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The Influence of Protective Buildings on Coastline Changes in Karampuana Using Genesis Software

Purwo Indra Irawan[1], Setiyawan[2], I Wayan Sutapa[3]
[1]Postgraduate Student of Civil Engineering Department, Tadulako University, Indonesia
[2,3]Civil Engineering Department, Faculty of Engineering, Tadulako University, Indonesia

ABSTRACT: This study aims to determine the changes in the coastline that occur at Karampuana Beach over the next 10 years and the influence of effective and efficient coastal protection construction on abrasion and accretion protection. This study uses a method of predicting shoreline changes until 2035 using the Generalized Model for Simulated Shoreline Change (GENESIS) software. The results of the study of shoreline changes at the research location for 10 years showed that there was an average sedimentation (accretion) of 6.1 meters per year with a maximum of 14.9 meters and an average abrasion of -6.8 meters per year with a maximum of -23.6 meters. The analysis conducted in Towale Village showed that there were changes that were classified as small to moderate. Coastal protection on the south side has been secured with a breakwater. The results of the study at Karampuana Beach over the next 10 years showed that the maximum abrasion value of the Seawall building was -23.95 m and the maximum accretion was 13.6 m, based on the simulation results, the Seawall building is the right coastal building to overcome abrasion problems at the research location.

KEYWORDS: Protective Building, GENESIS, Accretion, Abrasion.

INTRODUCTION

The coastal area is a region bounded by land and sea. Although it is constantly changing, it represents a major natural and economic resource. Furthermore, this microcosm is a very complex ecosystem where various climatic, topographic, biological and human-made factors influence the erosion processes and, as a consequence, the retreat or advance of the coastline. Coastal zone monitoring is necessary for a number of reasons, including environmental protection, sustainable development and cartography. Estimation of shoreline change is one of the most important elements in the investigation of coastal morphodynamics and the detection of coastal erosion and deposition. The boundary between land and sea is the coastline, which can undergo erratic changes as a result of one or more natural factors, such as morphological, climatic or geological variables. Due to its dynamic environment and its role as a boundary between land and water, the coastline is constantly changing. Coastline features are influenced by the dynamic interaction between waves, tides, rivers, storms and tectonic and physical processes. Erosion makes coastal areas more vulnerable, which endangers human activities along the coast. In addition, increasing coastal disasters make the coast very vulnerable and easily changed (K. Badr Hussein et al., 2023). Changes to the coastline are a continuous process through various processes, both erosion (abrasion) and addition (accretion) of the coast caused by sediment movement, longshore currents, wave action and land use (Arief et al., 2011).

LITERATURE REVIEW

(R Marpen, R Triatmadja, N Yuwono, 2018) research on changes in the coastline of Baai Island, Bengkulu using the GENESIS-CEDAS application so that changes in the coastline can be known from year to year. In scenario 1, changes in the coastline that occurred over 5 years showed an increase and decrease in the area of the coastal area due to erosion and sedimentation. Erosion occurred in sections 1 and 3 with a total area of erosion of 105,627.7043 m2. While sedimentation occurred in section 2, covering an area of 79,086.18 m2. In scenario 2, changes in the coastline that occurred over 10 years showed an increase and decrease in the area of the coastal area due to erosion and sedimentation. Erosion occurred in sections 1 and 3 with a total area of erosion of 207,671.5938 m2. While sedimentation occurred in section 2, covering an area of 64,745.44 m2. There is quite serious erosion on part 1 of the Pulau Baai harbor beach which is almost close to the harbor pool.

(Hajar Shofwatul Islam, Agus Anugroho Dwi Suryoputro, Gentur Handoyo, 2022) The coastal area of Batang Regency is the center of local community activities that directly borders the North Java Sea which is influenced by the wave components generated by the wind and can cause changes in the coastline. This study aims to determine the changes in the coastline that occurred on the coast of Batang

Regency in the period 2017 - 2021. The method used is the Digital Shoreline Analysis System (DSAS) analysis with the Net Shoreline Movement (NSM) and End Point Rate (EPR) methods using Landsat 8 satellite imagery data. Other data used are coastal slope data from field observations, wind data from the Copernicus website, and tidal data published by BIG. The results of the study obtained showed that during the period 2017 - 2021 along the coastal area of Batang Regency, abrasion was greater than accretion. The maximum abrasion is 117.4 m2 with a rate of change of 58.22 m/year, and the maximum accretion is 66.1 m2 with a rate of change of 32.8 m/year. The total area experiencing abrasion and accretion is 17.79 ha and 12.36 ha respectively.

(Chintiya, Geby, 2024) conducted a study to determine the changes in the coastline that occurred on Lembasada Beach for the next 10 years after the construction of the Coastal Protection compared to other Coastal Protection. This study uses a method of predicting coastline changes in 2033 using the Generalized Model for Simulated Shoreline Change (GENESIS) software. The results of forecasting coastline changes in all research locations for 10 years showed erosion and accretion with an erosion change rate ranging from 0.5 meters per year. The analysis carried out in Lembasada Village showed moderate to large changes, no protection on the south side or coastal protection on the north side that had been secured with a breakwater. The results of the study showed the maximum abrasion value of Lembasada Beach for 10 years with the existing breakwater building of 20.77 m and maximum accretion of 27.15 m, based on the simulation results, the Seawall building is the right coastal building to overcome abrasion problems at the research location.

Coast

The coast is a path that is the boundary between land and sea, measured at the highest tide and the lowest ebb, influenced by the physical sea and marine socio-economics, while towards the land it is limited by natural processes and human activities in the terrestrial environment (Yuwono, 1992). In terms, the coast is a land area on the edge of the sea that is still influenced by the sea such as tides, sea breezes and seawater infiltration, while the coast is an area on the edge of the waters that is influenced by the highest tide and the lowest ebb (Triatmodjo, 1999).

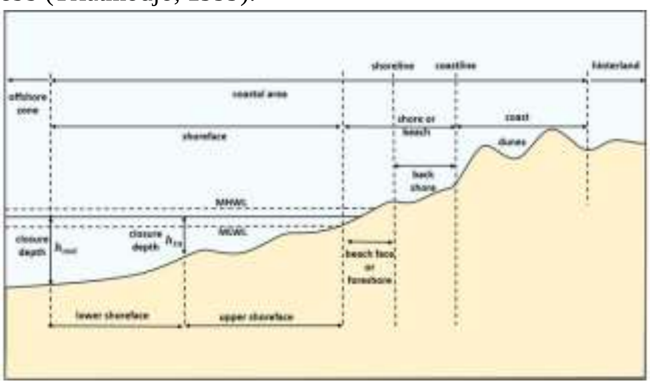


Figure 1. Technical Definition of Coast

Wave

According to Bambang Triatmodjo (1999), waves on the beach are the movement of sea water rising and falling that forms a sinusoidal curve. Waves on the beach can be formed due to several factors, including: wind, ship movement, earthquakes, volcanic eruptions at sea. waves formed at sea will experience changes in shape when moving from the deep sea to the beach. Changes in sea depth will cause the wavelength to decrease and the wave height to increase. When the wave height reaches its peak, the wave will break. Waves on the beach can cause various effects, including: Forming beaches, Causing currents, Transporting sediment in a perpendicular direction and along the coast, Causing forces that act on coastal structures.

The area on the coast that stretches from the breaking wave line towards the coast is divided into three areas, namely:

1. Breaker zone is the area of breaking waves where waves coming from the sea (offshore) reach instability and break. On a gentle coast, breaking waves can occur twice.
2. Surf zone is the area that stretches between the inside of the breaking wave and the boundary of the wave rise and fall on the coast. A gentle coast has a wide surf zone.
3. Swash zone is the area bounded by the highest boundary line of the wave rise and the lowest boundary of the wave fall on the coast.

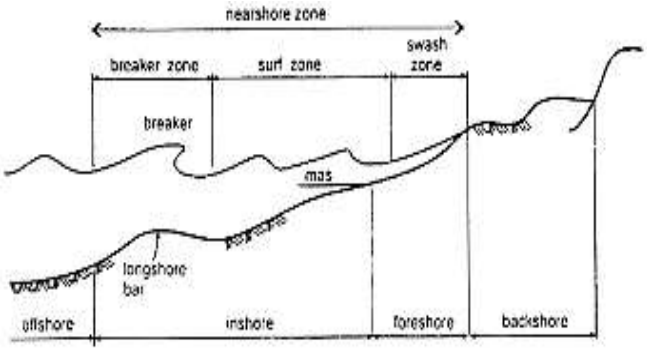


Figure 2. Breaking Wave Area (nearshore zone)

Based on relative depth, namely the comparison between water depth (d) and wavelength (L), or (d/L), waves can be classified into three types, namely:

1. Waves in shallow seas, if $d/L < 0.05$........................(1)
2. Waves in transitional seas, if $0.05 < d/L < 0.5$.........(2)
3. Waves in deep seas, if $d/L > 0.5$...............................(3)

Description:
d = Sea depth
L = Length between wave crests

Breaking waves are waves that propagate from the deep sea towards the coast and experience changes in shape due to the influence of changes in sea depth, which is called the depth of breaking waves (db). The equivalent height of deep sea waves is given the notation (H'0) and the height of breaking waves is given the notation (Hb). The condition of breaking waves depends on the slope of the beach base and the steepness of the waves, so that the height of breaking waves can be calculated using the equation:

$$\frac{Hb}{H'0} = \frac{1}{3{,}3\left(\frac{H'0}{L0}\right)^{1/3}} \quad \text{...}(5)$$

$$db = Hb - \left(a.\frac{Hb}{gT^2}\right) \quad \text{...}(6)$$

Description:
Hb = height of breaking wave.
db = depth of water when the wave breaks.
a = constant that depends on the slope of the seabed.
g = acceleration due to gravity.
T = wave period.

Wind

(Bambang Triatmodjo, Coastal Engineering, 1999) explains "Wind is a circulation that is more or less parallel to the earth's surface. Wind speed is measured with an anemometer, and is usually expressed in knots, which is a unit of speed used in marine navigation. Wind is one of the important factors that influences the occurrence of waves at sea. Wind gusts on the surface of the sea can produce enough energy to cause waves.

The wind data used for wave forecasting is data on the sea surface at the generation location. Wind measurements are expressed in knots, 1 knot = 0.514 m/s. (Triatmodjo, 1999). The correction factor is symbolized by RL, the value of which is presented in Figure 3.

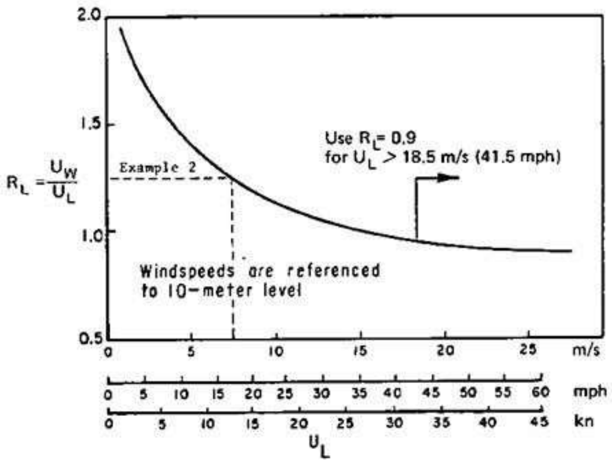


Figure 3. Relationship between Wind Speed at Sea and on Land (Triatmodjo, 1999)

Wind speed is converted to wind stress factor using the following formula:
UA= 0.71 U1.23...(7)
With:
UA : Wind stress correction
U : Wind speed in m/s

Fetch

A fetch is a wave generating area that is assumed to have a relatively constant wind direction and speed. The effective fetch at a given point is the area within the radius of the water surrounding that point where the wind is blowing at a constant speed from any direction towards the given point. In the wave generating area, waves are generated not only in the same direction as the wind but also at various angles to the wind direction. The effective average fetch is given by the following equation:

$$F_{eff} = \frac{\sum X_i \cos\alpha}{\sum \cos\alpha} \quad (8)$$

Description:
F_{eff} = effective average fetch
x_i = fetch segment length measured from the wave observation point to the end of the fetch.
α = angle between the Fetch path under review and the wind direction.

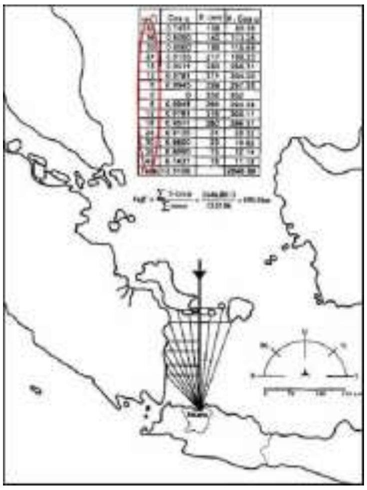


Figure 4. Fetch (Source: Triatmodjo, 1999)

Tidal

Ebb and flow of sea water/tidal is a change in sea water level caused by the gravitational force of the Moon and the Sun that affects the sea surface. This movement occurs periodically and is influenced by the rotation of the Earth, the movement of the Moon around the Earth, and the movement of the Moon around the Sun. Ebb and flow cause the depth of water on the beach to always change over time, so an elevation is needed that is determined based on tidal data (Triatmodjo, 2011). In general, the types of tides in Indonesia are divided into 4, namely:

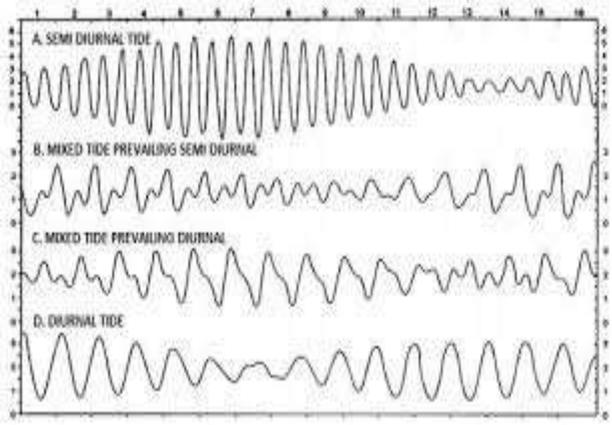


Figure 5. Tidal type (Triatmodjo, 2011)

A. Double daily tide (semi diurnal tide). In one day there are two high tides and two low tides in sequence. The average tidal period is 12 hours 24 minutes.
B. Mixed tides tending to be double daily (mixed tide prevailing semi diurnal). In one day there are two high tides and two low tides, but the height of the period is different.
C. Mixed tides tending to be single daily (mixed tide prevailing diurnal). In this type in one day there is one high tide and one low tide, but sometimes for a while there are two high tides and two low tides with very different heights and periods.
D. Single daily tide (diurnal tide). In one day there is one high tide and one low tide. The tidal period is 24 hours 50 minutes.

The planned water level elevation is needed for the development and management of coastal areas, so an elevation is needed that is determined based on tidal data. There is a term for sea tides:

1. Mean High Higher Water Spring (MHHWS)
2. Mean High Higher Water Neap (MHHWN)
3. Mean Sea Level (MSL)
4. Mean Low Lower Water Neap (MLLWN)
5. Low Lower Water Spring (LLWS).

Coastline

A coastline is the boundary between the sea and land when the highest tide occurs. The coastal boundary is a certain area along the coast that has important benefits to maintain the sustainability of the coastal function whose width is in accordance with the shape and physical condition of the coast, a minimum of 100 m from the highest tide point towards the land.

Coastline changes are one of the non-stop / continuous processes through various natural processes on the coast which include sediment movement, longshore currents, wave action and land use. Processes that affect changes in the coastline include: ocean waves, sea winds, tides, and sedimentation which have an impact on abrasion and accretion.

Coastal Protection Structures

Coastal protection structures are structures built to protect coastal areas from erosion, abrasion, and damage caused by waves and ocean currents.

1. Groin

Groins are coastal protection structures that are usually made perpendicular to the coastline, and function to hold sediment transport along the coast, so that it can reduce/stop erosion. Groins can be divided into several types, namely straight type I, type T, type L.

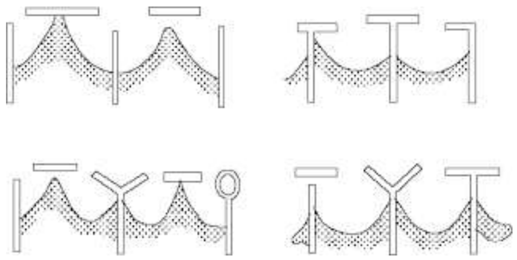


Figure 6. Groin building models and types (Triatmodjo, 1999)

2. Seawall

Seawall functions as a coastal protector against wave attacks and to prevent wave overflow to the land behind it. Usually seawalls are used to protect residential areas and/or public facilities that are very close to the coastline. This building is usually in the form of a vertical, sloping, curved, or stepped wall; and is usually made of stone masonry, concrete walls, or concrete pipes.

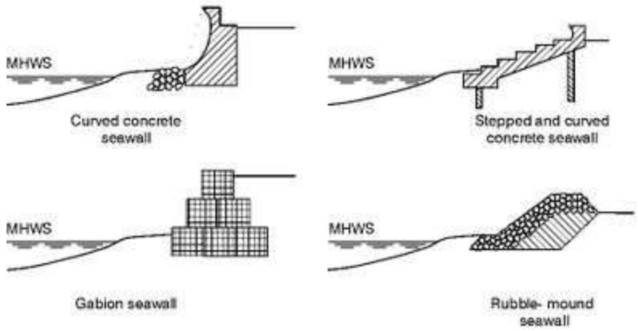


Figure 7. Seawall Building models and type (Triatmodjo, 1999)

3. Breakwater

Breakwaters are divided into two types, namely inshore and offshore breakwaters. The first type is widely used in protecting port waters, while the second type is for protecting the coast against erosion. Offshore breakwaters are buildings that are built parallel to the coast and are located at a certain distance or before the waves break from the coastline. This building is planned to protect the coast behind it from wave attacks. If the building is long enough, the coast will move closer to the building to form a Cuspate or Tombolo.

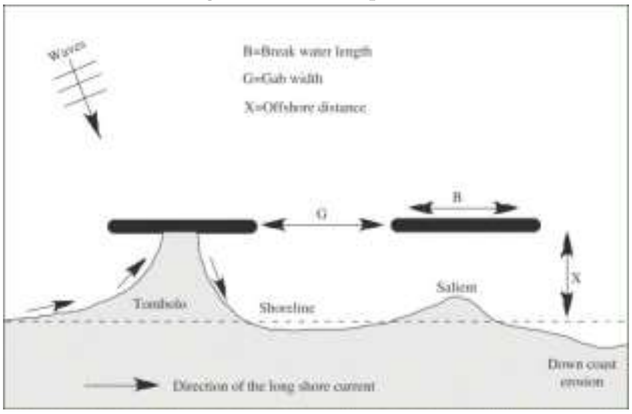


Figure 8. Breakwater Against the Coastline (Triatmodjo, 1999)

GENESIS Program

GENESIS is a program that calculates changes in the shoreline caused by the influence of waves with various possibilities including the construction of groin, jetty, breakwater, seawall coastal structures. GENESIS (Generalized Model For Simulating Shoreline Change) program was introduced by the US Army Corps of Engineers. GENESIS program can predict longshore and onshore sediment transport values which will ultimately be used to predict the shoreline. The basic assumption used in the calculation is to use a one-line shoreline change model which assumes that:

1) The beach profile has a constant shape.
2) Sediment transport along the coast is caused by breaking waves.
3) Details of structures around the nearshore can be ignored.
4) The shoreline used is the shoreline at the ± 0 contour of the Mean Sea Level (MSL) condition.
5) Changes in the shoreline move back and forth depending on the sediment that enters or exits.

The input and output files of the GENESIS program are as follows:

- ☑ START.ext contains project configuration content and program setup;
- ☑ SHORL .ext contains shoreline measurement data at the start of the simulation;
- ☑ SHORM.ext contains shoreline measurement data at a certain time;
- ☑ WAVE.ext contains wave condition data (angle, height and wave period);
- ☑ SEAWL.ext contains information on coastal structures to be used and their placement;
- ☑ NSWAV.ext contains information on wave angles and heights on the reference line around the coast;
- ☑ DEPTH.ext contains information on water depth around the coastal reference point;
- ☑ SETUP.ext contains information on model configuration, projects and setup results presented in START.ext;
- ☑ OUTPUT.ext contains changes in the position of the coastline and the amount of sediment discharge (abrasion or accretion) in a certain time stage;
- ☑ SHORC.ext contains the final position information of the coastline.

RESEARCH METHOD

The research used is quantitative research. This study uses many numbers, starting from the data collection process to its interpretation. The following is a research flow chart:

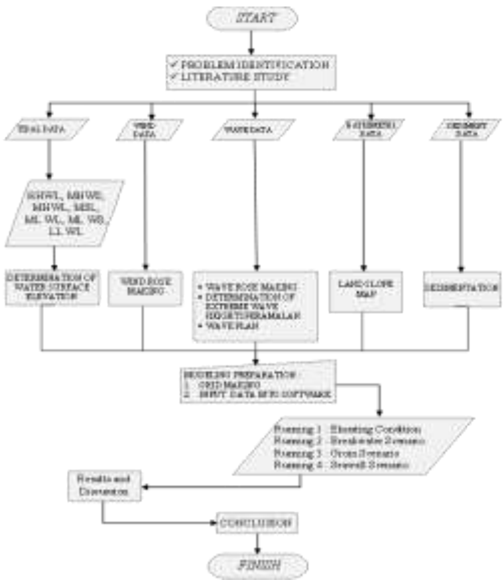


Figure 9. Research Flowchart

Research Location

The research location is precisely on Karampuana Beach, Towale Village, Banawa Tengah District, Donggala Regency which has a location coordinate of 0º43'48.39" S / 119º40'48.02" E. Changes in the coastline on Karampuana Beach are very significant, seen in low tide conditions, so that it will affect the environmental ecosystem and the existence of the beach as a livelihood for the surrounding community. The Karampuana Beach coast is densely populated with existing community settlements, so it is considered necessary to have effective protective buildings.

Figure 10. Research Location

Data Source and Analysis

1. Base Map

Bathymetric and topographic maps were obtained from the Sulawesi III River Basin Office in 2013.

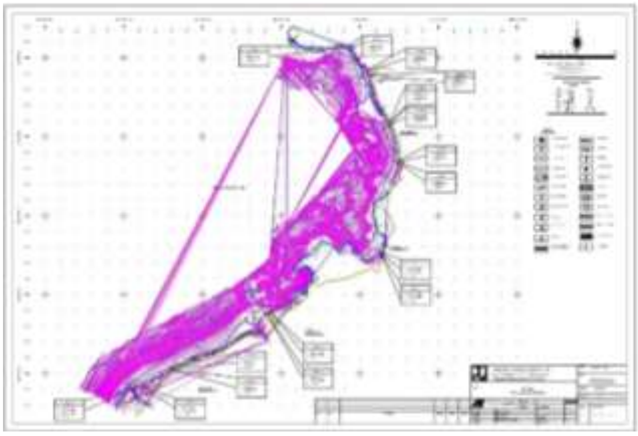


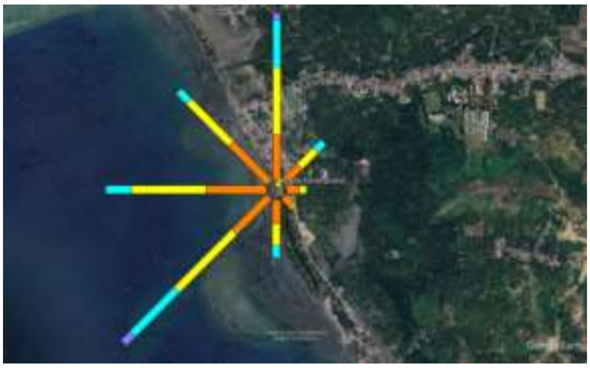
Figure 11. Bathymetric Map

2. Wind Data

Wind data obtained from Nasa Power Access Viewer is then processed using WRPlot Software to obtain wind events that can be seen as follows:

Table 1. Distribution of Wind Speed and Wind Direction Hourly in Intervals (Wind speed in m/s)

Direction	Direction Speed Hourly						
	0,5-2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	≥ 11.1	Total
North	4717	7284	5191	749	0	0	17941
Northeast	2362	2403	1250	59	0	0	6074
East	1355	670	181	18	0	0	2224
Southeast	1219	278	25	0	0	0	1522
South	2504	2243	1174	193	0	0	6114
Southwest	5163	8356	6368	1295	18	0	21200
West	6329	7908	2678	171	0	0	17086
Northwest	5794	6405	1591	60	0	0	13850
Sub-Total						=	86011
Calm (<0,5)						=	1573
Unrecorded						=	72
Total						=	87656
Direction	Persentage						
	< 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	≥ 11.1	Total
North	5.381	8.31	5.922	0.854	0	0	20.467
Northeast	2.695	2.741	1.426	0.067	0	0	6.929
East	1.546	0.764	0.206	0.021	0	0	2.537
Southeast	1.391	0.317	0.029	0	0	0	1.737
South	2.857	2.559	1.339	0.22	0	0	6.975
Southwest	5.89	9.533	7.265	1.477	0.021	0	24.186
West	7.22	9.022	3.055	0.195	0	0	19.492
Northwest	6.61	7.307	1.815	0.068	0	0	15.8
Sub-Total						=	98.123
Calm (<0,5)						=	1.795



Gambar 12. ***Windrose*** **Distribusi Kecepatan dan Arah Angin Pantai Karampuana**

3. Fetch

Fetch is effectively used in wave forecasting to determine the height, period and duration of waves.

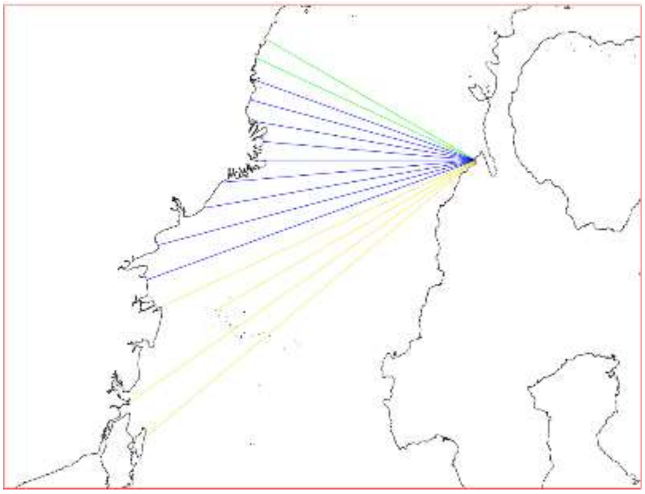


Figure 13. Fetch Diagram of Karampuana Beach Location

Table 2. Calculation of Effective Fetch South Direction

$$F_{eff} = \frac{17029}{8.7732}$$

$$F_{eff} = 1941\ m$$

Table 3. Effective Average Fetch

FETCH (m)								
Arah	N	NE	E	SE	S	SW	W	NW
Panjang (m)	0	0	0	0	1941	167928	254390	52461

4. Wave Distribution

Wave hindcasting is a wave forecasting technique to find the value of wave height (H) and wave period (T) using wind data, which is known to greatly influence the presence of waves.

Table 4. Distribution of Wave Speed and Wind Direction Hourly in Intervals.

Direction	Wave Height (meter)				
	0,50 - 1,00	1,00 - 1,50	1,50 - 2,00	>= 2,00	Total
North	2	3	3	11	19
Northeast	0	0	0	0	0
East	0	0	0	0	0
Southeast	0	0	0	0	0
South	2421	3191	123	11	5746
Southwest	1950	2885	3177	12708	20720
West	2488	3383	3425	7171	16467
Northwest	2315	3018	2939	4915	13187
Sub-Total				=	56139
Calm (<0,5)				=	2997
Unrecorded				=	28520
Total				=	87656
Arah	Persentase Tinggi Gelombang				
	0,50 - 1,00	1,00 - 1,50	1,50 - 2,00	>= 2,00	Total
North	0.002	0.003	0.003	0.013	0.021
Northeast	0	0	0	0	0
East	0	0	0	0	0
Southeast	0	0	0	0	0
South	2.762	3.64	0.14	0.013	6.555
Southwest	2.225	3.291	3.624	14.498	23.638
West	2.838	3.859	3.907	8.181	18.785
Northwest	2.641	3.443	3.353	5.607	15.044
Sub-Total				=	64.045
Calm				=	3.419
Unrecorded				=	32.536

Figure 14. Waverose Distribution of Wave Height and Direction at Karampuana Beach

From the results of wave hindcasting, it can be seen that the significant wave height (Hs) is 0.68 m and the significant period (Ts) is 2.4 s.

5. Tidal Data

The tidal data used is tidal data from the Indonesian Geospatial Reference System (SRGI).

1. Mean High Higher Water Spring (MHHWS) as deep as +122,69 cm
2. Mean High Higher Water Neap (MHHWN) as deep as +85.69 cm
3. Mean Sea Level (MSL) as deep as ± 0 cm
4. Mean Low Lower Water Neap (MLLWN) as deep as – 85,69 cm
5. Low Lower Water Spring (LLWS) as deep as – 106, 29 cm

6. Sediment Data

D50 bottom sediment data was obtained from the Sulawesi III River Basin Center, from the test results, the value of the sediment grain size that passed 50% (D50) was 0.65 mm.

RESULT AND DISCUSSION

Coastline Modeling

The Karampuana coastline modeling was carried out using GENESIS Software. Coastline change modeling has an analysis in modeling the pattern of coastline change. The analysis of coastline change was carried out in two conditions. The first analysis shows the direction of the waves that occur using the help of the STWAVE sub-Software. The next analysis is with the help of the GENESIS sub-Software which estimates the changes in the coastline that will occur in the next 10 years based on the influence of no coastal buildings and the presence of coastal protection buildings.

Before modeling is carried out, the data is processed first as input in the modeling. The first data processing is carried out in the Grid Generator by importing bathymetry data. Bathymetry data is arranged in the form of a notepad with X, Y, and Z coordinates shown in Figure 13.

(A) (B)

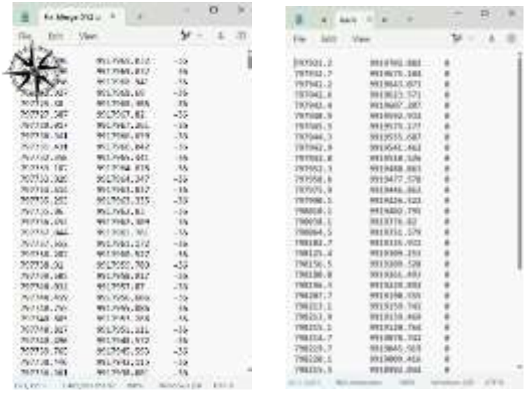


Figure 15. XYZ Bathymetric Data and XY Coastline

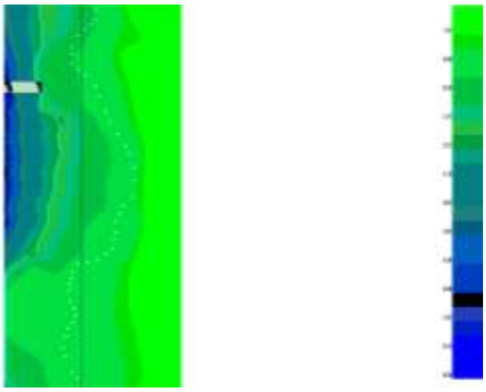


Figure 16. Results of Inputting Bathymetric Data, Coastlines and Breaking Waves

Modeling Calibration

From the data, a simple model test was tried to determine the direction of sediment transport events that cause changes in the coastline. The longshore transport components that were calibrated were the K1 and K2 components which are calibration coefficients. The simulation carried out was by trying the K1 and K2 values, then the results of the model test were obtained on wave data at Karampuana Beach.

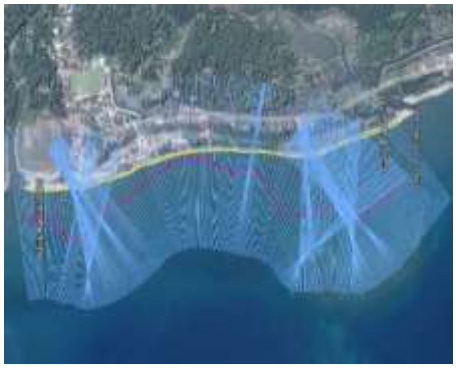
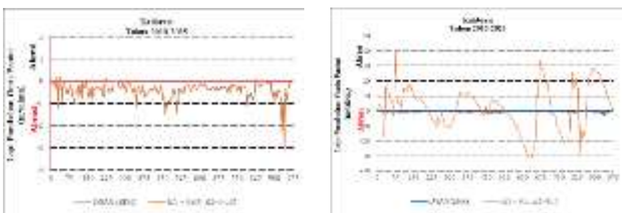


Figure 17. DSAS Coastline Change Rate of Karampuana Beach 2013-2025



(C)

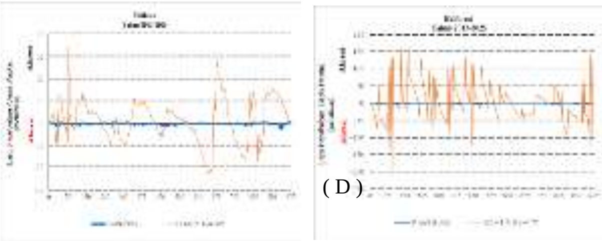


Table 4. Simulation Calibration Model K1 and K2

No. Uji Coba	Koefisien		Persentase Error
	K1	K2	
A	0.05	0.025	4.71%
B	0.3	0.15	504.14%
C	0.15	0.075	277.49%
D	1.5	0.75	104.04%

From several simulation experiments of calibration tests carried out, it was obtained in graph (A) using calibration factors K1 = 0.05 and K2 = 0.025, the direction of sediment movement approaching the coastline that occurred in the field was obtained.

1. Changes in the Coastline Without Protective Buildings

Figure 18. Results of GENESIS Software Simulation Without Buildings 10-year timeframe for abrasion and sedimentation

Figure 19. Results of GENESIS Software Simulation on Changes in the Karampuana Coastline Without Buildings in 2025 – 2035

The results of the simulation modeling with a time span of 10 years into the future in the scenario of changes in the coastline seen without buildings show a total sedimentation of 636.9 m, an average of 6.1 m per year from the initial position of the coastline with a maximum sedimentation value of 14.9 m. Then the total abrasion is -881.7 m, an average of -6.8 m abrasion per year from the initial position of the coastline with a maximum abrasion value of -23.6 m.

2. Changes in the Coastline with Breakwater Buildings

Figure 20. Results of GENESIS Software Simulation Using Breakwater Structures Against Abrasion and Sedimentation in 2025-2035

Figure 21. Results of GENESIS Software Simulation Using Breakwater Buildings on Changes in the Karampuana Coastline in 2025 – 2035.

The results of the simulation modeling with a time span of 10 years into the future in the scenario of changing the coastline using the Breakwater coastal protection structure show a total sedimentation of 502.6 m, an average of 5.1 m per year from the initial position of the coastline with a maximum sedimentation value of 11.9 m. Then the total abrasion is -683 m, an average of -5 m abrasion per year from the initial position of the coastline with a maximum abrasion value of -14.7 m.

3. Changes in the Coastline with Groin Construction

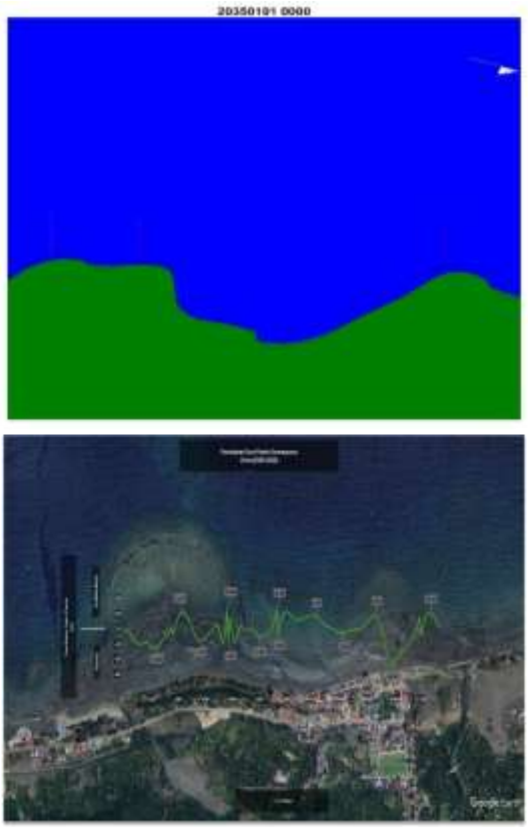


Figure 22. Results of GENESIS Software Simulation Using Groin Structures Against Abrasion and Sedimentation in 2025-2035.

Figure 4.15. Results of GENESIS Software Simulation Using Groin Buildings on Changes in the Karampuana Coastline in 2025 – 2035.

The results of the simulation modeling with a time span of 10 years into the future on the scenario of coastline changes seen using the Groin coastal protection structure show a total sedimentation of 592.5 m, an average of 5.8 m per year from the initial position of the coastline with a maximum sedimentation value of 12.9 m. Then the total abrasion is -835.9 m, an average of -6.4 m abrasion per year from the initial position of the coastline with a maximum abrasion value of -24.1 m.

4. Changes in the Coastline with Seawall Building

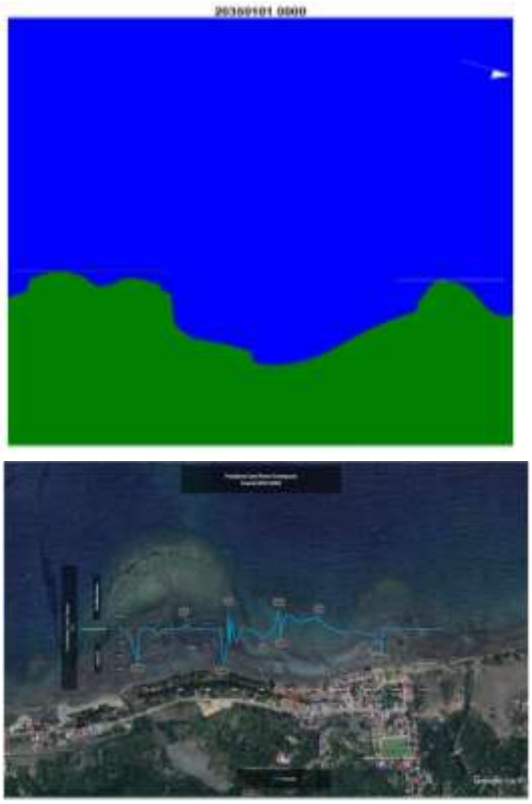


Figure 24. Results of GENESIS Software Simulation Using Seawall Buildings Against Abrasion and Sedimentation in 2025 – 2035

Figure 25. Results of GENESIS Software Simulation Using Seawall Buildings on Changes in the Karampuana Coastline in 2025 – 2035

The results of the simulation modeling with a time span of 10 years in the scenario of changing the coastline using the Seawall coastal protection structure show a total sedimentation of 323.6 m, an average of 4.6 m per year from the initial position of the coastline with a maximum sedimentation value of 13.6 m. Then the total abrasion is -437.4 m, an average of -5.3 m abrasion per year from the initial position of the coastline with a value of -23.95 m.

DISCUSSION

Coastline changes can be in the form of Coastline Progress (Accretion) or Coastline Retreat (Erosion). Accretion or Erosion will have an impact on the ecosystem and socio-economic life of the community along the coast. From the simulation results of existing conditions (2025) to the next 10 years (2035), it can be seen that there is maximum abrasion (erosion) on the north side as far as -23.65 meters or an area of 1128.5 m2 with a total of 2,876.55 m2 and there is accretion (sedimentation) almost along the coastline as far as 14.92 meters or an area of 671.4 m2 with a total of 1,844.65 m2. After the simulation was carried out by placing the Breakwater, Groin and Seawall protective structures, it can be seen in Table 4.7 that the Seawall protective structure is more effective in holding back the rate of abrasion and sedimentation.

CONCLUSION

Simulation scenario of shoreline changes without protective structures, shoreline changes at Karampuana Beach experienced changes but were not too significant so that they were classified as small to moderate with a total erosion (abrasion) of 2,876.55 m2 and a total sedimentation (accretion) of 1,844.65 m2. In handling the shoreline changes, the author chose a coastal protection structure using Seawall, where accretion and abrasion are almost balanced and classified as small so that the stability of the shoreline can be maintained. This is because along the shoreline at the research location there are existing community buildings that need to be protected due to changes in the shoreline.

SUGGESTIONS

From the results of the research on changes in the coastline that the author conducted, it can be used as a basis for further research and also as an alternative for designing and planning coastal protection structures in overcoming the problem of changes in the coastline of Karampuana Beach. To produce more accurate and precise design and planning products, it is recommended to use the latest primary data.

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