Suitability water quality parameters for seaweed culture at Muara Gembong coastal area, Bekasi District

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Abstract. Seaweed is one of the vital export aquaculture commodities in West Java of Indonesia. Since 2013, seaweed production in Muara Gembong Sub-District, especially Pantai Mekar Beach and Pantai Sederhana Villages, can be produced 7,000 tons from total 10,000 seaweed culture fisheries of Bekasi District (80%) that was developed with a polyculture system. To ensure the long-term success of providing seaweed production, evaluation of suitable location is an essential step in any aquaculture operation. This study was conducted to analyze suitable sites for seaweed aquaculture in the coastal area of Muara Gembong based on the condition of water quality. Water quality data were collected from 11 stations during field surveys in March, July, and October 2018. Water quality parameters were observed with physical parameters (Secchi disk transparency, temperature, and depth) and chemical parameters (salinity, pH, DO, phosphate, and nitrate). Evaluation of water quality data included compile of matrix suitability design through some works of literature. The suitability coastal areas were analyzed to get suitable location used GIS software from coordinate data and water quality parameters, which were compared. The class “suitable” has a score of 4, the “suitable enough” class has a score of 3, the “suitable with conditionals” class has a score of 2, and the class “not suitable” has a score of 1. Based on the measurement result, the “suitable” areas were Station 7 (Front of Muara Mati), Station 8 (Outermost Muara Mati), Station 11 (Muara Kuntul), and Station 12 (Front of Muara Kuntul). The coverage area that was in a suitable area category is 962.72 Ha (9.63 km\textsuperscript{2}). The location also linear with the result based on salinity, DO, and transparency (Secchi dish transparency). There are selected locations compared with other stations in Muara Gembong coastal waters because those locations face waste problems from Citarum Watershed and Jakarta Bay. Also, the sites serve as a source of livelihood for the community.

Keywords: water quality, suitability, seaweed, Muara Gembong

1. Introduction
Muara Gembong Sub-District lies between latitudes 5° 54’25.83” E-5° 57’22.52” S and longitudes 106° 58’52.45” E-107° 2’59.72” W. By 11% from 127,288 Ha area of Bekasi District is Muara Gembong Sub-District. This sub-district has six villages (Jayasakti, Pantai Bakti, Pantai Bahagia, Pantai Sederhana, Pantai Mekar, and Pantai Harapanjaya) \cite{1}. Most of the livelihood of Muara Gembong communities is the agriculture sector with rice commodity, palawija, and fisheries (around 47.67 %). In contrast, the others work in the non-agricultural sector, such as factory workers, traders,
etc. (52.33%). In 2008, Muara Gembong Sub-District developed a seaweed culture with a polyculture system, which was initiated by The Small and Medium Enterprises Unit (UMKM) Development Bureau Bank of Indonesia. The type of seaweed cultured in the Muara Gembong District is *Gracilaria* sp. [2].

From 2012 until 2014, seaweed culture with a polyculture system was one of the potential production and as a livelihood for Muara Gembong Sub-District community. The polyculture system consists of seaweed and fish culture. Fish culture, which is carried out together with seaweed cultivation, can minimize the effects caused by fish farming [3]. Seaweed culture in Muara Gembong Sub-District in 2013 produced 7,000 tons/year from the whole production of 10,000 tons/year in the Bekasi District (around 80%) [4, 5].

Seaweed cultivation is carried out on agricultural land, covering an area of more than 1,000 ha out of 10,189 ha total, which is divided into 3 best commodities. They are seaweed, *Penaeus monodon* (shrimp), and *Chanos chanos* (fish) [5]. It was also explained that the seaweed technique for development was a polyculture method between *Chanos chanos* and seaweed. The polyculture system is based on the principle of natural balance, where seaweed functions as an oxygen producer, a fish nursery (e.g., *Chanos chanos*), and can also absorb CO$_2$ derived from fish respiration (*Chanos chanos*), while fish (*Chanos chanos*) will dispose of their feces that can be used as nutrition by seaweed [5, 6].

Coastal District of Muara Gembong is one of the coastal areas that have estuary and mangrove ecosystems to support community life. These ecosystems have an essential role in the lives of all people on the coast of Muara Gembong. Also, the ecosystem has an ecology function to save the balance of the coastal environment [7]. Moreover, the function of the coastal ecosystem in the waters of Muara Gembong is now used for aquaculture, fisheries, agriculture, other services, as well as transportation.

The coastal area of Muara Gembong is an area with waters that are still reachable by the community by small vessels. In the coastal zone, despite the lowest tide, the site is still a potential for developing seaweed cultivation. This potential must positively be reviewed to provide useful data and information for the development of marine culture, especially seaweed culture in the coastal areas of Muara Gembong. The right location will benefit the environment and community livelihoods. Some things that must be considered activities that threaten seaweed production are household waste, ship waste, and industrial waste. This study was conducted to analyze suitable sites for seaweed cultivation in the coastal area of Muara Gembong District based on physical and chemical parameters. The analysis process for appropriate sites uses spatial parameters with GIS (Geographic Information Systems) and also multi-criteria analysis. The results of this research are expected to provide an overview of the area suitability on the Muara Gembong coast.

2. Materials and methods

2.1 Study site

Research has been conducted in March, July, and October 2018. March represents the rainy season, July was the dry season, and October was considered the transition season (the dry season to the rainy season. Observation of stations that can represent coastal areas in Muara Gembong District is presented in Figure 1 and Table 1.
Figure 1. Map of research stations in Muara Gembong Sub-District
(Note: The map was modified from [8] to adjust this research)

Table 1. The geographical position of research stations

| Stations | Locations          | Coordinate                  |
|----------|--------------------|-----------------------------|
|          |                    | East Longitude | South Latitude |
| 1        | Front of Muara Bendera | 106.00535     | 5.93583       |
| 2        | Front of Muara Mati   | 107.00388     | 5.9625        |
| 3        | Outermost Muara Mati  | 106.97987     | 5.96624       |
| 4        | Muara Besar          | 107.01348     | 5.98224       |
| 5        | Asdam                | 106.00548     | 5.99718       |
| 6        | Front of Muara Kuntul | 106.9921      | 6.0047        |
| 7        | Outermost Muara Kuntul| 106.9761      | 6.0025        |
| 8        | Muara Jaya           | 106.9959      | 6.026         |
| 9        | Muara Blacan         | 107.0135      | 6.0287        |
| 10       | Nawan                | 107.0002      | 6.0425        |
| 11       | CBL (Cikarang Bekasi Laut) | 106.9772    | 6.0415        |

Note: The geographical position in this table was modified from [8] to adjust this research study

2.2. Data collection

Data and information collected consists of primary data (water quality) and secondary data (documents and study literature support this research). Collecting data was conducted in three surveys, which were in March 2018 (first sampling), July 2018 (second sampling), and October 2018 (third sampling). The random sample was designed by simple observation stations used GIS software [10, 11].

The research station is chosen based on the proportional area so that it can represent the characteristics of the waters to be surveyed. The total stations in this study were 11 stations selected from 23 research stations [8], 11 stations were set as data and information analyzed to determine the level of suitable area for seaweed cultivation (Figure 1).

Data collected was carried out around 09.00 a.m. - 04.00 p.m. The parameter observed were physical parameters (Secchi disk transparency, temperature, and depth) as well as chemical parameters (salinity, pH, DO, phosphate, and nitrate).
2.3. Data analysis

Analysis of water quality parameters includes matrix compilation, compiled through desk studies (literature studies) so that the boundary parameters needed for seaweed cultivation can be identified. Moreover, analysis of water quality parameters, including the suitability matrix design, was compiled through literature. The “suitable” class is given a score of 4, the “suitable enough” class is given a score of 3, the “suitable with conditionals” class is given a score of 2, and the “unsuitable” class is given a score of 1 (Table 2).

Table 2. Water quality for seaweed aquaculture in Muara Gembong Sub-District

| Parameters       | Unit   | Suitable | Suitable enough | Suitable with conditionals | Not suitable |
|------------------|--------|----------|-----------------|---------------------------|--------------|
| Depth            | (m)    | 6.03 - 1.5| 1.49 - 1.0      | 0.9 - 0.5                 | < 5          |
| Secchi disk transparency | (cm) | 153.3 - 75.0| 50.0 - 74.7 | 25.0 - 49.9 | < 25 |
| Temperature      | (°C)   | 29.0 - 32.0| 27.0 - 28.9     | 26.0 - 29.9               | < 26         |
| Salinity         | (ppt)  | 16.0 - 25.0| 14.0 - 15.9     | 12.0 - 13.9               | < 12         |
| pH               | (unit) | 7.5 - 8.5 | 7.0 - 7.49      | 6.5 - 6.9                 | < 6.5        |
| DO               | (mg/L) | 6.5 - 8.5 | 5.0 - 6.49      | 4.0 - 4.9                 | < 4          |
| Phosphate        | (mg/L) | 0.03 - 0.05| 0.02 - 0.03     | 0.01 - 0.02               | < 0.01       |
| Nitrate          | (mg/L) | 0.7 - 0.9 | 0.5 - 0.69      | 0.2 - 0.49                | < 0.2        |

Water quality parameters that have a stronger effect are given a higher score, which has a lower effect [12]. The level of suitable area to each parameter refers to [13-18] (Table 1). Analyzing data between primary water quality parameters and coordinate stations using GIS to obtain the suitable seaweed culture area (Figure 2).

Figure 2. Flow chart of the determination of suitable areas for seaweed culture using GIS software
3. Results

3.1. Water quality on a coastal area

The results of water quality analysis from 11 stations in the Muara Gembong coastal area resulted in an average value of three samples, which can be seen in Table 3. Data and information on water quality, taken from [19], were analyzed to focus on locations that would meet the criteria for the development of seaweed culture in the Muara Gembong Coastal area. During this time, cultivation activities carried out in fish ponds combined with *Chanos chanos*. So, by choosing stations that focus on coastal areas make it easier to analyze suitability, because there is water that always floods during the lowest recede.

The average water depth value of Front Muara Bendera (6.03 m) and Front Muara Mati (5.37 m) was classified as deep, in comparison with other stations. During the repetition of three times sampling, the water depth in the Muara Gembong coastal area is classified as shallow water, so the survey ship to the research station must be rotated first. As can be seen in Table 3, the bottom depth for three repetitive samplings in the Muara Blacan, Nawan, and CBL (Cikarang Bekasi Laut) stations have been identified. The Secchi disk water transparency value for observation in all stations is linear between the depth and brightness of the water. The water conditions are proven by the maximum depth and also the maximum water transparency. The water depth and brightness at the Muara Bendera station can be seen. The depth of water at the Muara Blacan, Nawan, and CBL stations only reaches a maximum depth of 0.77 m (77 cm) and has a maximum brightness level of 0.48 m (48 cm).

| Stations | Locations                  | Depth (m) | σ    | Transparency (cm) | σ    | Temperature (°C) | σ    | Salinity (%) | σ    | pH    | σ    | DO (mg/L) | σ    | Phosphate (mg/L) | σ    | Nitrate (mg/L) | σ    |
|----------|---------------------------|-----------|------|------------------|------|------------------|------|--------------|------|-------|------|-----------|------|------------------|------|----------------|------|
| 1        | Front of Muara Bendera   | 6.03      | 0.76 | 153.33           | 20.00| 32.24            | 2.36 | 17.27        | 4.28 | 8.23  | 0.06 | 7.23      | 0.48 | 0.040            | 0.005| 0.894          | 0.316|
| 2        | Front of Muara Mati      | 5.37      | 1.13 | 145.00           | 32.53| 31.71            | 1.88 | 16.97        | 10.49| 8.18  | 0.25 | 7.01      | 0.51 | 0.030            | 0.007| 0.842          | 0.025|
| 3        | Outtermost of Muara Mati | 3.18      | 7.27 | 73.33            | 144.14| 31.26            | 2.23 | 16.00        | 12.06| 8.09  | 0.28 | 6.70      | 1.95 | 0.012            | 0.004| 0.825          | 0.070|
| 4        | Muara Besar              | 3.05      | 4.78 | 70.00            | 18.93| 30.72            | 1.37 | 14.83        | 10.73| 8.04  | 0.15 | 6.32      | 0.54 | 0.012            | 0.002| 0.781          | 0.034|
| 5        | Adan                     | 1.70      | 0.29 | 70.00            | 23.09| 30.49            | 5.28 | 13.83        | 3.24 | 7.87  | 0.28 | 5.87      | 0.92 | 0.012            | 0.005| 0.813          | 0.108|
| 6        | Muara Kantoel           | 1.53      | 0.42 | 58.33            | 15.28| 30.38            | 2.80 | 11.33        | 0.38 | 7.86  | 0.43 | 5.45      | 0.95 | 0.008            | 0.005| 0.554          | 0.109|
| 7        | Outtermost Muara Kantoel | 1.07      | 2.00 | 53.33            | 46.19| 30.09            | 1.50 | 10.80        | 8.32 | 7.22  | 0.33 | 5.42      | 2.34 | 0.005            | 0.013| 0.468          | 0.039|
| 8        | Muara Jaya              | 1.00      | 0.40 | 50.00            | 36.06| 29.87            | 1.11 | 9.93         | 5.19 | 7.48  | 0.58 | 4.80      | 1.42 | 0.005            | 0.016| 0.183          | 0.171|
| 9        | Muara Blacan           | 0.77      | 2.12 | 48.33            | 0.00 | 29.82            | 2.64 | 9.20         | 5.56 | 7.66  | 0.31 | 4.38      | 1.72 | 0.005            | 0.002| 0.352          | 0.244|
| 10       | Nawan                   | 0.73      | 0.42 | 43.33            | 36.06| 29.77            | 2.12 | 5.20         | 8.02 | 3.56  | 0.44 | 2.46      | 0.78 | 0.005            | 0.027| 0.311          | 0.265|
| 11       | CBL                     | 0.57      | 0.26 | 40.00            | 28.87| 29.57            | 2.57 | 0.27         | 0.46 | 3.54  | 0.60 | 2.46      | 2.12 | 0.003            | 0.016| 0.290          | 0.054|

The average values for three repeated samplings were not seen at significant differences in water temperature. The water temperature values of all stations have a range between 29.7-32.4°C. The average concentration of water quality parameters seen differs between stations close to the mainland and stations close to the sea, based on salinity and Dissolved Oxygen (DO). Stations that are close to the sea tend for salinity values to increase even though their value is still affected by high freshwater.

The values can be proven by the average maximum salinity between 16.9-27.3 % found at the end of Muara Mati (16.97 %) and in front of the Muara Mati station (16.00 %). In comparison, the maximum salinity value is 17.27 %, which was found in front of the Muara Bendera station. This value is more linear with the average DO value, where water classified as directed to the sea, has a value range of 5-7 mg/L. Higher DO concentrations are found in Muara Mati Front (7.01 mg/L) and Front of Muara Bendera (7.23 mg/L), while low DO concentrations were found at CBL station (2.46 mg/L). The average pH concentration for 3 repeated samplings has a range between 7.46-8.23 but does not show a significant difference between all research stations.

To obtain the results of the analysis, in addition to in-situ measurements, also carried out water quality parameter analysis in the laboratory, which was the concentration of phosphate and nitrate. The results of phosphate and nitrate concentrations have a range of values from 0.003 to 0.40 mg/L, while nitrates produce an average value ranging from 0.200 to 0.892 mg/L. From these parameters, higher
concentrations are found in open water, and also all locations have a more significant influence on ocean waves than water flow from rivers. Higher nitrate concentration values were found at the front of Muara Bendera station (0.894 mg/L), the front of Muara Mati station (0.842 mg/L), and also the outermost of Muara Mati (0.825 mg/L). Variations in the distribution of phosphates and nitrates in Muara Gembong coastal area are caused by the differences in temperature, wind direction, season, and sea wave distribution patterns from the Jakarta Bay and the North beach of Java.

3.2. Suitability of coastal water
The results of the scoring analysis to see the suitability level of the waters as an area of seaweed culture development is generated in the distribution of water quality parameters. The level suitability scoring has 4 categories, which are “suitable” is given a score of 4, the “suitable enough” class is given a score of 3, the class “suitable with conditionals” is given a score of 2, and the class “not suitable” is given a score of 1. The result of scoring from physical parameters (transparency, temperature, and depth) and chemical parameters (salinity, pH, DO, phosphate, and nitrate) can be seen in the distribution map (Figure 3 and 4).

The coastal area that suitable for seaweed culture development based on water quality parameters (depth and transparency) has been found on some stations with a different depth water level. Based on the water depth level, waters with the highest score are the appropriate stations. Muara Mati Front and Muara Kuntul Station Front are considered conditional based on the brightness level. In terms of depth, Muara Blacan Station is quite suitable (Figure 3). Stations leading to the sea are suitable for the development of seaweed culture, which is outermost of Muara Mati and Muara Kuntul. However, it needs further testing because it can be influenced by the wind and waves from the sea.
Figure 3. Map of suitability coastal area to seaweed culture-based on depth, transparency, temperature, and salinity in Muara Gembong Sub-District.
Figure 4. Map of suitability coastal area to seaweed culture-based on pH, DO, phosphate, and nitrate in Muara Gembong Sub-District.

The scoring result of a suitable area for seaweed culture seen from the water quality parameters (temperature and pH); they do not indicate a location that is “Not Suitable” and “Suitable enough”. From all the stations, temperature and pH concentrations are still in water quality standards for seaweed culture development. Different conditions resulted in suitable seaweed culture analysis based
on salinity concentrations. Significant differences are showed in Muara Blacan station, Nawan, and CBL stations, which are classified as “Not Suitable”. On the contrary, other stations (Asdam, Front of Muara Kuntul, Front of Muara Mati, and Outermost Muara Mati) are suitable for seaweed culture development (Figure 3). Although Muara Bendera Front station is classified as quite deep waters and has the best brightness value, its salinity concentration does not indicate that it is suitable for the development of seaweed cultivation.

The result of suitability analysis based on DO concentration found that the appropriate location is around the area of Front of Muara Mati, Outermost Muara Mati stations to Front of Muara Kuntul station. Some other stations that are still in the category of “Suitable with conditionals” are in Muara Besar, while some other stations are not recommended as a development area based on DO concentration. Whereas the results of the analysis with the parameters of phosphate and nitrate, the suitability area was found around Front of the Muara Mati Station, the Outermost Muara Mati Station, to Front of the Muara Kuntul station. The coverage area that was in a suitable area category is 962.72 Ha (9.63 km$^2$). The location also linear with the result based on salinity, DO, and brightness (water transparency).

4. Discussion

4.1. Water quality on the coastal area

The water depth in the estuary and the coastal waters of Muara Gembong is influenced by the phenomenon of erosion and water flow from the Citarum watershed [20]. The level of sediment carried by the Citarum watershed flows into the sea is more dominated by sediment flow from the downstream of the Citarum watershed, which includes the Cikao watershed, Cibeet watershed, and Citarum River Downstream of Basin. Based on the mapping data on land use areas through Citra Landsat in the estuary and coastal of Muara Gembong in 2014, land use area was 3,828.3 Ha [20]. For seaweed culture development, the method of seaweed cultivation is determined by the depth of the water, which is influenced by the changes in tides and water base contours [21].

The level of water transparency (transparency Secchi disk) obtained at all stations is very good for seaweed growth. Penetration to the bottom of the pond supports the maximum photosynthesis process. For ideal seaweed cultivation, the level of water brightness should range between 80% -100% (> 5 m) [14]. Shallow water brightness (<5 m) can reach 100% or reach the seabed. Low brightness values at CBL, Nawan, and Muara Blacan stations are caused by high turbidity with the amount of dissolved and suspended organic matter, floating objects, and light intensity. Concentrations of temperature and pH have shown that water conditions are suitable for the development of seaweed culture in the coastal area of Muara Gembong. The optimal water temperature around seaweed ranges between 26-30 °C [22]. The range of pH values can affect carrageenan seaweed yields. According to [23], pH range around 7.5-8.5 has shown an increase in carrageenan yield and decreased at pH 9.

Salinity concentrations in areas that are near the coastline have salinity concentrations between 10.80-17.27 ‰. The areas included in the coastal zone are Muara Bendera Front, Muara Mati Front, Outer Muara Mati, and Outer Muara Kuntul [2] explained that the type of seaweed that is widely cultivated in the District of Muara Gembong is Gracilaria sp., which was the type of euryhaline seaweed. This type allows Gracilaria sp. to live in salinity concentrations of around 15-30 ‰. This type of seaweed has sufficient tolerance to salinity and turbidity environments. The research results of Rohman et al. [24] found that salinity concentration in the seaweed pond area in Muara Gembong District was around 10 - 11 ‰. Rohman et al. [24] also stated that the suitable salinity for maintenance of Gracilaria sp. in a pond was around 15-25 ‰. Furthermore, Atmadja et al. [25] stated that high salinity will hamper the reproduction process of seaweed.

Dissolved oxygen concentration at the study site ranged from 5-7.24 mg / L. The lowest dissolved oxygen value was around <5 mg / L, because dissolved oxygen was lower than that value, it could be indicated that water had been disturbed. This condition happens because of the temperature rise during the day, whereas at night, due to aquatic organisms’ respiration [26]. The oil layer on the water surface and organic waste entry also caused the situation [27].
Other elements cannot replace the benefits of nitrogen and phosphate for seaweed growth. This is caused by the role of nitrogen as a protein constituent and phosphate as an energy provider [28, 29]. In nitrogen water is not less than 0.01 mg/L and phosphate ranges from 0.02-1.00 mg/L [30]. If water is deficient in nitrogen and phosphate, water is categorized as nutrient-poor waters. Phosphate content levels during the study ranged from 0.20 to 0.89 mg/L. This value is suitable for seaweed farming activities. This condition is in line with the explanation of Simanjuntak [31] and Fikri et al. [32], waters are relatively fertile if the range of phosphate nutrients in normal sea waters is 0.10-1.68 ppm.

Nitrate is one of the essential factors to support metabolic processes, growth, and living organisms [12]. According to Wahyuni et al. [33], nitrate concentration affects the growth of seaweed. The range of nitrates in aquaculture is around 0.2525-0.6645 mg/L [34]. The difference in nitrate concentrations in several research stations is due to the concentration of nitrates in the bottom of the waters. Hutabarat [35] stated that nitrate concentrations would be high due to increasing depth. Human settlements cause the difference in the average value of the nitrate parameter, so this condition allows the entry of nitrates into the waters. Water nitrate levels are affected by anthropogenic pollution originating from human activities and animal feces [36]. So based on the value of nitrate content in the waters of Muara Gembong, we can develop seaweed cultivation around Front of Muara Kuntul and Outermost of Muara Kuntul station.

4.2. Water suitability for development of seaweed culture
The distribution of each interpolated water quality parameter is based on the result of suitability scoring seaweed culture development in Muara Gembong coastal. Based on the dynamics of water quality parameters (Secchi disc transparency, temperature, and depth) and chemical parameters (salinity, pH, DO, phosphate, and nitrate) in Muara Gembong coastal area, the area classified as “suitable” are Station 7 (Front of Muara Mati), Station 8 (Outermost of Muara Mati), station 11 (Muara Kuntul) and Station 12 (front of Muara Kuntul). The research results on seaweed culture development by Alamsyah [12] showed that each of the water quality parameter variables used as a suitability level at all sampling stations had the integration of several variables with four codes of conformity, namely: very suitable (SS), suitable (S), suitable enough (CS) and not suitable (TS). The result value from the suitable cultivation area matrix will get suitability from each observation station location in the fish pond of Panaikang Village [12].

Seaweed culture in Muara Gembong is conducted with a combination of seaweed culture and fish farming. Based on the results of the suitability analysis, if seaweed culture will be developed on Muara Gembong coastal, it is necessary to create an environmentally friendly and sustainable form of seaweed culture so that the potential can be fully utilized. Besides, buffer zones and other fishing areas must be provided. The Muara Gembong coastline is located on the North Coast of Java, which is vulnerable to influences from the sea (Jakarta Bay) and land (Citarum watershed). Jakarta Bay is the estuary of 13 rivers, where rainfall around the watershed (DAS) flows into Jakarta Bay [37]. Inlet from the river certainly affects the water volume around Jakarta Bay, which can cause floods and changes the condition of the water environment from Jakarta Bay to the surrounding land (e.g., Muara Gembong, Muara Blacan, Muara Angke, etc.). One of the important rivers that disembogued into the Jakarta Bay is the Citarum river, downstream of the river is Muara Gembong waters, Bekasi District around the Jakarta Bay [38]. Also, the development of seaweed culture requires several regulations and transportation routes for fishing vessels and fishing activities [21].

5. Conclusion
Suitable areas for the development of seaweed culture on the coast of Muara Gembong are Front of Muara Kuntul to Outermost of Muara Kuntul and also Front of Muara Mati until Outermost Muara Mati. The coverage area included in the suitable area category is 962.72 Ha (9.63 km²). The location is also linear with the results based on salinity, DO, and brightness (water transparency). Those areas are high-selection locations compared to other stations in the coastal waters of Muara Gembong because the sites will save from some waste problems from the Citarum watershed and Jakarta Bay, and can also be a livelihood for the community.
Based on the suitability results and to provide better information to farmers, it is necessary to conduct substrate basic research and analysis on the coast of Muara Gembong. Studies are needed to consider that water in Muara Gembong is affected by erosion and land conversion to non-vegetation, industrial estates, housing, agriculture, and other uses. Substrates on the coast of Muara Gembong are influenced by the Citarum watershed, Cikao River basin, Cibeet River basin, and downstream of the Citarum River.

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