CLEAN WATER AMIDST BLACK WATER
A NEW OASIS FOR PEAT COMMUNITIES

DIRECTORATE OF PEATLAND DEGRADATION CONTROL
DIRECTORATE GENERAL OF POLLUTION AND ENVIRONMENTAL DEGRADATION CONTROL
MINISTRY OF ENVIRONMENT AND FORESTRY OF THE REPUBLIC OF INDONESIA

CLEAN WATER AMIDST BLACK WATER A NEW OASIS FOR PEAT COMMUNITIES

DIRECTORATE OF PEATLAND DEGRADATION CONTROL
DIRECTORATE GENERAL OF POLLUTION AND ENVIRONMENTAL DEGRADATION CONTROL
MINISTRY OF ENVIRONMENT AND FORESTRY OF THE REPUBLIC OF INDONESIA

Clean Water Amidst Black Water A New Oasis for Peat Communities

Editor in Chief:
Sigit Reliantoro

Managing Editor:
SPM Budisusanti

Writer:
Muhammad Askary
Heni Puji Astuti

Editor:
Haris Gunawan
Agus Suwendar
Delvano Haryad Akbar

Contributors:
Abul Haitsam, Budhi Anwar, Debby Yulfira, Asraf, Adina Dwi Rezanti, Yuli Purnamawati, Arum Kusumastuti, Tiara Nadhira Prasaja, Rambaian village group, Sialang Dua Dahan group, Teluk Meranti village group

Layout:
Arian Wicaksana

Published by:
Directorate of Peatland Degradation Control
Jl. DI. Panjaitan No. Kav. 24, Jakarta 13410 Indonesia
Phone : 021-8520886
Fax : 021-8580105
www.pkgppkl.menlhk.go.id

Appreciation and dedication:
Directorate of Peatland Degradation Control
Directorate General of Pollution and Environmental Degradation Control
Ministry of Environment and Forestry of The Republic of Indonesia

First edition: Jakarta, 2022



TABLE OF CONTENTS

GLOSSARY

Raw Water	Sources of water from surface water, groundwater, rainwater, or seawater that meet certain quality standards for drinking water
Marginal Water	Low quality raw water such as peat water, brackish water, or polluted water
Groundwater	Rainwater that has gone deep into the ground and has undergone a natural filtration process
Filtration	Process that removes particles from suspension in water
Injection	Admit air into raw water in pipeline by using dosing pump
IPAG	Peat Water Treatment Plant
Coagulant	A chemical that is used to remove suspended small particles from raw water
SDGs	Sustainable Development Goals
Sedimentation	The process of settling particles

PREFACE

Alhamdulillahi Rabbil 'Alamiin.

(Praise be to Allah, the Lord of the Universe). We thank Allah Subhaanahu wa Ta'ala (May He be praised and exalted) for His grace and mercy that the writing process of a book with the title: **Clean Water Amidst Black Water, A New Oasis for Peat Communities**, was completed on time.

This book is part of the the Publication Series: **Sustainable Peat - Peatlands Survive, People Thrives**, which is a collection of best best practices in the implementation of Peatland Ecosystem Protection and Management activities. This book was compiled based on empirical experience in the field during the implementation of the Sustainable Management of Peatland Ecosystems in Indonesia (SMPEI) - Global Environment Facility- 5 (GEF 5) Project, Located in 14 villages in the Peatland Ecosystem Unit in the Peat Hydrological Unit (PHU) of the Kampar River - Gaung River and Gaung River- Batang Tuaka River, located in three district of Indragiri Hulu, Pelalawan, and Indragiri Hilir, Riau Province. References to various related publications have been included in this book to enrich the information provided.

Provision of clean water facilities integrated in community economic revitalization activities in the implementation of the independent peatland villages are very necessary, considering the availability of water for drinking water sources and for the daily living needs of the community is essential, Peat water that tends to be acidic and cannot be used as source of drinking water, cooking, etc. The provision of drinking water and clean water facilities will also be part of the income-generating activities of the local community because it will then develop into a new economic aspect for drinking water providers. we hope this experience can be a lesson learned for the development of independent peatland villages in enhancing the welfare of local communities.

The Directorate of Peatland Degradation Control Directorate General of Pollution and Environmental Degradation Control, the Ministry of Environment and Forestry as the executing. Agency and the International Fund for Agricultural Development (IFAD) as the Implementing Agency have established good cooperation and collaboration with various agencies and work units of the Regional Government (Environment and Forestry Service of Riau Province, Environment Agency (DLH) of Indragiri Hulu District, Pelalawan District, Indragiri Hilir District, Forest Management Unit-KPH, and other related agencies).

We thank all those who have provided suggestions, feedback and positive contributions during the preparation of this book, either directly or indirectly. This book is still open for suggestions and constructive input for further improvement.

Finally, we hope this book will provide benefits and insight for readers in protecting and managing peat ecosystems. **Caring for Peat – Growing Hope, Preserving Peat – Safeguarding Civilization**

Jakarta, 2022

Ir. SPM Budisusanti, M.Sc.
Directorate of Peatland Degradation Control
Project Director SMPEI-GEF 5

LOCATION OF SMPEI PROJECT CLEAN WATER MANAGEMENT PLANT

01

ENSURE AVAILABILITY OF CLEAN WATER FOR PEAT COMMUNITIES AS AN EFFORT TO ACHIEVE SDGS 6

SUSTAINABLE DEVELOPMENT GOALS

One of the points in Sustainable Development Goals (SDGs) for all countries in the environmental sector is ensuring that people reach universal access to drinking water, sanitation and hygiene by 2030 as stated in SDGs 6.

Clean water with sufficient quantity and quality is important in moving toward sustainable development. The pledge to “leave no one behind”, a commitment not to leave anyone who is less fortunate and those in need, should be a priority. This is an effort to eliminate inequality in having access to drinking water.

Clean water is a fundamental human need so that people can live a healthy and productive life. Access to clean water, especially drinking water will indirectly improve the quality of human resources in the future.

Achieving universal access to safe and affordable drinking water by 2030 presents a major challenge for all countries. High commitment is crucial in realizing easy access to clean water for all levels of society. Daily access to clean water is necessary to satisfy water needs for household and other water needs. Effective and sustainable water management require participation and support from various stakeholders to achieve the global target of SDG 6 by 2030.

Making progress on SDG 6 will enable and drive progress on all the other SDGs, from good health and well-being (SDG 3), zero hunger (SDG 2), gender equality (SDG 5) to environmental protection and sustainable socioeconomic growth.

Access to clean water remains a major problem for people living in various regions in Indonesia, especially those in environments with marginal raw water, such as peat water, brackish water or polluted water. Communities live on peat land, included those in the SMPEI Project intervention areas are also facing similar challenge.

The condition of thick yellow-black peat water has become a normal issue for local community in that area. In their daily lives, people always use peat water for their basic needs such as for bathing, washing, cooking and other household needs. They have no other option but using what are available in their surrounding environment.

They have abundant raw water, but unfortunately this water cannot be used to meet their needs for safe drinking water. Referring to Government Regulation No. 122/2015 concerning Drinking Water Supply Systems, raw water is surface water, ground water, rain water, or sea water that can meet certain quality standards for drinking. The lack of clean water source and a limited knowledge about the impact of peat water on their health has made the local people use peat water for their daily needs.

Some people use rainwater stored in containers as their raw water source for their drinking water. However, its availability depends on the frequency of rainfalls in each region. Some other people opt to buy drinking water gallon even though they have to travel quite a distance from where they live. Due to the scarcity of clean water sources, peat water has been widely used as an alternative water source available in nature.

In fact, water that flows from pure peatlands is typically of good quality and can be utilized as a source of sustainable drinking water supply. However, peatlands degradation in recent decades has resulted in faster decomposition of peatlands and lead to a decline in the quality of peat water. The use of peat water directly and continuously over a long period without proper processing might have impacts on people's health.

The decrease in water quality might also increase water treatment costs due to carcinogenic by-products in water. To consume peat water as drinking water, it needs to go through a further processing and apply environmentally friendly innovation in processing technologies.

Thus far, the development of methods for treating peat water into clean water for safe consumption has been intensively initiated. Laboratory scale tests such as absorption, filtration, coagulation, flocculation, and incorporation of activated carbon have been successfully conducted. The combination of several methods is considered quite effective and efficient in peat water treatment into clean water. It is hoped that the development of peat water treatment technology can help communities overcome difficulties in accessing clean water for safe consumption in their respective areas and help achieve SDG 6.

02

CHARACTERISTICS OF PEAT WATER BECOME THE BIGGEST CHALLENGE FOR PEAT COMMUNITIES

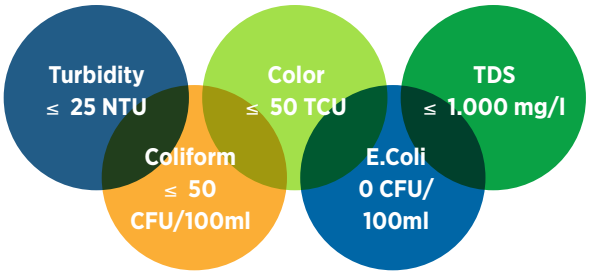
A water source is considered clean if it fulfills the following three conditions:

1. Physical requirements, the water is colorless, odorless, tasteless, not cloudy, and has a temperature below the local air;
2. Requirements for bacteria, after going through a water examination there are no coli bacteria;
3. Chemical requirements, water does not contain toxins or mineral substances, as well as chemical substances in large quantities.

The color of peat water can turn to darker brown if the content of iron (Fe) dissolved in the water increases. Fe in water create metallic taste and be unpleasant to drink. If the Fe content is higher, the water will have carcinogenic / cancer-triggering properties, and may cause tooth decay and digestive disorders.

Its spongy nature allows peat soil to store water up to 90% of its dry weight or around 850 liters of water/m3. The amount of reserved peat water remains inadequate to meet large demand for clean water of local communities. Peat water has special characteristics with parameters of high degree acidity (pH between 3-5), intensity of red-brown to black color with high organic matter content, high suspended sediment concentration, and has high concentrations of Fe metal and organic carbon (Dissolved Organic Carbon, DOC).

These characteristics of peat water become the biggest challenge when processing peat water into a source of clean water. When referring to the environmental health quality standards and clean water health requirements (Regulation of the Minister of Health No. 32 of 2017), this condition of peat water does not meet the quality standards to turn into clean water. The high DOC indicates that peat water requires processing before it can be consumed as drinking water.



No.	Water parameters	Unit	Water Quality Standard (Maximum Limit)
1	pH	mg/l	6,5 - 8,5
2	Iron (Fe)	mg/l	1
3	Fluorida	mg/l	1,5
4	Hard water	mg/l	500
5	Manganese (Mn)	mg/l	0,5
6	Nitrate	mg/l	10
7	Nitrite	mg/l	1
8	Cyanide	mg/l	0,1
9	Detergent	mg/l	0,05
10	Total pesticides	mg/l	0,1

03

APPROPRIATE TECHNOLOGY INNOVATION FOR TREATMENT OF BLACK PEAT WATER INTO CLEAN WATER

SUSTAINABLE DEVELOPMENT GOALS

6 AIR BERSIH DAN SANITASI LAYAK

SMPEI IPAG development has provided easy access to proper clean water for people living in peat areas

3 IPAG
Rambaian
Sialang Dua Dahan
Teluk Meranti

6.486 People
Direct Beneficiary

Like a new emerging oasis in the middle of black water, this is an appropriate analogy to describe the presence of a Clean Water Treatment Plant (IPAG) in three villages in SMPEI project area, namely Rambaian Village in Indragiri Hilir District, Sialang Dua Dahan Village in Indragiri Hulu District, and Teluk Meranti Sub-district in Pelalawan District. In 2021, SMPEI project has succeeded in bringing IPAG to the community. The IPAG was developed to provide easy access to clean water for people in peat areas by utilizing marginal water sources around people's dwelling.

The IPAG has been able to respond to problems in the community regarding the management of peat water. This technology is able to convert the pH of acidic water to neutral, able to turn existing water sources into clear and odorless drinking water by removing turbidity, iron (Fe) and manganese (Mn) content. This drinking water supply system is designed to meet water needs of the community and improve the quality of peat water to become clean water that meet health standards for now and for several years to come.

The IPAG construction design has the best combination method design which is considered quite effective and efficient in converting marginal water sources such as peat water or river water into clean water that is suitable for consumption. In one IPAG construction, it is equipped with several parts of tool that can process several stages of method such as coagulation and flocculation, absorption, and membrane filtration, as well as the Reverse Osmosis (RO).

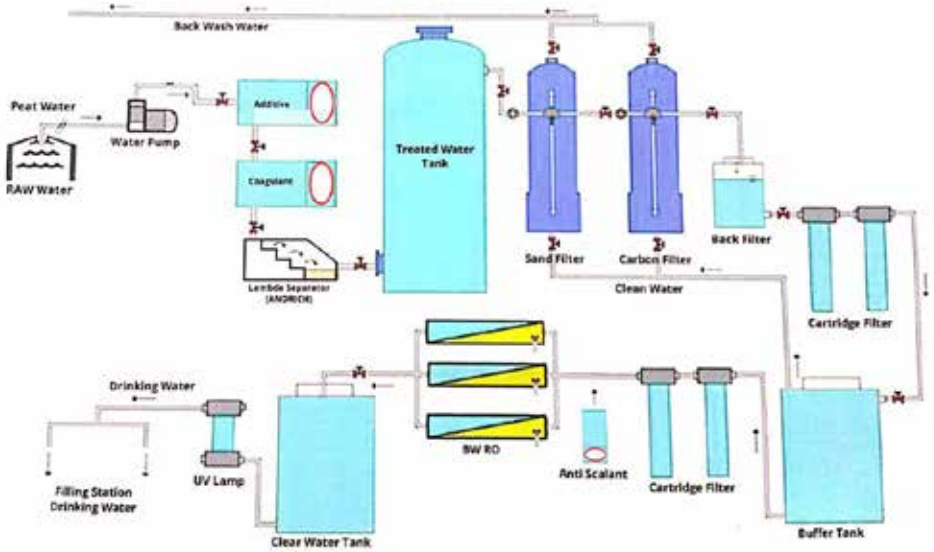
PMO SMPEI, IFAD, Village Head, and TK-PPEG Group at the Inauguration of IPAG in Rambaian Village, Indragiri Hilir Regency

Handover of IPAG from PMO SMPEI and IFAD to the TK-PPEG Group in Sialang Dua Dahan Village, Indragiri Hulu District

IPAG in Teluk Meranti Sub-District, Pelalawan District

PEAT WATER TREATMENT EQUIPMENT

BRACKISH WATER (BWRO) - KAPASITAS 0,8 M³ / HOURS



In the construction of water treatment plant, needs to consider the following:

01 The location of equipment should be free from stagnant water and close to main water source;

02 There must be a management team who has received clean water treatment training;

03 Community participation is necessary to ensure the continuity of its management

The construction of water treatment plant is designed as a complete process installation unit with an effective system and simple design. This equipment is expected to be a pilot solution and can be developed for areas facing the same problems in marginal water management.

This water treatment equipment has a clean water production processing capacity of 0.8 m3/hour which is equipped with intake treatment units, coagulation, sedimentation tanks, filtration, storage tubes, and reverse osmosis tubes. It requires an environmentally friendly chemical input materials in the process of converting marginal water into clean water, such as lime, aluminum sulfate coagulants, and sodium sulfate coagulants.

For sustainable use, this equipment requires regular maintenance, especially in the processing tanks, where garbage and sediment will clog the inlet to the filter.

Irregular cleaning process will cause clogging of the processing structure, and will certainly affect the performance of the equipment. To maintain its function, the equipment must be cleaned by washing or replacing media/filters.

Gallon Water Products from IPAG in Rambaian Village, Indragiri Hilir District

Stages of Clean Water Treatment for Safe Consumption

01 pH measurement at the main water source

02 Preparation of a mixed solution for the initial stage

03 Mixing the solution with water

04 Oxidation and coagulation stages

05 Sedimentation Stage

06 Water Filtration Stage

07 Raw water results in storage tubes

08 Reverse Osmosis Process

Water pH measurement is carried out for the first time to help the effectiveness of the next process in clean water treatment equipment. Peat water commonly has an acidic pH ranging from 2.5 – 4. To neutralize the pH, we need to add lime or certain chemicals in the next process.

Before starting water treatment process, we need to prepare a chemical mixture solution consisting of alum, soda, and raw water. Adding soda (soda ash) and alum is done to improve/increase the pH of the water before oxidation process. The chemical formulation process was done in two 35-liter water drums with a ratio of alum and soda 1:2 (10 kg of alum and 5 kg of soda). The first drum contains a mixture of water and soda, while the second drum contains water and alum. The raw water that has been spiked with a chemical mixture solution is then flowed into the first intake pipe to facilitate the aeration and sedimentation processes. One drum of a mixture of chemicals and water can be used for 1-month water treatment.

Oxidation process is a process of injecting air into raw water in the piping line using a dosing pump, while coagulation process is a process of injecting chemicals into raw water. The coagulation is an important stage because it affects the effectiveness of the next processing stage. These two processes take place simultaneously in pipelines in the first stage to separate the manganese and iron elements in the raw water. The result of this process is lumps/sediments/suspended solids.

The purpose of air injection is to make iron (Fe) and manganese (Mn) content in raw water reacts with oxygen in the air to form iron and manganese compounds which can be precipitated. This process also removes unwanted toxic gases such as H2S gas, methane, carbon dioxide and other toxic gases. Factors that might affect this reaction process are amount of oxygen/air bubbles contacted in water and the degree of acidity (pH of water). The more evenly distributed and smaller the air waves blown out in raw water, the greater the oxygen reacts. The purpose of the oxidation reaction is to make compounds in water precipitates.

After the aeration and coagulation processes for raw water is complete, then the sediment (sludge) will flow to holding tank. There will be two parts in this sedimentation process, clean water at the tank top and sediment at below the tank. If the two parts are separated, it will smooth the multi-titration process.

Not all lumps of dirt can be precipitated in the sedimentation process. Granular lump of dirt will sink in water due to its large and heavy size, while small and light dirt will float. To get crystal clear water, require a filtering process in a filtration tube containing carbon, sand, gravel, giolite and grinsen. The water that has passed through sedimentation tank is then flowed into the multi-titration filtering tank.

The filter media in this filtering tank will be able to decompose organic pollutants from peat water. This filter tank work easier because some of the pollutant particle material has been precipitated at the previous stage thus reduce the frequency of filter washing. As for the taste, color and smell that are characteristic of peat water have been removed through an activated carbon filter at the ultrafiltration stage. The ultrafiltration is the final stage in the filtration process to produce raw water which can be processed further in the next stage.

Water that has gone through the previous stages will be stored in the clean water storage tank which then become raw water ready for further stages in the RO (Reverse Osmosis) device. In this RO process, there are RO membrane and ultraviolet sterilizer that can purify water and kill remaining polluting bacteria. Most of E. Coli bacteria in peat water have typically been dissolved during the coagulation and sedimentation processes, however the RO process remains necessary to filter out and flush away all the contaminants, leaving clean and pure drinking water. Afterward, the water is stored in gallons that have been prepared in the output chamber.

04

THE SUCCESS OF TK-PPEG GROUP IN SIALANG DUA DAHAN VILLAGE, RAMBAIAN VILLAGE, AND TELUK MERANTI SUB-DISTRICT IN CLEAN WATER MANAGEMENT

RAMBAIAN VILLAGE

Before receiving Clean Water Treatment Plant (IPAG) support through SMPEI project, the people of Rambaian Village were having difficulties in accessing clean water for safe consumption. They use rainwater as a source of clean water for household and domestic needs. They have to process the rainwater before consumption. Some people opt to buy bottled water from other villages. The clean water treatment plant in Rambaian Village has become a new oasis that will benefit all village communities. In the future, people will no longer worry about finding water ready for consumption, both in dry season and rainy season.

The source of the water used by the TK-PPEG group in the clean water treatment is from large canal with dark black color water and from drilled wells. During the first experiment, TK-PPEG found unstable pH conditions after coagulation process. They learned that the process requires a mixture of coagulants in the right proportions to stabilize the pH of the water and make the water clear. The coagulants usually used by the group are alum, chlorine, and soda ash. After going through several trials, the group finally managed to do water treatment up to the Reverse Osmosis process and produce clear and odorless drinking water. The drinking water products of Rambaian Village have met the quality standards in terms of color, smell, taste, TDS, dissolved metal content, water pH, and total coliform, and they are considered safe for consumption.

In one production process, the TK-PPEG group can produce 20 gallons of clean water. The price is quite affordable (IDR 5,000/gallon). It is not surprising that this gallon water product is in great demand by local community. The IPAG provides great benefit for local people as they no longer have to buy drinking water from depots in neighboring villages.

At the product launching, the group's strategy to draw people's attention was to sell the gallon at IDR 0. Through this marketing strategy, more and more people are interested in buying water products at the SMPEI depot.

No	Parameters	Unit	Reference	Water Quality Standard (Maximum Limit)	Result
A	**Physics**				
1	Turbidity	NTU	SNI 06-6989.25-2005	25	1,12
2	Color	Pt-Co	SNI 6989.80-2011	50	<10
3	Total Dissolved Solid (TDS)	mg/L	IKP.LABOR.02.MT1.14	Suhu udara ± 3	17,93
4	Air temperature	°C	SNI 06-6989.23-2005	1000	25
5	Taste	-	SNI 06-6859-2002	Tidak Berasa	Tidak Berasa
6	Odor	-	SNI 06-6860-2002	Tidak Berbau	Tidak Berbau
B	Biological				
7	Total coliforms	Jml/100ml	IKP.LABOR.02.MT1.11	50	<1,8
C	Required chemistry				
8	pH	-	SNI 06.6989.11.2019	6,5-8,5	6,71
9	Iron (Fe)	mg/L	SNI 6989.84.2019	1	<0,021
10	Fluoride	mg/L	SNI 06.6989.29-2005	1,5	<0,181
11	Hard water	mg/L	SNI 06.6989.12-2004	500	<5,0000
12	Manganese (Mn)	mg/L	SNI 6989.84.2019	0,5	<0,010
13	Nitrate as N	mg/L	IKP.LABOR.02.MT1.06	10	0,5
14	Nitrite as N	mg/L	SNI 6989.9-2004	1	<0,017
15	Cyanide	mg/L	IKP.LABOR.02.MT1.04	0,1	<0,003
16	Detergent	mg/L	SNI 06-6989.51-2005	0,05	<0,150
C	additional water chemistry				
17	Chadmium (Cd)	mg/L	SNI 6989.84.2019	0,005	<0,003
18	Chromium Valence 6 (Cr)	mg/L	SNI 06-6989.53-2010	0,05	<0,025
19	Dissolved zinc (Zn)	mg/L	SNI 6989.84.2019	15	0,008
20	Sulfate (SO_4^{2}-)	mg/L	SNI 06-6989.20-2019	400	4,052
21	Heavy Metal Lead (Pb)	mg/L	SNI 6989.84.2019	0,05	<0,025
22	Organic ($KMnO_4$)	mg/L	SNI 06.6989.22-2004	10	1,092

Test Results of Rambaian Village Water Samples in the Laboratory

Over time, the TK-PPEG group succeeded in embracing BUMDes (Village-owned enterprise) to get involved in clean water management. BUMDes started to take part in supporting the provision of gallons and gallon cleaning tools, as well as in marketing. The collaboration mechanism with BUMDes is profit sharing system. Out of IDR 5,000/gallon selling price, IDR 3,000 will go to BUMDes' treasury which will contribute to the Regional Original Revenue (PAD), then a portion will be allocated for operational costs such as electricity and maintenance costs. BUMDes and TK-PPEG group in the near future will jointly innovate the manufacture of glass bottled mineral water products.

Mr. Anto's story about the prices of drinking water products in Rambaian Depot that are more affordable and attractive to communities

Before there was a clean water treatment equipment in Rambaian Village, people in Rambaian Village met their needs for clean water by purchasing it from a depot in another village. Pak Anto, who is a TK-PPEG of Rambaian Village, said that with the help of the equipment the need for drinking water is no longer an issue.

"We used to buy drinking water, which was more expensive than what we produced here, it is around IDR 7,000 per gallon. People here are very grateful since we can produce drinking water gallons in our village. The price of our water is much cheaper, and it can also be delivered quickly to buyers' house. In the past, we used to boil rainwater for drinking, but now we don't do it as often because we already have water gallons.

During dry season, we are not worried, as there are water gallons ready for consumption. In rainy or dry season, we can still produce water at lower price. We market our gallons only around our village. We established collaboration with Rambaian BUMDes. We set aside some sales profits for TK-PPEG treasury.

Hopefully in the future, this water treatment equipment will continue to provide drinking water for the people in Rambaian, so there's no need to buy from another village anymore" Mr. Anto added.

SIALANG DUA DAHAN VILLAGE

In the past, the majority of people in Sialang Dua Dahan Village used river water as main source of water to meet their household's domestic needs for bathing, washing, toilets, as well as for drinking water. Over time, the village community began to receive government assistance to gain access to clean water from dug wells, drilled wells and PAMSIMAS (The National Rural Water Supply and Sanitation Program). However, the need for drinking water remained an issue because the condition of water from these sources were of concern: it has yellow color, has an unpleasant taste, and smells a bit. Not many people were interested in using water from these sources.

To meet their daily water needs, people bought water gallons in a neighboring village with a distance of ± 20 km. Usually each family ordered 2-4 gallons for one-week water needs. Initially, community benefited from the service provided by this depot because water gallons could be delivered directly to their homes. Due to the long distance from their village, sometimes there were frequent delays in the delivery of drinking water.


Network 9 Jun 2022 16:16:34 WIB
0°2'27,578"S 102°28'55,225"E
Jalan Tanpa Nama
Sialang Dua Dahan
Kecamatan Rengat Barat
Kabupaten Indragiri Hulu
Riau
Index number: 80
Google
INSTALASI
PENGOLAHAN AIR BERSIH/MINUM
DESA SIALANG DUA DAHAN
KECAMATAN RENGAT BARAT KABUPATEN INDRAGIRI HULU
PROVINSI RIAU

Water treatment process in Sialang Dua Dahan Village use river water as source of water. People's main consideration in using river water instead of canal water because the location of the river is closer to their village thus it is easier for TK-PPEG group in collecting and channeling water from the river to water treatment plant. The main principle is to facilitate access to clean drinking water for the community, so all water sources may be used provided they meet all criteria for processing. Using river water for treatment has similar challenge to canal water treatment as both are marginal water. The coliform content in river water is greater than canal water, thus it requires advanced technology to convert river water into clean water.

The community has been waiting a long time for a clean water treatment plant in their Village. They have a strong interest to be able to process water from nearby water source. From the experiments conducted by TK-PPEG, it is evidenced that the river water can be used as raw water for processing drinking water product. The water product generated from the equipment tastes better than the water they have consumed before. Since the installation in 2021, the group has succeeded in selling 8,000 water gallons, which was approximately 800 gallons per month.

In one production process, they need approximately 2,000 liters of river water. Of this amount, only about 600 liters can be processed as raw water and collected in a storage tank. It indicates that only 1/3 part of the total water are tolerable, the other 2/3 will be rejected water. It was not a problem for TK-PPEG group as their main water source is quite abundant.

Every day the Group can produce and sell around 30-40 water gallons. Demand for products does not only come from the village community, but also from people outside the village who manage grocery shops. People enthusiasm is very high to buy, because only by spending IDR 3,000 they can get gallons of clean water with pleasant taste and free delivery to their homes. Currently, only few villagers who still buy water from outside village depots, because their homes are closer to major roads and depots.

TK-PPEG group has a good strategy to attract more people's attention to always buy at their depot, by a promotion of "buy 2 gallons get 1 gallon free" and "buy 3 gallons get IDR 2,000 cashback". This strategy succeeded in attracting more people who were initially curious and finally decided to choose the SMPEI depot and become regular customers. Currently, TK-PPPEG group only focus on meeting the demand for clean water for the village. However, there is always possibility to expand their service to provide drinking water to a broader area.

Mr. Haris' story about the use of river water sources for potable water

Mr. Haris said that since the initiation of clean water program from the Ministry of Environment and Forestry, the people of Sialang Dua Dahan Village are no longer worried about the lack of water for their drinking water needs.

"We are very grateful and thankful for the support to our village. Now the people of Sialang will no longer have a shortage of clean drinking water because of the water treatment plant. The price of our village water is also cheaper than other depots, and directly delivered to our doorsteps. At the beginning of the trial, the water produced from the equipment was still slightly yellow in color and tasted sour. That was because we were only taught and introduced about the process briefly. We were mainly self-taught, with a little training, and tried to produce drinking water with more pleasant taste (not sour anymore). After the installation of water treatment equipment, we bought gallons at our own expense"

Pak Haris also explained that in clean water treatment process, there should be a replacement filter, which price is bit expensive for village members.

"The source of water that we use is from river which during the dry season the water does not recede. There is a color difference of the river water in dry season and in rainy season. In dry season the water is clearer so it is not necessary to change filters frequently, but during rainy season when the river water is overflowing, the water become cloudy and we need to buy lots of filters. During rainy season, we have to change the filter every 10 days, otherwise the taste of water will be different. The price for 1 filter is not cheap, it could reach IDR 15,000 but so far maintenance has been smooth. The village treasury proceeds from the water program have been able to support mutual cooperation activities to build mosques. The profits were also used for regular maintenance such as buying electricity tokens and filters. Our plan for the future we want to make a brand on our water gallons to familiarize our product and depot to broader communities." Mr. Haris added.

TELUK MERANTI SUB-DISTRICT

In contrast to TK-PPEG Group of Rambaian and Sialang Dua Dahan Villages which utilize surface water as water sources, the TK-PPEG Group of Teluk Meranti Sub-district utilizes groundwater from dug wells as raw material for water treatment.

Water sources from community wells are in good condition and do not dry up even in the dry season. As the location of the wells mostly in peatland area, the water still contains peat water. Based on the results of laboratory tests, this water source meets clean water quality standard and is suitable for further processing. This clean water treatment technology has been able to change peat water which has yellow-brown color to clear and odorless water.

The clean water product from Teluk Meranti drinking water depot “Bayqua” has succeeded in providing drinking water needs of the community living around the village, community health center, lodging, and project work needs. Even though there are many consumers, the TK-PPEG group has not been fully able to meet the demand for water in large quantities. The price of a gallon of Bayqua water is relatively affordable, IDR 4,000/gallon, if delivered to the house it is IDR 5,000/gallon.

The challenge faced by the TK-PPEG group is that the water treatment process cannot be done in one go because the electric power used is household electricity. Often the electricity goes out when the water treatment process is in progress, thus the process takes longer time.

If raw water in the orange holding tank is full, this equipment can produce around 30-40 gallons of water within 12 hours non-stop. However, not all of the raw water from the holding tank can enter the process system in RO devices due to its quality. This unprocessed wastewater is called ‘rejected water’

TK-PPEG then made a new innovation to overcome the problem of large amount wastewater. The group added a new hose and drained the wastewater into the first process stage tank. This modification was made to reduce wastewater and re-processed the water to re-entered the RO device.

Mr. Arifin's Story Regarding Electrical Constraints in the Clean Water Treatment Process

Mr. Arifin said that during clean water production activities using IPAG, TK-PPEG Teluk Meranti is having difficulties in the production process. The main problems are electrical power and chemicals which are important factors in the process.

"The water treatment equipment assistance from the Ministry of Environment and Forestry was located near my house and it was managed by my wife who works in sub-district office. Usually TK-PPEG turns on the equipment for 1.5 hours to pump water from the dug well to the settling tank, then another 1 hour to flow the water into the clean water storage tank, after that we turn off all the machines. Our electricity power is not sufficient to undertake the process as it consumed around 2,500 watts of electricity. In the early days, we also bought our own gallons using community self-reliance budget. We once turned on the device from 5 am to 5 pm and managed to produce around 40 gallons. On one occasion we left the water for 2 months, and we found that the color and taste did not change, the water stayed clear. We've tried that experiment, but electricity remained a problem. Our electricity is for household, and is expensive. For future, we hope to get assistance of high-power generators for our community."

"Aside from electricity, other constraints are maintenance problems and difficulty in finding chemicals. This equipment requires routine filter replacement every 2 days with filter sizes that are not available in Kerinci area. Every 2 weeks we have to replace the filter, otherwise it will affect the performance of the machine. Purchasing large number of filters requires lots of money, and we cannot afford it. If we purchase a few, the shipping cost is expensive. Since July 2021 we have started selling water, but due to difficulties in the provision of water gallons and transportation issue to deliver gallons, our consumers are only people nearby. Our marketing scale is still small and not able to meet the need for drinking water for a larger area. Even though our water tastes good, it has a sweet taste, but due to existing obstacles, the production is not optimal. The water gallon price is IDR 3,000 but the sales are insufficient for maintenance costs such as buying chemicals and filters. If we increase the price to IDR 5,000, people will look for other depots with lower prices. As for maintenance, the price of soda is IDR 45,000/kg, alum is not available locally, we have to go to Pekanbaru, and the price is IDR 35,000/kg. For the initial process we need 2 kg of chemicals which we mix in 1 drum of water. We can use this mixture for 1-month processing. Currently, we are running out of chemicals, so we stop the production process for a while," explained Mr. Arifin.

BIBLIOGRAPHY

Badan Pusat Statistik. 2016. *Potret Awal Tujuan Pembangunan Berkelanjutan (Sustainable Development Goals) Di Indonesia.* BPS Press. 978-602-438-071-7

Kementerian Perencanaan Pembangunan Nasional / BAPPENAS. 2017. Metadata Indikator *Tujuan Pembangunan Berkelanjutan (TPB) / Sustainable Development Goals (SDGs) Indonesia "Pilar Pembangunan Lingkungan*". BAPPENAS. 978-602-1154-89-2

Keputusan Menteri Lingkungan Hidup dan Kehutanan Nomor SK. 246/MENLHK/SETJEN/KUM.1/6/2020 tentang *Rencana Perlindungan dan Pengelolaan Ekosistem Gambut Nasional Tahun 2020-2049*

Lembaga Ilmu Pengetauan Indonesia. 2019. *Pengembangan Instalasi Pengolahan Air Gambut (IPAG60) Sebagai Sarana Pemenuhan Hak Dasar Masyarakat Atas Air Di Dearah Gambut*. LIPI Press. ISBN 978-602-496-065-0

M. Ortega, Allott, Glenk, Schaafsma. 2014. *Valuing water quality improvements from peatland restoration: evidence and challenges*. Ecosystem Services. 9. 34-43

Morris, PJ., Liu J., et al. 2018. *Hotspots of Peatland-derived Portable Water Use Identified by Global Analysis*. Nature Sustainability. 1(5). Pp. 246-253

N.N. Arifianingsih, Y. Zevi, Q. Helmy, S. Notodarmojo, H. Fujita, Y. Shimayama, and M. Kirihara. 2020. *Peat Water Treatment Using Oxidation and Physical Filtration System and Its Performance in Reducing Iron (Fe), Turbidity, and Color*. EDP Sciences E3S Web of Conferences. 148, 07011

Peraturan Menteri Kesehatan Republik Indonesia Nomor 32 Tahun 2017 tentang *Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air untuk Keperluan Higiene Sanitasi, Kolam Renang, Solus per Aqua, dan Pemandian Umum*

Pusat Penelitian dan Pengembangan Permukiman Balitbang Kementerian Pekerjaan Umum. 2014. *Spesifikasi Instalasi Sederhana Pengolahan Air Gambut Individual Dengan Memanfaatkan Tanah Liat Setempat.* PUSKIM. ISBN: 978-602-8330-83-1

United Nations. 2018. Sustainable Development Goal 6 *"Synthesis Report on Water and Sanitation".* United Nations Publications. ISBN: 978-92-1-362674-0


gef


IFAD
Investing in rural people


SMPEI

DIRECTORATE OF PEATLAND DEGRADATION CONTROL
DIRECTORATE GENERAL OF POLLUTION AND ENVIRONMENTAL DEGRADATION CONTROL
MINISTRY OF ENVIRONMENT AND FORESTRY OF THE REPUBLIC OF INDONESIA

Jalan D.I. Panjaitan Kav. 24, Kebon Nanas, Jakarta Timur
Gedung B, Lantai 3 – Indonesia 13410

Phone & Fax
Phone : 021-8520886
Fax : 021-8580105

Online
Website : pkgppkl.menlhk.go.id
Email : ditgambut.klhk@gmail.com