Design of Sea Water Increase Response on Marunda Tourism Destination in North Jakarta

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Abstract. Tourism becomes a human need lately in the busy modern urban lifestyle. Recreational and stress reliever destinations influence human personal health condition. The Government of DKI Jakarta establishes 12 coastal tourism destinations in North Jakarta, recently. However, the destinations are not well developed and integrated with the transportation. Moreover, they confront the tidal flood threats. In Marunda, North Jakarta, there are 2 potential tourism attractions that had been abandon and misused as ships parking and docks. Those conditions undervalue the land use and needs to be redesigned properly for the community benefits. Design analysis with the criteria of resilience to climate change response to the sea level rise, is used an approach to the problems. This research covers the responsive designs to solve the coastal flood and optimizing the land use as tourism destination.

1 Introduction

Climate change is a natural phenomenon that cannot be denied and must be accepted. The limitation of climate change also cannot be overcome instantly and micro, however, we can respond to the impacts caused by climate change, one of which is sea-level rise. Jakarta is one of the cities bordering the affected sea and is threatening to sink a number of lands in North Jakarta. This factor is not only caused by sea-level rise but because land surface height in Jakarta has the same height as sea level or even lower than the average sea level. Even though the people of Jakarta need a certain amount of land to make it into a facility that is needed by the community. One of the locations in Jakarta bordering the sea is Marunda, North Jakarta. This location has the same height as the average sea level so that every time a tide occurs, a certain amount of land is threatened by flooding. In fact, this location has two attractions which are historical relics and have been designated by the North Jakarta government as the Twelve Coastal Tourism Destination Destinations.

Unfortunately, besides being threatened by the danger of tidal flooding and sea-level rise, a number of tourism potentials are not well integrated and instead surrounded by shipyards that are not supposed to be in the region. This has an impact on the decline in land values that threaten the sustainability of the region even though this region has a number of potentials to be maintained, especially in the tourism sector. According to Popi Puspitasari in his journal Dynamics of Land Utilization in the Historic Village of 'Luar Batang' - North Jakarta [1] stated that the conception of the dynamics of land use refers to the process of variations in land function changes within a certain time span. So the use of land functions must be able to see the needs of the community in a long span of time so that land use becomes sustainable, especially utilization in coastal areas.

In The Habitat Agenda: Chapter IV: C. Sustainable human development settlements in an urbanizing world with issues raised regarding Sustainable Land Use [2] states that increasing land value is by optimizing the function of sustainable land that is free of from industrial pollution and natural disasters as well as land use that can have an impact on humans with the use as an area for sports, recreation and interacting moreover sustainable land use in coastal areas must be protected from sources of pollution threats. To create sustainable land, we need a design that is responsive to rising sea levels that can function as a Tourist Destination.

Tourism and recreation are psychological needs that are owned by every individual in the world. However, looking at the situation around this area is far from meeting the needs of the local community, moreover the space for recreation and sports. Creating a tourist area can have a large impact on various aspects. According to [3] in his journal, the influence of tourism on socio-economic characteristics in the area around the Borobudur temple states that the tourism sector is one aspect of city development that can provide promising positive impacts. Tourism is also a multiplier effect that is able to encourage other sectors such as trade and services, housing, labor, to participate in growth and be able to develop with it. However, in developing a tourism facility it will not be sustainable if it does not take into account natural and environmental factors, especially for this area that is threatened by disaster, so a design of a Destination is required to respond to threats and environmental conditions [3].

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Design for Flooding is a book by [4] which has guidance on design criteria for resilience to climate change in response to rising sea levels. These criteria include, Providing Coastal Stabilization, Preventing Erosion, Restoring or creating natural features, Building and maintaining landscapes that have the potential to flood, providing land for flood diffusion and absorption, providing security evacuation circulation paths, and ensuring the utility of the area.

Based on this criterion, a comparative study was carried out to four places with comparative parameters, including responsive design with rising sea levels and increasing land use-values. The four places used as comparative studies include Topographical Shift at Urban Waterfront [5], Seattle Floating Bridge (TS Studio) [6], Microcosm River (TS Studio) [7], New Meadowland as a place [8]. Each footprint applies seven criteria for resilience to climate change in response to the desires of seawater but only the best elements are suitable for application in the design.

Some elements are taken into consideration and references can be applied in the footprint, one of which is the floating design elements from Seattle Floating Bridge (TS Studio) [6]. An [9] research on the journal Floating Architecture: A Design on Hydrophilic Floating House for Fluctuating Water Level with the case of the Netherlands as a country that continues to be affected by rising seawater caused by climate change requires a home design that adapts to seawater desirability. The floating house is designed with dimensions 6.15m x 4.33m x 3m for a 6m water depth analysis of the structure and stability of the structure for the safety of the house. In addition, according to [10] in his journal A study on Sustainable Features of Realized and Planned Floating Building resulted in research that floating building is an alternative needed today due to climate change factors. However, besides using responsive design elements with sea-level rise as a Destination, the region needs to consider the things needed to support the Destination facility. According to [11] in their journal Role and Challenges of Public Space Planning as Changes in Community Life states that a public space or open space can function optimally when it can fulfil aspects or rules such as ethics, functional and beauty.

2 Research methods

The method used is qualitative by conducting a Comparative Study of Design criteria for resilience in the context of responding to rising sea levels. The results of a comparative study will get the best design elements that can respond to rising seawater based on the results of research that has been done on the seven best design elements. After that, categorizing the footprint condition data analyzed so as to obtain the need within the footprint to create a Destination that is responsive to rising sea levels is supported by the best design elements to meet the design criteria for resistance to sea-level rise. Thus, the design of Wisata Destination that are responsive to rising sea levels can answer the objectives of this study (see Table 1).

Table 1. Method.

Data	Technique	Source
Comparative Study	Literature and comparison studies	Literature data and similar projects in progress
Land Potential	Literature and Observation Study	Direct observations to the field and DKI Jakarta government official data
The footprint and building functions and facilities	Literature Study and observation	Architect data, government regulations, and other supporting data
Space program	Analysis and observation	Literature, observation and footprint analysis data
Design A response to rising sea levels	Results of design analysis with resilience criteria that respond to rising sea levels	The book Design for Flooding and Analysis of data processing

2.1 Comparative study of sea rising response design

A comparative study was carried out by looking for objects that have similar comparative parameters, namely the water edge design criteria parameters that are responsive to rising sea levels. Objects that are compared are as many as four objects that also have the same characteristics as the footprint so that comparable objects can be measured and valid. The same characteristics for comparison objects are water edge areas that have a function for the public, are government projects, and are responsive to rising sea levels. From the results of a comparative study, design elements that can be applied and matched in this project will be taken.

2.2 Potential land

Potential land consists of processing data on the potential contained in the footprint. From the start of environmental characteristics, the influence of tides, current footprint conditions, environmental conditions around the footprint, and social conditions around the footprint because the project is intended for the public it is necessary to pay attention to social aspects of the surrounding environment.

2.3 Footprint and building function and facilities

Processing footprint functions and facilities data from a number of sources of literature, standards from literature and government standards as well as needs analysis based on the results of the analysis of land potential against sea-level rise.

2.4 Division of land zones

The division of land zones takes into account elements of the design criteria for response to sea-level rise that can show the relationship between water and land so that, it can put functions and facilities that have been analyzed that can be applied in the footprint by laying out functions and spaces according to consideration of elements of the response design criteria sea level rise and land space relations with water.

2.5 Design of sea-level rise response design

After the division of the land zone will get a spatial processing design in accordance with the layout recommended by the book Design for Flooding [4] which contains elements of the design criteria for response to rising sea levels, the relationship between land and water and a number of facilities support the Destinations so that they can reach the conclusion of a draft response to sea-level rise in the Destinations in Marunda, North Jakarta.

3 Results and discussion

Fig. 1. Footprint location [12].

The footprint (see Figure 1) is located in Marunda, North Jakarta, which has a land area of ± 2.0 Ha with a KDB of 30% and KLB 5 so that the footprint area that can be built is ± 0.6 Ha. The area is at an ASL land height of 0 which means it is at the same height as the average sea level so that when the tide occurs the footprint is prone to flooding every day especially if sea level continues to rise then the footprint conditions will be lower than the surface seawater, therefore, requires a design based on response criteria for rising sea levels. To get the best response criteria for sea-level rise, a comparative study was carried out to four places that have the same comparative parameters, therefore, the best design elements of the seven criteria were applied to the design.

These elements include the use of vertical wall type seawalls, berms systems, preserving mangrove forests, providing a floating bridge and using detention ponds. This element is applied based on the results of the analysis of the surrounding environment with the potential for sea-level rise and tides. Based on tidal data from the results of research by the Indonesian PUSRIKEL Institute [13] in 2016 the highest tide was obtained in November the third week with a height of 50.85 cm while the highest height of the average tide was in May with a height of 48.45 cm. Therefore, there are a number of threats and potential for tides in the footprint.

When low tide occurs, the low tide height is in the range of 15-20 cm and has the potential to focus the flow of the tide on the detention pond which can be used as a play area with water such as an area to soak feet and utilize water as an attraction in the footprint. Whereas when the tide is moderate, the tide at an altitude of 30-40 cm has the potential to be focused on detention ponds which can then be used for play areas with water. High tide is at a height of 60 cm or more has the potential to be focused on detention ponds and can be a water tour.

Erosion is one of the threats in the footprint because tides and seawater waves also contribute to erosion that can erode soil and potentially reduce the soil. Therefore, appropriate erosion containment measures are needed in some areas that are directly bound to water so that the land can be sustainable. While circulation is an important aspect because of the footprint as a Tourist Destination and at risk of disaster therefore, the footprint requires good circulation to enjoy tourism and disaster evacuation. And the last threat is the management of water flow in the footprint is crucial because the footprint is an area that is prone to tidal flooding, therefore, there must be good management of water flow.

Provides Shoreline Stabilization and Protection through Structures and Non-Structures that are Able to Reduce, Split Water with Elevated Construction or Run-Off Profile.

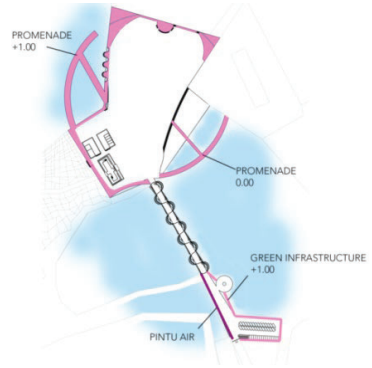

Fig. 2. Analysis.

On Figure 2 shows a shoreline stabilization analysis that has different treatments based on location and type of water. Figure 2 explains the stabilization of the coastline that is directly related to seawater using a promenade at an altitude of +1.00 M. It is intended that the promenade can function at the same time blocking the possibility of the highest tide which so far stands at 50.85 cm [13] so that coastline stabilization is not just a wall blocking sea water, this area is focused on functioning as a promenade walk that can be used as a communal area to enjoy along the shoreline or water transportation jetty, while shoreline stabilization related to the waters of the mangrove forest tends to use the

promenade for the water tourism pier and the promenade for water tourism transportation at an altitude of ± 0.00 M in this area there is no need for elevation as high as 1.00 M because this area is not directly adjacent to sea water and is bordered by mangrove waters and in this area there is a detention pond and water gates are set up to a limit that does not touch the height of ± 0.00 M. While in parking areas use coastline stabilization that is directly related to mangrove forest waters using green infrastructure at +1.00 M elevation.

Avoid or Prevent Increased Erosion or Other Effects of Flooding on Coastal Properties and Waterways and Waterfront Structures:

Fig. 3. Analysis.

On Figure 3 describes the line that is a defense against erosion. Avoiding erosion has a different treatment based on the type of water with areas that are directly related to water, such as promenade areas that are directly related to sea waters using a vertical wall and green infrastructure type seawalls. This aims to ensure that seawalls used can minimize scour holes in the sea and green infrastructure work optimally to absorb water and care for it. As for the back area that is associated with mangrove forest waters use the berms system as a barrier to erosion and promenade for water transportation. Whereas access to enter the footprint using a floating bridge so that access is not interrupted and in the parking area enough to use existing mangrove plants to resist erosion.

3.1 Restores or creates natural features

Fig. 4. Analysis.

On Figure 4 explains that the dark green area is the addition of vegetation within the footprint while the light green color retains the existing natural features. Maintaining mangrove forests and providing additional vegetation within the footprint with plant species that can build a sense of place and can grow on peatlands. Plants used in the footprint include Coconut Trees, Sago Trees, Ketapang Kencana Trees, and Chords.

3.2 Build and maintain potentially flooded landscape

Fig. 5. Analysis.

Figure 5 explains the location of the detention pond which is in brown has the potential for flooding, therefore, it is made as a detention pool that functions as a water attraction that can double function when it occurs and no tidal pool can become an amphibian and can be used for tourism needs. This detention pool temporarily accommodates incoming water which has previously been filtered under the promenade using a natural pond system that can filter water into clean water and can be used as a water vehicle. However, the height of the incoming water is controlled through the floodgates from the source of the incoming water which controls the height of the water entering the water vehicle. At low tide, the water will be pumped back into the sea through an artificial river created in the footprint which is used as a water flow.

3.3 Providing land for flood diffusion and absorption

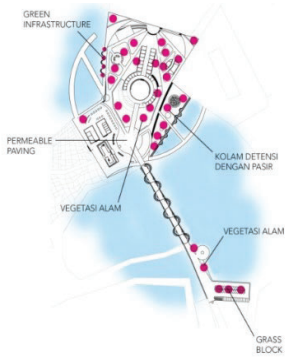

Fig. 6. Analysis.

Figure 6 illustrates the points that can become a diffusion of water absorption. These points are vegetation and green infrastructure. Land diffusion has the potential to be flooded by absorption in vegetation, green infrastructure and the use of permeable paving.

3.4 Providing evacuation and security routes

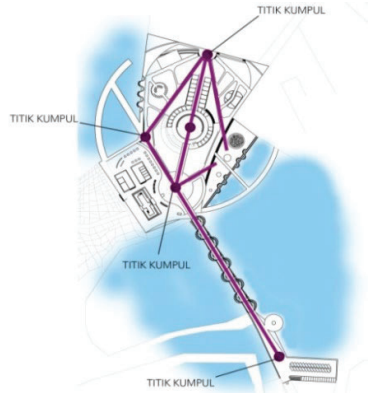

Fig. 7. Analysis.

In Figure 7 there are points that are linearly connected gathering points that function as circulation functions that guarantee safety for evacuation. This path is linear pathways to facilitate the circulation of evacuations to temporary gathering points before finally being evacuated from the footprint. These gathering points are places that are easily found and can hold a large amount of human concentration.

3.5 Guarantee water utilities and sewage treatment

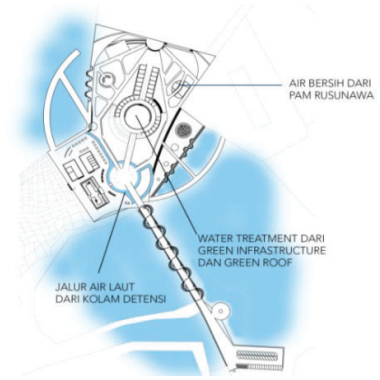

Fig. 8. Analysis.

Figure 8 gives the utility line of water from the detention pond to the sea. Water treatment utilities with stagnant waterways at high tide in detention ponds for pumping and discharged into the sea at low tide. Whereas waste utilities are based on government policy to provide trash bins every 20 billion.

Fig. 9. Analysis.

To create the facilities needed in the footprint, a number of facilities are needed based on the needs of the local community. This is influenced by the situation around the footprint which has the potential to be a factor of the needs of the local community so as to create spaces for community tourism activities. Figure 9 shows the number of buildings around the footprint, among others, the Pitung House House of Heritage, Al-Alam Mosque, Marunda Beach Tourism, Mangrove Waters, Pertamina Alpha Jetty Port, Marunda Fisherman Village, Marunda Pagi Elementary School 2, Marunda Rusunawa, High School Shipping, Pier, Marunda Center, and Nusantara Bonded Regions.

Buildings around the footprint have the potential to become facilities within the footprint such as the Pitung House Maritime Museum to be preserved and become part of footprint processing and tourism by adding a number of commercial areas aimed at the local community and the Rusunawa community, while the pier is moved into the footprint to facilitate transportation of waterways into the footprint while mangrove waters are a potential view that maintains its beauty.

4 Conclusions and suggestions

The seven criteria were applied in the footprint to produce design elements in the form of seawall that functioned as a promenade walk, the use of detention ponds on dual-purpose water rides as well as a berms system that resisted erosion and confirmed shoreline stabilization and then the detention pool could temporarily hold water with the existence of a flood gate that controls the height of the incoming water, maintains the mangrove forest as a barrier to erosion as well as the positive value of the potential beauty in the footprint and the addition of vegetation in the footprint with trees that can live on peatlands. Another design element is the use of a floating bridge that aims to keep the entrance from being cut off by disaster hazards and to make an entrance that can provide a unique and different spatial experience.

Whereas linear circulation and gathering points function as plaques. In addition to applying resilience criteria, footprint heights are also set based on building defenses against possible disasters, such as raising ground levels in areas that are concentrated as the safest areas and avoiding disasters such as commercial areas. In addition, the building is applied to a green roof so that it can absorb rainwater well and treat it as clean and absorb water into the ground. The use of green infrastructure as a substitute for riol or gutter is intended so that water entering the riol contained in the green infrastructure can easily absorb into the soil.

By applying resilience criteria into the design based on the results of the analysis of the effect of tidal water levels of rising sea levels and the type of water, the footprint can become a place that responds to sea level rise and can become a place for activities needed by local communities such as commercial areas filled by a number of restaurants and shops, the existing maritime museum of the Pitung's house, jogging track, an area for

sports, a pier for water transportation, a dock for water tourism and a water park area, a rest area and a place for a number of street vendors, and a service area that has a management room for control the area. When this land can respond to rising sea levels, a number of activities can occur and have a major impact on local communities in terms of land sustainability, human psychological needs, social needs, and provide an economic impact on the community so that it can increase the value of land use [13].

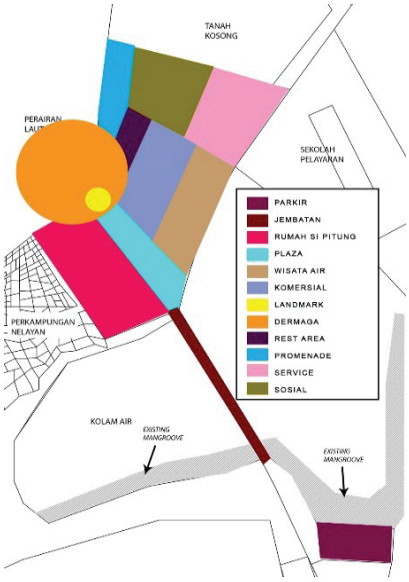

Fig. 10. Analysis.

Based on the results of the analysis of the previous chapters, several conclusions can be drawn, namely, the application of Get to Know the Five Senses has a simple display that is easy to understand so that users become easier to use and learn about the features available. The Get to Know the Five Senses application already has complete features where in addition to learning material for the five senses in humans' users can also test their abilities with training and knowledge testing features. The Get to Know the Five Senses application contains material that has been adapted to the needs of users. This teaching tool also helps increase children's interest in getting to know more deeply the organs of the human senses because it has an attractive appearance. Besides, this teaching tool can facilitate students in learning the material of the five senses even without a supervisor.

As for some suggestions that are proposed for the development of The Get to Know the Five Senses application is to build The Get to Know the Five Senses teaching device that has a mobile operating system, increase response speed when loading animations, as well as adding the number and variety of questions to the Exercise and Knowledge Test features.

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