mushroom* (CMR), and *Coral Submassive* (CS). The percentage of those coral growths can be seen in Figure 15.

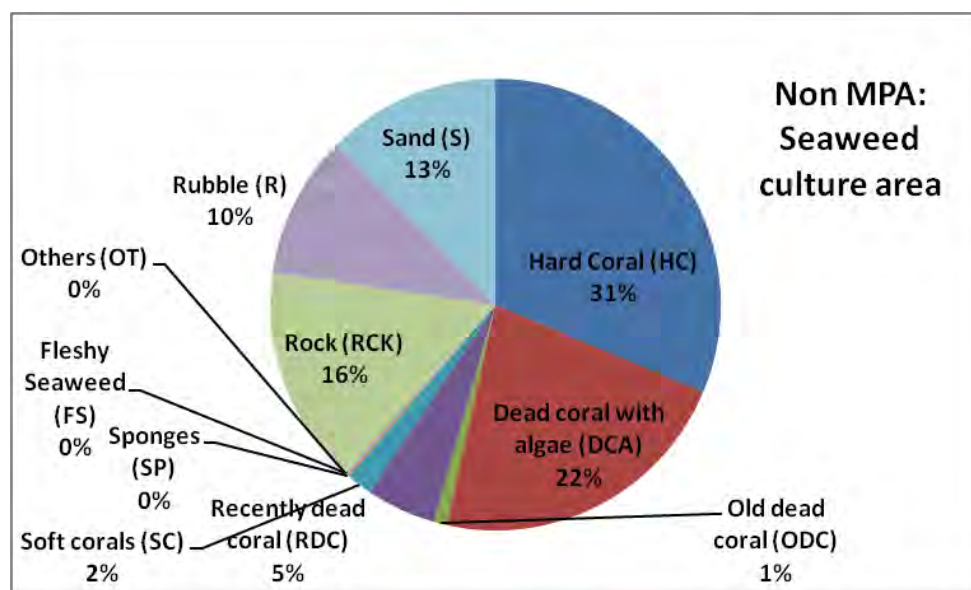


Figure 15. Coral cover categories at Station 2, the seaweed culture area.



Based on data analysis at Station 2 (which is the seaweed cultivation area), the percentage of bottom substrate cover by live coral was 33.22% (hard coral = 31.36% and soft coral = 1.86 %). The highest percentage of hard coral was found at massive corals group (CM) of 19.49%, while the lowest percentage of hard coral was found at foliose (CF) and millepora (CME) corals of 0.8%.

The condition of coral reefs in this area is considered a moderate category. Shipping, fishing boat traffic, and cultivating seaweed affect this coral cover's health. Those activities are considered a cause of high habitat degradation at the observation sites. It discloses that dead coral algae (DCA) reached 22.12%, while RDC and ODC were 5% and 0.93%, respectively. At this location, the abiotic category was 38.9%, consisting of sand, rocks, and coral rubble of 12.46%, 15.68%, and 10.25%, respectively. Figure 16 shows the condition of coral reefs at the station.

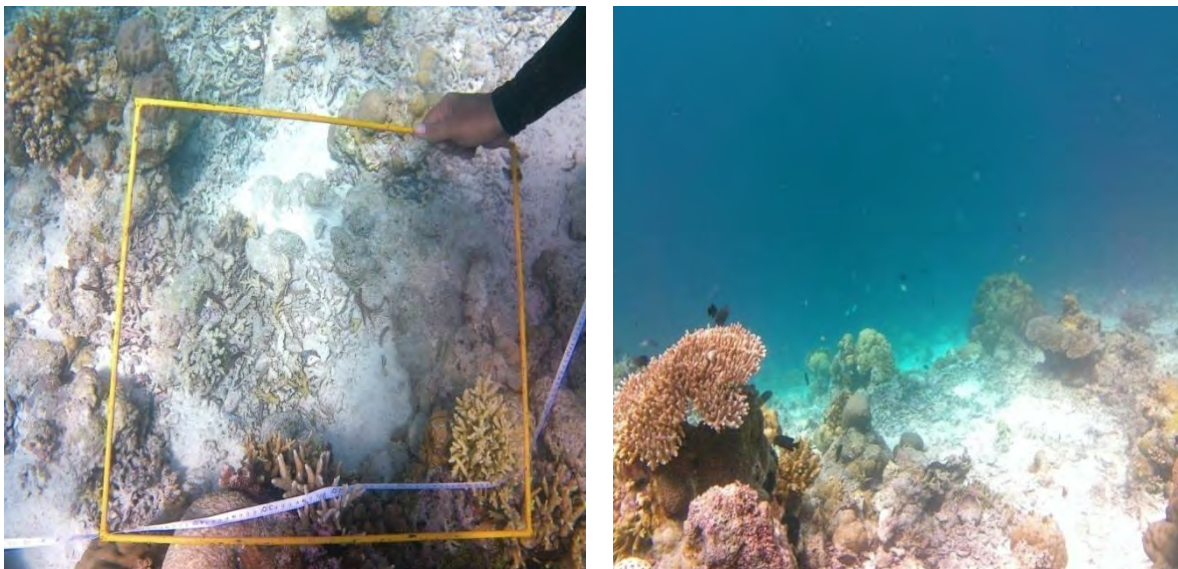


Figure 16. Coral reef health observation at Station 2, around the seaweed cultivation area of Liya Togo Village.

### 3. Coral Reefs at Station 3 (Non-MPA: Kapota Isle)

Station 3 (Kapota Isle) located at coordinates 05°20.269' S and 123°30.419' E. At this station, a live coral component consisted of a hard coral with a cover percentage of 55.73% (good category). The condition of coral reefs at this station can be seen in Figure 17. The hard coral consisted of 9 growth forms, i.e.: *Acropora Encrusting (ACE)*, *Acropora Submassive (ACS)*, *Coral Branching (CB)*, *Coral Encrusting (CE)*, *Coral Foliose (CF)*, *Coral Massive (CM)*, *Coral Millepora (CME)*, *Coral Mushroom (CMR)*, and *Coral Submassive (CS)*.

The highest percentage of hard coral cover was CM, by 24.69%, while the smallest was CME, by 0.08%.

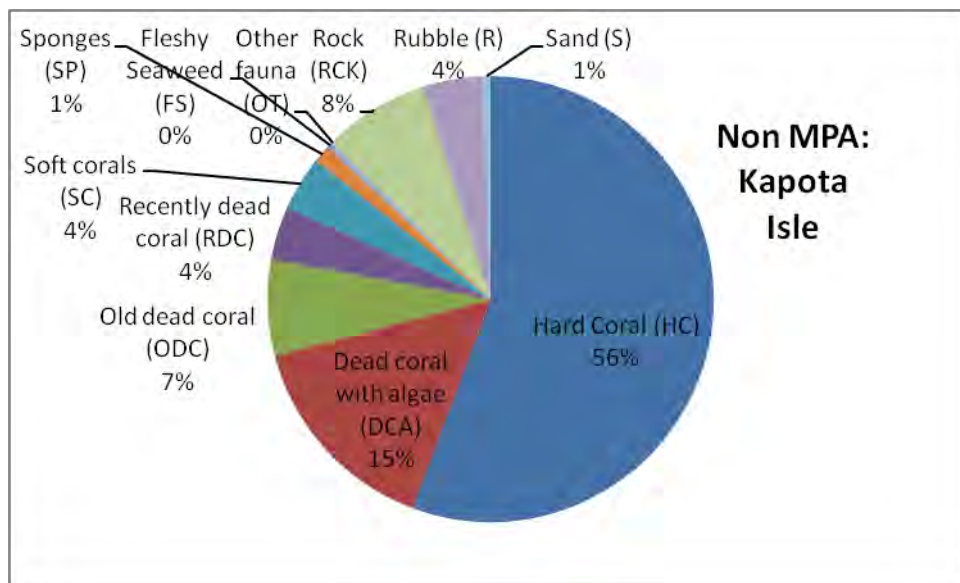


Figure 17. Coral cover distribution at Station 3, Kapota Isle waters

Figure 17 indicates that live coral cover (hard and soft corals) is 59.68%, and dead coral cover (DCA, RDC, and ODC) at the observation site is 26.00% (remains high). The level of coral dead in this observation area is high because it is nearby a residential area. The observers also found a lot of plastic waste scattered in the sea bed.



Figure 18. Coral reefs health at Station 3, Non-MPA Kapota Island



#### 4. Coral Reefs at Station 4 (Non MPA: Marina Beach)

Station 4 - Marina Beach is in the Pongo Village area at coordinates 05°19.561' S and 123°31.974' E. This station is near the center of community activities in Wanci City. Its live coral/hard coral cover was found to be 61.49% (good category). The hard coral components consisted of 11 growth forms, i.e.: *Acropora branching* (ACB), *Acropora Digitata* (ACD), *Acropora Encrusting* (ACE), *Acropora Submassive* (ACS), *Coral Branching* (CB), *Coral Encrusting* (CE), *Coral Foliose* (CF), *Coral Massive* (CM), *Coral Mushroom* (CMR), and *Coral Submassive* (CS). Of the several growth forms, the largest percentage was coral foliose, with 11.59%, while the smallest was *Acropora Digitate*, with 0.07%. Other components including soft corals, anemones, and sponges are found with a percentage of 3.89%. At this station, abiotic components were also found consisting of sand and broken coral, dead coral, and dead coral overgrown with algae, with a percentage of 13.19%. Figure 19 shows coral cover observation at station 4.

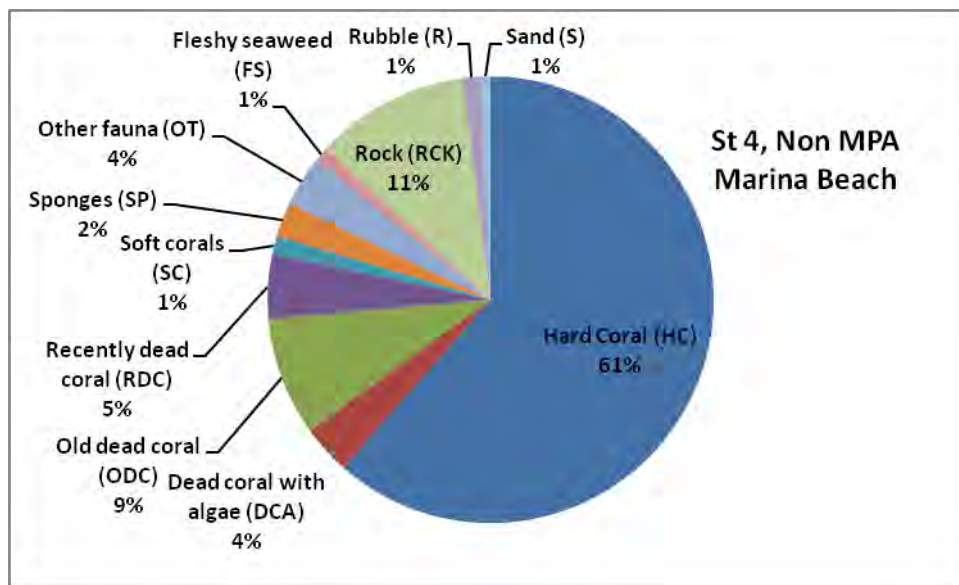


Figure 19. Coral cover distribution at Station 4 (Non MPA - Marina Beach)

The level of coral cover at station 4 was in a good category, even though it is close to settlements and shipping route activities. The water is in a good category, with water conditions clear enough to allow corals to grow well. The condition of the coral reefs can be seen in Figure 20 below.



Figure 20. Coral reefs at Station 4, Marina Beach

### 5. Coral Reefs at Station 5, MPA Sombu

The coastal area of Sombu Village is located at coordinates 05°16.969' S and 123°31.329'. At this station, it was found that the living coral component consisting of hard coral and soft coral components of 47.58% (medium category). The types of coral growth found at this station are *Acropora branching* (ACB), *Acropora Digitata* (ACD), *Acropora Encrusting* (ACE), *Acropora Submassive* (ACS), *Coral Branching* (CB), *Coral Encrusting* (CE), *Coral Heiopora* (CHL), *Coral Foliose* (CF), *Coral Massive* (CM), *Coral Millepora* (CME), *Coral Mushroom* (CMR), and *Coral Submassive* (CS). Another group was the algae at 28.73%; the dominating one was the *halimeda* type at 26.96%. Also, abiotic components consisting of sand, broken coral components, dead coral, and dead coral overgrown with algae were found.

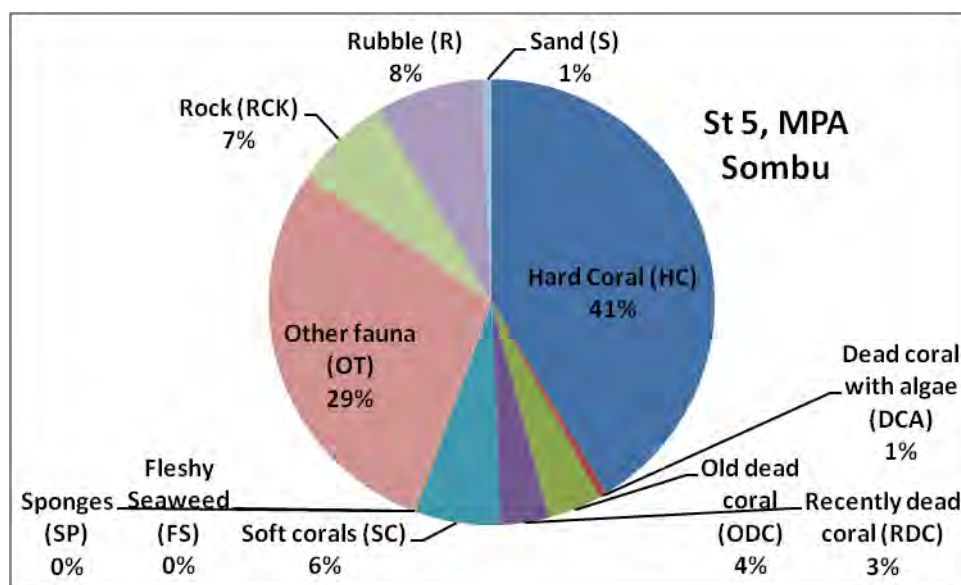


Figure 21. Percentage of coral cover at Station 5, MPA Sombu

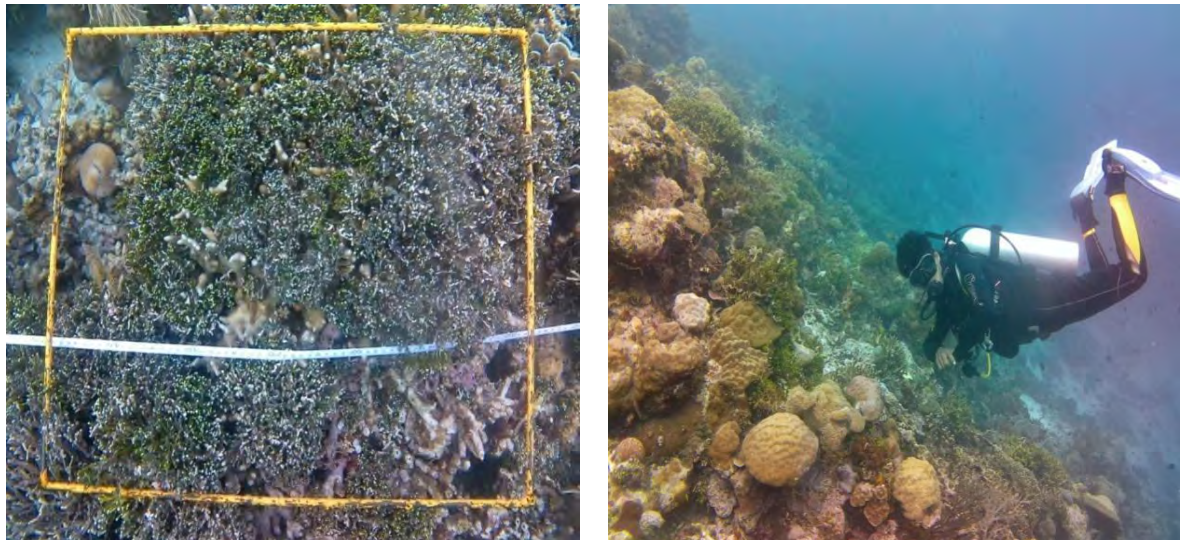


Figure 22. Coral reefs observation at Station 5, MPA Sombu

The level of live coral cover at station 5 MPA Sombu is in the medium category, with high algae cover at the station. The algae type that dominates at station 5 is the *halimeda* type. Halimeda alga grows between submissive hard corals.

## 6. Coral Reefs at Station 6 (MPA: Waha)

Station 6 is located at coordinates 05°14.947'S and 123°31.582'E. At this station, a live coral component comprised a hard coral component with a cover percentage of 57.16% (good category). The coral reefs' health at this station can be seen in Figure 23.

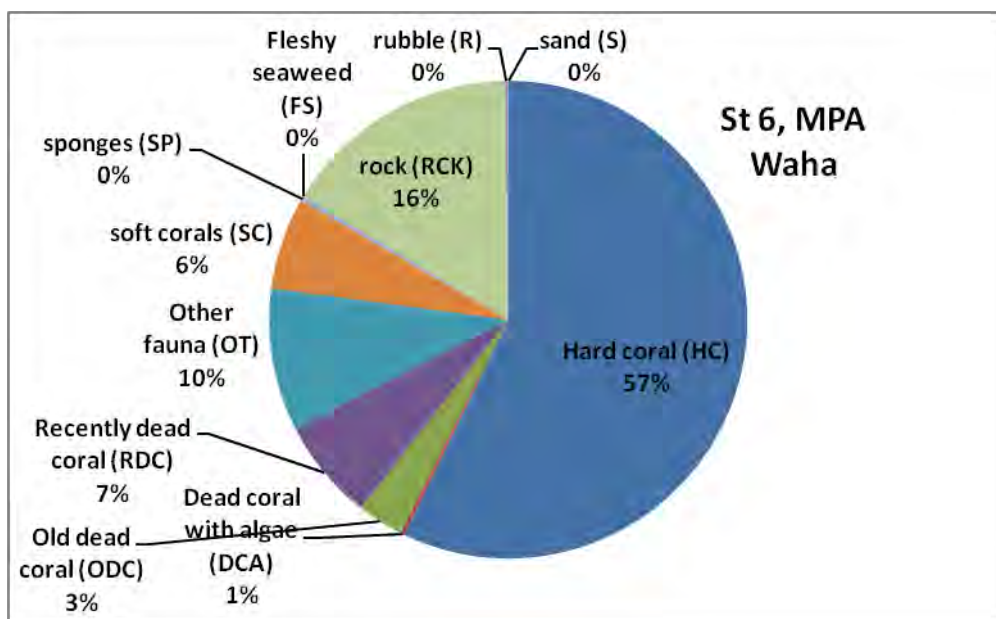


Figure 23. Percentage of coral cover at Station 6, MPA Waha



The hard coral components consist of *Acropora branching* (ACB), *Acropora Digitata* (ACD), *Acropora Encrusting* (ACE), *Acropora Submassive* (ACS), *Acropora Tabulate* (ACT), *Coral Branching* (CB), *Coral Encrusting* (CE), *Coral Foliose* (CF), *Coral Heliopora* (CHL), *Coral Massive* (CM), *Coral Millepora* (CME), and *Coral Submassive* (CS). Other biota groups consist of anemones, zoanthids, soft corals, and sponges, with a percentage of 6.88%. Abiotic components consist of sandy mud and broken coral, dead coral, and dead coral overgrown with algae of 12.05%.



Figure 24. Coral reefs health observation at Station 6, MPA Waha

Data collection at station 6 was carried out at 3 meters in depth. The basic topography is steep cliffs. Water clarity is very good, which supports coral growth. By having favorable water conditions, the coral reefs' health is in a good category, as indicated by the high diversity of fish around the coral reefs. In general, in healthy coral reefs, more fish are in the coral reef ecosystem. The condition of the coral reefs is shown in Figure 24.

## 7. Coral reefs at Station 7 (MPA: Longa)

The Station 7 area belongs to Waetuno Village at the coordinates 05°14'41.34" S and 123°34'47.28"E. There are 10 types of hard coral growth found at Station 7, including: *Acropora branching* (ACB), *Acropora Digitata* (ACD), *Acropora Submassive* (ACS), *Acropora Tabulate* (ACT), *Coral Branching* (CB), *Coral Encrusting* (CE), *Coral heliopora* (CHL), *Coral Massive* (CM), *Coral Millepora* (CME), *Coral Mushroom* (CMR), and *Coral Submassive* (CS). Basic substrate constituent categories are grouped into 6 major groups, i.e., hard coral,

soft coral, death coral, algae, other biotic, and abiotic. The distribution for each category is illustrated in Figure 25.

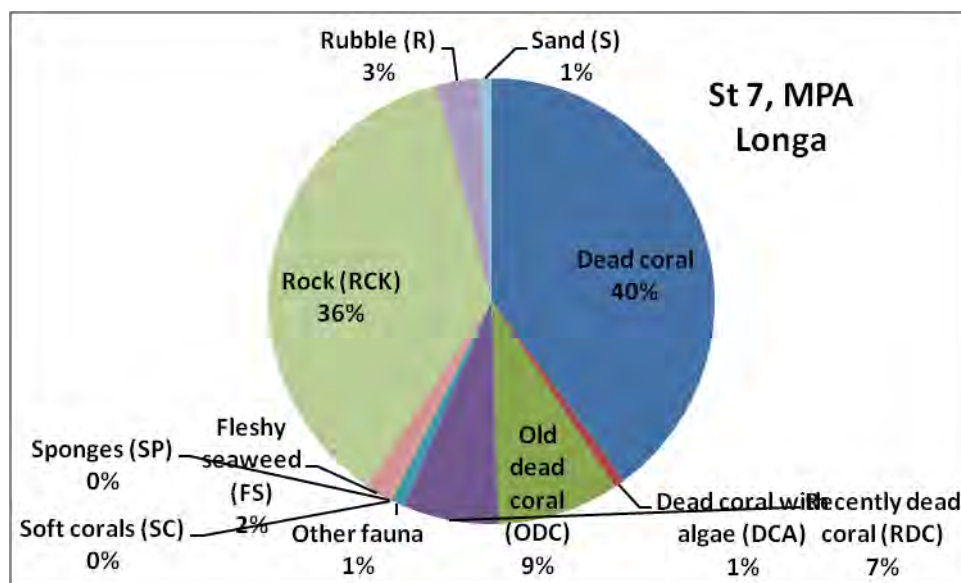


Figure 25. Coral cover distribution at Station 7, MPA Longa

Based on data analysis, the percentage of bottom substrate cover of live hard corals is 39.90% (medium category). The highest percentage of hard corals is the *Acropora Tabulate* group of 34.56%, while the lowest percentage of hard corals is the *Acropora Branching* group of 0.64%. At this station, the abiotic component is dominant, i.e. 40.54%. It exceeds the total percentage of hard corals. Major component of the abiotic category is rock. This rock may come from coral that has been dead for a long period. This station also has rubble and is most likely influenced by community activities because of this station is close to people settlements. Figure 26 shows the condition of the coral reefs.



Figure 26. Coral reefs health observation at Station 7, MPA Longa



## 8. Coral Reefs at Station 8 (Non MPA: Longa Village)

Station 8 is located at coordinates 05°14.947'S and 123°31.582'E in Longa Village. At this station, a live coral component consists of a hard coral component with a coral cover distribution of 59.63% (good category). The coral reef distribution at this Station can be seen in Figure 15. The hard coral components consist of *Acropora branching* (ACB), *Acropora Digitata* (ACD), *Acropora Encrusting* (ACE), *Acropora Submassive* (ACS), *Acropora Tabulate* (ACT), *Coral Encrusting* (CE), *Coral Foliose* (CF), *Coral Heliopora* (CHL), *Coral Massive* (CM), *Coral Millepora* (CME), and *Coral Submassive* (CS).

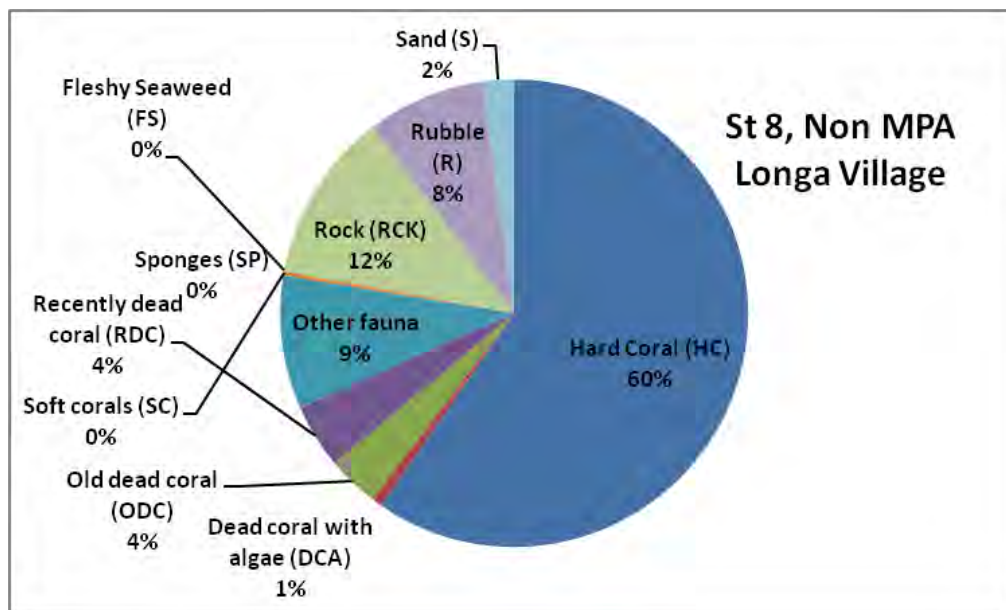


Figure 27. Coral cover distribution at Station 8, Non-MPA Longa Village



Figure 28. Coral reefs health observation at Station 8, Non-MPA Longa Village

Hard coral cover distribution condition is in a good category, and the percentage of dead coral is moderate. At this station, the dominant hard coral cover results from the submassive coral lifeform, i.e., 29.17%. It implies that half of the percentage of live coral is submassive coral. However, dead corals were still found at 8.76% and the abiotic category at 22.13%. These indicate that the coral reefs in this area are threatened by degradation. The condition of the coral reefs at Station 8 is shown in Figure 28.

## 9. Coral Reefs at Station 9 (MPA: Patuno)

Station 9 is located at Patuno MPA, administratively included in the Patuno Village, Wangi-Wangi District area. The coordinates' locations are 05°15'26.37"S and 123°36'33.63"E. At this station, the hard coral component with a coral cover is 41.24%, and only 1% of soft coral. The hard coral consists of 12 growth forms i.e., *Acropora branching* (ACB), *Acropora Digitata* (ACD), *Acropora Encrusting* (ACE), *Acropora Submassive* (ACS), *Acropora Tabulate* (ACT), *Coral Branching* (CB), *Coral Encrusting* (CE), *Coral Heliopora* (CHL), *Coral Massive* (CM), *Coral Millepora* (CME), *Coral Mushroom* (CMR), and *Coral Submassive* (CS). Coral submassive type is the dominant category of 13.29%, while the smallest was coral mushroom at 0.14%. The distribution of each category can be seen in Figure 29 below.

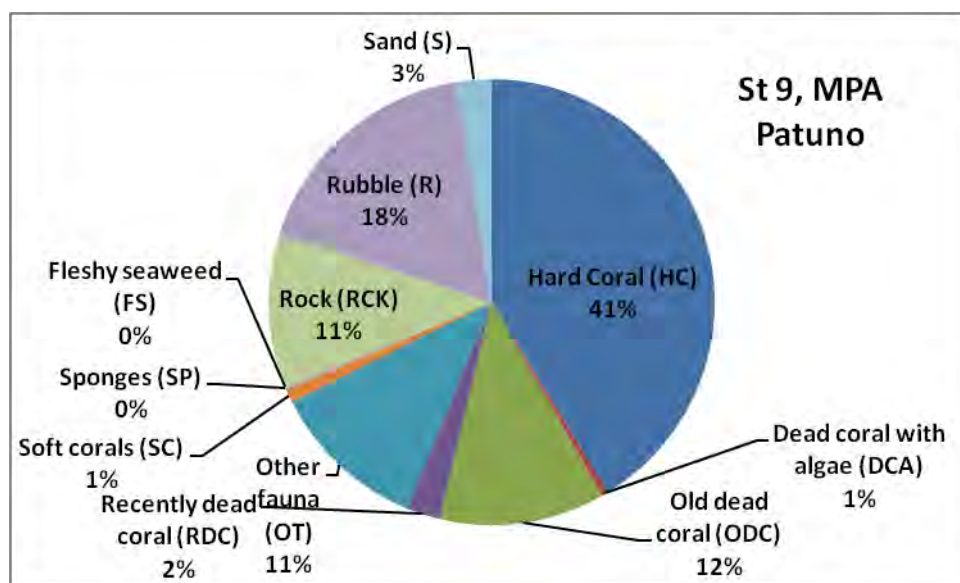


Figure 29. Coral cover distribution at Station 9, MPA Patuno

Coral reefs distribution at Station 9 is in the moderate category. Additionally, other biota groups were found, i.e., *anemones*, *zoanthids* and *sponges*, with a percentage of

1.22%. At this station, abiotic components such as rocks, sand, and coral rubble were also found. The destructed coral was 17.53%, while the rock was 11.21%. Even though this site is a community-based marine protection area (MPA), the effectiveness of the MPA area management has not been optimal, as indicated by the Rubble parameter or coral rubble is high, i.e., 17.53% with a total percentage of dead coral is 14.94%. It indicates that coral reefs are experiencing a serious threat of degradation. The condition of the coral reefs at Station 9 is shown in Figure 30.

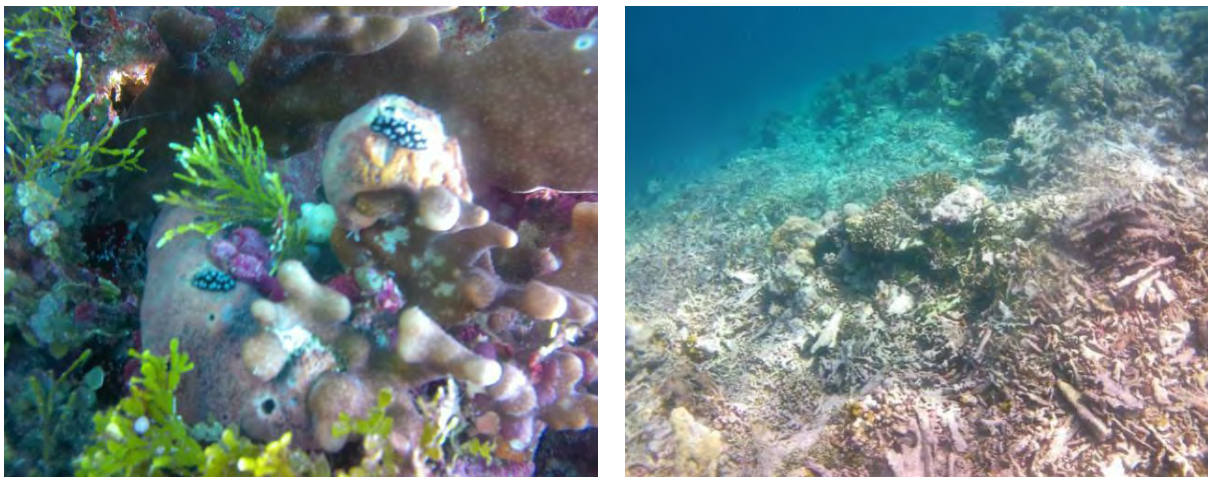


Figure 30. Coral cover health at Station 9, MPA Patuno

#### 10. Coral Reefs at Station 10 (MPA: Matahora)

Station 10 is located at the coordinates of 05°18'15.36"S and 123°39'0.62"E in the MPA Matahora area. At this station, a live coral component consisting of a hard coral component with a coral cover of 61.77% (good category). The hard coral components consist of *Acropora branching (ACB)*, *Acropora Submassive (ACS)*, *Acropora Tabulate (ACT)*, *Coral Encrusting (CE)*, *Coral Heliopora (CHL)*, *Coral Massive (CM)*, *Coral Millepora (CME)*, and *Coral Submassive (CS)*. Other biota groups, such as anemones, zoanthids, soft corals, and sponges, were found at 4.85%. The percentage of soft corals was only 1.66%. The abiotic components such as sand, broken coral, and dead coral were 27.56%. The distribution of each lifeform category can be seen in Figure 31. The condition of the corals in the Matahora MPA observation area is in a good category where minimal threats can be identified by the small percentage of dead coral (DCA, RDC, and ODC), which is only 5.12%.



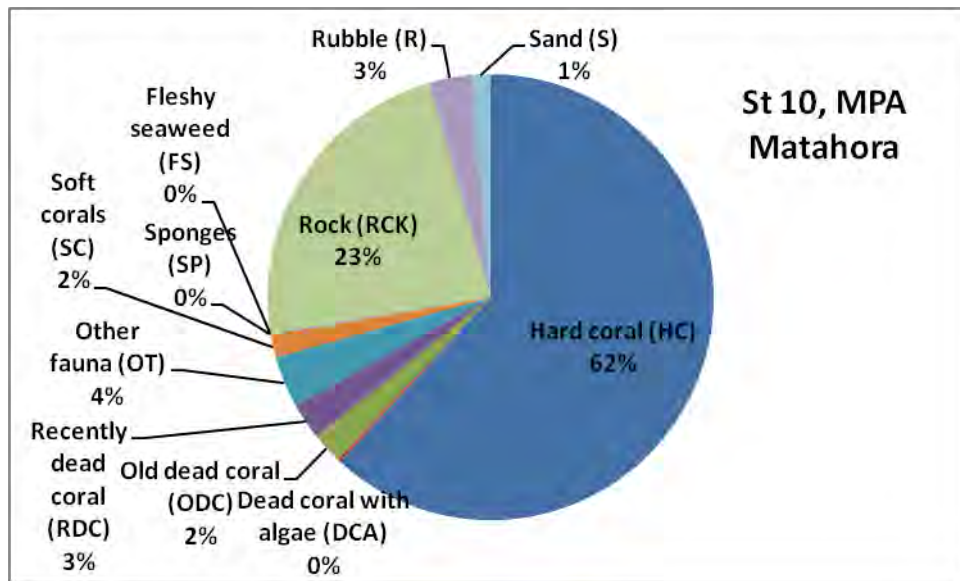


Figure 31. Coral cover distribution at Station 10, MPA Matahoro

Based on the basic substrate cover at the observation area, hard coral distribution is 61.77% (good category). The largest type of life form is *Acropora* branching (AB), with 17.04%, while the smallest is coral millepora of 0.55% with minimum damaged coral, i.e., 5%. Among the abiotic components, rock is the highest percentage (23.13%). The water turbidity at this station area is very good with a high level of clarity.

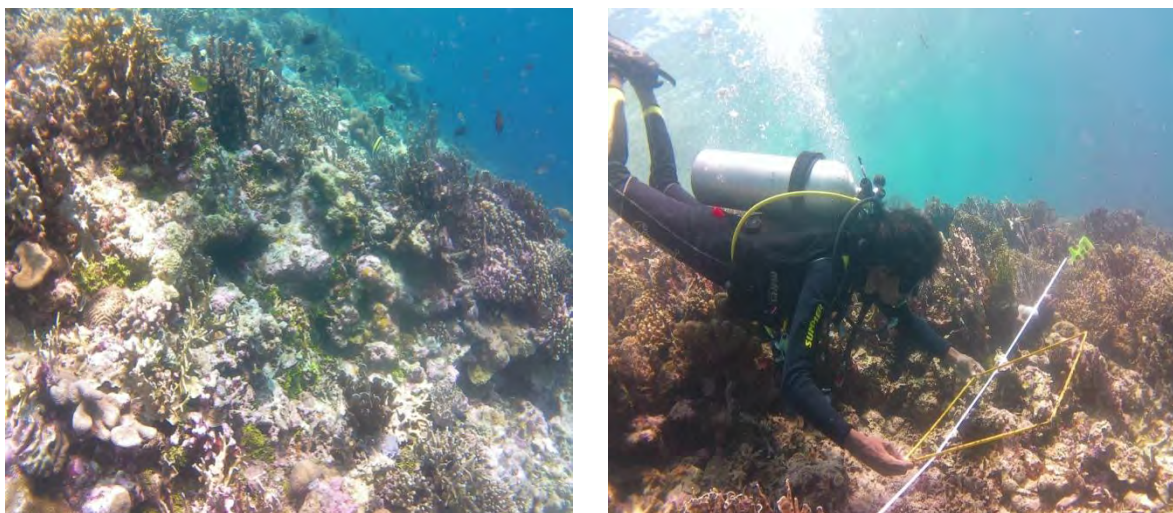


Figure 32. Coral cover health observation at Station 10, MPA Matahoro

Based on the coral cover analysis at the station 10 observation site, there is no significant difference between the condition of the corals at 6 areas of MPA locations and 4 locations of the non-MPA areas. The average percentage of live coral cover at 6 Stations was 54.9%, and dead coral was 13.97%, while those in non-MPA areas were 53.9% and

16.43% for live coral and dead coral, respectively. Both MPA and non-MPA areas are in good coral cover categories.

The highest live coral cover was found at Station 1 (MPA Liya Togo) of 72.72%, which dominated by soft corals. The lowest coral cover was found at Station 2, i.e., 33.22%, where this area is the seaweed cultivation area. The highest dead coral cover was also found at Station 2, while the lowest dead coral cover was found at MPA Sombu, MPA Longa, and MPA Matahora.

The coral's health at the transect locations for all observation stations was in good category, where the coverage area of live hard coral (HC) was 46.31%, while that for soft coral (SC) was only 8.18%. It indicates that there is an increase of hard coral healthy compared to the results from Reef Health Monitoring in 2016, for which the distribution of Hard Coral was 25% at 12 MPA locations. In addition, dead coral overgrown by algae was recorded at a small level, at 5.62%. Generally, it can be said that the threat of coral degradation has been reduced where Reef Health Monitoring (RHM) conducted by Coremap in 2016 shown the percentage of dead coral overgrown with algae was 20%. It implies that dead corals, for several years, become good media for algae to grow on the dead rock. If the environmental and biological conditions are favorable, then it is likely that the rock will become a good medium for enriching coral larvae and growing coral reefs. It occurs when plant-eating fish (herbivores) take a role in coral reef ecosystems' food chain balancing cycle.



Table 10. Coral reefs distribution in the MPA and Non-MPA areas in Wangi-Wangi Island (*Source: Survey 2022*)

Station	HC	DCA	ODC	RDC	SC	FS	SP	RCK	R	S	OT	Live	Dead	Category
St 1, MPA: Liya Togo	13.47	12.22	0.00	3.59	59.25	0.345	1.24	9.46	0.00	0.35	0.07	72.72	15.81	Good
St 2, Non MPA: Seaweed Culture Area	31.36	22.12	0.93	5.00	1.86	0.17	0.17	15.68	10.25	12.46	0	33.22	28.05	Medium
St 3, Non MPA: Kapota Isle	55.73	15.17	6.966	3.87	3.947	0.46	1.238	7.663	4.412	0.542	0	59.68	26.00	Good
St 4, Non MPA: Marina Beach	61.49	3.543	8.605	4.65	1.318	1.04	2.498	11.17	1.319	0.694	3.67	62.81	16.80	Good
St 5, MPA: Sombu	41.39	0.569	3.912	3.485	6.188	0.142	0.213	6.97	7.824	0.64	28.66	47.58	7.97	Medium
St 6, MPA: Waha	57.16	0.303	3.108	6.899	6.217	0	0.303	16.15	0.227	0	9.629	63.38	10.31	Good
St 7, MPA: Longa	39.9	0.785	8.851	6.924	0.143	1.856	0.071	36.55	3.141	0.857	0.928	40.04	16.56	Medium
St 8, Non MPA: Longa Village	59.63	0.718	3.592	4.454	0.287	0	0	11.78	8.19	2.155	9.195	59.91	8.76	Good
St 9, MPA: Patuno	41.24	0.503	12	2.443	1.006	0	0.144	11.21	17.53	2.514	11.42	42.24	14.94	Medium
St 10, MPA: Matahora	61.77	0.277	2.216	2.632	1.662	0	0.139	23.13	3.047	1.385	3.74	63.43	5.12	Good
Average	MPA		Category		Non MPA		Category				Ave	54.50	15.03	Good
	LC	54.9	Good		LC	53.9	Good				Max	72.72	28.05	
	DC	13.97			DC	16.43					Min	33.22	5.12	

**Noted:**

Hard Coral (HC); Dead coral with algae (DCA); Old dead coral (ODC), Recently dead coral (RDC); Other fauna (OT), Soft corals (SC); Sponges (SP); Fleshy seaweed (FS); Rock (RCK); Rubble (R); Sand (S); Live Coral (LC) = HC + SC; Dead Coral (DC) = DCA + ODC + RDC.

= MPA

= Non MPA

## B. Reef Fish Monitoring

Observations of reef fish are grouped into three major groups according to family and number of individuals, i.e., target fish, indicator fish, and major fish. These groups of fish are commonly used by researchers in monitoring the reef fish health in specific waters.

In general, the highest abundance of fish was found at Station 6 of 0.0110 individuals/m<sup>2</sup> with a total of 2760 individuals. The second highest abundance was found at Station 10 of 0.0054 individuals/m<sup>2</sup> or 1355 individuals in total. The lowest abundance was recorded at Station 5 (0.0017 individuals/m<sup>2</sup> or 432 fishes individuals in total). The abundance and presence of fish in the waters indicate the aquatic environment's health that can still contribute to the survival of aquatic biota.

Target fish groups were found at each observation station. This group of fish is a fish that is consumed and has high economic value that lives within coral reefs environment, lives in groups and belongs to the herbivore class. There were 49 target fish species (14 families), 14 indicator fish and 52 major fish species (16 families). The most target fish groups are *Caesionidae* and *Balistidae* families, such as *Pterocaesio tile*, *Pterocaesio tessullutus*, *Pterocaesio trilineatus*, *Caesio cunning* and *Odonus niger* and other species. Based on their food habits, the fishes are herbivores, and plankton-eating fish. They use coral reef ecosystems to find food. Damaged coral reefs do not provide sufficient food for living organisms, so the abundance of associated organisms, such as reef fish, shall be found in small quantities. Most of the target fish groups are also the target of catching because of they have high economic value.

A total of 52 fish species (16 families) of major group fish were found during the investigation. Most of these fish are species with a relatively small body size and play an important role in the food chain, especially as a food supply for carnivorous fish. These fish live sedentary (resident species) on coral reefs. Coral reefs are a place to find food and shelter for the *Pomacentridae* fish from predators. Therefore, *Pomacentridae* is the main major fish group in large numbers in coral reef ecosystems. The DCA component (dead coral overgrown with algae) at several stations was one of the factors for the abundance of fish from the *Pomacentridae* family due to the eating habits of several types of this family, which are herbivores, for instance eating algae components such as those from *Dascylus reticulatus* and *Pomacentrus armilatus*. The observations result of reef fish group type for all stations can be seen in Figure 33.

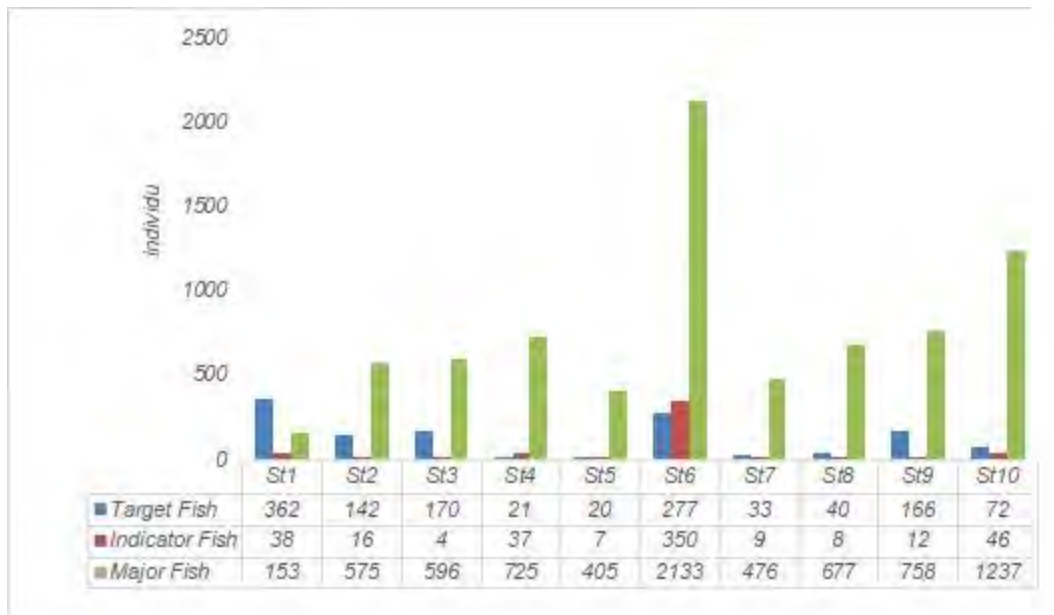


Figure 33. Abundance of reef fish groups at each observation station

In general, the composition of reef fish groups in the observation area was dominated by major fish groups which indicated an unstable condition in the ecosystem.. It is the major fish group composition with the highest distribution comparing to other fish groups. The composition of reef fish species is shown in Figure 34.

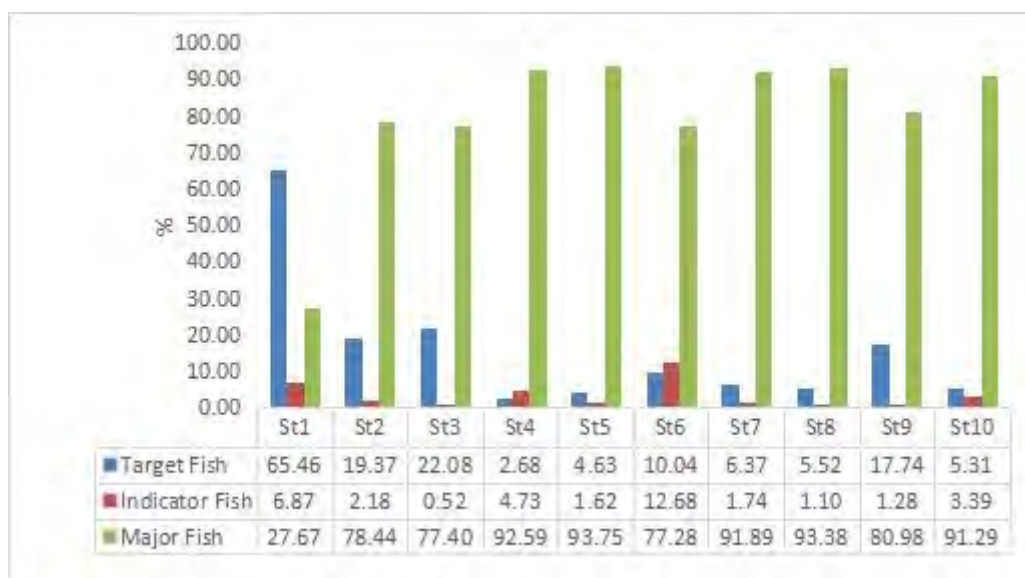


Figure 34. Species composition of coral reef fish at the observation stations

In more detail, the results of identification of reef fish at 10 observation sites can be found in Table 11.

Table 11. Reef fish identification based on families, fish groups, and the number of individual abundances at each station

Fish Category	Family	Species	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9	St 10
			Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)
TARGET FISH	SERRANIDAE	<i>Cephalopolis Argus</i>	3	0	0	0	0	7	0	0	0	0
		<i>Cephalopolis Urodeta</i>	1	3	0	0	0	0	0	1	0	2
		<i>Epinephelus Macrospilos</i>	2	0	2	0	0	3	2	0	4	0
		<i>Cephalopolis Sonnerati</i>	0	1	0	0	0	0	0	0	0	0
		<i>Aethaloperca Rogaa</i>	0	0	0	0	0	0	0	1	0	0
		<i>Variola Louti</i>	0	0	0	0	0	0	0	0	3	0
	CAESIONIDAE	<i>Caesio Cunning</i>	50	0	0	0	0	67	0	0	0	0
		<i>Pterocaesio Trilineatus</i>	120	0	0	0	0	0	0	0	0	0
		<i>Pterocaesio Tile</i>	0	23	0	0	0	37	0	0	75	0
		<i>Pterocaesio Tessullutus</i>	0	0	145	0	0	0	0	0	0	0
	NEMIPTERIDAE	<i>Scolopsis Lineata</i>	83	0	18	0	0	0	0	0	0	0
		<i>Pentapodus Trivittatus</i>	0	0	0	0	5	0	0	0	0	0
		<i>Scolopsis Margaritifer</i>	3	0	0	0	0	0	0	0	0	0
	LUTJANIDAE	<i>Lutjanus Rufolineatus</i>	36	0	0	8	0	0	0	0	0	0
		<i>Lutjanus Gibbus</i>	0	0	0	0	0	0	0	0	0	2
		<i>Macolor Macularis</i>	0	0	0	0	0	0	0	0	1	2
	SIGANIDAE	<i>Siganus Virgatus</i>	5	0	0	0	2	3	0	0	0	0
		<i>Siganus Vulpinus</i>	0	3	3	2	3	9	0	0	0	0
	TETRAODONTIDAE	<i>Arothron Nigropunctatus</i>	0	0	2	0	0	0	0	0	0	0
	ACANTHURIDAE	<i>Acanthurus Mata</i>	1	0	0	0	0	0	0	0	0	0
		<i>Acanthurus Nigricans</i>	12	0	0	2	0	32	0	0	0	5
		<i>Acanthurus Lineatus</i>	2	0	0	0	0	0	0	0	0	0
		<i>Acanthurus Bariene</i>	2	0	0	0	0	0	0	0	0	0
		<i>Acanthurus Auranticavus</i>	0	25	0	0	0	0	2	0	0	0

Fish Category	Family	Species	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9	St 10
			Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)
		<i>Acanthurus Guttatus</i>	0	0	0	0	0	22	0	0	0	0
		<i>Ctenochaetus Cyanochaetus</i>	0	0	0	0	0	0	0	0	8	30
		<i>Ctenochaetus Striatus</i>	0	0	0	0	0	0	0	0	0	3
		<i>Naso Lituratus</i>	0	3	0	0	0	16	1	0	0	0
		<i>Naso Caeruleacaudus</i>	0	0	0	5	0	0	0	0	25	17
	LABRIDAE	<i>Halichoeres Hortulanus</i>	0	0	0	2	0	0	0	0	0	0
	BALISTIDAE	<i>Balistapus Undulatus</i>	1	0	0	0	0	17	0	0	0	0
		<i>Melichthys Niger</i>	13	0	0	0	0	0	12	0	0	0
		<i>Melichthys Indicus</i>	0	0	0	0	0	0	0	0	43	0
		<i>Odonus Niger</i>	0	78	0	2	0	37	0	0	0	0
	SCARIDAE	<i>Scarus Tricolor</i>	6	0	0	0	3	15	0	0	0	0
		<i>Scarus Hypselopterus</i>	15	0	0	0	0	0	0	0	0	0
		<i>Cetoscarus Bicolor</i>	1	1	0	0	0	0	0	0	3	4
		<i>Scarus Flavipectoralis</i>	0	0	0	0	2	9	0	0	0	0
		<i>Scarus Prasiognathes</i>	0	0	0	0	0	3	0	0	0	0
		<i>Scarus Quoyi</i>	0	0	0	0	0	0	0	0	0	5
		<i>Chlorurus Sordidus</i>	0	0	0	0	0	0	3	0	0	0
		<i>Hipposcarus Longiceps</i>	0	0	0	0	0	0	0	27	0	0
	MULLIDAE	<i>Parupeneus Macronema</i>	5	3	0	0	0	0	0	6	0	0
		<i>Parupeneus Bifasciatus</i>	0	0	0	0	0	0	0	0	0	1
		<i>Mulloidichthys Flavolineatus</i>	0	0	0	0	0	0	0	4	0	1
	HOLOCENTRIDAE	<i>Sargocentron Caudimaculatum</i>	0	2	0	0	5	0	13	0	0	0
		<i>Myripristis Macrolepis</i>	0	0	0	0	0	0	0	0	3	0
	DASYATIDAE	<i>Taeniura Lymma</i>	1	0	0	0	0	0	0	1	0	0



Fish Category	Family	Species	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9	St 10
			Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)
	CARANGIDAE	<i>Carangoides Orthogrammus</i>	0	0	0	0	0	0	0	0	1	0
MAJOR FISH	POMACENTRIDAE	<i>Pomacentrus Nigromarginatus</i>	7	0	0	30	0	0	0	0	0	0
		<i>Pomacentrus Coelestis</i>	0	0	0	0	0	0	14	35	0	0
		<i>Pomacentrus Moluccensis</i>	8	31	43	72	56	0	0	23	32	53
		<i>Pomacentrus Stigma</i>	0	0	200	0	0	0	0	0	0	0
		<i>Pomacentrus Auriventris</i>	0	0	0	4	0	0	0	0	0	0
		<i>Pomacentrus Smithi</i>	0	0	0	37	0	0	0	0	0	0
		<i>Abudefduf Vaigiensis</i>	120	0	0	0	0	92	0	0	0	150
		<i>Acanthochromis Polyacanthus</i>	5	0	0	4	0	0	0	0	0	0
		<i>Ablyglyphidodon Curacao</i>	5	0	0	0	0	61	0	0	0	0
		<i>Ablyglyphidodon Leucogaster</i>	0	71	0	30	0	0	0	0	0	0
		<i>Chrysiptera Hemicyanea</i>	0	0	0	0	0	0	113	0	49	0
		<i>Chromis Xanhorica</i>	0	0	0	0	0	780	0	0	0	0
		<i>Chromis Amboinensis</i>	0	123	120	350	120	115	122	75	320	130
		<i>Chromis Margaritifer</i>	0	0	135	110	15	78	0	0	250	0
		<i>Chromis cf Caudalis</i>	0	0	0	3	0	57	150	0	0	0
		<i>Chromis Viridis</i>	0	0	0	0	32	0	0	0	0	0
		<i>Chromis Scotochiloptera</i>	0	0	0	0	23	0	0	0	0	0
		<i>Chromis Lineata</i>	0	0	0	0	0	0	0	35	0	0
		<i>Chromis Xanthura</i>	0	0	0	0	0	0	0	0	35	0
		<i>Dascyllus Carneus</i>	0	5	0	0	0	0	0	0	0	0
		<i>Dascyllus Trimaculatus</i>	0	20	0	0	0	0	37	0	0	15
		<i>Dascyllus Reticulatus</i>	0	129	18	48	123	32	31	270	47	125
		<i>Dascyllus Aruanus</i>	0	0	0	0	7	0	0	0	0	0

Fish Category	Family	Species	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9	St 10
			Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)
		<i>Neoglyphidodon Nigroris</i>	0	7	0	7	7	37	0	0	0	0
		<i>Neopomacentrus violascens</i>	0	11	0	0	0	0	0	0	0	0
		<i>Amphiprion Melanopus</i>	0	0	16	0	7	3	0	0	0	0
		<i>Amphiprion Clarkii</i>	0	0	7	5	0	0	0	0	5	0
		<i>Amphiprion Perideraion</i>	0	0	0	1	0	0	0	0	0	0
		<i>Plectroglyphidodon Dikii</i>	0	0	0	0	0	21	0	0	0	0
		<i>Ctenochaetus Cyanocheilus</i>	0	0	0	0	0	17	0	0	0	0
	LABRIDAE	<i>Thalassoma Lunare</i>	1	1	3	1	0	0	0	0	0	0
		<i>Diproctacanthus xanthurus</i>	0	160	0	0	0	510	0	238	0	750
		<i>Labroides Dimidiatus</i>	0	0	0	2	0	0	0	0	0	0
		<i>Cirrhilabrus Solorensis</i>	0	0	0	0	0	0	1	0	0	0
	HOLOCENTRIDAE	<i>Myripristis Macrolepsis</i>	5	0	0	0	0	0	0	0	0	0
	BLENNIDAE	<i>Aspidontus Taeniatus</i>	2	0	0	2	0	9	0	0	0	0
	ACANTHURIDAE	<i>Zebrasoma Scopas</i>	0	2	0	0	7	9	0	0	0	0
	APOGONIDAE	<i>Apogon Multineatus</i>	0	5	0	0	0	0	0	0	0	0
	CIRRHITIDAE	<i>Paracirrhites fosteri</i>	0	2	0	0	0	0	0	0	1	2
	GOBIIDAE	<i>Nemateleotris Magnifica</i>	0	2	0	0	0	0	0	0	0	0
	POMACANTHIDAE	<i>Pygoplites Diacanthus</i>	0	6	0	0	0	0	0	0	2	2
		<i>Pomacanthus Sexstriatus</i>	0	0	1	0	0	0	0	0	0	0
		<i>Pygoplites Diacanthus</i>	0	0	0	0	2	0	0	0	0	0
	AULOSTOMIDAE	<i>Aulostomus Chinensis</i>	0	0	1	9	2	0	1	1	0	0
	CIRRHITIDAE	<i>Paracirrhites Fosteri</i>	0	0	2	2	0	7	1	0	0	0
	PLOTOSIDAE	<i>Plotosus Lineatus</i>	0	0	50	0	0	0	0	0	0	0
	SCORPAENIDAE	<i>Pterois Antennata</i>	0	0	0	1	1	0	0	0	0	0

Fish Category	Family	Species	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9	St 10
			Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)	Amount (ind)
	ZANCLIDE	<i>Zanclus Cornutus</i>	0	0	0	7	3	8	6	0	0	8
	SERRANIDAE	<i>Pseudanthias Dispar</i>	0	0	0	0	0	297	0	0	8	0
	PTERELEOTRIDIDAE	<i>Nemateleotris Magnifica</i>	0	0	0	0	0	0	0	0	9	0
	OSTRACIDAE	<i>Ostracion Cubicus</i>	0	0	0	0	0	0	0	0	0	1
		<i>Ostracion Meleagris</i>	0	0	0	0	0	0	0	0	0	1
INDICATOR FISH	CHAETODONTIDAE	<i>Chaetodon Vagabundus</i>	7	0	0	0	0	0	7	5	5	13
		<i>Chaetodon Citinellus</i>	0	2	0	7	0	0	0	0	0	0
		<i>Chaetodon cf Octofasciatus</i>	11	1	0	5	0	10	0	0	0	0
		<i>Chaetodon lunulatus</i>	0	0	0	9	3	0	0	0	0	0
		<i>Heniochus Acuminatus</i>	0	13	0	0	0	0	0	0	0	0
		<i>Heniochus Chrysostomus</i>	0	0	0	4	0	0	0	0	4	0
		<i>Forcipiger Longirostris</i>	7	0	3	0	3	3	0	3	3	9
		<i>Parachaetodon Ocellatus</i>	0	0	1	0	0	0	0	0	0	0
		<i>Heniochus Pleurotaenia</i>	0	0	0	0	1	0	0	0	0	0
		<i>Hemitaurichthys Polylepis</i>	0	0	0	0	0	320	0	0	0	0
		<i>Chaetodon Kleinii</i>	5	0	0	7	0	8	0	0	0	0
		<i>Chaetodon Trifasciatus</i>	8	0	0	5	0	5	2	0	0	15
		<i>Chaetodon Interruptus</i>	0	0	0	0	0	0	0	0	0	9
		<i>Chaetodon Melannotus</i>	7	0	0	4	0	4	0	0	0	5
		Total Target Fish			362	142	170	21	20	277	33	40
Total Indicator Fish			38	16	4	37	7	350	9	8	12	46
Total Major Fish			153	575	596	725	405	2133	476	677	758	1237
Total of Individu			533	733	770	783	432	2760	518	725	936	1355
Fish Abundance (ind/m²)			0,0022	0,0029	0,0031	0,0031	0,0017	0,0110	0,0021	0,0029	0,0037	0,0054

Source : Observation and Analysis 2022

### C. Seagrass Ecosystem

Seagrass condition analysis consisted of determining percent coverage (%), total density (ind/m<sup>2</sup>), and species density. Observation points were made at 6 locations, i.e. Marina Beach, Cemara Beach, Patuno Beach, Matahora Beach, Numana Beach and Tikungan. Table 12 shows coordinate observation point for seagrass monitoring in Wangi-Wangi Island.

Table 12. Coordinate points for seagrass monitoring in Wangi-Wangi

Location	Coordinate Point		Description
	East	South	
1	123°31'45.05"E	5°19'9.15"S	Marina Beach
2	123°31'9.19"E	5°15'44.73"S	Cemara Beach
3	123°35'4.01"E	5°14'50.12"S	Patuno Beach
4	123°38'32.64"E	5°17'23.26"S	Matahora Beach
5	123°38'6.17"E	5°20'10.44"S	Numana Beach
6	123°34'18.71"E	5°22'26.45"S	Tikungan

Based on the analysis, seagrass coverage at selected locations on Wangi-Wangi Island was categorized as unfavorable. For the total density, all locations belong to rare dense, except at Patuno Beach (Station 3) where it found to be rather dense category (Table 13).

Table 13. Percent coverage ( $\pm$ SE, n=3) and total density ( $\pm$ SE, n=3) of seagrass on selected location in Wangi-Wangi Island

Station	Substrate	Percent coverage ( $\pm$ SE) (%)	Density ( $\pm$ SE) (ind/m <sup>2</sup> )
1. Marina	Muddy Sand	35,23 ( $\pm$ 4,55)	71 ( $\pm$ 5,90)
2. Cemara	Sand	34,47 ( $\pm$ 3,61)	200 ( $\pm$ 11,68)
3. Patuno	Rubble	55,87 ( $\pm$ 3,60)	247 ( $\pm$ 25,74)
4. Matahora	Muddy Sand	58,24 ( $\pm$ 1,42)	139 ( $\pm$ 11,64)
5. Numana	Sandy Mud, Coral	17,23 ( $\pm$ 5,25)	43 ( $\pm$ 3,92)
6. Tikungan	Muddy Sand	35,8 ( $\pm$ 3,23)	106 ( $\pm$ 10,76)

Seagrass species found in 6 different locations were *Enhalus acoroides*, *Thalassia hemprichii*, *Halodule pinifolia*, *Halopila ovalis*, *Syringodium isoetifolium*, *Thalassodendron ciliatum*, *Cymodocea rotundata*, and *Cymodocea serrulata*. *E. acoroides* was found in 4 stations, i.e., Marina, Cemara, Matahora and Numana, with the highest density in Marina and the lowest in Matahora. *T. hemprichii* was found in all station, with the highest density in Patuno and the lowest in Marina. *H. pinifolia* was found in 4 stations, i.e., Cemara,

Patuno, Matahora and Tikungan, with the highest density in Cemara and the lowest in Tikungan. *H. ovalis* was found in all station, with the highest density in Cemara and the lowest in Numana. *S. isoetifolium* was found in 2 stations, i.e., Cemara and Matahora, with the highest density in Cemara and the lowest in Matahora. *T. ciliatum* only found in Cemara. *C. rotundata* was found in 4 station, i.e., Cemara, Patuno, Matahora and Tikungan, with the highest density in Cemara and the lowest in Patuno. *C. serrulata* was found in 2 station, i.e., Patuno dan Matahora, with the highest density in Patuno and the lowest in Matahora (Figure 35).

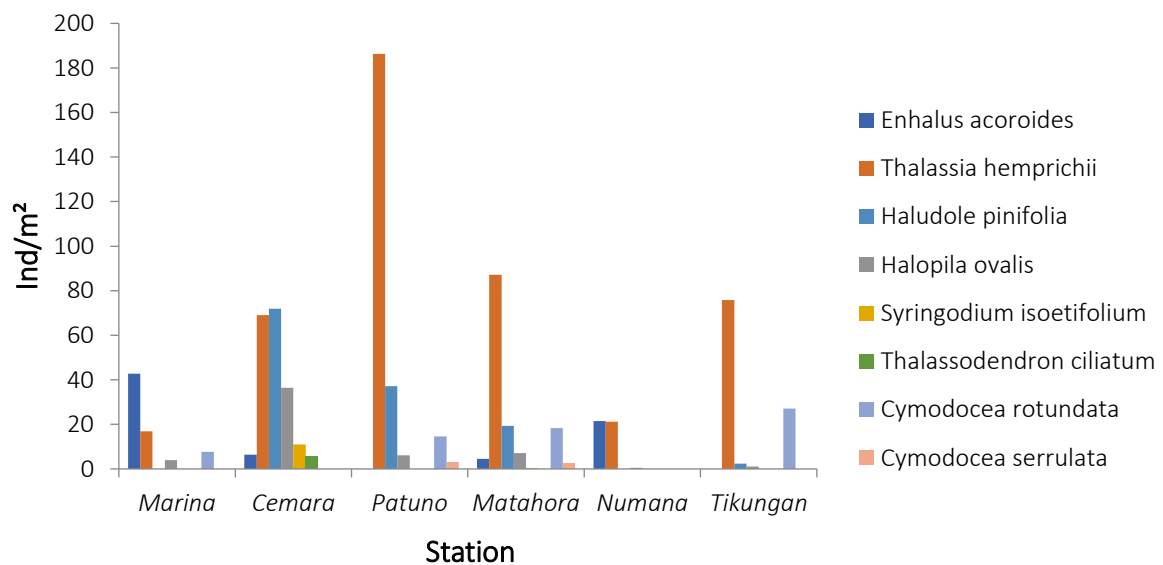


Figure 35. Species density ( $\pm$ SE,  $n=3$ ) of seagrass on selected location in Wangi-Wangi Island.

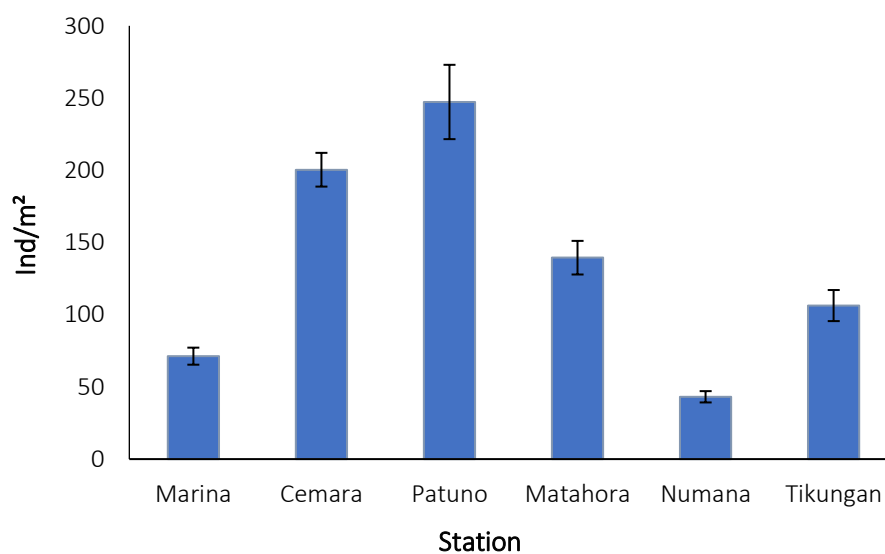


Figure 36. Total density ( $\pm$ SE,  $n=3$ ) of seagrass on selected location in Wangi wangi Island.



According to the species density, the highest density was recorded in Patuno which have 5 species, and rubble substrate, while the lowest was in Numana with 3 species and sandy mud coral substrate (Figure 36). The highest percent coverage of seagrass represented in quadrant transect (50 × 50 cm) was in Matahora and the lowest was in Patuno (Figure 37).

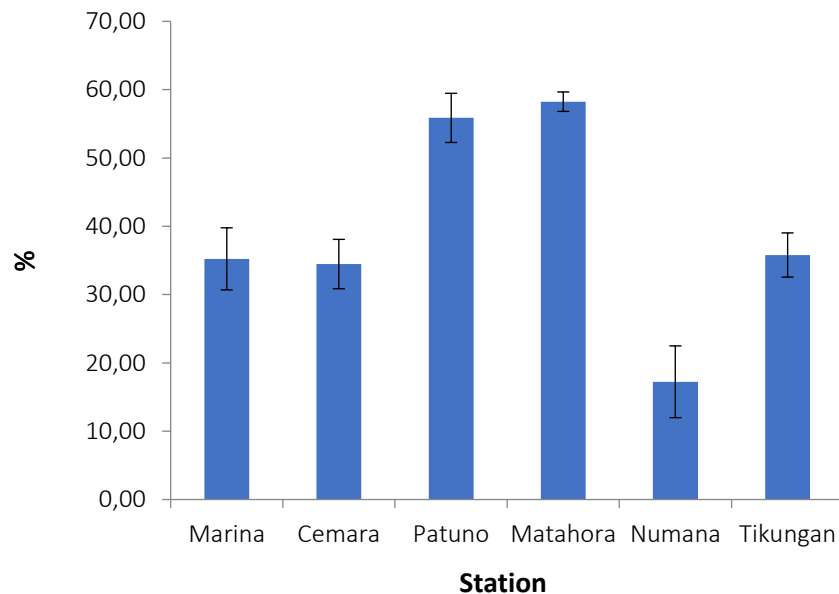


Figure 37. Percent coverage ( $\pm$ SE,  $n=3$ ) of seagrass on selected location in Wangi-Wangi Island.

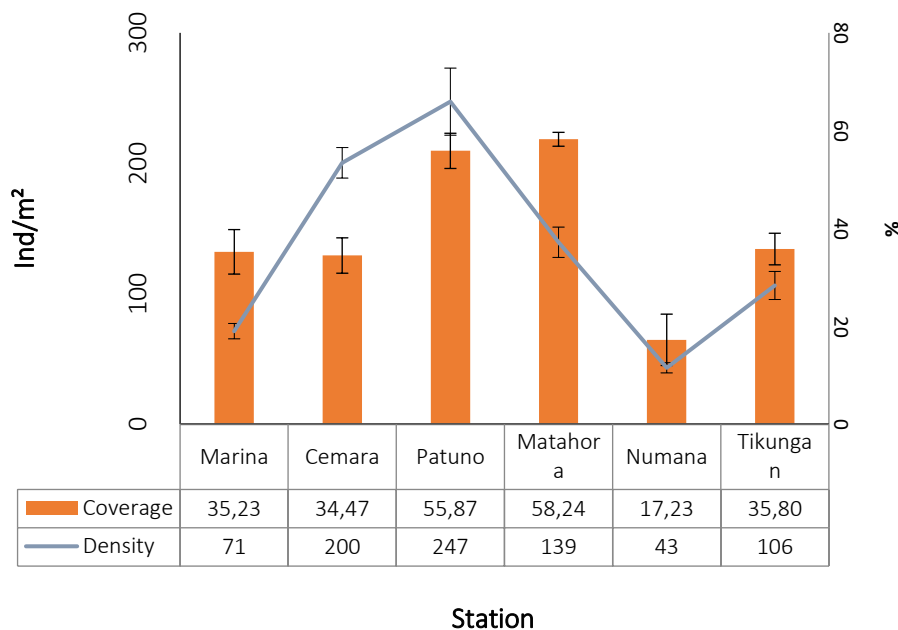


Figure 38. Comparison between Total Density and Percent Coverage ( $\pm$ SE,  $n=3$ ) of seagrass on selected location in Wangi-Wangi Island.

#### D. Mangrove Ecosystem in Kaledupa Island

Mangroves are spread over almost all of the major islands in Kaledupa. The presence of mangroves can be seen on three different islands: Kaledupa, Lentea, and Darawa Island. These islands are administrated in two sub-districts, i.e. Kaledupa and South Kaledupa District. The observation stations were located in the two sub-districts, i.e., three stations were in the Kaledupa sub-district covering the villages of Laulua, Balasuna Selatan, and Horua, the other two stations were located in the Kaledupa sub-district, including Tanomeha and Lentea Village.

The observation station consisted of 5 observation points: Station I (Laulua), Station II (Balasuna), Station III (Tanomeha), Station IV (Lentea), and Station V (Horua-sampara).

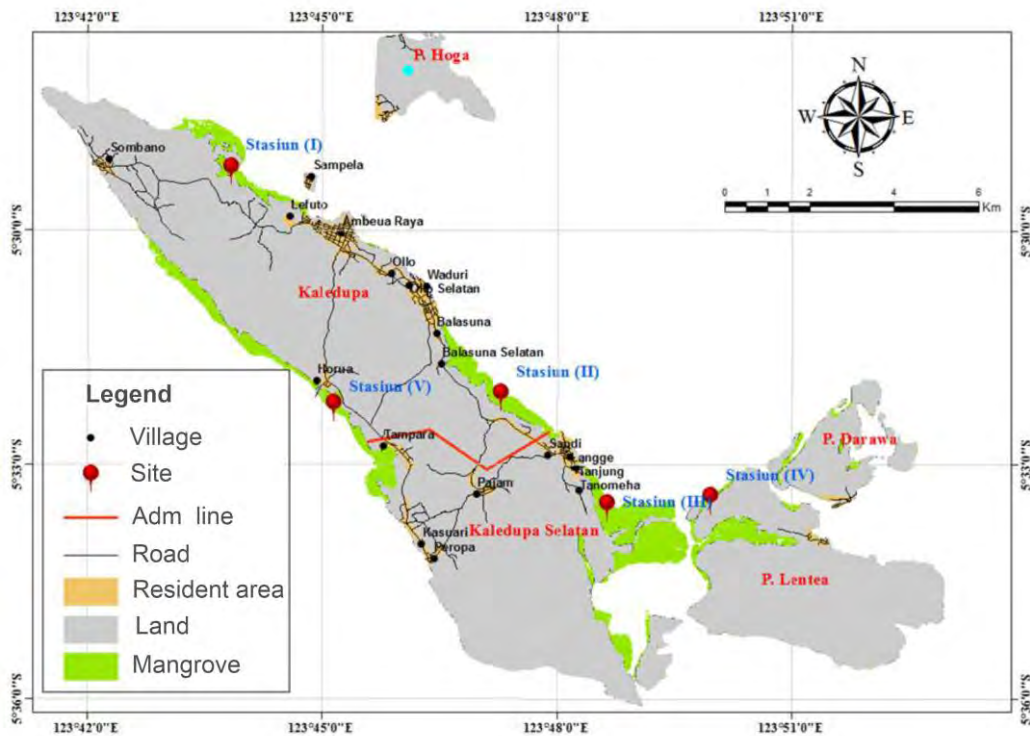


Figure 39. Mangroves distribution in Kaledupa Island

In general, the population of mangroves were found in the Kaledupa District, including the villages of Laulua, Ambeua Raya, Balasuna-Balasuna Selatan, and Horua Tampara Village (South Kaledupa), which has an area of 483.89 ha. In South Kaledupa District, the distribution of mangroves covers Tanomeha-Tanjung Village; there are also Lentea Island and Darawa Island, which have a mangrove area of 387.22 ha. Details of the mangrove area on Kaledupa Island are tabulated in Table 14.

Table 14. The area of mangroves in each village and district

District/Village	Mangrove Area (Ha)
<b>District of Kaledupa</b>	
Lalulua	100.03
Ambeua Raya	9.05
Balasuna - South Balasuna	104.52
Horua-Tampara	270.29
Total	<b>483.89</b>
<b>District of South Kaledupa</b>	
Tanomeha-Tanjung	259.15
Lentea Isle	100.88
Darawa Isle	27.19
Total	<b>387.22</b>
<b>Grand Total</b>	<b>871.11</b>

#### a. Species Density (Ind/m<sup>2</sup>)

Mangrove density area depends on the number of mangroves; the more mangroves in an area, the denser the mangroves. The observation results of the density of mangrove species based on tree categories at each station showed that station I has the highest density of 5,200 trees/ha, i.e., *B. gymnorhiza* type. At stations II and IV were dominated by *R. mucronata* of 7,700 trees/Ha and 5,700 trees/Ha, respectively. Moreover, *B. gymnorhiza* had the highest density at stations III and V of 7,500 trees/Ha and 4,300 trees/Ha, respectively.

*R. mucronata* species had the highest mangrove density. It is because the mangrove is tolerant and able to grow in nutrient-poor areas. Meanwhile, the type of *X. granatum* was the type of mangrove with the lowest density at station III. It is considered that this type of mangrove is unable to adapt to high salinity. The results of field observation showed that *X. granatum* is the only type of mangrove that grows on Kaledupa Island, since it was only found at station III.

Table 15. Density of mangrove species on Kaledupa Island

Station	Mangrove Species	Amount of Tree (ni)	Density (ind/m <sup>2</sup> )
I	<i>Rhizophora mucronata</i>	40	0.04
	<i>Bruguiera gymnorhiza</i>	52	0.052
	<i>Rhizophora apiculata</i>	29	0.029
	<i>Ceriops tagal</i>	24	0.024
	<b>Total</b>	<b>145</b>	<b>0.145</b>
II	<i>Sonneratia alba</i>	60	0.06

Station	Mangrove Species	Amount of Tree (ni)	Density (ind/m <sup>2</sup> )
	<i>Rhizophora mucronata</i>	77	0.077
	<i>Ceriops decandra</i>	20	0.02
	<b>Total</b>	<b>157</b>	<b>0.157</b>
III	<i>Bruguiera gymnorhiza</i>	75	0.075
	<i>Xylocarpus granatum</i>	9	0.009
	<i>Rhizophora apiculata</i>	51	0.051
	<b>Total</b>	<b>135</b>	<b>0.135</b>
IV	<i>Bruguiera gymnorhiza</i>	47	0.047
	<i>Avicennia mariana</i>	15	0.015
	<i>Rhizophora mucronata</i>	57	0.057
	<i>Sonneratia alba</i>	20	0.02
	<b>Total</b>	<b>139</b>	<b>0.139</b>
V	<i>Sonneratia alba</i>	23	0.023
	<i>Avicennia mariana</i>	12	0.012
	<i>Rhizophora mucronata</i>	22	0.022
	<i>Bruguiera gymnorhiza</i>	43	0.043
	<i>Rhizophora apiculata</i>	24	0.024
	<b>Total</b>	<b>124</b>	<b>0.124</b>

## b. Vegetation Density

Field observation showed that the highest density of mangrove vegetation was found at station II with the dense category. In contrast, the lowest density of mangrove vegetation was found at station V which is also in the dense category.

Vegetation density at Station I, II, and III is 1.45 Ind/ha or 14,500 trees/ha, 1.57 Ind/ha or 15,700 trees/ha, 1.35 Ind/ha or 13,500 trees/ha, respectively. Meanwhile, station IV and V have a vegetation density of 1.39 Ind /ha or 13,900 trees/ha, and station V has a density of 1.24 Ind/ha or 12,400 trees/ha, respectively.

Agusrinal (2015) reported that the largest deforestation occurred in Horuo-Tampara Village (station V), and the smallest deforestation occurred in Balasuna Village (station II). In Horuo Village - Tampara, there is a Bajo Mantigola village. The Bajo community strongly relies on the mangrove ecosystem in Horuo Village -Tampara for firewood and materials construction of housing. In Balasuna Village, there is no Bajo people lie on the mangrove ecosystem, so the mangrove ecosystem deforestation is smaller than in other areas. Illegal logging for firewood and land conversion to residential are the main factors for the deforestation of mangroves.

Table 16. Mangrove vegetation density at Kaledupa Island

Station	Mangrove Species	Species Density (ind/m <sup>2</sup> )	Vegetation Density (tree/ha)	Category
I	<i>Rhizophora mucronata</i>	0.04	14.500	High
	<i>Bruguiera gymnorrhiza</i>	0.052		
	<i>Rhizophora apiculata</i>	0.029		
	<i>Ceriops tagal</i>	0.024		
	<b>Total</b>	<b>0.145</b>		
II	<i>Sonneratia alba</i>	0.06	15.700	High
	<i>Rhizophora mucronata</i>	0.077		
	<i>Ceriops decandra</i>	0.02		
	<b>Total</b>	<b>0.157</b>		
III	<i>Bruguiera gymnorrhiza</i>	0.075	13.500	High
	<i>Xylocarpus granatum</i>	0.009		
	<i>Rhizophora apiculata</i>	0.051		
	<b>Total</b>	<b>0.135</b>		
IV	<i>Bruguiera gymnorrhiza</i>	0.047	13.900	High
	<i>Avicennia mariana</i>	0.015		
	<i>Rhizophora mucronata</i>	0.057		
	<i>Sonneratia alba</i>	0.02		
	<b>Total</b>	<b>0.139</b>		
V	<i>Sonneratia alba</i>	0.023	12.400	High
	<i>Avicennia mariana</i>	0.012		
	<i>Rhizophora mucronata</i>	0.022		
	<i>Bruguiera gymnorrhiza</i>	0.043		
	<i>Rhizophora apiculata</i>	0.024		
	<b>Total</b>	<b>0.124</b>		

Mangrove density classification using Citra Sentinel 2A in 2022 can be found in Figure 40 below.

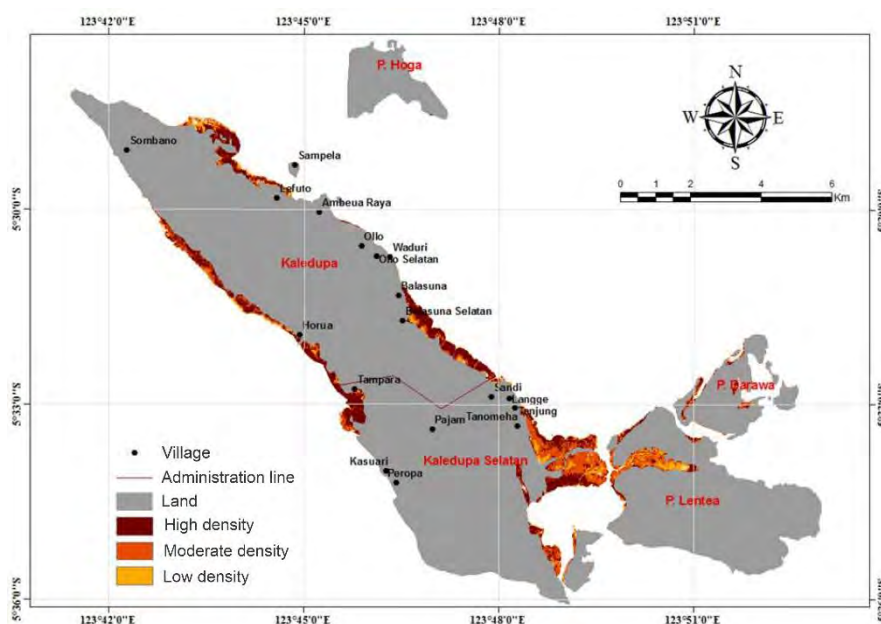


Figure 40. Mangrove density classification in Kaledupa Island



Tabel 17. Classification of Mangrove density area in Kaledupa Island

Category	Area (ha)	(%)
Low	189.22	22
Moderate	290.34	33
High	391.88	45
<b>Total</b>	<b>871.11</b>	<b>100</b>

## E. Conclusion

1. The condition of the coral reef ecosystem on Wangi-Wangi Island was in the medium - good category. Live coral cover ranged from 33.22 - 72.72%. The highest live coral cover was at Station 1 MPA Liya Togo and the lowest live coral cover was at the Non MPA station around the seaweed cultivation area (Station 2). In aggregate, no significant differences were found between coral cover in the 6 MPA areas and 4 Non MPA areas. Those of two areas had an average live coral cover of 54.9% and 53.9%, respectively.
2. There were 49 species (14 families) of target fish discovered, 14 species of indicator fish, and 52 species of major fish (16 families). The Liya Togo MPA station had the largest concentration of target fish, which are edible fish. This was probably because the station has the largest living coral cover, with a DCA of 12% and a soft coral predominance. The target fish found were generally herbivorous fish. Major fish predominated at all sites based on abundance composition, while indicator fish were found to be rather uncommon compared to other reef fish category. This suggests that there were ecological signs of unstable ecosystems in all sites.
3. On Wangi-Wangi Island, seagrass cover, total density, and species density have all been analyzed. Based on analysis, Patuno and Matahora have quite high seagrass coverage, placing certain sites on Wangi-Wangi Island in the unfavorable category. Theses two stations are likewise more dense than other stations. *Enhalus acoroides*, *Thalassia hemprichii*, *Halodule pinifolia*, *Halopila ovalis*, *Syringodium isoetifolium*, *Thalassodendron ciliatum*, *Cymodocea rotundata*, and *Cymodocea serrulata* are some of the seagrass species that can be found in six different sites. The highest total density was found in Patuno, which has 5 species, while the lowest total density was found in Numana, which has 3 species. The most common types of substrate in the seagrass ecosystem were sandy mud, mud sand, and sandy mud coral.

4. Mangroves are distributed in two sub-districts of Kaledupa Island: Kaledupa District, which has an area of 483.89 hectares, and South Kaledupa District, which has an area of 387.22 ha. *Rhizophora sp* and *Bruguiera sp* were the two most prevalent ones. All observation sites had a high category of vegetation density, with an average of 1,400 trees/ha. In Horuo-Tampara sub district, Kaledupa District, there is a risk of mangrove degradation based on the observation. Mangrove wood is utilized by the local ethnic Bajo people to build some of their homes and is also used as fuel for cooking.

#### **F. Recommendation**

It is interesting to look into the elements that contribute to changes in coastal ecosystem conditions led by environmental change, climate change, and socio-economic factors. Studies in the future can be focused on examining environmental disturbances and stressors, as well as the effects of climate change on coastal habitat in relation to social-ecological resilience. Additionally, research is required to determine how changes in water quality based on activities on the mainland may affect coastal ecosystems, particularly coral reef ecosystems.

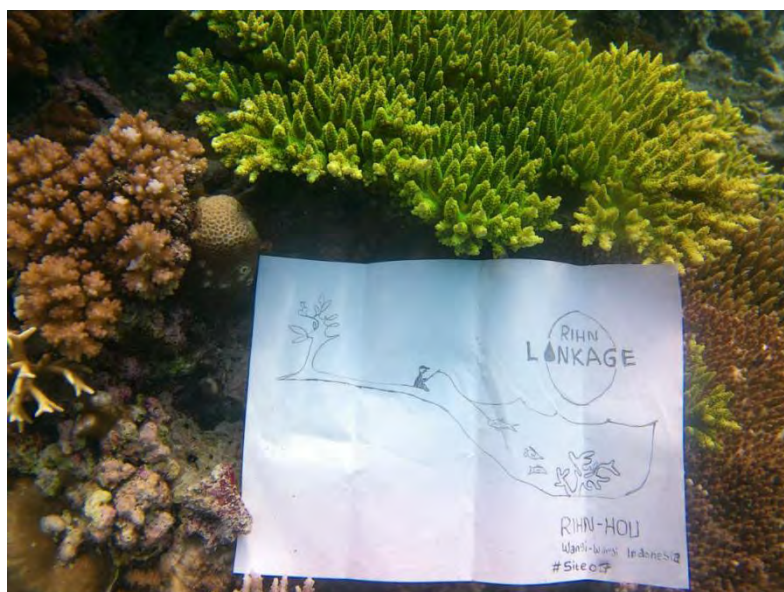
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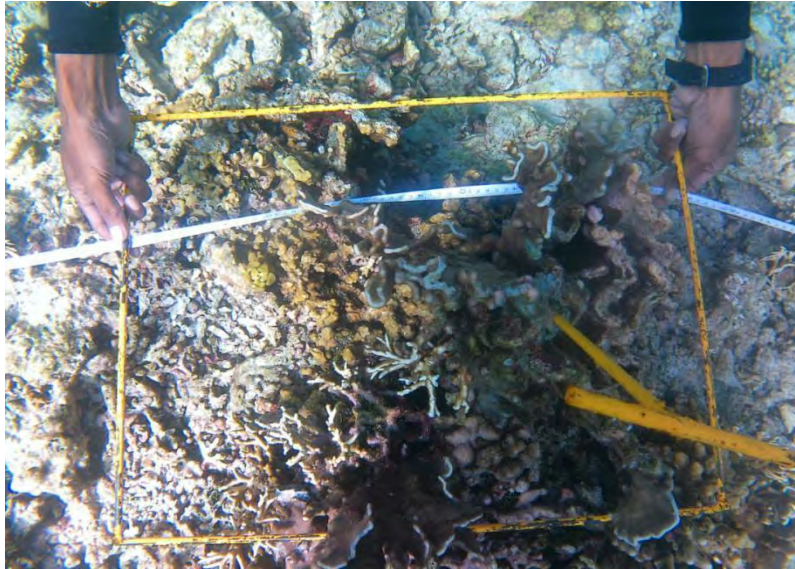
## Appendix II.1. Additional Documentation



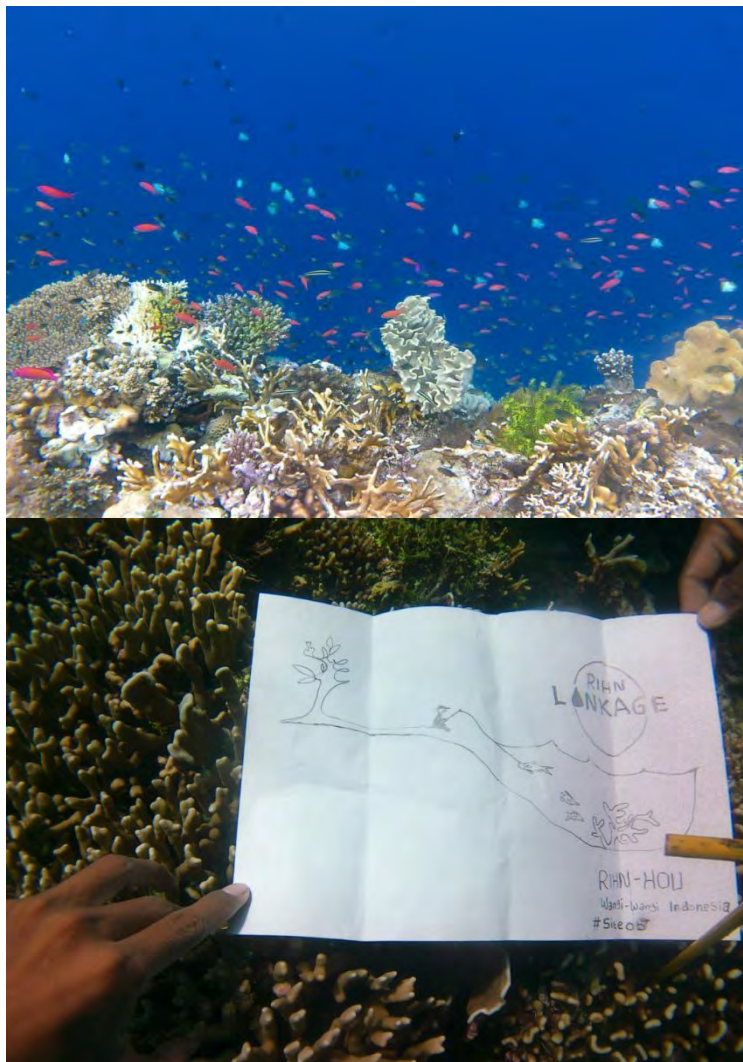
Monitoring of coral reef condition with permanent transect in MPA of Liya Bahari Indah, Wangi-Wangi







Monitoring of coral reef condition with permanent transect in MPA of Longa, Wangi-Wangi



Monitoring of coral reef condition and reef fish with permanent transect in MPA of Waha, Wangi-Wangi





Monitoring of seagrass in Cemara Beach, Wangi-Wangi.







Monitoring of seagrass in Marina Beach, Wangi-Wangi.



Monitoring of mangroves in Kaledupa Island.

# SOCIO-ECONOMIC CONDITION OF THE WANGI-WANGI COMMUNITY

## Chapter 3

Wakatobi Regency is located in Southeast Sulawesi Province, consisting of Wangi-Wangi, Kaledupa, Tomia and Binongko Districts. Wangi-Wangi Island, also known as Wanci, is the capital of Wakatobi Regency, consisting of 2 sub-districts, i.e. Wangi-Wangi and South Wangi-Wangi Districts.

### A. Population

Wangi-Wangi District has 6 sub-districts, 14 Villages, 36 Hamlets, and 22 Neighborhoods, with a total land area is 67.49 km<sup>2</sup>. The population by age and gender group of Wangi-Wangi District is presented in Table 18.

Table 18. The population of Wangi-Wangi District by age and gender categories

No.	Age (yr)	Male	Female	Total	Percent (%)
1.	0 – 14	4,016	3,898	7,914	28.16
2.	15 – 64	9,407	9,218	18,625	66.28
3.	65+	718	843	1,561	5.56
<b>Grand Total</b>		<b>14,141</b>	<b>13,959</b>	<b>28,100</b>	<b>100</b>

*Source: Indonesia Central Bureau of Statistics) of Wangi-Wangi District, 2022*

Table 18 shows that the total population in Wangi-Wangi District based on age and gender is 28,100 people. The population aged 0-14 years is 7,914 residents with a percentage of 28.16%, consisting of 4,016 males and 3,898 females. The population aged 15-64 years was 18,625 residents with a percentage of 66.28% consisting of 9,407 males and 9,218 females. Meanwhile, the elderly ( > 65 years old) comprise a small portion of the population, consisting of 1,561 residents (718 males and 843 females) or 5.56% of the total population.

Livelihood is a occupation for someone to fulfill their life needs. The livelihoods of residents in Wangi-Wangi District are presented in Table 19.

Table 19. Resident livelihoods in Wangi-Wangi District

No.	Occupation	Population (amount)	Percent (%)
1.	Farmers	2,370	38.05
2.	Fishermen	1,029	16.52
3.	Breeders	486	7.80
4.	Trading	294	4.72
5.	Civil-servant	871	13.98
6.	Industry	742	11.91
7.	Service sector	437	7.02
<b>Total</b>		<b>6,229</b>	<b>100</b>

Source: Secondary Data, 2022

Table 19 shows that the livelihoods of residents in Wangi-Wangi District are very diverse, consisting of 2,370 farmers with a percentage of 38.05% of total population, 1,029 fishermen (16.52%), 486 livestock breeders (7.80%), 294 residents (4.72%) are traders, 871 civil servants (13.98%), 742 residents (11.91%) are working in industry, and 437 residents (7.02%) work in service sector. This data shows that the most dominant livelihood is farmers and the lowest livelihood is for trading sector business.

## B. Economic Sector

### 1. Fishery

Apart from the service and trade sectors, the fisheries sector is the main type of community business on Wangi-Wangi Island. Table 20 provides information on the condition of fishing activities in Wangi-Wangi Island in 2022.

Table 20. The economic condition of the fisheries sector on Wangi-Wangi Island

<b>Number of Fishermen</b>			
Subdistrict	Full Fisherman	Part time fisherman	Total
Wangi-Wangi	1,089	120	1,209
South Wangi-Wangi	1,656	183	1,839
<b>Number of Fishing Boats</b>			
Subdistrict	Powerboat	Boat	Motor vessel
Wangi-Wangi	405	280	805
South Wangi-Wangi	617	423	1,223
<b>Number of Fish aquaculture</b>			
Subdistrict	Household	Production (ton)	Market value
Wangi-Wangi	-	-	
South Wangi-Wangi	61	14	IDR 700,000,000
<b>Number of Seaweed aquaculture</b>			

Subdistrict	Household	Production (ton)	Market value
Wangi-Wangi	-	-	-
South Wangi-Wangi	101	273	IDR 2,457,000,000
<b>Fishery</b>			
Subdistrict	Household	Production (ton)	Market value
Wangi-Wangi	554	4,364	IDR 123,722,235,000
South Wangi-Wangi	1,875	6,657	IDR 188,734,455,000

*Source: Indonesia Central Bureau of Statistics) of Wangi-Wangi District, 2022*

## 2. Agriculture and Plantation

Horticultural commodities commonly found in Wakatobi Regency are shallots, water spinach, tomatoes, eggplants, snake beans, cucumbers, and mustard greens. However, those agricultural commodities are insufficient to meet people's needs in Wakatobi. Therefore outside commodities are supplied from Lasalimu District-Buton, and Kendari City.

The essential program of dry land use is commodity intensification and diversification supported by limited extensification. Cropping pattern optimization is achieved by intercropping systems that match plant types to climatic and soil conditions. The development area of the cropping system is intended for all districts. The dry land can also be used with an integrated farming system for livestock development.

Mostly, the plantation crops developed by the people in Wangi-Wangi Island are coconut, cashew, cocoa, coffee, and tamarind. For fruit crops, it includes mango, banana, and jackfruit. Moreover, the development of livestock and agriculture is focused on an integrated eco-farming system, i.e., integrating livestock into food crop agriculture, plantation and forestry (agro-forestry pasteur).

## 3. Tourism

Tourism is one of the leading economic sectors after the fishery. The type of tourism practices being developed is marine tourisms, i.e., beach and sea panoramas, coral reefs, waves for water sports, fishermen's lives activities view, and natural tourism (mountain panoramas, underground caves, art, and cultural tourism).

The main natural tourist attraction in this area is the existence of several white sandy beaches with beautiful coastal vegetation. These beaches include: Jodoh Beach, Molisahatu Beach, Sousu Beach, Molae One Beach, and Matahora Beach. Marine vegetation, such as coral reefs and reef fish diversity, are also attractive tourism for Wakatobi island. Additionally, several diving spots are also available. Several small isles



around these waters are a unique attraction for this area. These isles include *Nuabala*, *Matahora*, *Nua Indah*, and *Nua Ponda* Isles.

Caves, forests, and peak/hill tours are other natural tourist attractions in Wakatobi island, such as *Kontamale* natural cave and *Teecosapi* natural cave. The cave has stalactites with clear water at the bottom. Natural forests have unique flora, such as nutmeg, sago, and palm trees, with natural water sources. The mangrove forest, with unique vegetation around the *Liya* area, is also special and impressive for tourism. *Waginopo* top hill also presents an interesting panorama such as Wangi-Wangi fields, sea panorama, and sunset view.

Cultural and man-made tourism in Wakatobi includes *Wabue-Bue* Fort, located in *Waha* Village, Wangi-Wangi. Outside the area, there are also several other types of cultural and man-made tourism in several villages, such as the *Liya* Palace Fortress located in *Liya* Village. Several traditional building units, such as traditional Buton houses, old mosques, and tombs of noble families surround this fort. Other tourism sites are *Baluara* Fort in *Kapota* Village, *Mandati Tonga* Fort, *Watinti* Fort in *Mandati* Village, *Tindoi* Fort and old tombs in *Tindoi* Village, *Togo Malengo* Fort in *Kapota* Village, *Koba* Fort, and art crafts shape. The tourism object area in Wangi-Wangi Island is tabulated in Table 21.

Tabel 21. Tourism object in Wangi-wangi

<b>Terrestrial/traditional sites/cultural tourism</b>	<b>Marine tourism (Beach)</b>	<b>Cultural tourism (Dance)</b>
1. <i>Tee Kosapi</i> cave water	1. <i>Jodoh</i>	1. <i>Kenta-Kenta</i>
2. <i>Lia Ntade</i> cave water	2. <i>Moli'i Sahatu</i>	2. <i>Moborira</i>
3. <i>Lobu</i> cave water	3. <i>Molai One</i>	3. <i>Pajoge Ngiwi</i>
4. <i>Kontumale</i> cave water	4. <i>Sousu</i>	4. <i>Lengko</i>
5. <i>Tindoi</i> fort	5. <i>Onemeha</i>	5. <i>Aliondo</i>
6. <i>Mandati</i> fort	6. <i>Nuaindah</i>	6. <i>Palin-Palia</i>
7. <i>Liya Togo</i> fort	7. <i>Cemara</i>	7. <i>Honari Mosega</i>
8. <i>Togo Molengo</i> fort	8. Diving Site: <i>Sombu, Waha, Longa, Patuno, Matahora, and Liya</i> area	<i>Karia</i>
9. <i>Liya Togo</i> old mosque	9. Dolphin Watching Tour in <i>Kapota</i> island	8. <i>Kabuenga</i> cultural ceremony
	10. The traditional village of <i>Bajau Mola Raya</i>	9. <i>Bangka</i> cultural ceremony
		10. <i>Mbule-Mbule</i>

Wangi-Wangi Island coastal area consists of a beach and cliff area. The beaches commonly visited by tourists on Wangi-wangi Island including *Cemara/OaYiOgu*,

*Matahora, Tompu One Patuno, and Sousu Beaches.* There are also several beaches that have white sand, including *Molii Sahatu, Kaluku Kapala/Hugua, Oa Warinsi, Dongkala, Roda/Sahara, Topakula/Bayangkara, Onelonge, Topanuanda, Butu, One Satanda, Oa Méléanga, Kolo, Watu Posunsu, Bontu, Melai One, Ponta, Oa YiOgu/Cemara, Wambulinga, Yija La Iyai, One Satanda Waha, Tengko and Onowa beach.*

According to information from the Wakatobi District Tourism Office, around Wangi-Wangi and Kapota Reef, 20 dive points have been found. These dive points are mostly scattered in the northern and western parts of the waters of Wangi-Wangi Island which have *reef plate* and *dropoff* types. Meanwhile, snorkeling activities can be carried out at the edge of the *dropoff* such as in Waha which has a fairly high diversity of fish.



a. *Cemara beach*



b. *Patuno resort*



c. *Wasabinoa isle*



d. *Sombu diving site*

Figure 41. Several tourist destinations on Wangi-Wangi Island

Wangi-Wangi Island also has natural caves and springs called *Topa* (cave springs). Local residents often use the spring to meet their daily needs, such as traditional bathing and washing. In general, the caves on this island have not been used as a tourism

destination. Naturally, Wangi-Wangi Island consists of a plateau or high hill. Several hills are often visited on this island, including *Woru Nunu hill* in *Liya Togo Village*, *Waha hill* in *Waha Village*, and *Tindoi hill* in *Tindoi Village*.

### C. Ethnicity and Local Wisdom

Wangi-Wangi Island residents consist of various ethnicities, i.e, indigenous of Wakatobi, Bugis, Butonese, Javanese and Bajo ethnicities. However, the original ethnic culture is still dominant and has not fully acculturated. Each ethnic group lives with their own culture harmoniously and respectfully. The Bajo ethnic is unique because their life depends on marine life, from livelihoods to building settlements above the sea coast using reefs.

The Buton-Wakatobi and Bajo ethnic groups in Wangi-Wangi are divided into four indigenous peoples: 1. *Wanse*, 2. *Mandati*, 3. *Liya* and 4. *Bajo*. The existence of various ethnic groups and indigenous peoples makes the cultural diversity of this region because each indigenous community has different traditions, customs, and languages.

Sea life acculturation makes their living tradition to be the coastal community oriented that is called the coastal community's culture or anthropological marine. The community is mostly dependent on marine resources. Therefore, traditional fishing management is carried out to maintain its sustainability, such as “no-catching agreement in certain areas” which are often referred to as *tubba dikatutuang* (*Tubba* refers to marine habitat, to live, coral; *dikatutuang* means love, care for, maintained: Bajo language), because the area is a fish spawning area.

Regarding cultural ideology, the Wangi-Wangi residents strongly uphold the *gau satoto* philosophy, which contains the values of the importance of mind firmness, attitude, and consistency between words and actions. *Gau satoto* consists of five main principles, i.e, *tara* (steadfastness), *туру* (patience), *toro* (commitment), *taha* (courage), and *toto* (honesty). The life philosophy is closely related to the natural conditions where they live, namely the barren and rocky islands and the fierce sea condition surrounding them, especially the waves of the Banda Sea in the east season and the Flores Sea in the west season.

## D. Results of Interviews on Utilization of Water Resources

### 1. Respondent Categories

Table 22 tabulates the respondent used in the interview. There were 45 respondents aged 15-64 years old (81.82% of total respondents) and 10 respondents aged >65 years old or 18.18%.

Table 22. Respondent age

No	Age category (years)	Respondents (person)	Percent (%)
1.	> 15	-	-
2.	15-64	45	81.82
3.	> 65	10	18.18
<b>Total</b>		<b>55</b>	<b>100</b>

Source: Primary Data, 2022

Respondents' livelihoods are tabulated in Table 23. The respondents' livelihoods were diverse, i.e, 17 fishermen or 30.91%, 10 farmers or 18.18%, 2 civil servants with 3.64%, 10 housewives and sellers/traders or 18.18%, 3 Teachers or 5.45%, 3 Village Officials or 5.45%, 3 Community Leaders or 5.45%, 2 Boat Crews or 3.64%, 3 temporary public workers with or 5.45%, 1 service worker or 1.82% and 1 person who does not have occupation or 1.82% of total respondents.

Table 23. Respondents' livelihood

No.	Occupation	Respondents (person)	Percent (%)
1.	Fishermen	17	30.91
2.	Farmers	10	18.18
3.	Civil Servant	2	3.64
4.	Housewife and traders	10	18,18
5.	Teachers	3	5.45
6.	Village Aparaturs	3	5.45
7.	Community leaders	3	5.45
8.	Ship crews	2	3.64
9.	The temporary staff of the government	3	5.45
10.	Service sector	1	1.82
11.	Unemployment	1	1.82
<b>Total</b>		<b>55</b>	<b>100</b>

Source: Primary Data, 2022

Table 24. Respondents' families

No.	Family member	Respondents (person)	Percent (%)
1.	1	2	4,65
2.	2	1	2,33
3.	3	7	16,28
4.	4	9	20,93
5.	5	14	32,56
6.	6	9	20,93
7.	7	0	-
8.	8	1	2,33
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 25. Land ownership

No.	Land ownership	Respondents (person)	Percent (%)
1.	> 1 ha	8	18.60
2.	1 ha	2	4.65
3.	2 ha	8	18.60
4.	3 ha	1	2.33
5.	4 ha	1	2.33
6.	None	23	53.49
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Based on Table 25, respondents who own land area greater than 1 ha are 8 people or 18.60%, the land area of 1 ha are 2 people (4.65%), the land area of 2 ha are 8 people (18.60%), land area of 3 and 4 ha are 1 person respectively by 2.33% of total land, and those who do not own land are 23 people that take majority among the respondents, i.e. 53.49%.

Table 26. Respondents' Income

No.	Income/month (IDR)	Respondents (person)	Percent (%)
1.	100,000-500,000	20	46.51
2.	600,000-1,000,000	14	32.56
3.	1,100,000-1,500,000	2	4.65
4.	1,600,000-2,000,000	3	6.98
5.	2,100,000-2,500,000	-	-
6.	2,600,000-3,000,000	-	-
7.	3,100,000-3,500,000	1	2.33



8.	3,600,000-4,000,000	2	4.65
9.	None	1	2.33
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Based on Table 26, the respondents' income is varied. The majority of the respondents (20 people or 46.51% of total respondent) has income of IDR 100,000-500,000; income of IDR 600,000-1,000,000 is 4 people (32.56%); income of IDR 1,100,000-1,500,000 are 2 people (4.65%); income of IDR 1,600,000-2,000,000 are 3 people (6.98%); income of IDR 3,100,000- 3,500,000 is 1 person or 2.33%; income of IDR 3,600,000- 4,000,000 are 2 people (4.65%) and those who do not have income is 1 person or 2.33%.

## 2. Water Resources Usage

Wangi-Wangi has many water sources, especially groundwater. The groundwater sources make karst caves, which local people call "*Loba/Ufe/Moli'i*". The groundwater sources are close to the sea, and the tide period makes the water brackish. Other water source is refilleded-water with RO water, metered water supply, drilled wells or pumping wells, traditional wells, and springs (BPS Wakatobi, 2019). The water resources are used for various community needs, including drinking, bathing, washing, agriculture, animal husbandry, healing illnesses and custom ritual.

Cave-formed water resources in Wangi-Wangi are managed by the local government called *PDAM* (government municipal water works). They include *Wagehe-gehe* Spring in *Pada Raya Makmur* Village which supply domestic needs for several villages in Wangi-Wangi District and South Wangi-Wangi District. Groundwater/cave water is collected using a water pump and then channeled to people's homes using a piping system. However, several springs water resurces are managed by local communities, such as *Kontamale*, *Teekosapi*, *Topa Wanci*, *Lesa'a*, and *Moli'l Sahatu* springs. Table 27 shows the amount of village based on source of Drinking Water usage in Wangi-Wangi island for 2019-2022.

Table 27. Villages by Source of Drinking Water in Wangi-Wangi District, 2019-2021

<b>Drinking water resources</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
Branded-packaged water	-	-	-
Refilled water	3	5	9
Metered tap water	1	2	2

Non-metered tap water	-	-	-
Pumped well	10	9	5
Well	3	2	2
Spring	3	2	2
River/lake/pond/Reservoir/dew-water/Dam	-	-	-
Rain water	-	-	-
Others	-	-	-

Source: Indonesia Central Bureau of Statistics) of Wangi-Wangi District, 2022

Interviewing study revealed that 43 respondents used water resources daily life such as washing, bathing, cooking, and drinking. Figure 42 presents people's water usage in Wangi-wangi district.

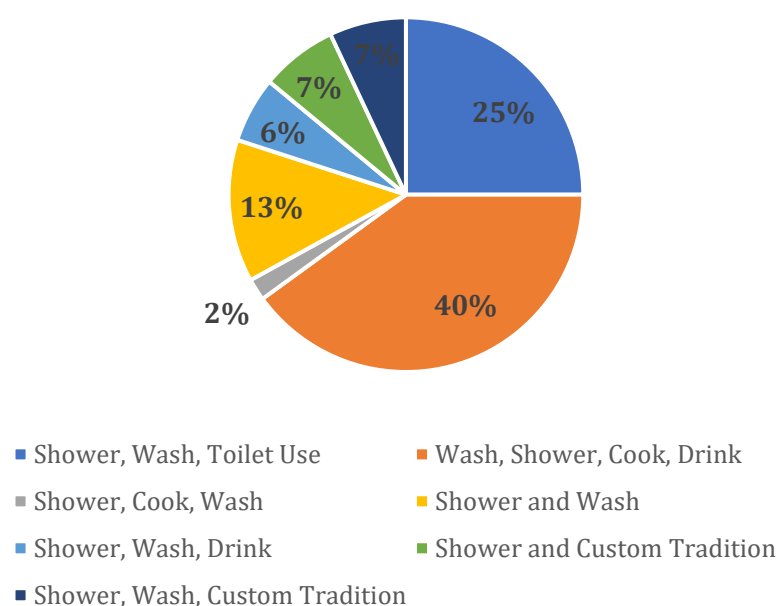


Figure 42. People's water use category in Wangi-Wangi

Daily water use from the cave well reaches 200 litres - 1 cubic per person, as summarized in Table 28.

Table 28. Amount of Water used by Respondents per Day

No.	Water used quantity/day	Respondents (person)	Percent (%)
1.	100-200 Litres	15	34.88
2.	210-300 Litres	16	37.21
3.	310-400 Litres	5	11.63
4.	410-500 Litres	6	13.95
5.	1000 litres	1	2.33
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 28 presents the amount of water used by respondents per day is 100-200 litres by 15 people or of 34.88%, 210-300 litres by 16 people (37.21%), 310-400 litres by 5 people (11.63%), 410-500 litres by 6 people (13.95%) and 1000 litres for 1 person with a percentage of 2.33%.

Table 29. Spring Water Users

No.	Spring water user by group	Respondent(person)	Percent (%)
1.	Personal	27	62.79
2.	2 Households	7	16.28
3.	5 Households	1	2.33
4.	Local people	8	18.60
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 29 shows that 27 respondents use private wells or 62.79%, jointly of springs used by 2 households is 7 respondent (16.28%), 5 households is 1 person (2.33%), and springs users by local community are 8 people or 18.60%.

### 3. Local Community Opinions on Water Quality

In general, all 43 respondents stated that the quality of the water used daily for bathing, washing and cooking needs is in good condition, both in terms of color, smell and taste. However, several sources of clean water were found in the slightly murky category in terms of color and brackish. Public perception of the quality of water is presented in Tables 30-37.

Table 30. Public perception for water color

No.	Water Color	Respondents (person)	Percent (%)
1.	Clearwater	51	92.37
2.	Turbid	4	7.27
<b>Total</b>		<b>55</b>	<b>100</b>

Source: Primary Data, 2022

Table 31. Public perception for water odor

No.	Water Odor	Respondents (Person)	Percent (%)
1.	Odor	-	-
2.	Odorless	43	100
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 32. Public perception for water taste

No.	Water Taste	Respondents (person)	Percent (%)
1.	Tasteless	49	89.09
2.	Brackish	6	10.91
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 33. Public perception for depth of water sources

No.	Depth of water resources (meter)	Respondents (person)	Percent (%)
1.	1-5	26	60.47
2.	6-10	13	30.23
3.	11-15	4	9.30
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 34. Public perception for water area of clean water

No.	Water resources by area (meter)	Respondents (Person)	Percent (%)
1.	1	9	16.36
2.	1×1	4	7.27
3.	1×2	2	3.64
4.	2	2	3.64
5.	2×2	16	29.09
6.	3	1	1.82
7.	3×2	5	9.09
8.	3×3	1	1.82
9.	5×1,5	1	1.82
10.	5×3	4	7.27
11.	5×4	4	7.27
12.	5×5	1	1.82
13.	8×8	1	1.82
14.	10×6	4	7.27
<b>Total</b>		<b>55</b>	<b>100</b>

Source: Primary Data, 2022

Table 35. Public perception for consumability of water resources

No.	Water consumability	Respondents	Percent (%)
1.	Consumable	43	100
2.	Unconsumable	-	-
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 36. Public perception for spring location cleanliness

No.	Spring location	Respondents	Percent (%)
1.	Clean	43	100
2.	Contaminated	-	-
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

Table 37. Distance of water Source from respondent's house

No.	Distance	Respondent(s)	Persentase (%)
1.	1 m	5	11,63
2.	2 m	13	30,23
3.	3 m	7	16,28
4.	5 m	4	9,30
5.	6 m	2	4,65
6.	10 m	2	4,65
7.	12 m	1	2,33
8.	30 m	1	2,33
9.	100 m	1	2,33
10.	200 m	2	4,65
11.	250 m	1	2,33
12.	300 m	2	4,65
13.	1 km	1	2,33
14.	3 km	1	2,33
<b>Total</b>		<b>43</b>	<b>100</b>

Source: Primary Data, 2022

#### 4. Local Wisdom on Water Resources Use in Wangi-Wangi

Local wisdoms on water resource use in Wangi-Wangi consist of *Values* (religion, togetherness, and tradition), *Norms* (prohibition of trash careless, bathing for menstruating women, habit of mutual cooperation, and praying before bathing), *Belief* (It can grant requests of water users, purifying people who will take part in the *Karia* ritual, bringing storms and sea waves if one move away the *Kansira* stones around the springs, bringing clouds for rain and calming waves at sea when using the water as a ritual offering, healing sick of people who drink and bath in this water, and having threats for



monster fish and octopus for someone who jumps or baths directly into the water, warnings and punishment (detained by the Police and or imprisoned).

Table 38. Local Wisdom related to the utilization of water resources in Wangi-Wangi

Values	Religious, Togetherness, Traditions
<b>Norms</b>	1. No liters into the water 2. No bathing for menstruating women 3. Habits for mutual cooperation 4. Habit for praying before bathing
<b>Beliefs</b>	1. Granting the request of user 2. Purifying people who involve in <i>Karia</i> tradition/ritual 3. Bringing storms and sea waves if one moves away the <i>Kansira</i> stones around the springs 4. Bringing clouds for rain and calming waves at sea when using the water as a ritual offering 5. Healing sick of those who drink and bath in this water 6. Having threats of monster Fish and Octopus for those who jump or bath directly into the water
<b>Sanctions</b>	1. Positive warning 2. Social norm sanction

Source: Primary Data, 2022

## E. Conclusion

1. The biggest source of livelihood for the population in a particular order: Farmer, Fisherman, and Civil Servant.
2. Fisheries sector is the main business income for the people in Wangi-Wangi.
3. Agricultural product has not been able to fulfill the daily needs of the people in Wangi-Wangi.
4. There is still local wisdom in the utilization of water resources.
5. The cave water around Wanci is suitable for drinking and also for showering, washing, and for toilet usage.