Improving Water Conservation at Universitas Diponegoro, Indonesia

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Abstract. It is estimated that the amount of water needed by Universitas Diponegoro will increase in the years to come. Several efforts are required to ensure the fulfillment of water needed while also considering its sustainability. There have been studies on water conservation at the industrial level. Still, limited studies have discussed this problem in Indonesia specifically at university level. Therefore, this study discusses the water conservation program at Universitas Diponegoro that might be used as a reference for other universities to address water supply problems. This study aims to discuss in depth water conservation efforts at Universitas Diponegoro. This study incorporates a descriptive-qualitative approach along with direct observation. Some programs on water supply have been implemented in Universitas Diponegoro such as conservation, treated water consumed, water recycling and water-efficiency. The existence of rainwater harvesting tanks (RWH), reservoirs, biopores, wastewater treatment plans (WWTPs) and ponds are among the efforts that have been applied at Universitas Diponegoro in order to conserve the water. To date, Universitas Diponegoro has successfully conserved more than 75% of the water, recycling about >50% of wastewater, installing about >50% of water-saving equipment, and has treated clean water into drinking water using reverse osmosis.

Keyword:
water, conservation, sustainability, campus

1. Introduction

Water is a basic need of living things, especially humans, and one of the natural resources that must always be available. The need for water is essential, and every human being has the right to obtain and use access to clean water [1]. Availability of water in a sustainable manner must be guaranteed to meet daily needs while at the same time achieving sustainable development goals (SDGs) number 6, namely access to clean water and sanitation. Many sectors other than domestic that need water to run their operations include the industrial sector, agriculture, and the academic sector such as universities.

As one of the best universities in Indonesia, Diponegoro University strives to develop a comfortable, healthy and safe campus for all students, lecturers and university employees [2]. For example, by developing integrated waste management [3], energy management [4], park development, and so on. In addition, in its development, Diponegoro University also refers to programs related to the Sustainable Development Goals [5, 6, 7]. These various programs make the Diponegoro University campus very attractive to prospective students.

Diponegoro University requires large amounts of water for infrastructure and activities on campus. It is estimated that the amount of water needed at Diponegoro University in 2024 will significantly increase [8]. Given that Diponegoro University has a vision to become a research university [9], the activities related to laboratories that require water are very high. According to [10], practicum activities, flushing toilets, and ablution are activities that require a lot of water and will increase along with the increasing number of students and campus facilities being upgraded every year. In addition, the expansion and improvement of facilities resulted in changes in land use. This reduces the area of water catchment areas to reduce runoff from surface water and groundwater. Clean water sources also experienced a decline [8].

Therefore, efforts are needed to ensure water needs sustainability. Water conservation efforts at several world universities have been carried out, such as the Federal University of Bahia. In a study by [11], they have been explained in reduction, daily monitoring, preventive screening, and leak correction of water consumption. Conservation efforts have also been carried out at Diponegoro University. It can meet campus water needs from several sources, namely 40% well water, 40% treated surface water, 10% recycled wastewater, and 10% from rainwater storage [12].

These efforts will be discussed further in this paper. There have been studies on water conservation at the industrial level, such as the research conducted by [13]. Still, there have been no studies that discuss this problem in Indonesia at the university level. Hence it can be used as a reference for universities or other agencies to overcome consumptive water use. The method used is a descriptive qualitative approach, and observation will be used to collect data.

2. Methodology

This study uses a descriptive approach by describing and interpreting a form, characteristics, etc., without providing treatment or hypothesis testing. According to [14], the data were collected directly from the source, and the researcher became the analyzer.

2.1. Research Object

The research object in this study is programs and facilities in water conservation efforts in Diponegoro University, Tembalang, Semarang City.

2.2. Data Collection

The data collection method in this study is direct observation in the field and documented. The data collected includes water conservation programs that have been running (conservations, treated water consumed, recycling, and water-efficient programs) and existing building facilities (Rainwater Harvesting Tanks (RWH), reservoirs, biopores, etc.).

2.3. Data Analysis

Data were analyzed by descriptive-qualitative. Unrelated data will be reduced, then similar data from the field are grouped and interpreted. After that, a general conclusion can be drawn.

3. Result

3.1. Conservation Program at Diponegoro University

Diponegoro University has implemented conservation programs, evidenced by the presence of Rainwater Harvesting Tanks (RWH), Reservoirs, Ponds, and Biopores. This program aims to ensure the existence and sustainability of water sources used in UNDIP. The achievement of this program is that more than 75% of the water around the campus has been successfully conserved.

3.1.1. Rainwater harvesting Tank (RWH)

Some RWH are developed for alternative water sources in the campus area. It can reduce the use of shallow groundwater as the main source of water to fill the increasing demand of water on campus. According to [15] rainwater harvesting (RWH) can be the best alternative in increasing water supply and reducing the discharge of rainwater pollutants. It is an obligation for each faculty to build RWH. It ensures all faculty members participate actively in sustainable campus living. The RWH is also installed in the rectorate office **Fig.1** and in open spaces all over the campus.

Figure 1. Rainwater harvesting Tank (RWH)

3.1.2. Diponegoro University Reservoir

The reservoir is an essential part of water conservation efforts [16]. In collaboration with the National River Management Agency – Ministry of Public Works, Diponegoro University, under the coordination of the Department of Civil Engineering, manages polders

located on campus which aim to maintain the balance of ecosystems and the environment, flood control, and water reservoirs, and as a field laboratory for University students. Diponegoro. The function of the reservoir as a field laboratory is for the Faculties of Civil, Chemical and Environmental Engineering, Fisheries and Marine Affairs, power plants, and recreation areas. In addition, this reservoir also functions as a laboratory for the Master of Dams, which was opened by UNDIP in collaboration with the Ministry of Public Works. This reservoir is located in Tembalang, near the campus forest and the Diponegoro University stadium. This reservoir is located at 7°03'07.52"LS, 110°26'46.11"E. This reservoir can accommodate average inundation up to 478.240 m with a catchment area of 7.1338 ha, a river length of 7.52 km, and a dam body height of 22 m.

Figure 2. Diponegoro University Reservoir

3.1.3. Ponds

Several pools at the university were built for several purposes, including air storage to optimize the provision of blue infrastructure in the campus area and open spaces to provide better species habitat and living environment. According to [17, 18], the pool also works as water purification and regulation of water flow, traps, aesthetic value, environmental education, and recreational activities.

Figure 3. Ponds

3.1.4. Biopores

Biopores are simple technology used to increase the water absorption capacity of the soil by making holes in the ground and filling it with organic waste to produce compost [19].

Organic waste buried in these holes becomes a food source for microbes, which can create pores in the soil. Earthworms could create a favorable environment for root growth by opening channels to the soil layer and covering it with hummus [20]. With an increase in better water absorption, the risk of flooding and puddles is reduced. Besides that, with good water absorption, groundwater conditions will be maintained for both plant life and the maintenance of shallow well water [12].

Figure 4. Biopores

Like the RWH initiative, biopores were built on a large scale at the university to sustain the water supply. New buildings such as vocational buildings are developed based on green principles, including biopores development, as one of the initiatives on the list.

3.2. Recycling and Water Efficient Program

Diponegoro University implements a wastewater recycling program to be reused in meeting university water needs. About >50% of the wastewater generated has been recycled and used for flushing, watering, and watering plants. Diponegoro University has a Wastewater Treatment Plant located at the Diponegoro University National Hospital. This Wastewater Treatment Plant is a treatment system known as anaerobic WWTP with a discharge capacity of 160m^3/day. In addition, about >51% of buildings at Diponegoro University have used highly efficient automatic toilet flushing faucets/faucets and touchless toilets and soap tools to save water from implementing water efficiency programs.

a.   b.

Figure 5. (a) Toilet Flush; (b) Water Tap

Diponegoro University has 2,826 toilets spread across buildings in the campus area, with a total of 1,554 non-touch toilets in each toilet. In addition, the number of sinks in the campus area is 1,041 units, with 489 automatic faucets/faucets flushing toilets. Thus, it was found that Diponegoro University owns 51% of the total number of efficient water equipment.

3.3.   Treated Water Consumed Program

Diponegoro University already has several water treatment technologies such as reverse osmosis, ultrafiltration, industrial wastewater treatment, and seawater desalination. This product is the Undip Membrane Research Center, which was established in 2009 and focused research on developments related to membranes and their applications. Prof. Heru Susanto is the initiator to establish a laboratory that focuses on membrane technology, water, and wastewater treatment. In addition, this center also organizes various workshops related to membrane technology and water and wastewater treatment.

a.   b.

Figure 6. (a) Reverse Osmosis Water Treatment; (b) Drinkable Water Stock

Diponegoro University has groundwater that comes from wells. Diponegoro University processes groundwater into drinking water using a reverse osmosis-based machine to utilize this water and other general purposes. The treated drinking water is stocked and distributed throughout UNDIP for consumption.

4. Conclusions

Diponegoro University is a green campus that improves water conservation by implementing water conservation, water recycling, and water-efficient and treated water consumed programs. The implementation of the water conservation program consists of Rainwater Harvesting Tanks (RWH), Reservoirs, Ponds, and Biopores. It has succeeded in conserving more than 75% of the water in the university area. In the implementation of the water recycling program, Diponegoro University has managed to recycle about >50% of the wastewater in the campus area and use it for rinsing water and watering plants. Furthermore,

in the water-efficient program, about >50% of buildings in Diponegoro University have installed water-efficient appliances, including high efficient toilet flush and water tap. Finally, in the treated water consumed program, Diponegoro University has processed groundwater into drinking water using a reverse osmosis-based machine.

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