Floating resort planning in Tano Ponggol with water conservation approach

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Abstract. The government of Republic of Indonesia built a supporting infrastructure for the growth of the Toba Lake National Tourism Strategic Area as an international tourist destination. One of infrastructure built is the Tano Ponggol Bridge, which becomes the only road connecting into that area. To help the government work program, planning accommodation becomes very urgent along with the development of tourist areas on Toba Lake. Planning a Floating Resort that has design ideas and new innovations is one solution to support government programs and tourism activities in Tano Ponggol. The method in this design starts from the site survey directly, then the data collection by observation, documentation, literature review and comparative study of similar projects and themes for the preparation of the planning concept of the Floating Resort in Tano Ponggol with the concept of a water conservation approach that will use water from Toba Lake as a support utility and can also be used as a design settlement at the resort. The application of the concept is applied to the utility system and also the design of the building that will show the process of collecting rainwater through the roof of the building and returning water to the lake.

1. Introduction

The government of Republic of Indonesia built a supporting infrastructure for the growth of the Toba Lake National Tourism Strategic Area as an international tourist destination [1]. One of the infrastructure built in the Tano Ponggol Bridge [1], which is the only road that connects to the area. making this area has the potential to be developed into eco-tourism areas [2]. This aims to invite the public to both preserve the attractiveness and culture of Toba Lake to introduce it to the world so that can attract tourists local and foreign tourists.

Based on tourist visit statistics, the number of tourists who come into Toba Samosir in 2018 is 645,503. There are 1,242 foreigner tourists and 644,261are domestics. The number of tourist attractions in 2018 decreased by 0.13% (96,063 people) from 2017, which consisted of foreign tourists by 0.90% (10,879 people) and domestic tourists by 0.12% (85,184 people) [3].
As an area located around Toba Lake, Toba Samosir is a tourist destination in North Sumatra Province [3]. Based on data from Statistics of Toba Samosir Regency, in 2018 there were 25 accommodation businesses with 639 rooms. The whole for this accommodation is spread across four sub-districts, namely Balige 17 accommodation, Laguboti 3 accommodation, Porsea I accommodation, and the remaining 4 in Ajibata [3].

A survey of the Environmental Impact Management Agency of North Sumatra Province (2007) showed that there were 147 settlement locations on the outskirts of Toba Lake, where 88% used lake water as raw water to drink and also clean water without further processing [4]. It showing how important is water conservation to be applied at Toba Lake. Water is very important critical to successful, growing communities where populations can enjoy a high quality of life [5]. Therefore, water conservation is treated as a source of new water supply. This is an important goal in effective water resource planning [6].

The aim of this research is to provide the concept of new accommodation facilities to support the government's work program by utilizing water resources in the Toba Lake region while helping to maintain the quality of clean water in Toba Lake through water conservation.

2. Water Conservation

Water conversation is one of the green building principles that consists of water purification, rainwater catchment, and infiltration wells [7]. This conservation resources in an effort to support the existence and sustainability of the condition, nature, and purpose of water resources so that it’s constantly available in quantity and adequate quality to fulfill the needs of living things in the present and future generations [8].

2.1. GBCI Rating Standards for New Buildings Version 1.2

A building is said to be a green building if the building has received a certificate from a designated institution (in this case the Green Building Council Indonesia or GBCI). The details of the criteria set by the GBCI to assess the application of the aspect of water conservation are shown in Table 2 [9, 10].

| Categories and Criteria          | Max Criteria Value | Unit description of categories |
|----------------------------------|--------------------|--------------------------------|
| WAC-Water Conservation           |                    |                                 |
| WAC-P1 Water Metering            | (P)                |                                 |
| WAC-P2 Water Calculation         | (P)                |                                 |
| WAC-1 Water Use Reduction        | (8)                |                                 |
| WAC-2 Water Fixtures             | (3)                | 2 criteria precondition 6 credit criteria |
| WAC-3 Water Recycling            | (3)                |                                 |
| WAC-4 Alternative Water Resources| (2)                |                                 |
| WAC-5 Rainwater Harvesting       | (3)                |                                 |
| WAC-6 Water Efficiency Landscaping| (2)             |                                 |
| Value Total of WAC Categories    | (21)               | 20.8%                          |

2.2. Water Utility System

2.2.1. Wastewater

Communal Wastewater Treatment Plant (IPAL) is a centralized wastewater processing system which is a building used to process domestic wastewater that is communally functioned (used by a group of households) to be safer when discharged into the environment, in accordance with the standards environmental quality. Liquid waste from residents’ houses has flowed to the building like a WWTP reservoir through a pipeline network [11, 12].
2.2.2. Water resources
The utilization of Toba Lake waters is also important as a source of community raw water. Most of the villages/hamlets around the lake utilize lake water directly, both for bathing and washing and drinking. Many of the villages/hamlets are very dependent on lake water for domestic needs because water sources from the mountains are not available. In addition, around Toba Lake there are also three points of intake of raw water sources of the Regional Drinking Water Company (PDAM), that are in Balige, Laguboti, and Pangururan. In general, most settlements, both hamlets and villages, around Toba Lake waters meet their drinking and domestic water needs from lake water [13].

The monitoring results show that Toba Lake's water quality has been polluted, with a medium polluted category (referring to Class I Water Quality Standards in accordance with PP No. 82/2001). Various sources of Toba Lake water pollutants include domestic waste, agriculture, animal husbandry, fisheries, water transportation and mining of class C excavated materials [14]. As it is known that the water quality standards for drinking water are very high, such as TP <0.005 mg/l (Beveridge, 1984) or oligotrophic water conditions. At the drinking water intake location, the development of floating net cages (KJA) should be avoided and a certain distance set for its development [13, 15].

3. Methods
Determination of site location based on requirements that can be used as a standard benchmark that can be considered for site selection, such as:

- The site environment is in a strategic location;
- Ease of achievement/accessibility by visitors, managers, and service vehicles, and congestion does not often occur;
- Consideration of a large enough area of land that can accommodate all the needs of space, both inside and outside space;
- Availability of supporting facilities and infrastructures such as utility networks, electricity, internet, etc.
The method used in this design planning research is a qualitative method which is divided into two steps data collection, the first is primary data collection that starts from a direct location survey by conducting a brief interview to the community and government project workers in the Tano Ponggol bridge area. Then the data collection by observation to determine the natural conditions and physical conditions of the area, observation of activities, and documentation. The second is secondary data collection by searching library research from books and the internet as a source of reading and references relating to the issues discussed. The data obtained from this literature study, both from theory, expert opinion, and government regulations and policies, form the basis of planning so as to deepen the analysis. After that, look for a comparative study of similar function buildings, namely floating resorts to see how the layout of space within and outside space, building structures, building concepts. And also looking for a study of similar theme building literature namely water conservation to see how the application of themes in buildings and water conservation treatment in buildings to prepare the planning concept of Floating Resort in Tano Ponggol. The data obtained were then analyzed through a programmatic design approach, namely by using architectural design theories relating to floating resort planning in the form of site analysis, function analysis, activity analysis, spatial analysis, shape and filter analysis, and building system analysis.

4. Discussion
The basic concept of the design of the Floating Resort in Tano Ponggol is to interpret the application of Water Conservation by linking the criteria of Water Conservation and surrounding cultures and the application of water conservation by means of utilizing water resources at the site location, which is sourced from Toba Lake.

4.1. Site Design
The building is designed to follow the shape of the existing outside site. The best view on the site is south to north which shows the view of the green hills and Toba Lake. Because the best view is in that direction, buildings, especially resorts, restaurants, and rooms that require excellent views, will be designed facing Toba Lake and the hills. While for other rooms that do not get optimal views, a green garden is designed so that all parts of the resort get the best and attractive views (Figure 2).

Figure 2. Masterplan and Perspective of Floating Resort

The layout of the building separates public facilities from private facilities. The division of the building can be seen clearly in the middle of the building where there is a water reservoir to be returned to the lake. Water treatment is carried out as a whole which can be seen from the master plan that the entire building has a pool to collect rainwater which also serves as an architectural landscape. And the existence of a special building for water conservation treatment.
4.2. Roof and Facade

4.2.1. Resort Roof and Facade

In the basic form, the roof part takes the form of the roof of the traditional Toba Batak house building to take the local wisdom concept of the local culture as well as adding ornamental ornaments from the Toba Batak (Figure 3, 4) and also the Toba Batak roof is useful for blocking direct sunlight and has a gutter so that when heavy rainfall does not enter the building.

![Figure 3. Toba Batak Roof](image3.png)

![Figure 4. Toba Batak Roof](image4.png)

The building facade combined with the use of glass and local materials and applying the concept of Green Architecture to the building so that the concept can be realized and achieved (Figure 5).

![Figure 5. Facade Resort](image5.png)

4.2.2. Rainfall Water Conservation Roof

The application of the concept of water conservation can also be used on the roof that holds rainwater to be distributed to buildings. The concept of this resort takes the same design idea as an example of comparative study buildings such as the PT Dahana Campus, which is using rainwater techniques on the PT Dahana Campus rooftop rainwater harvesting technique as the storage area [16]. And the application of the concept of water conservation on the roof of the building is shown in Figure 6 and 7.

![Figure 6. Application of Rainfall Water Conservation Roof to the receptionist](image6.png)

![Figure 7. Application of Rainfall Water Conservation Roof to the bar](image7.png)
4.3. Water Usage

The swimming pool concept that will be applied at the floating resorts also has criteria such as; is directly related to other supporting facilities, has a concept that is integrated with the surrounding natural conditions, environmentally friendly, and has an attractive view and design [17, 18].

As for the concept of falling water to be achieved by designing a pool of water that falls from the water treatment process that is returning water to the lake at several building spots in the resort. The existence of falling water itself must be able to blend with nature (Figure 9).

Meanwhile, to create a cooler atmosphere and reduce noise around the building, with the addition of cooling water in the form of a pool to add a natural atmosphere at this floating resort, the sound of gurgling caused by water in the pool makes the atmosphere of parks and buildings become fresher. In addition, the sound of water can reduce the noise of vehicles passing in front of the site location (Figure 10).

The application of the same concept as PT Dahana Campus is that rainwater enters the pond and follows the filter process in the pond. The excess water in the pond is pumped to the ground reservoir and used to water the plants. Water that exceeds the storage limit will go out through overflow into the drainage canal [19]. Therefore, the processing of ore water involves elements of chemical compounds to produce clean water that is fit for use and can be drunk as well. The clean water treatment process is shown in Figure 11.
This clean water treatment goes through two stages of filtering and the use of chemicals to remove harmful substances that are in the water content so that the clean water produced from this treatment can be consumed to be used as drinking water as well [20].

5. Conclusion

The application concept of water conservation approach can support the availability of clean water to buildings and their users as well as utilize existing water sources to be used as well as possible, as well as the utilization of building wastewater to be processed again into suitable water and can help solve the problem of clean water sourced from Toba Lake.

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