

Training and assistance in clean water treatment for communities to meet hygienic water needs

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ABSTRACT

Yobeh Village, located in the Sentani district, consisted of 3 community units (RW) and 7 neighborhood units (RT) with a total of 173 families and 692 residents. A portion of the community, approximately 56 families with around 246 residents, lived along the shores of the island in the Lake Sentani area. The waters of Lake Sentani served as the "center of life" for the community, where the lake was utilized for fishing, disposing of household waste, and fulfilling bathing, washing, and sanitation needs. It was also used as a source of raw water for drinking and other clean water needs. This community service activity aimed to provide the community with an understanding of the importance of clean water for life. It also equipped them with the skills to assemble and operate filtration technology equipment using four filtration tubes arranged in series. Tube 1 contained bio foam media, tube 2 contained polypropylene media, tube 3 contained granular activated carbon (GAC) media, and tube 4 contained chlorine, taste, and odor (CTO) media. Testing the quality of the filtered water demonstrated very significant improvements, meeting the requirements for hygienic clean water suitable as raw water for drinking purposes.

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1. INTRODUCTION

Sentani is a district that also serves as the capital of Jayapura Regency, Papua Province, Indonesia. Sentani District covers an area of 98.00 km², with a population of approximately 75,742 people as of 2021 and a population density of 772.88 people per km². The capital of Sentani District is located in Sentani Kota Subdistrict (Djuniawal et al., 2019; Hamuna et al., 2018). As of 2020, Sentani District consisted of 10 villages, 60 RW (community units), and 217 RT (neighborhood units). Among these villages, Sentani Kota Subdistrict has the highest number of RT and RW, with 12 RW and 53 RT, while Yobeh Village has 3 RW and 7 RT, with 173 households and a total population of 692 people.

A lake is a body of water surrounded by land and either permanently or temporarily filled with stagnant or flowing water (Pamudjianto & Sutiono, 2018). A lake is a water body contained within a basin, filled with water, and encircled by land, either naturally formed or man-made (Suhartawan et al., 2023). In addition to serving as a source of drinking water and daily household needs, lakes are also utilized as a

source of industrial raw water, water transportation routes, irrigation, tourism, and protein sources from fisheries. The multi-sectoral use of lakes, along with activities in surrounding areas, has caused significant degradation of lake ecosystems over time. Clean water is water used for daily needs that meets health standards and is safe to drink when boiled or sterilized. Water for hygiene and sanitation purposes is water used for personal and/or household hygiene (Kementerian Kesehatan, 2023). Indonesia, with more than 840 beautiful and unique lakes, including Sentani Lake, requires community service efforts to address environmental issues affecting lake water. This ensures that lake water remains usable for human life, as people living around lakes fundamentally depend on lake water for their livelihood.

The issue of clean water supply has become a significant concern for both developed and developing countries. Indonesia, as a developing country, also faces challenges in providing clean water to its people (Pamudjiyanto & Sutiono, 2018; Wulandari et al., 2019). One of the main issues is the limited availability of clean water sources, the unequal distribution of clean water services, especially in rural areas, and the underutilization of available clean water resources (Nasution, 2021). Additionally, public awareness regarding environmental health remains low. This is due to low levels of education and a lack of knowledge and understanding of the importance of clean water for life.

Yobeh Village, located in Sentani District, is one of the areas on a small island in Lake Sentani. It is approximately 12.77 km from the University of Science and Technology Jayapura and can be reached in about 27 minutes by land transportation.

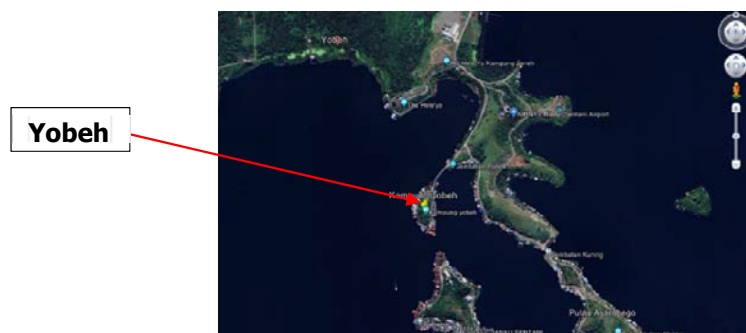


Figure 1. Location of Yobeh Village, Sentani District
(Retrieved from: <https://disbudpar.jayapurakab.go.id/keindahan-danau-Sentani/>)

The community of RW2 in Yobeh Village (floating settlement) directly utilizes Lake Sentani's water as clean water without any treatment. Therefore, filtration technology is needed to improve water quality and meet the demand for clean water. This filtration is expected to enhance the quality of lake water for daily use. The filtration process aims to clarify the water, remove impurities, and eliminate bacteria.

The water quality of Lake Sentani is highly unhygienic and physically unsuitable for clean water usage due to its turbidity exceeding quality standards (Suhartawan et al., 2022a; Suhartawan et al., 2022b). The water also has a yellowish hue, and chemically, its phosphate and nitrate content exceeds acceptable limits. Additionally, fecal waste from both livestock and humans contributes to high levels of total coliform and *Escherichia coli* (Suhartawan et al., 2023) in the lake's waters.

On the other hand, the community continues to rely on Lake Sentani as a clean water source (despite its unsuitability), which can have negative health impacts. The high concentration of Total Suspended Solids (TSS) in the lake reduces water clarity and potentially decreases dissolved oxygen levels, threatening aquatic life (Adhar et al., 2022).

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Some priority issues addressed in this community service program include: (1) Lack of knowledge and understanding of the importance of using clean water and its impact on health; (2) Absence of community skills in constructing filtration technology for clean water treatment; (3) Unavailability of clean water services provided by the local government, such as PDAM (Regional Drinking Water Company) or adequate water treatment facilities.

This community service program aims to provide an understanding of the importance of clean water for life, equip the community with skills to assemble and operate water treatment equipment, and ensure the sustainability of clean water processing operations so that the community's need for hygienic clean water can be met.

2. METHODS

To solve the problems experienced by partners, namely the unavailability of clean, adequate water, the service team designed two main activities, namely: (1) Testing the water quality of Lake Sentani as a basis for selecting filtration media to be used in clean water treatment. As an initial step, the choice of filtration media is based on research findings (Suhartawan et al., 2022a; Suhartawan et al., 2022b), which indicate that several water quality parameters exceed clean water standards, including odor, color, taste, and pollutant content such as TSS, Total Coliform, and Escherichia coli. Thus, the appropriate filtration media choices are Zeolite, PP (Polypropylene), GAC (Granular Activated Carbon), and CTO (Chlorine, Taste, and Odor) (Hasbiah et al., 2019; Mashadi et al., 2018); (2) Hygienic clean water filtration for the community of Yobeh Village, Sentani District, Jayapura Regency.

Steps to Implement the Solution

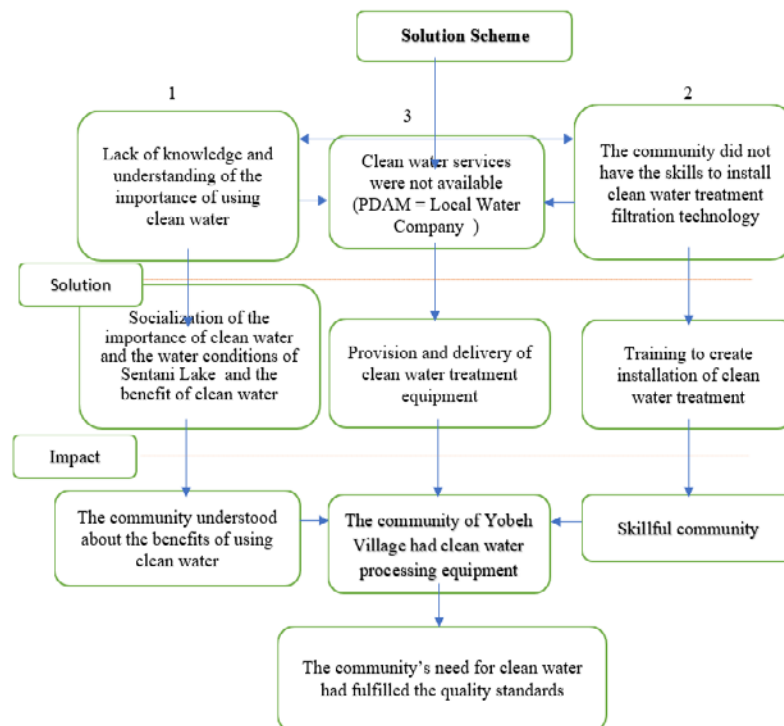


Figure 2. Solution scheme

Some problems revealed and there must be solution for each of problems. There are problems and how to solve them, such: (1) The lack of knowledge and understanding of the importance of utilizing clean water and its impact on health can be addressed through socialization by presenting the preliminary test results of Lake Sentani's water quality before treatment; (2) The absence of community skills in constructing filtration technology for clean water treatment can be resolved through training on how to build water treatment devices, followed by testing the equipment (the treated Lake Sentani water will be tested in a laboratory for quality assessment); (3) The unavailability of clean water services provided by the local government, such as PDAM (Regional Drinking Water Company) or adequate clean water treatment facilities, can be addressed by enabling the community to build their own clean water treatment systems. This will be preceded by socialization on the importance of using clean water and training in constructing water treatment devices (one unit per neighborhood). The devices will be tested, utilized, and ultimately provide clean water, ensuring the clean water needs of Yobeh Village residents are met.

Community Participation (Partners) in Activities

There are 2 things to do: (1) Socialization activities; the community as participants in the socialization about: (a) The condition of the water quality of Lake Sentani before processing; (b) The importance of utilizing clean water; (c) The impact of utilizing water that does not meet clean water requirements on health; (2) Training in making clean water filtration technology installations with the following scheme: (a) Community as training participants (male); (b) Forming a working group for training in making clean water filtration technology installations (grouping based on the Neighborhood Association (RT) group in the Citizens' Association (RW) 1 of Yobeh Village. Each group designs 1 filtration technology tool; (c) Trial of group work results to ensure that the filtration technology tool functions properly and does not leak; (d) Each group assembles the filtration technology tool at their respective RT locations; (e) Trial and then the community can utilize hygienic clean water so that the community's need for clean water can be "FULFILLED"; (f) The community has the knowledge and skills to make, repair and maintain clean water processing equipment so that after the community service activities its sustainability is maintained.

Monitoring, Evaluation, and Assistance

To ensure optimal and sustainable clean water service, the service team will conduct monitoring, evaluation and assistance to the community periodically both during and after the implementation of community service activities or after they end. Monitoring is carried out every month or if there are problems that need to be resolved and then repairs will be made if problems occur including replacing filtration media. In monitoring activities, guidance is also provided to the community who are in charge of maintaining and operating clean water treatment equipment. The stages of implementing community service activities in Yobeh Village, Sentani District, Jayapura Regency are outlined in Table 1.

3. RESULTS AND DISCUSSION

In accordance with the problem solutions that have been formulated above and the community service implementation scheme, the results obtained will be discussed.

Results

Yobeh Village is part of the Sentani District in Jayapura Regency. The community service initiative is focused on Neighborhood Unit (RT) 02, a settlement located on an island within the Sentani Lake area. The residents primarily rely on the lake for their livelihood, treating it as the center of life. In addition to fishing as their main source of income, they use the lake water for bathing, washing, and even drinking. However, they also dispose of domestic waste into the lake, which has led to a decline in water quality.

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Table 1. The stages of implementing community service activities

Implementation Time	Activities	Objectives	Objective Completion Strategies	Completion Targets
2nd Week of July 2024	Providing an overview of the quality status of Lake Sentani water to the Yobeh village community based on previous research results	The community understands the water quality status of Lake Sentani.	Socialization of the water quality status of Lake Sentani	The community has an understanding
2nd Week of July 2024	Increasing the understanding of the Yobeh Village community about the importance of utilizing clean water that meets health or sanitation hygiene standards	The community understands the importance of utilizing clean water.	Socialization of the importance of utilizing clean water and the impact of utilizing unclean water.	The community understands the importance of utilizing hygienic clean water
3rd Week of July 2024	Creating a clean water treatment filtration technology installation (to eliminate odor, color, taste, TSS, Total coliform and Escherichia coli)	The availability of clean water treatment equipment that can eliminate odor, color, taste, TSS, Total coliform and Escherichia coli	Designing installations and selecting filtration media adjusted to the characteristics of pollutants.	A good clean water treatment installation is produced
4th Week of July 2024	Training the community to create a clean water treatment filtration technology installation that meets clean water quality standards using Sentani lake water as raw material.	The community has skills in making clean water filtration technology installations.	Providing tools, materials and guidance to create adequate filtration technology installations.	The community has the skills to make clean water treatment equipment
1st Week of August 2024	Trial of the success of the Clean Water Filtration Technology Installation	The availability of good clean water treatment filtration technology installations.	Demonstrating trials and showing differences in color, taste and smell of water.	A difference is obtained where the processed results are of better quality
2nd Week of August 2024	Handover of the clean water filtration technology installation to community leaders.	The receipt of 3 clean water treatment units.	Preparing 3 clean water treatment units.	3 clean water treatment units were handed over to the head of Yobeh village.
Every 2nd Week of September, November and December	Monitoring, evaluation and assistance.	The fulfillment of clean water for the Yobeh village community.	Team visits to the location periodically.	The maintenance of clean water treatment equipment that produces hygienic clean water is sustainable.

Preliminary water quality tests on ten parameters revealed that six of them—odor, color, total suspended solids (TSS), detergent content, total coliform, and *Escherichia coli*—do not meet clean water standards. This situation poses significant health risks, especially for children.

To obtain clean water, it is necessary to treat the lake water first, for example, through simple filtration. The residents have independently attempted conventional filtration methods using local materials such as gravel, sand, and sago palm fibers. However, due to inadequate maintenance, the filtered water has not shown significant improvement and still fails to meet clean water standards.

The need for hygienic clean water in Yobeh Village is urgent and critical, making proper water treatment a necessity. Based on discussions between the community, the village deliberation body (Bamuskam), traditional leaders, religious leaders, youth representatives, women's representatives, and village authorities, it has been determined that a reliable clean water filtration facility or technology must be developed. This system should be capable of providing safe drinking water for the residents of Yobeh Village, particularly those living in RT 02, the island settlement within the Sentani Lake area.

Preparation and planning stage

As a further step after knowing the condition of the lake water quality, clean water filtration technology is designed using four tubes containing filtration media arranged in series according to the needs to reduce or eliminate pollutants, namely: (1) Tube 1: Contains Biofoam Media. Biofoam is a natural mineral with a large pore structure. Biofoam filtration media can trap bacteria and other organic substances, making it a good choice for reducing coliform and *E. coli*. Biofoam filtration media has several important functions in providing clean water. Its pore structure serves to clarify water and allows it to filter out solid particles and other materials present in the water; (2) Tube 2: Contains PP (Polypropylene) Media. PP (Polypropylene) filtration media is one of the most commonly used filtration media in water filtration systems. Its function is to filter out TSS, TDS, dust, dirt, and sediments present in water (Lista et al., 2023). PP filtration media is capable of filtering fine sediments and small dissolved particles in water. This helps maintain water clarity and prevents clogging in piping systems and other equipment; (3) Tube 3: Contains GAC (Granular Activated Carbon) Media. GAC (Granular Activated Carbon) filtration media is a type of filtration media made from activated carbon in granular form. The primary function of GAC filtration media is to remove various organic and chemical contaminants from water. Additionally, GAC can trap and retain bacteria, viruses, and protozoa from water. This helps reduce pathogenic microorganisms such as *E. coli* and coliform in water. Specific functions of GAC media include filtering organic substances, eliminating unpleasant taste and odor, removing harmful chemicals, heavy metals such as iron, and eliminating color; (4) Tube 4: Contains CTO (Chlorine, Taste, and Odor) Media. CTO (Chlorine, Taste, and Odor) filtration media is a commonly used filtration media in water filtration systems. The primary function of CTO filtration media is to remove chlorine, unwanted odors, and unpleasant tastes from water. Additionally, CTO media can also contain other filtration materials, such as polypropylene fibers, which help capture large particles in water, such as dust, sand, and other sediments. The filtration technology design showed in Figure 2.

To ensure that the clean water treatment equipment can function, a trial is needed and then a water quality test is carried out on the filtered water. The test results on the quality of the filtered water showed in Table 2.

Table 2 shows that the water quality after filtration treatment is getting better. Of the 10 (ten) parameters tested before treatment, 6 (six) parameters (Odor, Color, TSS, Detergent, Total coliform and *Escherichia coli*) did not meet the requirements, after treatment all parameters met the requirements as clean water or drinking water raw water based on Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management, Appendix VI part 2, especially class 1 water (clean water or drinking water raw water).

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Figure 2. Clean water filtration design

Table 2. Results of water quality tests after filtration

Parameters	Units	Quality Standards	Results	Description
Temperature	°C	± 3 Air temperature	29,1°C	Meet the standards
Taste	-	Tasteless	Tasteless	Meet the standards
Odor	-	No smell	Odorless	Meet the standards
Color	-	Colorless	Colorless	Meet the standards
Total Dissolved Solid (TDS)	mg/L	1.000	91	Meet the standards
Total Suspended Solid (TSS)	mg/L	25	17	Meet the standards
Acidity (pH)	-	6 - 9	7,92	Meet the standards
Detergent	mg/L	0,2	0,12	Meet the standards
Total coliform	CFU/100 mL	1.000	546	Meet the standards
Escherichia coli	CFU/100 mL	100	56	Meet the standards

Implementation

To provide an understanding of the importance of clean water for life, a water quality test of Lake Sentani was conducted before filtration, followed by an awareness program on the lake's water quality and the significance of clean water. During this activity, the community participated actively. As a result, they now understand that the lake water is not suitable for clean water use and have recognized the importance of utilizing clean water.

Socialization of the importance of clean water

The water quality status of Lake Sentani needs to be understood by the Yobeh community so that they realize the necessity of treating the water before using it as clean water. To achieve this goal, an awareness program was conducted to provide an overview of the water quality status of Lake Sentani to the Yobeh village community.

Socialization of the impact of non-hygienic water on health

This activity aims to provide the public with an overview of the impacts of unhygienic water use on human health, accompanied by case examples, symptoms and how to deal with them.



Figure 3. Socialization of the Importance of clean water



Figure 4. Socialization of the use of non-hygiene sanitation water for health

Training in the installation of clean water filtration technology

This activity is intended to provide knowledge on how to build a clean water filtration technology installation by identifying the necessary tools and materials, explaining the function of each filtration media, and selecting the appropriate media based on the contaminants present in the lake water. So that the community can acquire skills in designing, operating, maintaining, replacing, and repairing damaged parts of the equipment, training sessions were conducted.

In this activity, the community was divided into three groups based on their respective RTs. Representatives from each RT assembled the materials to create a filtration unit ready for testing, which would then be used to meet the clean water needs of each RT.



Figure 5. Making a clean water filtration technology installation

Figure 6. Training in assembling clean water filtration technology equipment

Figure 7. Testing of clean water treatment equipment

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Handover of clean water filtration technology installation

At the conclusion of the Community Service Program (PKM) in Kampung Yobeh, the Head of the Environmental Engineering Study Program, Mr. Alfred B. Alfons, representing the University of Science and Technology Jayapura (USTJ), officially handed over three units of Clean Water Filtration Technology Installation to the Yobeh community. The units were received by the Head of Kampung Yobeh, Mr. Sostinus F. Sokoy, who then directly handed them over to the heads of RT01, RT02, and RT03.

Before the handover, it was ensured that the Clean Water Filtration Technology Installation had been tested in the presence of the community and was confirmed to be functioning properly.



Figure 8. Handover of clean water treatment equipment

Discussion

This activity is intended to provide a description of the results of community service according to the objectives.

Water quality of Lake Sentani

Clean water that meets standards is essential for humans, whether for bathing, washing, or daily drinking needs. It has been established that the water quality of Lake Sentani does not meet clean water standards, with several parameters exceeding the permissible limits for clean water. These parameters include odor, color, TSS, detergent, Total coliform, and Escherichia coli. However, in reality, the community still uses it to meet their clean water needs. Research findings ([Suhartawan et al., 2022a](#); [Suhartawan et al., 2022b](#)) indicate that the levels of detergent, Total coliform, and Escherichia coli are significantly high.

Increasing public understanding of the importance of clean water

The community's understanding of the importance of clean water for life has improved. People have begun to realize that protecting and preserving lake water is crucial through various initiatives aimed at improving the quality of the lake's water.

Some agreements resulting from discussions include the decision that residents will no longer dispose of waste into the lake, particularly solid waste. The village head, together with the community, will establish Temporary Disposal Sites (TPS) in each neighborhood (RT) as interim waste collection points before being transported to the Final Disposal Site (TPA).

However, a serious issue remains regarding the presence of Total coliform and Escherichia coli contaminants in the lake water, with their primary source being human waste. [Balkrishna et al. \(2024\)](#) state that the presence of fecal coliform bacteria in water sources can indicate the existence of pathogens such as E. coli, which can cause gastrointestinal diseases and other health problems. Coliform bacteria are a global issue, as contaminated water can lead to disease outbreaks in populations ([Sunarti, 2015](#)).

To minimize the high levels of *Escherichia coli* in the lake water, the community will construct communal sanitation facilities (toilets) in each RT using the Village Fund budget in 2025. Additionally, the lake water to be filtered will be sourced from approximately 50 meters away from the residential area.

The high detergent content can be mitigated by preventing washing activities near the water collection area designated for filtration. [Larasati et al. \(2021\)](#) mention that the introduction of detergent pollutants into water bodies can lead to contamination, while [Suhartawan et al. \(2023\)](#) highlight that excessive detergent levels in the lake water can disrupt ecosystems and degrade water quality.

Training in the installation of clean water filtration technology

As a solution to the clean water supply issue in Yobeh Village, particularly in RT02, the community service team designed water treatment equipment. The community was guided in groups according to their RTs to construct filtration equipment that would be utilized in each RT, along with training on its operation and maintenance. The primary goal of this initiative was to enable the community to build their own clean water filtration equipment, operate it effectively, and maintain it sustainably.

To ensure the optimal performance of the filtration equipment, trial runs were conducted for each unit built by the RT groups. The test results of the filtered water showed that all parameters met clean water quality standards. This confirms that the filtration equipment functions effectively and produces water that meets the criteria for safe and clean consumption.

The final activity of the community service program at the site was the official handover of the clean water filtration units. The filtration equipment was presented by the Head of the Environmental Engineering Department at the University of Science and Technology Jayapura, who was also part of the community service team (Mr. Alfred B. Alfons), to the Head of Yobeh Village, Sentani District (Mr. Sostinus Sokoy).

The expected impact of providing this water filtration equipment is that the community will have access to clean water. Each RT will manage its own filtration unit to benefit its respective members. During the handover, the Yobeh Village Head announced plans to further support the management of the filtration equipment with funding from the Village Budget to ensure its sustainable use. Additionally, there are plans to extend water pipelines to individual households so that residents no longer have to manually collect water from the filtration station. Instead, they will be able to access clean water directly from their home faucets. With this equipment, the community will no longer struggle to obtain clean water.

Sustainability measures

Monitoring, evaluation, and assistance in managing the clean water filtration equipment in Yobeh Village will continue to be carried out by the community service team until the community fully understands how to maintain the equipment. The cost of maintenance (replacement of filtration media) each month and incentives for the operators will be allocated through the Village Fund budget.

4. CONCLUSION AND RECOMMENDATIONS

The community of Yobeh Village has understood the importance of clean water for life and is committed to maintaining the quality of the lake water so that it can be utilized sustainably. The people of Yobeh Village now have the ability to design filtration equipment that is ready to operate and produce water that meets clean water standards, ensuring that their clean water needs are met. Additionally, the community has acquired the necessary skills to operate and maintain the clean water filtration equipment, ensuring the sustainability of the clean water filtration program.

The Community Service Program has been completed, resulting in three units of clean water filtration technology that have been utilized by the people of Yobeh Village. However, there are still several limitations, including: (1) The production of clean water is not yet sufficient to meet the needs of the entire community. (2) The processed clean water is only available at the equipment station (the head of the RT's house), requiring residents to carry water using buckets. (3) The operation of the clean water filtration equipment is not yet optimal due to the need for labor and maintenance costs. In response to these limitations, the Community Service Team provides the following recommendations: (1) Establish a schedule for clean water distribution for each household; (2) Utilize village funds to install piping from the filtration equipment station to individual homes, allowing residents to access clean water directly from their taps without carrying buckets; (3) Allocate village funds for incentives for equipment operators and for replacing damaged filtration components, particularly the filtration media.

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REFERENCES

- Adhar, S., Lukman, L., Khalil, M., Ayuzar, E., Erlangga, E., Rusydi, R., Mainisa, M., Muliani, M. (2022). Influence of rainfall and spatial temporal distribution analysis of total suspended solid in Laut Tawar Lake. *IOP Conference Series: Earth and Environmental Science*, 1062(1). <https://doi.org/10.1088/1755-1315/1062/1/012022>
- Balkrishna, A., Mishra, S., & Rana, M. (2024). Effect of Coliform bacteria on various environmental factors: A review. *International Journal of Health Sciences and Research*, 14(5), 279–292. <https://doi.org/10.52403/ijhsr.20240537>
- Djuniawal, I., Salam, S., & Mulyani, S. (2019). Analisis pemanfaatan Danau Sentani untuk pengembangan budidaya Keramba Jaring Apung secara berkelanjutan. *Journal of Aquaculture and Environment*, 2(1), 23-26. <https://doi.org/10.35965/jae.v2i1.440>
- Hamuna, B., Tanjung, R. H. R., Suwito, S., Maury, H. K., & Alianto, A. (2018). Study of seawater quality and pollution index based on physical-chemical parameters in the waters of the Depapre District, Jayapura. *Jurnal Ilmu Lingkungan*, 16(1), 35-43. <https://doi.org/10.14710/jis.v%v.%i.%Y.633-644>
- Hasbiah, A. W., Mulyatna, L., & Pahilda, W. R. (2019). Penyisihan total coliform dalam air hujan menggunakan media filter zeolite termodifikasi, karbon aktif, dan melt blown filter cartridge. *Infomatek*, 21(1), 15-26. <https://doi.org/10.23969/infomatek.v21i1.1610>
- Kementerian Kesehatan. (2023). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2023*. Kemenkes Republik Indonesia.
- Larasati, N. N., Wulandari, S. Y., Maslukah, L., Zainuri, M., & Kunarso, K. (2021). Kandungan pencemar detejen dan kualitas air di perairan muara Sungai Tapak, Semarang. *Indonesian Journal of Oceanography*, 3(1), 1-13. <https://doi.org/10.14710/ijoce.v3i1.9470>

- Lista, Y. P. L., & Da Costa, M. (2023). Penurunan konsentrasi Total Suspended Solid (TSS) dan fosfat dalam limbah laundry menggunakan Metode Biosand Filter. *Envirotechsains: Jurnal Teknik Lingkungan*, 1(1), 26-32.
- Mashadi, A., Surendro, B., Rakhmawati, A., & Amin, M. (2018). Peningkatan kualitas Ph, Fe dan kekeruhan dari air sumur gali dengan metode filtrasi. *Jurnal Riset Rekayasa Sipil*, 1(2), 105-113. <https://doi.org/10.20961/jrrs.v1i2.20660>
- Nasution, A. (2021). *Evaluasi perhitungan kebutuhan air bersih PDAM Tirta Deli Kecamatan Lubuk Pakam Kabupaten Deli Serdang* (Doctoral dissertation, Universitas Medan Area).
- Pamudjianto, A., & Sutiono, W. (2018). Pemanfaatan air danau sebagai sumber air untuk irigasi. *OSF*. 2-6. <https://doi.org/10.31227/osf.io/wy2uc>
- Suhartawan, B., Alfons, A. B., & Daawia, D. (2022a). Water quality status based on pollution index to meet the needs of sanitary hygienic water for communities around Lake Sentani in Jayapura Regency. *Journal Research of Social Science, Economics, and Management*, 2(3), 273-290. <https://doi.org/10.59141/jrssem.v2i03.263>
- Suhartawan, B., Alfons, A. B., Rumawak, S. A., & Balabuana, G. B. (2023). Pemenuhan kebutuhan masyarakat terhadap air bersih di Kampung Hobong Distrik Sentani Kabupaten Jayapura. *JURNAL ABDIMAS DINAMIS: Jurnal Pengabdian Kepada Masyarakat*, 4(1), 14-19. <https://doi.org/10.58839/jad.v4i1.1168>
- Suhartawan, B., Haurissa, J., & Rumawak, S. A. (2022b). Lake Sentani water quality index based on NSF-WQI as raw water for drinking water for Lake Sentani coastal communities, Jayapura Regency. *Jurnal Syntax Admiration*, 3(9), 1189-1204. <https://doi.org/10.46799/jsa.v3i9.481>
- Sunarti, R. N. (2015). Uji kualitas air sumur dengan menggunakan Metode MPN (Most Probable Numbers). *Biolimi: Jurnal Pendidikan*, 1(1), 30-34. <https://doi.org/10.19109/bioilmi.v1i1.1128>
- Wulandari, D. A., Nasoetion, P., & Letare, M. (2019). Penurunan kadar bakteri E.coli dengan Metode Biosand Filter pada air sungai untuk penyediaan air bersih di Rumah Sakit Pertamina Bintang Amin Bandar Lampung. *Jurnal Rekayasa, Teknologi, dan Sains*, 3(1), 42-45. <https://doi.org/10.33024/jrets.v3i1.1136>
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