# Increasing Availability and Water Quality in Kampung Nelayan Seberang Belawan, Medan City

I. Suryati[1], N. Herlina[1], M. Nasri Akbar[1], R. Prayudhi Utama[1], N. Latifah[1] and A. Muhammad Iman[1]
[1]*Environmental Engineering, Universitas Sumatera Utara, Jl Almamater, Medan 20155, Indonesia*

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Abstract: The dominant coastal areas inhabited by the fishing villages are identical to slums. Slums can be seen from scattered rubbish, toilet from latrines, and the lacking of clean water quality and quantity. Problems relating to environmental sanitation in Kampung Nelayan Seberang Belawan are mainly caused by uneven distribution of clean water and the quality of clean water that is physically cloudy and has a taste. Clean water is needed in meeting the daily needs of fishing communities to drink, wash and bathe. The limited resources and distribution of clean water in which the community of fishing villages has to take a long way to get clean water and have to pay to get the clean water. The source of water which can be utilized in the form of deep wells with a depth of ± 50 m - 80 m. The well is equipped with a suction pump. Meanwhile, to improve the quality of water, was used simple a water filter tool in the form of slow sand filter with filter media such as zeolite, silica sand, gravel and activated carbon. This slow sand filter media effectively reduces Fe and Mn levels in clean water sources, especially ground water ranges from 33% - 96%.

## 1 INTRODUCTION

One of the goals of Sustainable Development Goals (SDGs) is to ensure the availability, management of clean water, and sustainable sanitation for all. In achieving these objectives, the government sets targets for 2019 outcome indicators such as 100% access to drinking water services, 0% proportion of inhabited households and inadequate slum settlements in urban areas, as well as 100% achievement of accessible sanitation services also with the 100-0-100 program (Kementerian Pekerjaan Umum, 2014).

Fulfilling the need for clean water is one of the basic rights for every individual. The 1945 Constitution has mandated that every citizen of Indonesia has the right to have a decent life. Water as one of the fundamental human needs, not only in terms of availability but also quality, accessibility and affordability economically (Komisi Nasional Hak Asasi Manusia, 2017).

Based on the global targets of sanitation and clean water by 2030, is to achieve universal and equitable access to safe and affordable drinking water for all. Meanwhile, the national target is to increase access to drinking water services, proper sanitation, and sustainable. The national indicator to achieve the target is the realization of 100% of drinking water services, with 85% of the population served by access to water in line with the 4K principle (affordability, continuity, quality and quantity) and the other 15% will be served in accordance with basic service needs; (Baseline 2014: 70%, 2019 target: 100%) and access to potable water (Komisi Nasional Hak Asasi Manusia, 2017;Badan Pusat Statisik, 2014).

Area with sanitary and clean water conditions which is quite alarming in Indonesia is a coastal area occupied by fishermen. Fishermen are a group of people whose lives depend directly on seafood, either by capture or cultivation. They generally live on the beach, a neighborhood close to the location of their activities (Mulyadi, 2007).

Geographically, the fishing community lives, grows and develops in coastal areas, ie a transition zone between land and sea (Kusnadi, 2009). The potential of Indonesia's vast marine and fishery resources can be considered to be the largest in the world, very contradictory to the current reality where 98.7% of Indonesian fishermen belong to the category of small fishermen group and 25.14% of Indonesia's poor communities are fishermen (Surono, 2016).



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The existence of the fishing village is close to the poverty stigma. Viewed from the scope, the poverty of fishermen consists of infrastructure and family poverty. Infrastructure poverty can be indicated in the inavailability of physical infrastructure in fishing villages, which are generally very limited, such as the absence of clean water, away from the market, and lack of access to fuel at a standard price. Indirect poverty of infrastructure also contributes to the emergence of family poverty, infrastructure poverty can also cause families in the near poor to decline into poor families (Mulyadi, 2007).

One of the fishing village in Medan City is Kampung Nelayan Seberang in Medan Belawan Sub-district. Kampung Nelayan Seberang is located on the outskirts of the river and sea. This condition affects the water used by the community for daily activities and water for consumption. Because the quality of brackish water is not feasible for consumption then the fulfillment of clean water needs in Kampung Nelayan Seberang is to make wells drilled either for private property or the government whose water is used for consumption as drinking water and for cooking. In addition, water wells are also used by residents for MCK activities (bathing, washing, and serving as a lavatory). The condition of the clean water availability in Kampung Nelayan Seberang can be seen in Figure 1.

Figure 1: Conditions of water supply in Kampung Nelayan Seberang Belawan.

In Figure 1, there is a pump that people use to supply clean water to houses. As for, the water quality is physically quite good, but there are some community wells whose water quality is poor as cloudy and has a taste.

Based on a preliminary survey at Kampung Nelayan Lingkungan XII, Belawan I Urban Village Medan and Dusun XIV Paluh Kurau Village, Hamparan Perak Subdistrict, Deli Serdang Regency, it can be seen the limited water-related infrastructure such as in Figure 2.

In Figure 2, there are 2 (two) water reservoirs to hold clean water from wellbore. The condition of one of the water reservoirs has been damaged and cannot be longer utilized, while one holder of water reservoir is not utilized optimally. There were also some complaints from local residents related to the continuity of water. Water obtained by communities around Kampung Nelayan Seberang has not been evenly distributed. Drill wells are only owned by certain groups who are quite well-established economically. Meanwhile, for people who do not have a drilled well, they are charged a certain rate if they connect the water source with pipes to their homes. In addition, there is only 1 (one) refill depot to meet the availability of drinking water for ± 500 households.

In addition to the problems of affordability and continuity, some of the physical water quality of the borehole in Kampung Nelayan Seberang is cloudy and has sweet taste. In line with the target of SDGs, it is necessary to improve the quantity and quality of clean water service in Kampung Nelayan Seberang, Medan Belawan Subdistrict. One of the programs which can improve the clean water service in Kampung Nelayan Seberang is through community service program by University of Sumatera Utara.

Figure 2: Damaged water reservoir condition and unused reservoir holder

## 2 IMPLEMENTATION METHOD

The implementation of community service starts from the initial survey and identifying problems in partner villages. To overcome the shortage of clean water supply, the location of drilling well was chosen. The location taken is near the residents' houses which do not have a drilled well. Meanwhile, for residents who already have drilled well but water quality is not good then it was designed a simple water purifier with slow sand filter method.

The implementation method is starting from the determination of the location of the activity, identification of partner problems, the drilling well stage, the design stage of a simple water purifier, the socialization stage of simple water purifier and preparation of reports.

## 2.1 Location

The location of community service activity of Mono Year scheme (Junior Lecturer) is at Kampung Nelayan Lingkungan XII, Kelurahan Belawan I, Medan City and Dusun XIV of Paluh Kurau Village, Hamparan Perak Subdistrict, Deli Serdang Regency.

## 2.2 Stage of Activity

The activity begins with a literature study on solutions to solve the problems of continuity, availability, and quality of water in the region of the coast. Afterward, surveying the location of community service, identifying partner problems, analyzing the situation and conditions, determining solutions to solve partner problems, determining the location of drilling wells, determine simple technology in order to purify well water drilling, preparing reports and publications. A flowchart of stage of activity of increasing availability and quality of clean water in Kampung Nelayan Seberang can be seen in Figure 3.

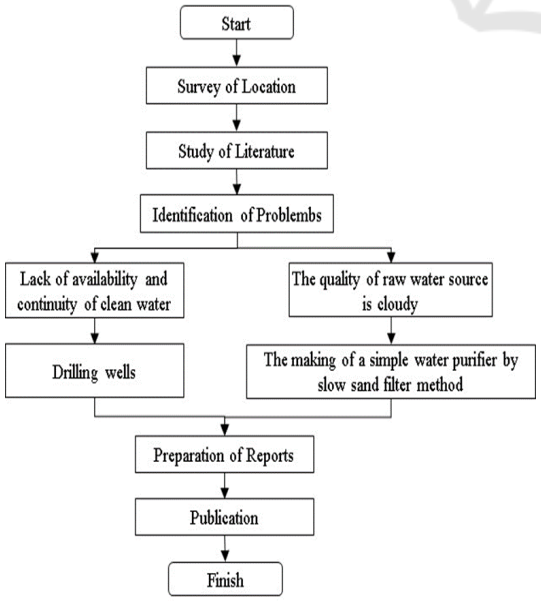


Figure 3: Flow chart of activities to increase the availability and quality of clean water in Kampung Nelayan Seberang

## 2.3 Drilling Deep Well Method

Drill wells are usually drilled by professional driller with experience and adequate equipment to obtain ground water more depth than other wells. Various well drilling methods have been developed according to geological conditions ranging from hard rock such as granite and dolomite to fully consolidated sediments such as alluvial sand and gravel. Certain drilling methods may be more dominant in certain areas as they are most effective in penetrating local aquifers, which can save costs (Kementerian Pekerjaan Umum dan Perumahan Rakyat, 2015).

The well construction usually consists of four or five steps of work, namely: (a) drilling, (b) installation of casing pipe and screen pipe, (c) placement of filter packs or filters; (d) casting grouting to provide contamination protection; e) well testing to ensure water is free of sand and maximum result (Kementerian Pekerjaan Umum dan Perumahan Rakyat, 2015).

The tools and materials used in the manufacture of deep wells are: (a) PVC pipe (length 4 m) of 16 pieces, (b) glue pipe as many as 1 bottle, (c) pipe accessories in the form of shock as many as 10 pieces, (d) coating or casing (length 4 m) of 3 pieces, (e) pumps of 1 unit, (f) drill pipe for 1 unit, (g) 1 freon / gas tube, (h) cement by ½ bag and (i) ) sand as many as 3 buckets.

The process of making a wellbore was starting from (a) determining the location / point of drilling of the borehole; (b) drilling and drilling wells depth ≥ 50 meters; (d) installing a water pumping machine, LPG freon / gas and suction pipe installation at the wellbore, (e) performing groundwater pumping tests (Rahmansah, 2017). The drilling well was done for 3 (three) days.

## 2.4 Simple Water Purification Method

In order to improve the quality of clean water in Kampung Nelayan Seberang, it was needed to design a simple water purifier. One of the simplest alternative technologies that can be applied is a slow sand filter.

The slow sand filter system is a very simple water treatment technology with good quality clean water. Slide sand filter system has advantages

including it does not require any chemical substances (coagulant) (Idaman, 1999).

The filtration process in slow sand filters is done physically and biologically. Physically, particles present in a cloudy or dirty water source will be retained by the sand layer present in the filter. Biologically, the sieve will form a layer of bacteria. The bacteria of the genus Pseudomonas and Trichoderma will grow and multiply to form a special coating. During the filtration process with slow water discharge (100-200 liters / hour / m2 of filter surface area), the pathogen retained by the sieve will be destroyed by the bacteria (Satrio, 2018). The scheme of a simple water purifier with slow sand filter can be seen in Figure 4.

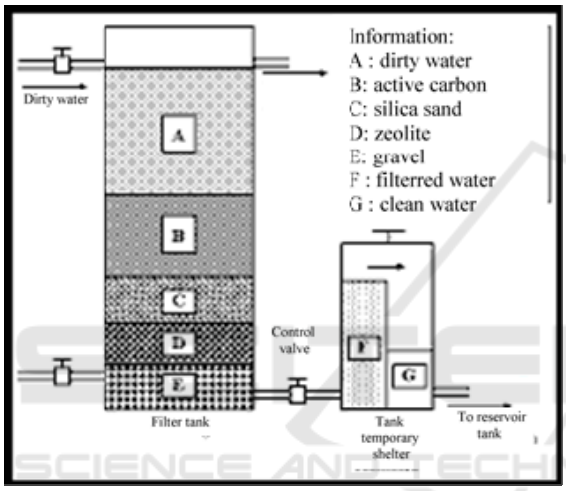


Figure 4: Water Purification Scheme With Slow Sand Filter (Satrio, 2018 modified)

## 3 RESULT AND DISCUSSION

The geographical condition of Kampung Nelayan Seberang which is a coastal, in which the needs of the water is constrained by the quantity and quality of clean water. To obtain clean water with good quality, it needs to be drilled deep well with depth ≥ 50 m. Based on the observation, the availability of clean water in Kampung Nelayan Seberang has not been fulfilled 100%. Complaints from some residents who do not have a drilled well is the cost they must spend in buying water to residents who have a large drill well. Therefore, in the program of community service was given the help of making 1 (one) borehole that can serve for ± 10 households.

The initial stage of drilling this well is drilling by drilling machine to find the raw water source of clean water (see Figure 5a). Thereafter are the installation of pipes, accessories ,pumps (see Figure 5b) and the last is to test the obtained water (see Figure 5c).

Figure 5: (a) drilling, (b) plumbing and (c) testing of water

In addition to the problem of water availability which is still lacking, the other residents' problems that the water is cloudy and has taste.The solution to overcome this is to design a simple water purifier such as a sketch in Figure 6.


Figure 6: Sketch of a simple water purifier (Sumardika, 2012 modified)

Based on the physical test, the water pH value in Kampung Nelayan Seberang is 8.2 - 8.5. Meanwhile, the Fe value was 0.1 mg / l and Mg of 0.03 mg / l. To reduce the content of Fe and Mn from raw water source, it can be used a simple technology, the slow sand filter. The slow sand filter depends on the filter media used. In the design of a simple water purifier for the Kampung Nelayan Seberang, it was used a gravel media, activated carbon, silica and zeolite.

Zeolite is a three-dimensional crystalline alumina silica, and is formed from tetrahedral alimina and silica with inner cavities containing metal ions, usually alkaline or alkaline and freely moving water molecules. Zeolite serves as an adsorbent and molecular filter, as well as ion exchanger in water treatment (Kusnaedi, 2010).

Activated carbon is a powder-shaped material derived from carbon-containing material such as coal and coconut shell. The activated charcoal can

adsorb certain gases and chemical compounds or selective adsorption properties (choosing), depending on the size or volume of the pores and surface area. The absorption capacity of activated charcoal is very large, ie 25-100% to the weight of activated charcoal. The usefulness of activated charcoal is as a remover of cloudy, bad smell, and resin in the water of households (Kumalasari, 2013).

Several previous studies have found the effectiveness of a combination of filter media such as zeolite, silica sand and active carbon can remove Fe by 96% and Mn by 84.3% (Yudi, 2017). Meanwhile, the results of the study (Syahputra, 2015) showed that the use of activated carbon could remove Fe by 75%, Zn by 14.29% and Cu by 10.78%. The combination of zeolite, silica, active carbon and gravel was effective to reduce Fe by 74% and Mn by 33% (Rizki, 2013).

# 4 CONCLUSIONS

Community service in Kampung Nelayan Seberang was conducted to overcome the problem of water availability and water quality. The solution to overcome water availability was done by providing assistance to drill deep wells with a depth of ≥ 50 m. Drilling wells were carried out for ± 3 days with well drilling stages, pipes and accessories and water testing. The water source in the form of a deep well drill can serve for ± 10 households.

In the case of overcoming the muddy and bad tasting water quality was done by using a simple water purifier in the form of a slow sand filter. The medium used is zeolite, silica, activated carbon and gravel. The use of this medium can reduce Fe and Mn levels in well water ranging from 33% - 96%.

The deep drill well is an alternative to fulfill the water needs of fishermen living in the coastal area. Another alternative that can be done next is to process brackish water into a source of clean water with membrane technology and desalination. Intensive and unstructured deep groundwater intake will have negative impacts such as decreasing ground water levels, damaging the hydrological cycle, and often the depletion of water reserves that are useful for balancing ground surface pressure and resulting in landslides and ground-level ambles. The use of membrane technology and desalination can be recommended to meet water quality and certainly require high investment costs.

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