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# Lakeside Resort Based On Eco-Architecture

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**Abstract.** Matano Lake is one of water tourism destination which widely popular in Sorowako City. The natural condition of Matano Lake is heavily scenic includes the land, water, air, and energy and reasonably required to preserve. Exploration in resort design with eco-architecture concept is one of preservation effort to maximize the natural potency of the area based on ecology aspect, socio economy aspect, and socio-cultural aspect. Method in the design process applied an eco-architecture concept with ecological principles implementation in material, building orientation to maximize the sunlight and the wind that have benefit to maintain the building thermal in cool and warm condition, and maximize the openings as wind track movements in ventilation from west or east direction. The result explained the lakeside resort based on eco-architecture model.

## 1. Introduction

One of water tourism destination located in Sorowako City is Matano Lake. The natural potency presents exotic panorama, freshwater, and extremely beautiful on the lakeside landscape. Even the location is located faraway, about 600 km or 373 miles from Makassar City, this lake could be reach with any vehicle. The Matano Lake wide is 16,408 km<sup>2</sup>.

In addition, Matano Lake has another uniqueness, the isothermal lake. Isothermal lake is the lake with the surface water and the bottom temperature is less than 2°C in the depth of 200-300 meter. The lake has fish pond with gravity current indication at the bottom of the lake. Moreover, the lake has endemic flora and fauna in Sorowako, it means the animal or the plant are only existing in this area. The Mantano Lake is also the 8th deepest lake in the world according to WWF.

There are some problems in existing condition, such as lack of attention to the natural condition around the lake. As a result, the natural ecosystem of the lake area become disturbed and influences the level of natural comfort for the building resident around the area. The core of ecology is a concept of balance. The ecology concept accommodates all interests. The development process must practice the mutualism process between environment, social, culture, and economy interests. An environment will harm because of clearing in agriculture land, massive deforestation, without respect on the environmental tolerance and the society. An extreme environment quality decrease will have serious impact.

The balancing process in the environment, social, culture, and economy of the edge of the Matano Lake would transform a productive land (will increase environment quality, support the society, and increasing the society economy). This area has self-capability regeneration by a good governance process support. Therefore, the Resort should provide a new experience for the visitor, not only enjoying the beauty of the nature but they also utilize the resort facility to spent their night when traveling to Matano Lake tourism area. Another visitor facility is water tourism facility, such as kayak, banana boat,



and jet ski. The facility supports by the gazebo positioning, bungalow, restaurant, and other facilities. These facilities will create a pleasure and natural scene.

According to the information of South Sulawesi Tourism and Culture Offices 2016, a domestic and international tourist visitor is steadily increase annually, 4,523,381 visitors in 2011 and increase to 7,320,599 in 2015 which explain a good improvement. With a good development on tourist visitor, the South Sulawesi government increase the activity in tourism sector and support the sector a few years ago, because of the tourism sector income is high enough, Rp14.61 trillion (2012), Rp18.61 trillion (2013), and Rp 20.72 trillion (2014).

Apart from the previous description, ecosystem is one of strongly considered because the Matano Lake is the object of GERMADAN (*Gerakan Penyelamatan Danau* or A movement to Save The Lake). The movement is initiated by an agreement in First Indonesian Lake National Conference (*Konferensi Nasional Danau Indonesia I*) in 2009 and conclude Bali agreement that signed by 9 Ministries. The agreement will maintain, sustain, and recover the lake function based on ecosystem balance principle and environment capacity in 15 National Priority Lakes. (GERMADAN, 2014).

Eco-architecture considers as an appropriate concept for building design in line with the environment. Eco-architecture is an architecture approach that synergy with the human life requirements and has interrelationship with the environmental. Eco-architecture contains some dimensions, time, environmental, socio-culture, space, and building engineering. This dimension explains the eco-architecture characteristic is extremely complex, solid, and vital rather than the general architecture. (Frick, 2007). Therefore, in order to sustain the environmental in natural condition, then the building material in the design process will practice local material around the area of Matano Lake.

## 2. The Design Method

In order to achieve the design of eco-architecture application result, then the design methods implementation includes:

1. Literature study, in form of data collection about eco-architecture, including ecology principles, examples of resort design in coastal area of Indonesia, and consider on the requirements and space standard for the resort facility.
2. Observing of the location, collecting the information from natural potency, socio economy, and physical environment of the location to support on design achievement.
3. Analysing the design approach, analysing and simulating the potency of site plan, strategy in form implementation, material, structure, and utility. In addition, this study conducts on ecological principles analysis for Matano Lake resort design implementation.
4. The ecological principles are:
  - a. Fluctuation  
Fluctuation principle stated the building is designed and accepted as the place with culture differentiated and natural process relationship. The building should reflect the natural process relationship that exist in the location. Furthermore, the building allowing a process as a process not as a presentation of the process. The process should success connects the people and the reality of the location.
  - b. Stratification  
Stratification principle explained the building organization must explicitly reflect from the difference interaction of the parts and the levels of building. These principles like an organization that allowing a complexity integrated organization.
  - c. Interdependence  
The principle describes the relationship between the building and the parts of the building is mutual. The reviewer (the designer and the user) like as the location are not separable with another part of the building. This interrelated characteristic shows the building and its parts will continue connected as long as the building exist.

5. Conceptual formation, organizing the building layout concept and resort building design with the application of eco-architecture principles that integrated with the environment of the location. Eco-architecture emphasizes high quality architecture even the quality is hard to be measured and determined. There is no clear border line between high quality architecture and standard architecture. The existing phenomena explains the quality architecture consider on the form and building construction and tends to avoid the living quality and the user needs, in fact the user is clearly as the main actor.
6. The result of the design is in form of area design and resort building with eco-architecture implementation. The design presents the lakeside resort model eco-architecture based on eco-architecture.

### 3. Results and Discussion

#### 3.1. Design Transformation

##### 3.1.1. Site Design

Site design contour follows the condition of lakeside area contour. The contour area is about 400-425 mdpl. The west side position Matano Lake landscape includes the hill, grassland, and lake view becomes the building orientation consideration. Afterwards, the building orientation processing analysing the wind and sun path and processed by Autodesk project Vasari software. Based on the consequences, the site design follows the site pattern and then oriented lengthways from east to the west to maximize the wind blows direction and sun pathway.

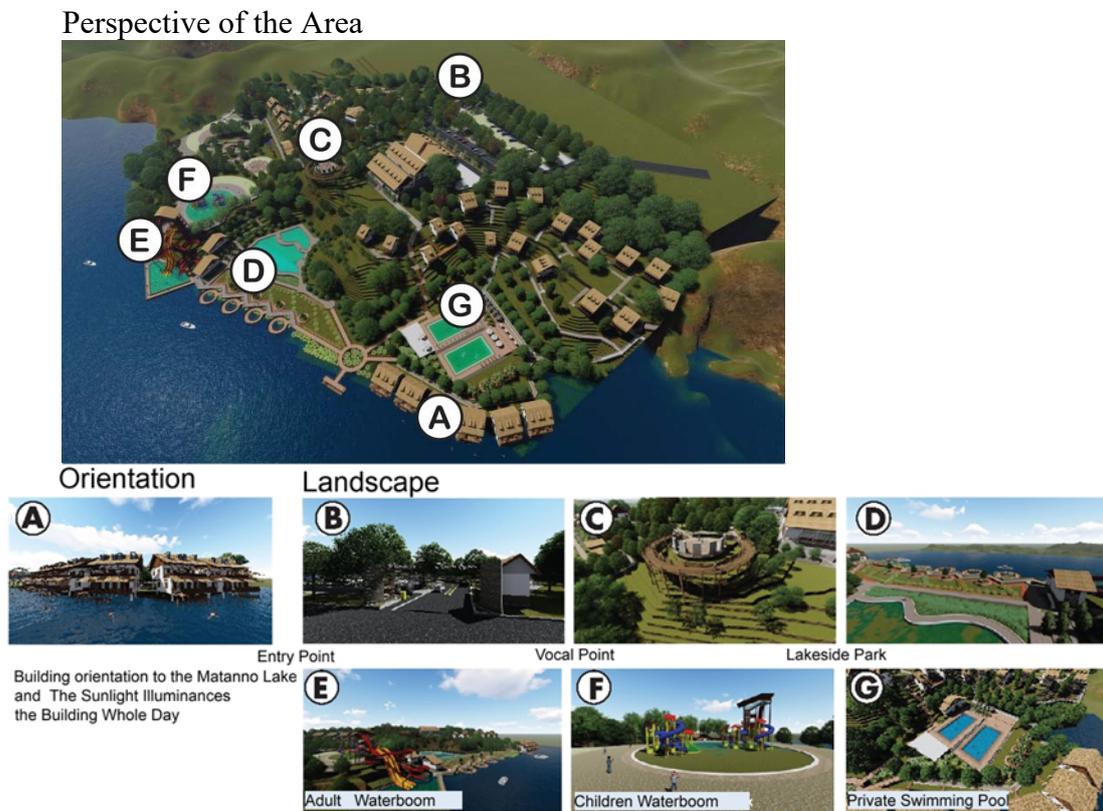


Figure 1. Landscape layout of site plan area

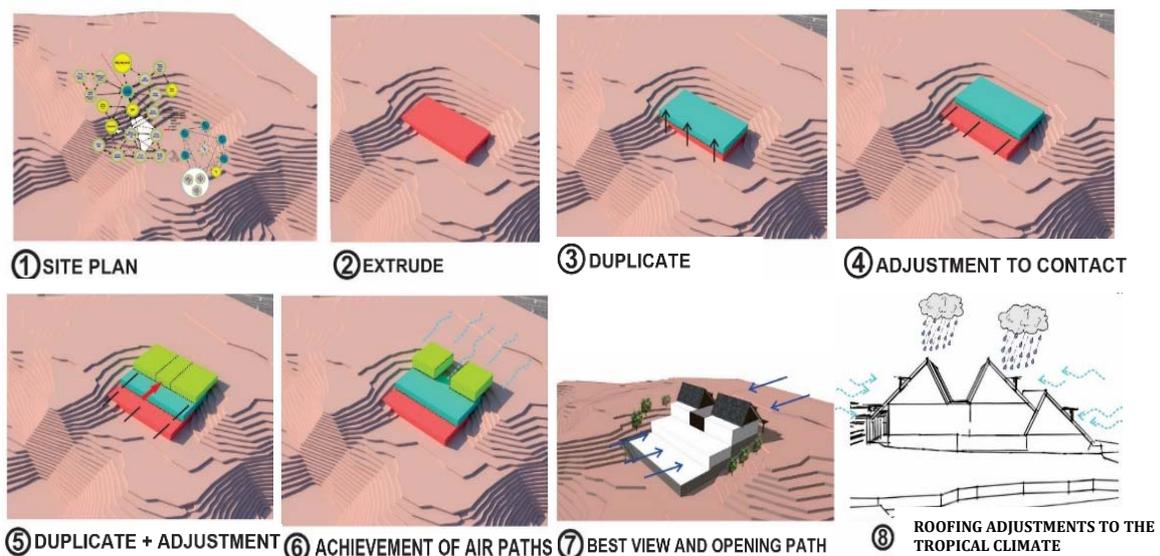


**Figure 2.** Area view around the design location

Site view condition from the west side presenting a Matano Lake view and the east side is the hills view. However, the west side has excessive thermal, thus a green element plantation in form of shading tree become the movement direction or sea breeze distribution. According to tropical site climate condition, then the secondary skin element applied in the building facade to control the thermal and excessive sunlight exposure. Moreover, the roof part will have a ventilation to cooling the roof.

**3.1.2. Building Form**

The processing of the building design is based on the space requirement and a contour of site plan based on eco-architecture concept application with split-level house treatment and terraced house, adjustment the site plan building, adjustment of the view, and the application of the roof based on the tropical climate condition. The transformation process of the building form in the site plan are as follows.



**Figure 3.** Formation of building process in the contour land

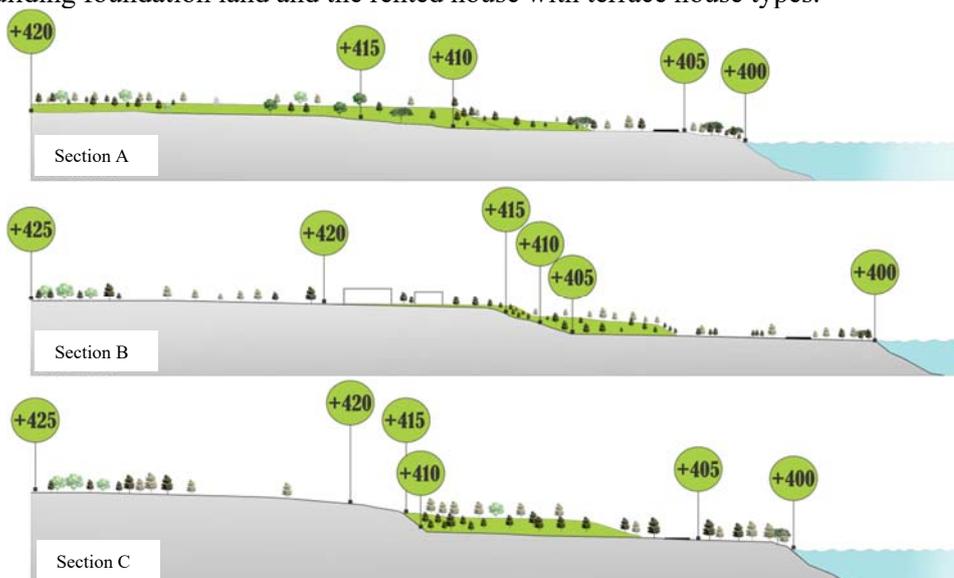


**Figure 4.** Split-level house and terraced house types

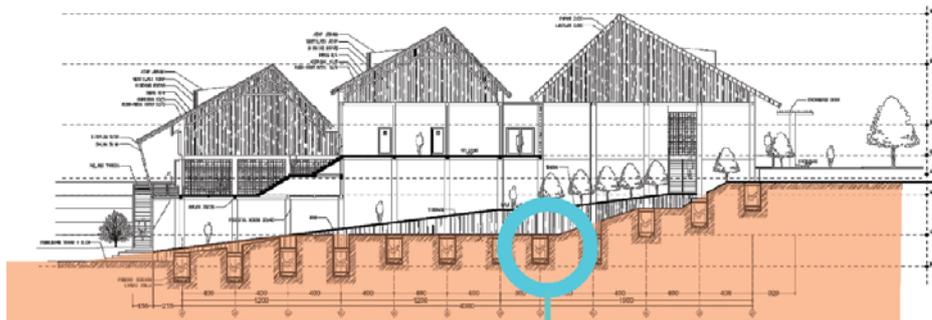
The split-level house types will develop with a difference elevation  $\frac{1}{2}$  of house height, and the roof modification will have roof elevation that follows the contour. As a result, the room construction will have maximal and fully sunlight exposure as a natural illuminance of the building. Moreover, the east side of building will dominant with the opening application as an advantage effort of sunshine and maximize the benefit of Matano Lake natural landscape panoramic view. Additionally, the terraced house types will have strip foundation as earth-retaining structure. The building opening will have maximum openings in the west side as wind movement and distribution track. However, this part will have fairly thermal condition, thus the west side touch with facade and secondary skin modification that built from the solid wood and the roof openings will have cross ventilation to organize building temperature stability.

### 3.1.3. Topography utility in the form processing

One of advantage of Matano Lake site area is the contour land that form a natural land aesthetic. Cut and fill method will not apply in the site processing because the natural land condition becomes a challenge in the physical design of the resort area. Contour line of the location is 400mdpl and the highest land area is 400mdpl which covers the design area. Moreover, the site layout is completely depending on the contour condition and suggested design will not damage the existing contour but to take advantage of the land condition. The contour land condition considers as an appropriate design for the terrace house type. Terraced house is the house with sloping and steep land topography characteristic. Therefore, the house has a different terrace level based on the contour line and the variance height is always one level of the house. The contour condition with 400-425mdpl becomes the main building foundation land and the rented house with terrace house types.



**Figure 5.** Land contour lakeside section in Matano Lake



Building Caisson Pile Form Based on The Contour Condition

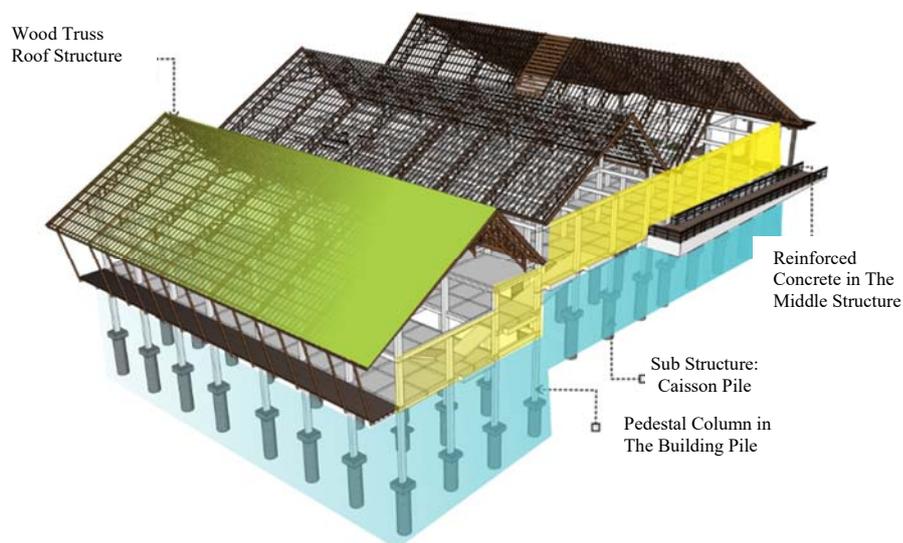
**Figure 6.** Terrace house building section in contour land

The building with the contour land will applied caisson pile that follows the contour. Because the land texture has different land hardness below 5 m depth and the caisson pile become an appropriate choice when the hardness soil construction is below 3-8 m.

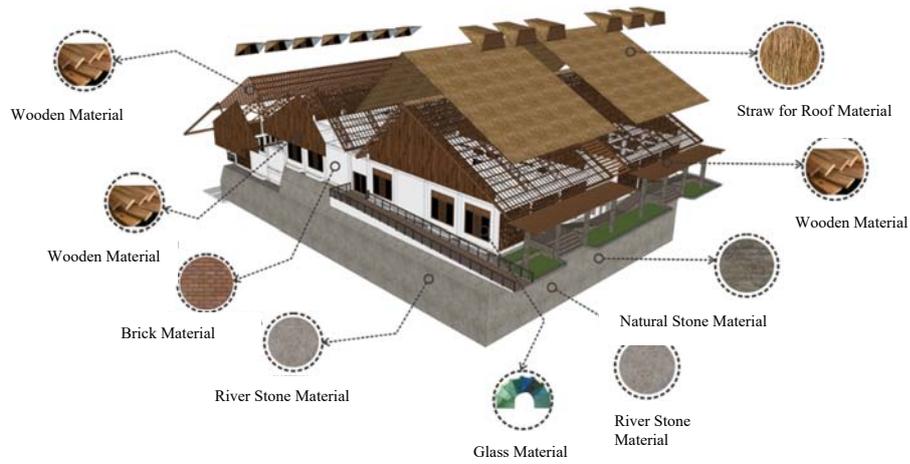
#### 4. Structure and Building Material

##### 4.1. Split-level house

The sub structure of split-level house building practice the caisson pile to adapt the land contour, and pedestal column applied in the building pile. The middle structure of split-level house building is reinforced concrete and the upper structure is wood truss. Most of material implementation are natural material, wood, stone, and straw. Additionally, the glass material applied in the building window.



**Figure 7.** Split-level building structure



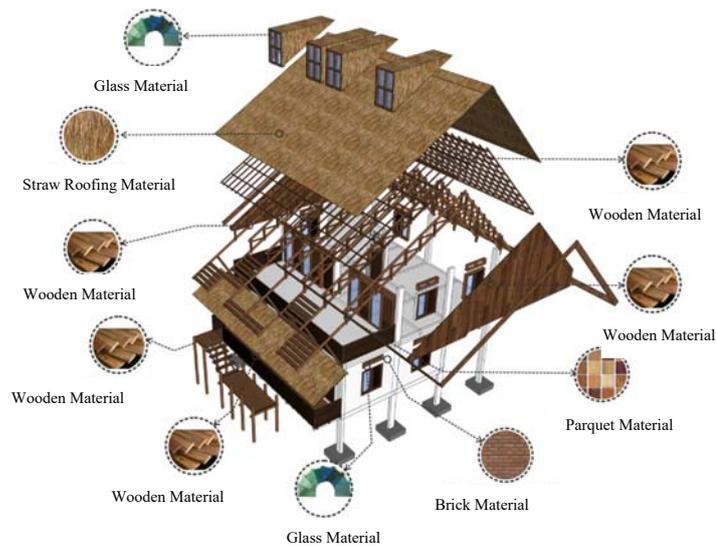
**Figure 8.** Split-level building material

4.2. Terraced house

The sub structure of terraced house founded by pile cap plat foundation that follows the land contour. The middle structure is reinforced concrete and the upper structure of terraced house is wood truss. Most of material in terraced house is natural material, wood, stone, and straw. Moreover, the glass material implemented on the building window. The purlin roof and lath, terrace, and the upper wall is wooden material and the main wall is brick wall.



**Figure 9.** Terraced house building structure



**Figure 10.** Terraced house building material

## 5. Conclusion

Most of Matano Lake resort area model designed with softscape and small portion in hardscape. Hardscape area focus on the contour land and creates two types of the building types, split-level house and terraced house with natural material, wood, stone, and straw for the roof part. Decision in the development of the building should consider the sunlight and wind orientation direction to maximize the tropical local climate usage in terms of illuminance aspect and natural cooling of the building. Additionally, softscape area functioned as recreation activity with natural interaction concept, provides the visitor to enjoy the vegetation landscape view and Matano Lake that facilitated with playground, swimming pool, and field area. As a result, ecology principles -fluctuation, stratification, and interdependence- has been applied in the design of Matano Lake lakeside resort.

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