SHORE PROTECTION ANALYSIS TO KEEP THE BATU LAYAR ACCESS FROM EROSION

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Abstract: *The shore protection process is carried out by reviewing the hydrodynamic and sedimentation conditions. This study was located at Batu Layar Beach on Ambon Island. On the Batu Layar beach, the main road between the districts of Central Maluku and Ambon City has collapsed on the side of the coastline. So a wave analysis was carried out from wind data forecasting for 10 years from 2012 – 2022 with the US Army SPM 1984 method and analysis of sediment grains in determining the type of soil at the study site to help identify the occurrence of sediment as well as validate the results of interpretation of google earth. The results of the analysis of the hindcasting waves obtained a pattern of long shore sediment transport from the northwest to the southeast which can trigger coastal erosion in the Batu Layar road section. From the analysis of wave height and direction of arrival, it is found that the most appropriate coastal building in overcoming coastal problems in Batu Layar is a combination of retaining walls and groynes.*

Keywords: **Coastline, beach, hydrodynamic, fetch, hindcasting**

I. Introduction

Larike village is Maluku Indigenous village located in the West Leihitu sub-district, Central Maluku district, Maluku Province. Larike has natural potential that can attract tourist visitors. The tourism potential is in the form of rivers where eels are visited or commonly called by local residents "morea", and beach tourism, especially Batu Layar beach which consists of large sail rocks on the beach. With this tourist area, visitors who come to shop for natural products that are served by local residents and become the community's economic potential. Based on the explanation above, the natural potential must be supported by good transportation access. So that people around and from outside the district can enjoy tourism comfortably. At the location of the river, the ease of access is more visible, but in access to Batu Layar tourism there are road damages. This damage also includes sea walls that support interstate roads. So it is necessary to make a solution to overcome this problem. To solve the beach problem, it is necessary to carry out hydrodynamic and sediment analysis [1]. Through this paper, it will examine the hydrodynamic conditions of the waves obtained from wind speed and wind direction and sediment transport at Batu Layar Beach, so as to determine the right safety building to protect the Batu Layar beach location.

II. Method

2.1. Hindcasting Process

The hindcasting process is carried out with the steps in **Figure 1**. using wind data and fetch as a reference for the wind generation area with a full wave

limit of 200 Km for an unobstructed area.

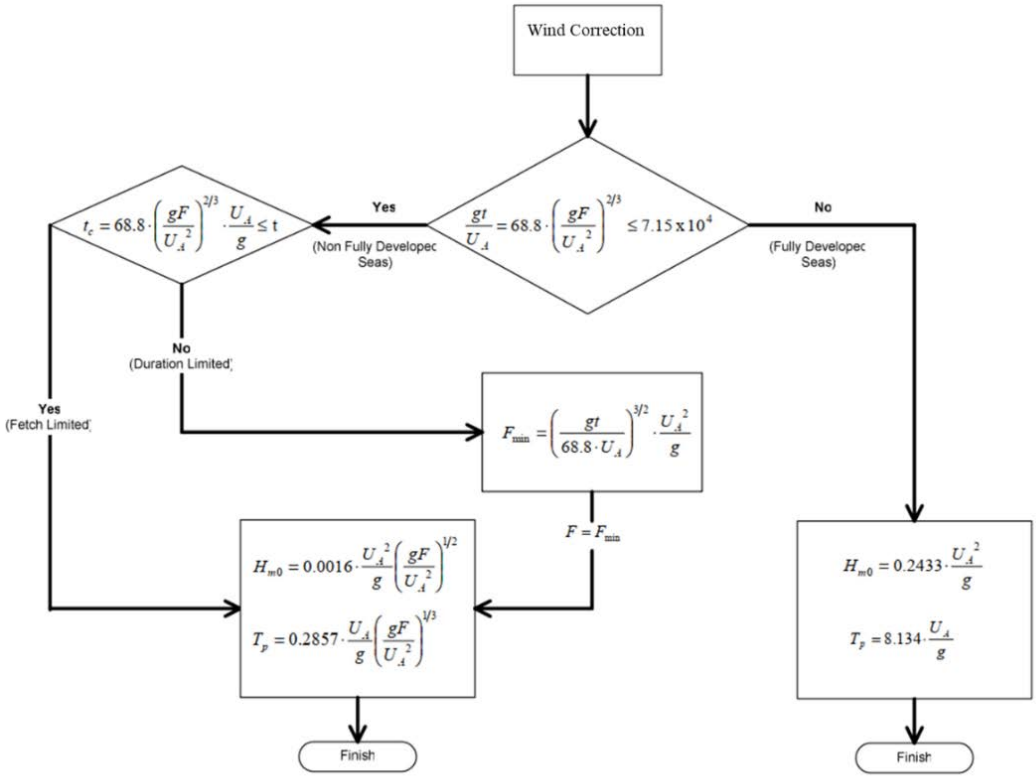

Figure 1. Hindcasting with SPM U.S. Army Method

The data collected are location photos, and soil data processed in the laboratory, BMKG wind data from the Pattimura Meteorological Station, Location Maps, and Google Earth interpretations for 2015-2022. Surveying, to collect information on the research location. Undisturb soil sampling using the boring process, aims to identify the type of soil and grain diameter. Wind data processing to obtain wave height forecasting with the 1984 SPM method. Analysis of the condition of coastal problems that occur based on hydrodynamic conditions and sediment transport. Assessing the type of coastal building based on the results of the coastal problems analysis.

III. Result and Discussion

3.1. Fetch

Fetch is made by drawing the line of the wave generation area in each cardinal direction that has the potential to generate waves towards the Batu Layar Beach location with a distance of each line is 5^0 .So that all lines can be accumulated in each cardinal direction to obtain one effective fetch value in each potential cardinal direction be the source of the wave generation area[2-3]. The results of the Fetch line depiction show that the perfect wave direction can occur from the southwest and south because it is not blocked by land within a distance of 200 Km, for from the west and northwest it experiences limited or imperfect wave formation because it is blocked within a distance of less than 200 Km. by the surrounding islands.

Furthermore, based on the Fetch image above, the effective Fetch value in each direction is tabulated. then the effective fetch line length in each direction is:

South	: 200 Km	West	: 110,325 Km
South West	: 200 Km	North West	: 83,327 Km

Wind data was recorded at an altitude of 14m above sea level, which based on the SPM method was corrected for elevation, then Corrected for Wind Data on Temperature Stability, the effect of the shear coefficient of place. The correction of wind data aims to make the wind data measured on land can represent the wind from the deep sea, as a wave generation area. Then, the corrected wind data are summarized in a wind rose chart to make it easier to read the 10-year data. The purpose of making a wind rose is to facilitate the interpretation of wind distribution patterns within a period of 10 years from 2012-2021. However, this process has not been able to describe the distribution conditions at the study site, so it needs to be narrowed down by using an effective fetch to get the wind direction that affects the wave generation area. For effective fetch analysis, it will be carried out at the stage of calculating waves with wind speed so that they will be tabulated in the form of wave roses [4].

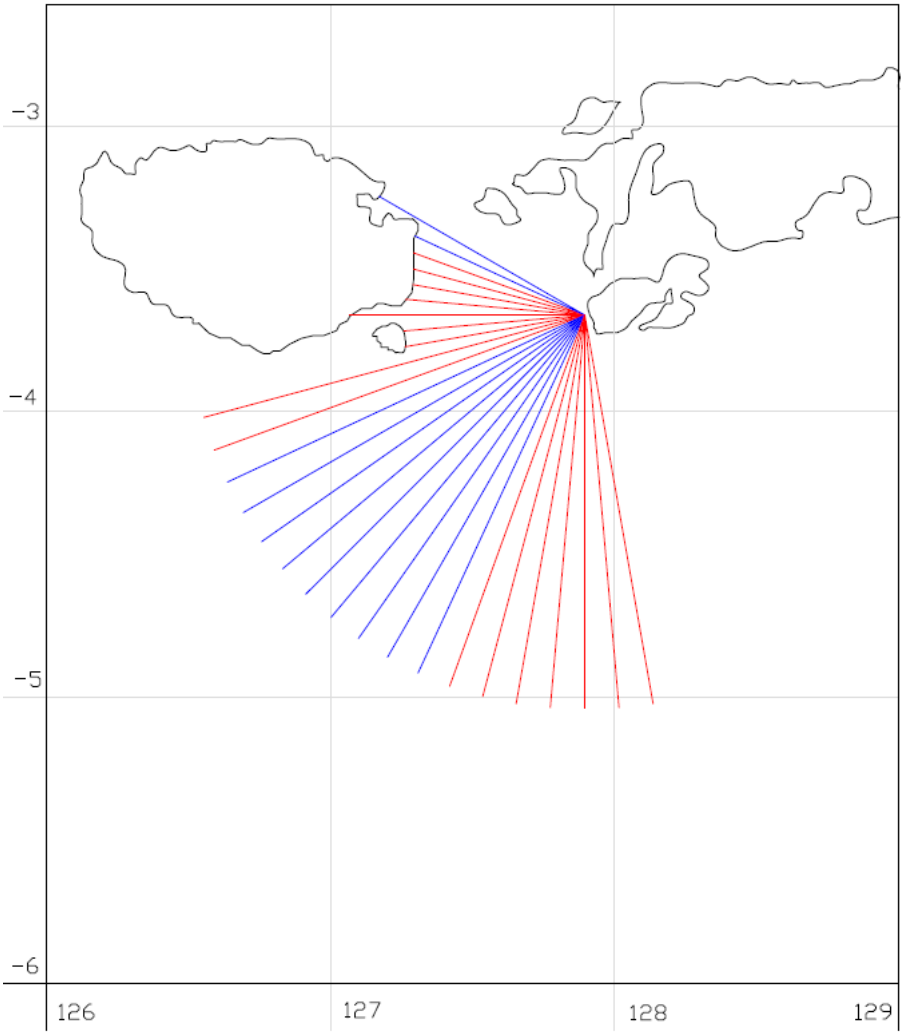

Figure 2. Wind-Fetch Area

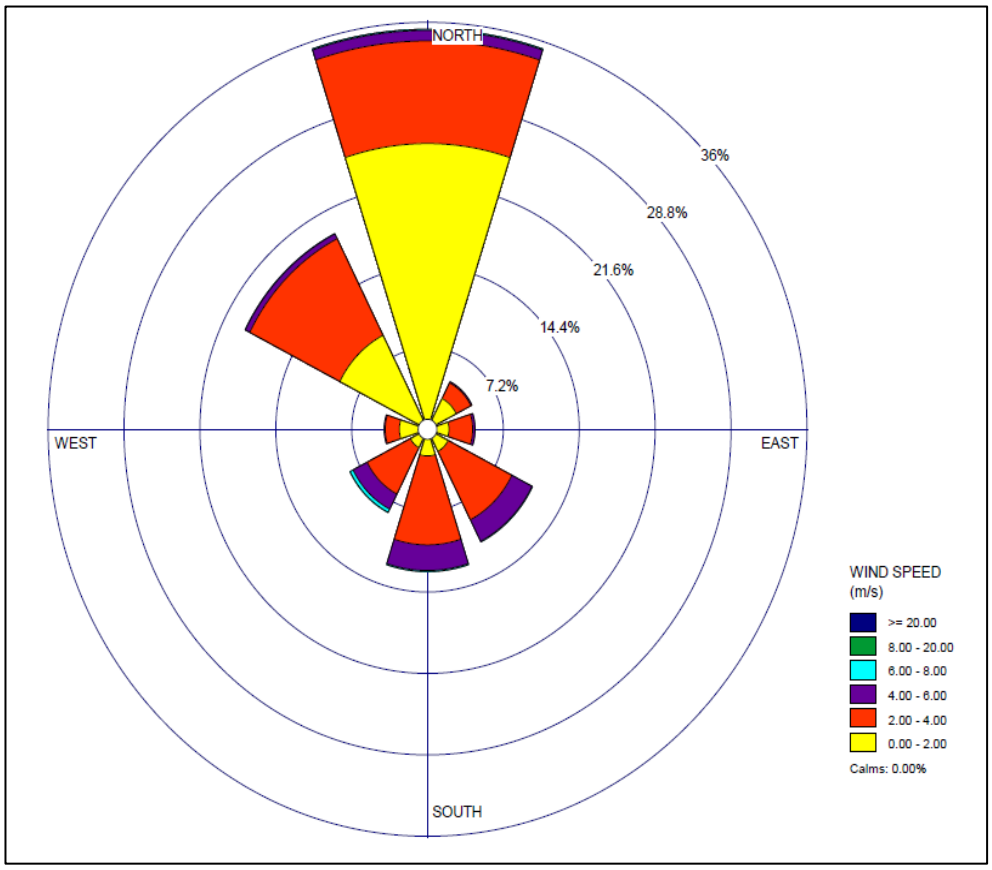

Figure 3. Wind-rose

Hindcasting process is important, so that later the wave height and period will be obtained, in the process of this study all that is needed is the wave height with a projected direction according to the fetch of the wave generation area on the Batu Layar beach. The results of the wave generation are then summarized in a wave rose [**Fig 4**.]diagram that describes the wave height and wave direction within 10 years, from 2012 to 2021.

From the results of wave generation from wind data, it is found that the dominant wave is generated from the northwest with a deep sea wave height of 0.4 meters. However, waves with a height of 1.1 meters are found in the south and southwest directions. So that later in the planning process of coastal protection buildings to protect the road above it needs to be planned above 1 meter and even more because it is necessary to consider incoming waves on the coast and wave run-up.

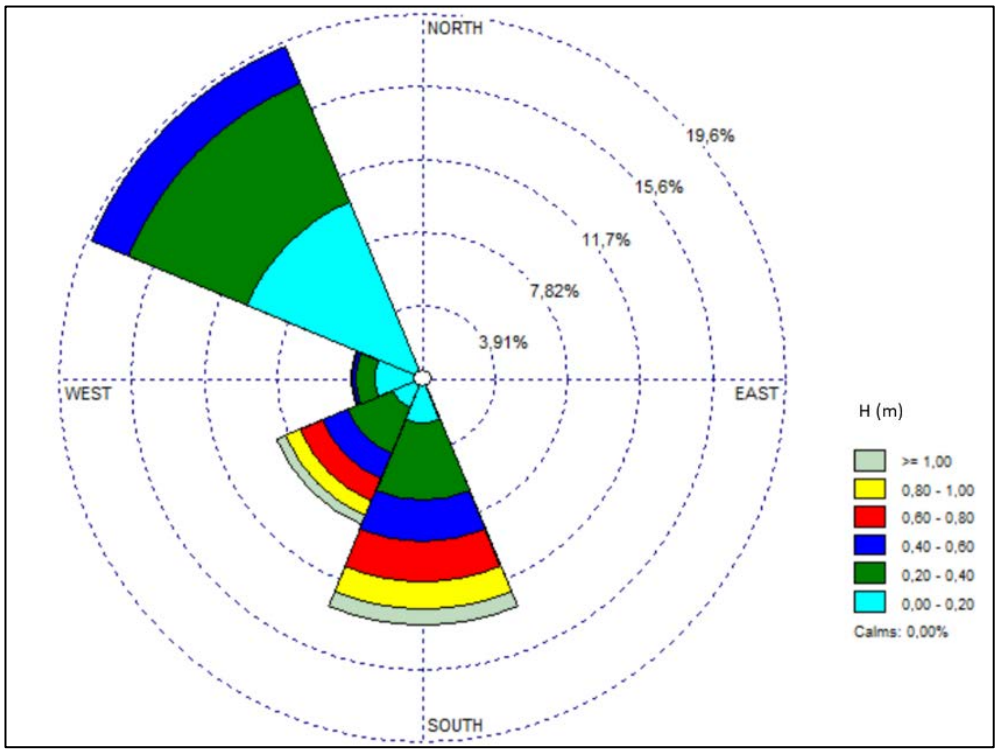

Figure 4. Wave Rose

3.2. Coastline Assesment

To determine the occurrence of the sedimentation process at the study site, soil test was carried out at the study location, to determine the type of soil. After that, the test results are compared with the display of the transport process on Google Earth history in 2015 and 2022 as a comparison. Then this process is validated with the results of the analysis of the dominant waves due to wind. From the results of the sieve test at the study site, a plot of the dominant soil grain diameter with a percentage of 50% was carried out, so that the d50 was 0.89 mm. based on the soil classification by the American Geophysical Union, the soil type at is coarse sand. Furthermore, this type of coarse sand is in line with the interface from Google Earth which describes the sandy location at the study site. This type of sand is easy to transport, especially long shore transport. Transformation of the coastline in **Figure 5** can threaten the road infrastructure on the coast. So that in the process of determining alternative coastal protection buildings, it is necessary to consider the existence of roads on the coast.

3.3. Shore Protection Analysis

Based on the results of the analysis in the discussion above, it can be determined the type of beach building that is representative for the conditions of the Batu Layar beach. At the study site where there is road infrastructure on the beach, it is necessary to plan coastal safety wall as it already is. However, considering the condition of the incoming wave height that propagates from the southwest and south. And because there is an elongated sediment transport process, it is necessary to add toe protection at

the location by taking into account the horizontal hydrodynamic forces that occur due to waves [5-6]. Because there is a long shore sedimentation process, it is necessary to build a coastal structure in the form of a groyne at the study site that can help balance the sediment transport process, or shorten the spread of sediment from one point to another. From the results of the Google Earth interpretation, it can be seen that the long shore process occurs along the Batu Layar beach, which is 500 meters from the northwest and stops when there is a barrier in the form of a pier in the study location. So that this pattern also facilitates the process of analyzing the movement of sediment.

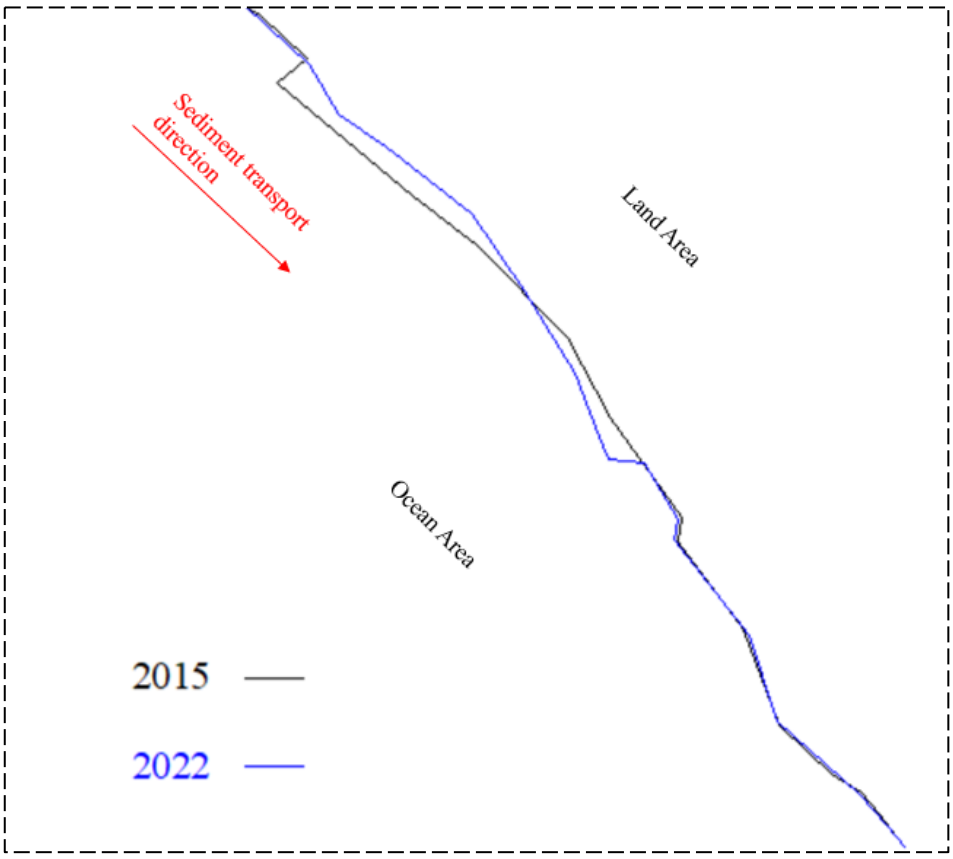

Figure 5. Coastline Transformation From 2015 to 2022

Based on the **Figure 6**, the function of groynes is not only in the sediment transport process, but can also function to reduce wave energy from the south and southwest which have maximum energy [7].

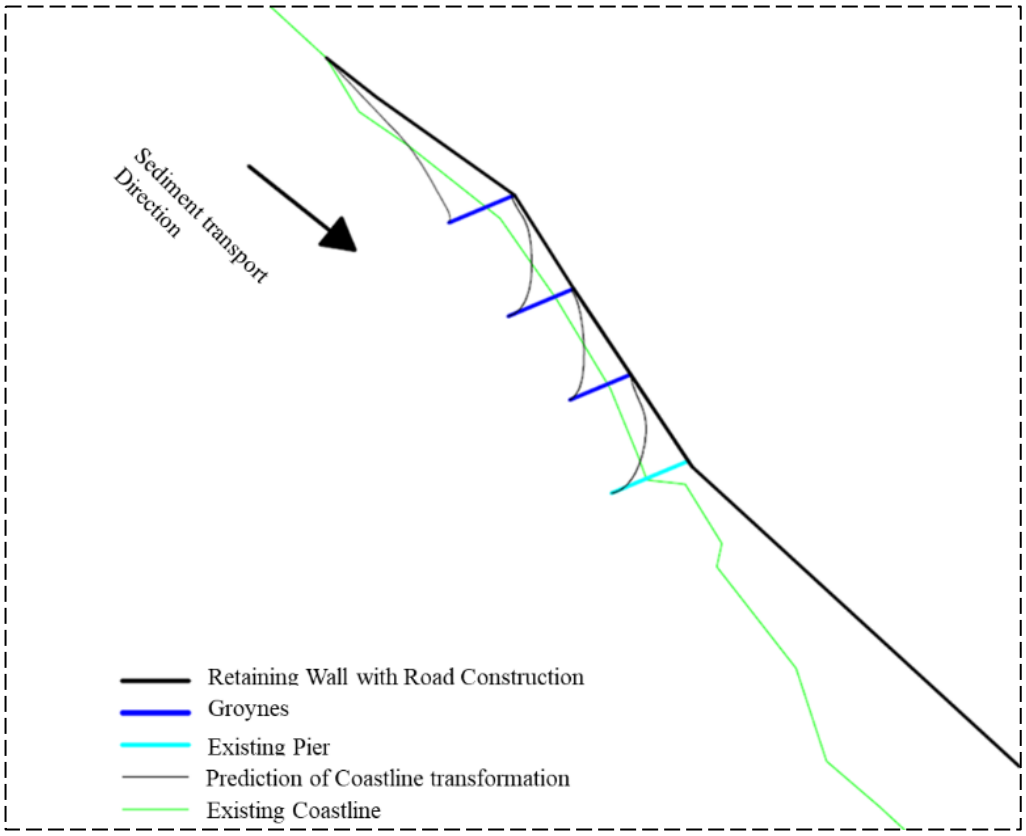

Figure 6. Shore Protection Master Plan

IV.Conclusion

The dominant incoming wave is from the Northwest. The incoming waves with a maximum height of 1.1 meters from the southwest and south. Based on the hydrodynamic analysis, the pattern of longitudinal or long shore sediment transport from the northwest to the southeast can be a trigger for coastal erosion in the Batu Layar road section. This result also matches the Batu Layar sedimentation pattern as seen from the Google Earth interpretation. From the analysis of wave height and direction of arrival, it is found that the most appropriate coastal building in overcoming coastal problems in Batu Layar is a combination of retaining walls and groynes. The retaining wall aim to protect the road above it from maximum waves, and the groyne serves to maintain the balance of sediment transport on the Batu Layar coastline.

V. Reference

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