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ASSESSMENT OF AREA SUITABILITY INDEX FOR PORT PLANNING IN LAMPUNG BAY

Penilaian Indeks Kesesuaian Area untuk Perencanaan Pelabuhan di Teluk Lampung

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ABSTRACT

This study aims to assess the land suitability index as a basis for port development planning in the Lampung Bay area, focusing on Sukaraja Beach, Bandar Lampung. A quantitative method integrating oceanographic data such as bathymetry, tides, waves, currents, and area size was applied using Remote Sensing and Geographic Information System (GIS) technologies with ArcGIS and Surfer software. Spatial analysis using Model Builder produced zoning maps of land suitability. The results show that the oceanographic and morphological conditions at Sukaraja Beach are less suitable for port construction for large ships due to depth and area limitations, making it more suitable for development as a Small Fishing Port (PPI). However, Lampung Bay shows greater potential for national and oceanic scale port development (PPS and PPN). The recommended large port location is in Srengsem Subdistrict, Panjang District, Bandar Lampung City, covering around 635 hectares. This location is supported by oceanographic parameters indicating a very high suitability level (S1). Detailed mapping and comprehensive evaluation of optimal zones serve as a strategic recommendation for sustainable and environmentally friendly port development in Lampung Bay, supporting maritime economic growth and environmental sustainability.

Keywords: Lampung Bay, Oceanographic Parameters, Port, Spatial Analysis, Suitability Index

ABSTRAK

Penelitian ini bertujuan untuk menilai indeks kesesuaian lahan sebagai dasar perencanaan pembangunan pelabuhan di wilayah Teluk Lampung dengan fokus pada Pantai Sukaraja, Bandar Lampung. Metode kuantitatif yang mengintegrasikan data oseanografi seperti batimetri, pasang surut, gelombang, arus, dan luas area diterapkan menggunakan teknologi Penginderaan Jauh dan Sistem Informasi Geografis (SIG) dengan perangkat lunak ArcGIS dan Surfer. Analisis spasial menggunakan Model Builder menghasilkan peta zonasi kesesuaian lahan. Hasil menunjukkan Pantai Sukaraja tidak memenuhi kriteria untuk pelabuhan kapal besar dan lebih sesuai untuk Pelabuhan Perikanan Kecil (PPI). Namun, Teluk Lampung memiliki potensi kesesuaian yang lebih tinggi untuk pembangunan pelabuhan berskala nasional dan samudera (PPS dan PPN). Lokasi rekomendasi pada zona pelabuhan besar terletak di Kelurahan Srengsem, Kecamatan Panjang, Kota Bandar Lampung, dengan luas area sekitar 635 hektar. Penentuan lokasi ini didukung oleh analisis parameter oseanografi yang menunjukkan tingkat kesesuaian sangat tinggi (S1). Pemetaan rinci dan evaluasi komprehensif ini dapat membantu perencanaan pelabuhan yang lestari dan berkelanjutan di Teluk Lampung, mendukung pengembangan ekonomi maritim dan keberlanjutan lingkungan.

Kata Kunci: Teluk Lampung, Indeks Kesesuaian, Analisis Spasial, Parameter Oseanografi, Pelabuhan

INTRODUCTION

Lampung Bay is a strategic coastal area in Lampung Province with high fisheries potential and is a key location for both capture and aquaculture activities (Alhuda *et al.,* 2016). The Lempasing Coastal Fisheries Port (PPP) serves as a fish landing center, but the growing fleet and the need for catch distribution require a port with more adequate capacity and facilities (Machdani *et al.,* 2023). Field conditions indicate that some fishermen still dock at Sukaraja Beach, which is unsuitable, primarily due to the accumulation of waste and coastal pollution (Akbar & Pratiwi, 2023). This highlights the need for in-depth studies to determine technically and environmentally appropriate port locations.

Several previous studies have emphasized the importance of oceanographic parameters in port planning. Waves and currents influence the safety and stability of port structures (Guan *et al.,* 2019; Milasari *et al.,* 2021), while tides determine effective depth and sedimentation processes (Fatimah & Fauzi, 2021). A study by Lololuan et al. (2019) shows that port location determination must consider water depth, waves, currents, and tides to ensure operational safety and efficiency. Geographic Information Systems (GIS) approaches have also been widely used to assess port land suitability, such as research by Sukuryadi & Mas'ad (2018), which successfully mapped port area suitability based on oceanographic parameters in Lombok.

Determining the optimal port development location requires an approach that can comprehensively assess land suitability based on oceanographic factors. The Land Suitability Index (Mappadjantji, 2001) is a systematic, rapid, and measurable assessment method using simple parameters such as depth, current, tides, waves, and area. Therefore, this method is effective for evaluating coastal area potential both quantitatively and qualitatively by weighting the obtained attribute values. Therefore, this study aims to assess the area suitability index in Lampung Bay as a basis for port planning, thereby generating strategic location recommendations that support the sustainable development of fishing ports and national-scale ports.

METHODS

Research Time and Location

This research is a series of hydro-oceanographic surveys and mapping conducted by the Indonesian Navy's Hydro-Oceanography Center from March 30, 2022, to May 28, 2022, in the waters of Lampung Bay, Bandar Lampung, Lampung, with coordinates ranging from -5.561315.105 to -5.441022 and 105.232201 to 105.369530. Data processing and analysis were conducted from July to October 2024 at the Indonesian Navy's Hydro-Oceanography Center Command Headquarters.

Figure 1. Research Location Map

Research Tools and Materials

This research used ArcGIS 10.8 software for thematic mapping and spatial analysis, Surfer 10 for bathymetric contouring and 3D visualization, and Microsoft Excel for tidal, wave, and current calculations. The data analyzed included bathymetry and tides obtained from the 2017 Pushidrosal Hydro-Oceanographic Survey, as well as wave and current data from the NOAA National Weather Station (April 2017). All of this data was used as the primary parameters in assessing the port land suitability index.

Research Procedure

Data Collection

Water depth measurements were conducted through sounding using a single-beam echosounder, which operates based on the reflection of sound waves from the seabed. Depth data were collected using a parallel transect pattern according to the method (Soeprapto, 2001). Tide data were collected through manual observations using a tide gauge, with recording intervals of 15–60 minutes, and then used as a reference for bathymetric depth corrections (Poerbandono & Djunarsjah, 2005). Meanwhile, current and wave data were obtained from the NOAA National Weather Station for April 2017, covering variables such as wave height and direction, as well as current speed. These data were then used to understand oceanographic dynamics and support the port land suitability analysis.

Data Analysis and Processing

Bathymetric data was measured using a single-beam echosounder to determine water depth. The depth measurements were then corrected for the transducer position and tidal effects. This correction was performed using the depth reduction equation:

$$r_t = TWL_t - (MSL + Z_0)$$

Where:

rt : the amount of reduction applied to the depth measurement at time t
$TWLt$: the measured sea level at time t
MSL : mean sea level
Z0 : the depth of the low tide surface below MSL

Wave data were obtained from NOAA, including wave height and period. Wave parameter calculations were performed in several stages. Wave data were calculated to obtain significant wave height, period, and breaking depth. Breaking wave depth is calculated using the Triatmodjo (1999) formula:

$$H_b = \gamma \times d_b$$

Where:
γ : Breaking coefficient
d_b : Breaking wave depth (meters)
H_b : Breaking wave height (meters)

Tide data is obtained through sea level observations conducted at the nearest tidal station, Panjang Station. These observations produce sea level data over time. The tidal data is then processed using the Admiralty method to obtain the principal harmonic constant. The formula for calculating tidal range is as follows (Pugh, 2005).

$$TR = Hmax - Hmin$$

Where:
TR : Tidal Range - Tidal Range
$Hmax$: Maximum height at high tide
$Hmin$: Minimum height at low tide.

Current data is taken from the results of wave breaking calculations. Longshore currents caused by waves breaking at a certain angle to the shoreline can be estimated. The equation for calculating longshore currents (V) uses the following formula (Azizi *et al.,* 2017):

$$V = 1{,}17\ (gH_b)^{1/2} \sin\alpha_b \cos\alpha_b$$

Where:
V : alongshore current velocity
g : gravitational acceleration
H_b : breaking wave height
α_b : breaking wave incidence angle

Port Suitability Index Analysis

The port suitability index for Sukaraja Beach, Bandar Lampung, was determined using the Land Suitability Index assessment method, derived from Mappadjanjti (2001) in a study on Coastal Spatial Planning. The parameters used in this index include wave height, current, tides, water depth, and site area. The index's convection parameters and related equations are shown in the following table.

Table 1. Port Suitability Index

Factor	**Symbol**	**Suitability Class**		
		S1	**S2**	**N**
Depth Range	D (m)	D > 5.5		D < 5.5
Tides	A (m)	A < 2	2 < A < 4	A > 4
Ocean Current Range	V (m/s)	V > 0.5	0.5 < V < 1	V > 1
Wave Height	H (m)	H < 0.2	0.2 < H < 1.2	H > 1.2
Area	L (m^2)	L < 126,000		L < 40,000

Source: Mappadjanjti (2001)

The weighting value of each parameter for port area suitability has been determined by (Fauzi *et al.,* 2009). The land suitability classification is obtained by calculating the total parameter weight multiplied by the assigned score, according to the following equation:

$$Y = \sum Ai \times Xn \quad (3.11)$$

Where:
Y : Total weighting
Ai : Weighting factor
Xn : Land suitability value (score)

The land suitability value is divided into three categories: category S1, indicating a suitable area, is given a score of 3. Category S2, indicating a conditionally suitable area, is given a score of 2. Category N, indicating an unsuitable area, is given a score of 1.

All analyzed parameters are then spatially integrated using ArcGIS software with the Model Builder feature. The initial step is to input the analysis data from bathymetry, tides, currents, waves, and area into a digital map format. Each parameter is converted into a raster layer with a value corresponding to the land suitability index classification. Next, an overlay process is performed by combining all layers based on predetermined weights and scores. The results of this process produce a port land suitability zoning map, which is then used to identify potential locations categorized as Highly Suitable (S1), Suitable (S2), and Not Suitable (N). This method allows suitability assessments to be not only numerical but also spatially visualized, making them easier to understand and apply to port development planning.

RESULTS

Bathymetric Profile

Bathymetric analysis of Lampung Bay shows significant depth variations from the coast to the central part of the bay. Water depths in the coastal area range from only 0 to 5 meters and gradually increase to 5 to 15 meters further out, with maximum depths reaching 24 to 27 meters, as shown in Figure 2. This condition reflects the morphological characteristics of the seabed, which slopes gently towards the center of the bay. Meanwhile, at Sukaraja Beach, depths are relatively shallow, ranging from only 2.61 to 4.22 meters, as seen in Figure 3, which depicts sandy beach waters with a gently sloping seabed.

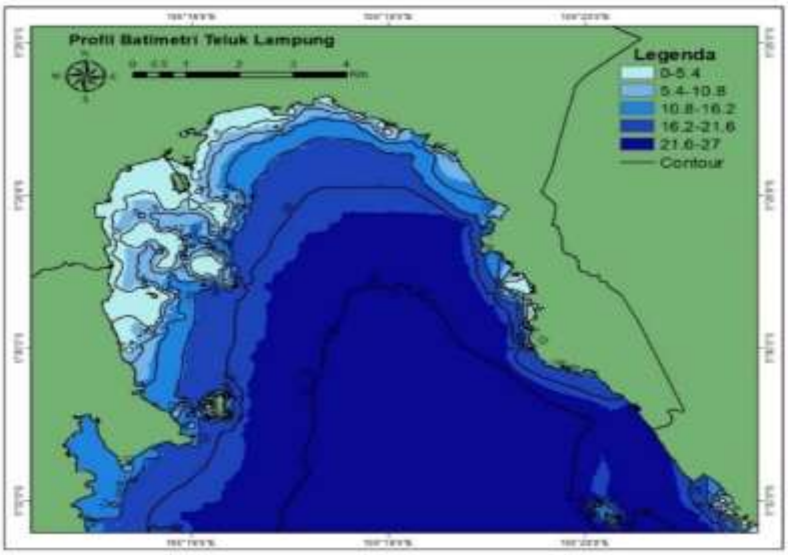

Figure 2. Bathymetry of Lampung Bay Waters

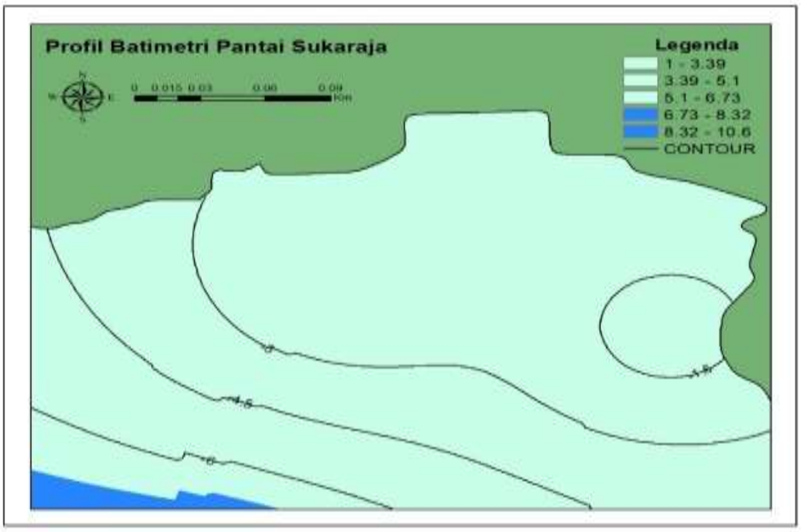

Figure 3. Bathymetric Profile of Sukaraja Beach, Lampung

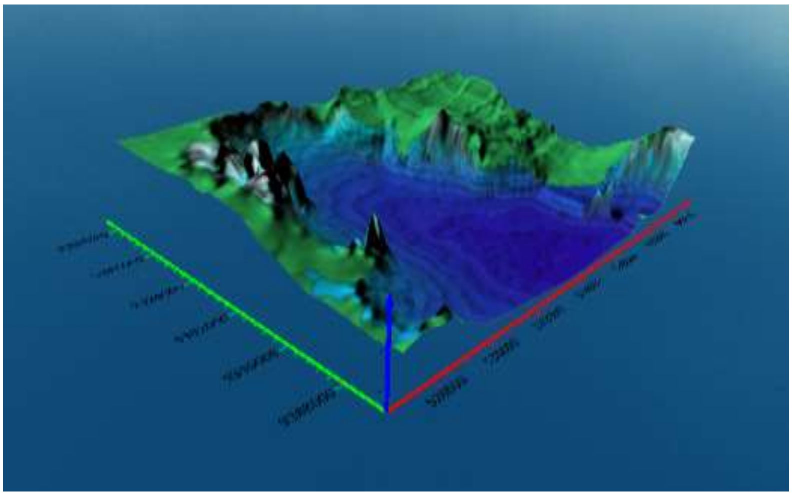

Figure 4. 3D Visualization of Lampung Bay Bathymetry

To provide a more comprehensive picture of the seabed morphology, the bathymetry results of Lampung Bay are also visualized in three dimensions. This representation shows a clearer difference in elevation between the coastal and central areas of the bay. The waters along the coast exhibit shallow depths with higher seabed elevations, while in the central part of the bay, depths increase significantly, reaching over 20 meters. These characteristics confirm the presence of a basin-shaped seabed contour with a relatively gentle slope.

Wave Data

The results of wave data analysis from the WaveWatch III model for the period April 2022–March 2023 show the spatial and temporal pattern of significant wave heights (Hs) in the waters around Lampung Bay. In general, wave heights at this location are relatively low, with a dominant range of 0.5–1.0 meters. In the inner areas of the bay, Hs values decrease (<0.5 m), as indicated by the dark color gradation in Figure 5.

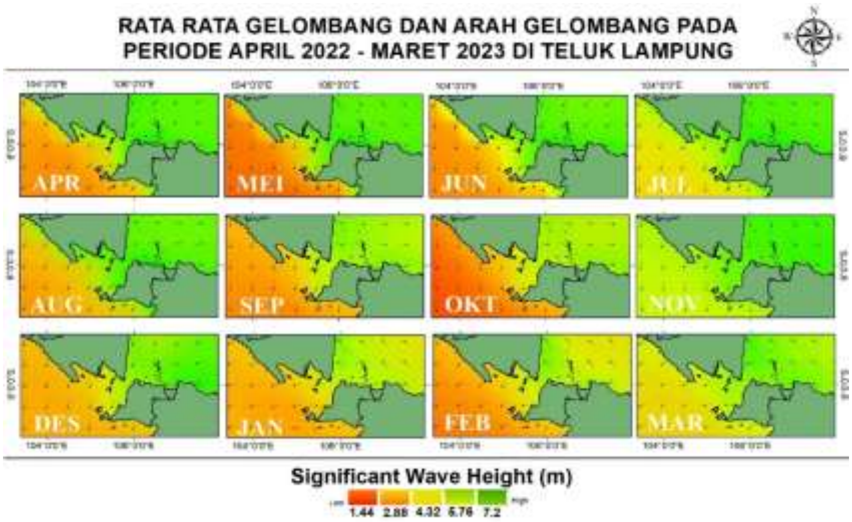

Figure 5. Average Wave Height and Wave Direction for the Period April 2022–March 2023

The wave direction in Lampung Bay is predominantly from the west–southwest to the east–southeast, and this pattern is relatively consistent throughout the year, although there are minor shifts due to the influence of the monsoon. In August–October, waves are more stable from the southwest, while in January–February they shift from the south. The wave height analyzed was the breaking wave height (Hb), calculated through wave transformation using the wave period (T) and significant height (Hs) from WaveWatch 3 data for 2022–2023. This analysis yielded the maximum and minimum wave height values, as presented in Table 2.

Table 2. Results of Calculation of Period and Significant Wave Height

No.	Time	Wave Period (T)	Significant Wave Height (Hs)
1	April	10.59 s	0.73 m
2	May	8.13 s	0.58 m
3	June	9.87 s	0.58 m
4	July	9.91 s	0.63 m
5	August	11.54 s	0.68 m
6	September	9.24 s	0.63 m
7	October	9.72 s	0.76 m
8	November	8.79 s	0.86 m
9	December	8.34 s	0.89 m
10	January	8.17 s	0.80 m
11	February	7.24 s	0.84 m
12	March	9.16 s	0.66 m
13	April	11.25 s	0.71 m
Annual Average		9.10 s	0.72 m
Maximum Wave Period and Height		11.54 s	0.89 m
Minimum Wave Period and Height		7.24 s	0.58 m

The results of the calculation of breaking wave height (Hb) and breaking wave depth (db) for Sukaraja Beach, Lampung, are presented in the following table.

Table 3. Results of Breaking Wave Height and Depth Calculations

No.	Time	Breaking Wave Height (Hb)	Wave Breaking Depth (db)
1	April	1.10 m	1.21 m
2	May	0.47 m	0.51 m
3	June	0.30 m	0.33 m
4	July	0.80 m	0.87 m
5	August	0.55 m	0.60 m
6	September	0.38 m	0.41 m
7	October	1.11 m	1.22 m
8	November	1.19 m	1.31 m
9	December	1.31 m	1.47 m
10	January	1.19 m	1.34 m
11	February	1.11 m	1.24 m
12	March	1.06 m	1.17 m
13	April	1.08 m	1.19 m
Year-Round Average		0.88 m	0.97 m
Maximum Wave Height		1.31 m	1.47 m
Minimum Wave Height		0.30 m	0.33 m

Current Data

Current analysis reveals quite dynamic velocity variations, with maximum values reaching 2.0 m/s. The dominant current direction tends to follow the local circulation pattern of Lampung Bay, which can affect vessel stability during maneuvers. In this study, the current measured was the current velocity parallel to the shoreline. To obtain this data, the Komar equation was used, which utilizes information on breaking wave height (Hb) and wave incidence angle (α). The following shows the parallel-shore current velocity data obtained for Sukaraja Beach, Lampung.

Table 4. Results of Breaking Wave Height and Current Velocity Calculations

No.	Time	Breaking Wave Height (Hb)	Current Velocity (V)
1	April	1.10 m	1.84 m/s
2	May	0.47 m	0.34 m/s
3	June	0.30 m	0.11 m/s
4	July	0.80 m	1.07 m/s
5	August	0.55 m	0.38 m/s
6	September	0.38 m	0.18 m/s
7	October	1.11 m	1.85 m/s
8	November	1.19 m	2.00 m/s
9	December	1.31 m	1.91 m/s
10	January	1.19 m	1.70 m/s
11	February	1.11 m	1.83 m/s
12	March	1.06 m	1.87 m/s
13	April	1.08 m	1.68 m/s
Year-Round Average		0.88 m	1.29 m/s
Maximum Wave Height		1.31 m	2.00 m/s
Minimum Wave Height		0.30 m	0.11 m/s

Tidal Data

Tide observations indicate a mixed tidal pattern with a double diurnal skew, with tidal rises ranging from 0.17 to 1.67 meters. The obtained harmonic constant values also support the tidal characteristics in the area. Based on tidal data processing from March 28 to April 25, 2022, the tidal harmonic component values are presented in Table 5 and the tidal graph in Figure 6.

Table 5. Tidal Harmonic Constants

Constant	So	M2	S2	N2	K2	K1	O1	P1	M4	MS4
A	104.4	36.0	14.5	7.8	3.3	16.8	8.2	5.5	0.2	0.2
g°		197.9	269.5	165.9	269.5	275.2	251.0	275.2	64.7	159.4

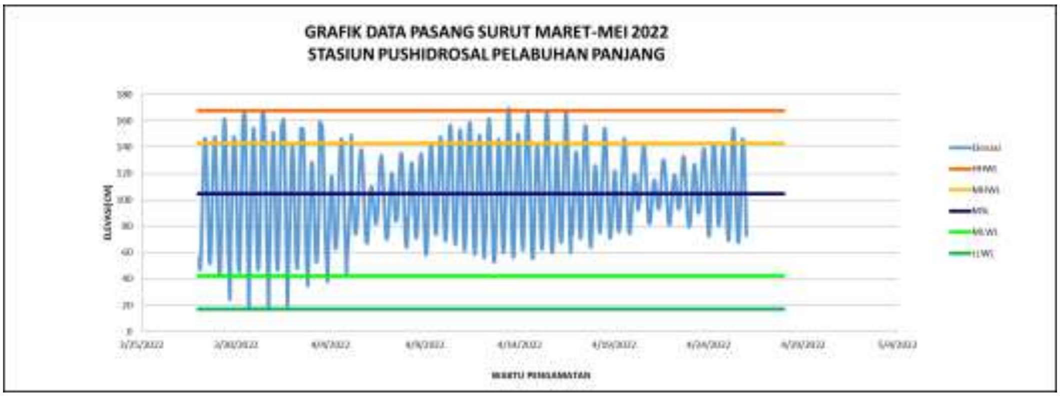

Figure 6. Tidal Graph

Land Suitability Parameters

Based on the results of oceanographic data processing at Sukaraja Beach and Lampung Bay, key parameters were obtained, including depth, wave height, current speed, tides, and area, as shown in Tables 6 and 7.

Table 6. Land Suitability Values at Sukaraja Beach

No	Parameter	Value	Category
1	Depth Range	2.61 - 4.22	Not in accordance
2	Wave Height	0.72 m	Conditionally Compliant
3	Current Strength Range	1.29 m/s	Not in accordance
4	Tides	1.67 m	In accordance
5	Area	2980.58 m^2	Not in accordance

Table 7. Land Suitability Values of Lampung Bay

No	Parameter	Value	Category
1	Depth Range	16.2 – 27 m	Very suitable
2	Wave Height	0.72 m	Conditionally Compliant
3	Current Strength Range	1.29 m/s	Not in accordance
4	Tides	1.67 m	Conditionally Compliant
5	Area	635,885 ha	Very suitable

Based on the analysis of oceanographic conditions and overlays using Model Builder, the Sukaraja Beach location shows a number of limitations in terms of water depth, current strength, and area, which makes this area more suitable for development as a Fish Landing Base (PPI) or class D port with a maximum capacity for small to medium-sized fleets. This category is in line with the regulations of the Minister of Maritime Affairs and Fisheries Regulation Number 8 of 2012 ([RSNI3] Indonesia, 2024). Lampung Bay has significant advantages, especially in terms of water depth and land area, which are very supportive of large-scale port development. Although there are challenges in the form of quite high current strength, this area is still within tolerance limits that can be overcome with current protection technology and adaptive infrastructure design. Wave heights that are in the conditionally suitable category and tides that are still within safe limits also strengthen the potential of Lampung Bay as a location for a PPS or PPN type port (Sukuryadi, 2016) and (Proto C. R. *et al.,* 2019).

DISCUSSION

Bathymetric Data

Bathymetric analysis shows a variation in depth in Lampung Bay, from 0–5 m at the coast to 24–27 m in the central part of the bay, with a gentle contour. Sukaraja Beach itself has a depth of 2.61–4.22 m, making it relatively shallow due to sedimentation from river and estuarine flows, which increases turbidity and accelerates silting. This condition is closely related to sedimentation from river flows and estuarine dynamics, which cause increased turbidity and local silting (Wisha & Heriati, 2016; Fatkhurrozi *et al.,* 2025). As an estuary area, Sukaraja Beach is heavily influenced by tides, which impact water quality. According to Mappadjantji (2001), the minimum port depth should be 5 m and ideally 12 m to accommodate ship drafts within a certain safe tolerance. With tidal values in Lampung Bay ranging from 0.17–1.67 m, the effective depth at Sukaraja Beach at low tide is clearly inadequate for port activities of medium to large vessels. Based on these conditions, the deeper central part of Lampung Bay is considered more suitable for port development, while the coastal area of Sukaraja Beach is categorized as unsuitable (N).

Wave Data

Observations using WaveWatch 3 data from 2022–2023 in the waters off Sukaraja Beach, Lampung, show relatively stable wave height fluctuations. This is because Sukaraja Beach is located in a bay or coastal location that is relatively sheltered from open sea winds, so its waves are less affected by storms or strong winds from the open ocean. Significant wave height is defined as the highest third of the waves ($H_{1/3}$), which accounts for 33% of the total recorded data (Kurniawan *et al.,* 2012). The average annual wave height is 0.72 meters, with a maximum recorded in December of 0.89 meters and a minimum recorded in May and June of 0.59 meters. Wave height fluctuations between seasons are influenced by various factors, such as wind and tides (Kurniawan *et al.,* 2011). During the east monsoon (June, July, and August), the average wave height was recorded at 0.63 meters, with the lowest waves occurring in June (0.58 meters) and the highest in August (0.68 meters).

In this study, the lowest waves were recorded in the east monsoon and the highest in the west monsoon. This pattern aligns with the general characteristics of Indonesian waters, where the west monsoon produces higher waves due to strong southwesterly winds, while the east monsoon tends to be calmer. According to Wheeler et al. (2007), this difference is influenced by the monsoon wind system, which forms due to pressure variations between the Asian and Australian continents, thus influencing wind direction and energy, the primary factors in wave formation. With a maximum value of 0.89 meters, Sukaraja Beach is categorized as S2 (conditionally suitable) according to the Land Suitability Index. This means that although the waves in this area are relatively safe for small to medium-sized shipping activities, the shallow waters remain a major limitation in port development.

Current Data

Ocean currents in Lampung Bay are influenced by the monsoon wind system and coastal morphology. According to Hadikusumah (2010) and Theoyana et al. (2015), monsoon winds are the dominant factor shaping currents in Indonesian waters, with a west-east pattern that changes seasonally. At Sukaraja Beach, analysis results show current speeds ranging from 0.11–2.0 m/s, with the lowest values in June (east monsoon) and the highest in November (second transitional season). Average currents also vary seasonally, with the highest speeds in the west monsoon (approximately 1.8 m/s) and the lowest in the east monsoon (approximately 0.5 m/s).

Current values at Sukaraja Beach are relatively more variable than the general conditions in Lampung Bay due to the gently sloping seabed topography, the dominance of muddy substrates, and the presence of sedimentation from the mainland, which slows the movement of water masses (Tsanyfadhila *et al.,* 2022; P. D. Kusuma *et al.,* 2016). In coastal areas, lateral friction along the shoreline also weakens surface currents. Therefore, although Lampung Bay is known for its relatively stable tidal currents, Sukaraja Beach exhibits greater fluctuations, which are important to consider in the context of port planning.

Tidal Data

Tidal currents are a major component of circulation in bay areas, including Lampung Bay, due to the movement of water masses from the open sea into shallow waters such as estuaries and coastal areas. Based on tidal observation data from March–April 2022 at Panjang Port, processed using the Admiralty harmonic method, sea level elevation values ranged from 136 cm to 264 cm. HHWL information is important as a reference for port infrastructure planning to anticipate maximum water level rise.

Analysis results at Sukaraja Beach indicate a mixed tidal type with a double diurnal tendency, characterized by two high tides and two low tides per day with unequal heights. The Formzahl value of 0.494 supports this classification, consistent with Wisha & Heriati (2016), who stated that a value of $0.25 < f \leq 1.5$ indicates a double mixed type. This pattern aligns with the results of Pariwono (1998), which confirm that tidal characteristics are strongly influenced by water depth and local conditions. Therefore, although Lampung Bay generally has stable tides, Sukaraja Beach exhibits significant tidal dynamics, which must be taken into account in the design of the port's basin depths and shipping channels.

Land Suitability Parameter Analysis

At Sukaraja Beach, the results indicate three unsuitable parameters: depth (2.61–4.22 m), current (1.29 m/s), and area (2,980 m²). Wave height (0.72 m) is only conditionally suitable, and low tide (1.67 m) is suitable. The main constraints are shallow depth and limited area, which do not meet medium- to large-scale port standards. Therefore, this location is more suitable for a Fish Landing Base (PPI) or a Class D port with a capacity for small to medium vessels. Conversely, Lampung Bay has very suitable depths (16.2–27 m) and a very adequate area (±4,427 ha), supporting large-scale port development. Wave height (0.72 m) is considered conditionally suitable, tides (1.67 m) are suitable, while currents (1.29 m/s) pose a challenge that requires technical mitigation. With its superior depth and area, Lampung Bay has the potential to become a location for a national or ocean-going fishing port (PPN/PPS).

Integrating spatial analysis with ArcGIS Model Builder strengthens the results by displaying the spatial distribution of land suitability. These results confirm that Sukaraja Beach is more suitable for a small-scale port, while Lampung Bay is worthy of development as a national-scale port, provided strong current management is implemented through adaptive infrastructure design.

Port Planning Recommendations

Effective port planning requires a comprehensive feasibility study, particularly in assessing site characteristics. Critical factors such as geological stability, topographic contours, and water depth must be carefully analyzed (Rodrigue & Notteboom, 2009). The ideal location should be able to support a variety of vessel types and have good connectivity with land transportation modes (Thoresen, 2018). Furthermore, environmental and social impact evaluations should be an integral part of the feasibility study process to ensure regulatory compliance and mitigate potential negative impacts on the surrounding community and ecosystem.

Port Planning Recommendations for Ship 10–20 GT

Based on oceanographic analysis and spatial overlays, the Sukaraja Coast area is known to have several limitations regarding water depth. Based on applicable technical requirements and regulations, Sukaraja Beach is more appropriately designated as a Fish Landing Base (PPI) with a focus on serving small to medium-sized vessels and local fishing activities (Citra *et al.,* 2020). These limitations prompted further spatial research and analysis to identify potential zones in Lampung Bay for the development of small fishing ports (PPI and PPP) that meet technical parameters and operational efficiency.

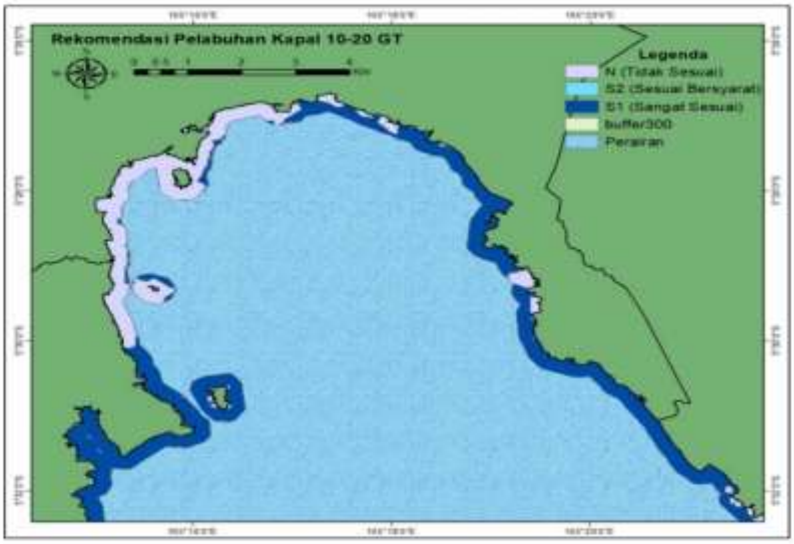

Figure 7. Recommended Ports for 10-20 GT Ships

Spatial analysis in Lampung Bay, with a 300-meter buffer from the shoreline, revealed a highly suitable area (S1) of 939.93 ha, a conditionally suitable area (S2) of 3,354.31 ha, and an unsuitable area (N) of 433.77 ha. The 300-meter buffer zone was chosen because it aligns with research (Putri *et al.,* 2024). This zone is ideal for small ports because it is close to the coast, easily accessible to fishing vessels, and is cost-effective. Oceanographically, depths of 2–5 m, waves <1.5 m, currents 0.2–0.4 m/s, and tides <1 m support the operation of vessels <10 GT. Therefore, Lampung Bay is considered safe and efficient for the development of small fishing ports.

Port Planning Recommendations for Ship 30-60 GT

Lampung Bay is a strategic area with significant potential for the development of Ocean Fishing Ports (PPS) and Archipelago Fishing Ports (PPN) due to its abundant fish resources and favorable geographic location, which allows for access to extensive fishing grounds. The development of large-scale ports such as PPS and PPN in this location is crucial to support the activities of medium- to large-sized vessels, which typically operate with capacities between 30 and 60 GT.

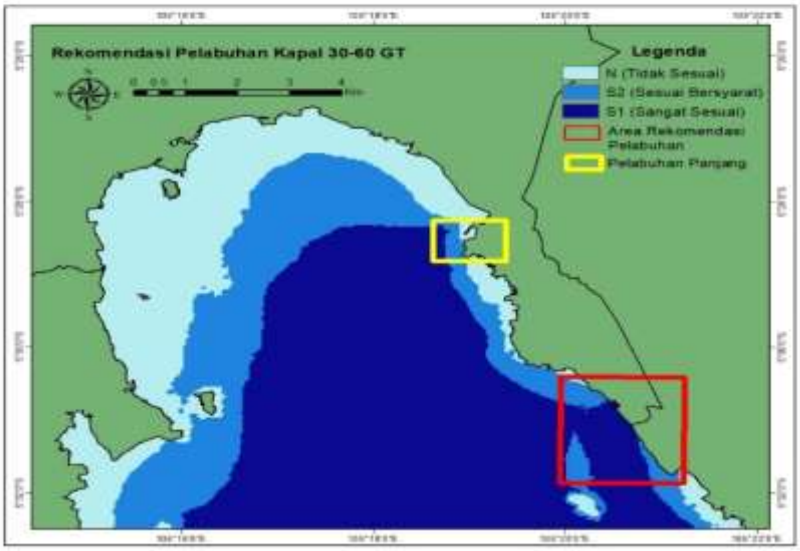

Figure 8. Port Planning Recommendations for Large Ship

The recommended location is in the area marked by the red box in the image, with coordinates ranging from -5.51301068 to -5.53292340 South Latitude and 105.33434452 to 105.35357059 East Longitude. This area is located within the administrative area of Srengsem Village, Panjang District, Bandar Lampung City, Lampung Province. The site covers an area of approximately 635 hectares, providing ample space for not only the development of a port for vessels with a capacity of 30–60 GT, but also allowing for the expansion of complete port facilities, including a port basin, long quay, processing and marketing areas, and other supporting service areas.

CONCLUSION

Oceanographic conditions in Lampung Bay show a depth of 16.2–27 m, tides of 0.17–1.67 m, maximum current speed of 2.0 m/second, and maximum wave height of 0.89 m. The results of land suitability analysis and recommendation maps indicate that the location of the 30–60 GT ship port is in the Srengsem Village area, Panjang District, Bandar Lampung City, with coordinates around -5.51301068 to -5.53292340 South Latitude and 105.33434452 to 105.35357059 East Longitude.

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