



Jurnal KORIDOR

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Analysis of The Suitability of Residential Land Around The Balongan Industrial Designation Area

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ARTICLE INFO

Article history:

Received 21 August 2023

Revised 13 September 2023

Accepted 29 December 2023

Available online 29 December 2023

E-ISSN: 2721-3463

P-ISSN: 2086-910X

How to cite:

Djatmiko, A., Raharja, A. B., Fadillah, M. L. (2023). Analysis of The Suitability of Residential Land Around The Balongan Industrial Designation Area. Jurnal Koridor, 14(2), 80-90.

ABSTRACT

In the analysis of the suitability of residential land locations around the Balongan industrial area, some provisions must be taken into account, one of which is land suitability, where with land suitability analysis, it is possible to determine the level of suitability of residential land that is suitable for use as a residence. To determine the limited level of land suitability by using variables determining land suitability, which includes slope, rainfall, soil texture, and land use. The analysis consisted of 3 (three) stages. The first stage used nearest-neighbor analysis to explain settlement distribution patterns. In the second stage, an analysis of the suitability of residential land was carried out using overlapping techniques related to physical environmental data based on selected variables for residential areas. The third stage is preparing recommendations for residential development locations around the Balongan industrial area with an overlay analysis based on parameters, namely parameters for protected rice fields (LSD), sustainable food agricultural land (LP2B), and the spatial pattern plan for Indramayu Regency for 2011-2031. Based on the analysis, it was concluded that there are three types of settlements around KPI Balongan. The ideal location for residential land to be developed based on land suitability analysis and spatial pattern planning is in Juntikebon Village, Sudimampir Village, with a settlement pattern that can be developed into medium and large types.

Keywords: Balongan, Industrial Area, Resident Area, Overlay Analysis

ABSTRAK

Analisis kesesuaian lokasi lahan pemukiman di sekitar kawasan peruntukan industri Balongan terdapat ketentuan yang diperhatikan salah satunya adalah kesesuaian lahan, dimana dengan analisis kesesuaian lahan dapat diketahui tingkat kesesuaian lahan pemukiman yang layak untuk dijadikan pemukiman. Untuk mengetahui tingkat kesesuaian lahan secara terbatas dengan menggunakan variabel-variabel penentu kesesuaian lahan yang meliputi kemiringan lereng, curah hujan, tekstur tanah, penggunaan lahan. Analisis yang dilakukan terdiri dari 3 (tiga) tahap, tahap pertama menggunakan analisis ketenggaan (nearest neighbor analysis) untuk menjelaskan pola sebaran permukiman. Tahap kedua dilakukan analisis kesesuaian lahan permukiman dengan teknik tumpang-susun terkait data fisik lingkungan berdasarkan variabel terpilih untuk kawasan permukiman. Tahap ketiga menyusun rekomendasi lokasi pembangunan permukiman di sekitar kawasan industri Balongan dengan analisis tumpang-susun berdasarkan parameter yaitu parameter sawah lindung (LSD), lahan pertanian pangan berkelanjutan (LP2B) dan rencana pola ruang Kabupaten Indramayu tahun 2011-2031. Berdasarkan analisis, disimpulkan terdapat tiga tipe pemukiman yang ada disekitar KPI Balongan. adapun lokasi lahan permukiman yang paling ideal untuk dikembangkan berdasarkan analisis kesesuaian lahan serta rencana pola ruang berada di Desa Juntikebon, Desa Sudimampir dengan pola permukiman yang dapat dikembangkan pada tipe sedang dan tipe besar.

Keyword: Balongan, Industri, Permukiman, Pertanian, Analisis Tumpang-susun



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<http://doi.org/10.32734/koridor.v14i2.13413>

1. Introduction

The scope of spatial planning has three points of activities that must be carried out, including planning, utilizing, and controlling space utilization activities (Sihombing, dkk., 2021). Development is part of the efforts to achieve the country's or society's vision (Prasetyawati, 2018). In the development process, there are environmental, cultural, social, economic, and physical change activities (Rosana, 2018). The community will get a positive impact from new environmental changes carried out based on development activities that have been carried out (Nurkholis, 2015). In the process of development, activities must also pay attention to the impacts caused, so in this case, human resources must minimize related environmental damage that will occur as a result of development activities to be carried out (Malihah, 2022).

Facts on the ground explain an unbalanced land supply caused by the increasing demand for land, especially in urban areas. Based on these facts, the price of field objects will undoubtedly increase. In addition, urban areas are a strategic point for industry development. Strategic land answers problems within the scope of industrial zones (Puspita, dkk., 2021). In this case, non-physical and physical factors must be considered to make land into an industrial area. Non-physical factors include government policies, the livelihood of the surrounding population, and the surrounding community (Santoso, 2019). The physical factors include land use, climate, hydrology, landform, soil type, geomorphology, and geology (Faturrahman, 2021).

Based on Government Regulation No. 14 of 2015 concerning the Industrial Development Master Plan 2015 – 2035 for the Industrial Growth Center Area (WPPI) nationally, it has 22 city district locations, including two city districts of West Java Province, which are grouped into WPPI including Indramayu Regency which is included in the Cirebon - Indramayu - Majalengka WPPI group and seen based on Presidential Regulation 81 of 2021 concerning the Tambourine area that the KPI industrial designation area in the Tambourine area has 10 KPI locations spread across Subang, Majalengka, Cirebon and Indramayu, where for Indramayu Regency itself has 6 KPIs, one of which is the Balongan KPI which is encouraged by its development for the designation of the chemical, oil and gas, food processing, fish processing, shipping industries. In addition to entering the industrial designation area, the Balongan sub-district has a Pertamina oil refinery, which can attract workers to come. This impacts land demand for residential land, which affects changes in space use.

In Balongan and Juntinyuat sub-districts included in the delineation of Industrial Designation Areas where these two sub-districts have an essential role in supporting industrial activities, it is necessary to locate settlements for workers and surrounding communities who live near suitable industrial areas and have proper land supporting factors for residential housing. This research evaluates the location of accommodations for workers and surrounding communities residing around the Balongan industrial designation area, resulting in a surge in settlement needs and suitable sites. It has supporting factors for settlement needs such as land for comfortable housing, proper and safe and adequate settlement types suitable for spatial functions in supporting the development of the area carried out location analysis in addition to Planning new residential areas must also optimize the use of residential area space.

Balongan and Juntinyuat Districts are very strategic sub-districts in Indramayu Regency because they are directly adjacent to the coastal areas of the Java Sea, but along with the development of the two sub-districts are included in the Balongan industrial designation area based on Government Regulation No. 14 of 2015 concerning the Industrial Development Master Plan 2015 – 2035. Industrial development in coastal areas indirectly impacts the social, economic, and environmental characteristics of the regions in the two sub-districts (Pinto, 2015).

The condition of existing settlements in the two sub-districts is that many people live on the coastal border. This is exacerbated by the abrasion of seawater, which is relatively high and impacts damage to the surrounding community's residential buildings. The construction of inappropriate residential areas will endanger the surrounding environment. Then, with the processing of the Balongan oil refinery, which is included in the Balongan industrial designation area, the condition of settlements in the existing location is hazardous for the local community because it is too close to the site of the Balongan oil refinery, which is less than 1 Km away, of course, this is very dangerous for the local community considering the incident in 2021 when the Balongan oil refinery explosion caused many victims of residents living around the refinery site oil.

Based on the problems found, it is necessary to evaluate the location of settlements for workers and surrounding communities living around the Balongan industrial designation area, which results in a surge in

settlement needs. Hence, there is a need for suitable locations and supporting factors for settlement needs, such as land for comfortable, safe, and adequate housing according to the function of space in supporting the development of the area.

The author chose "Analysis of Land Suitability Around KPI (Industrial Designation Area) Balongan" through the explanation above. This journal aims to identify recommendations for the location function of settlement patterns/zones around the KPI Balongan. The limitations of this study are (1) identifying the distribution of Settlement Patterns around the Balongan KPI; (2) this study includes physical aspects of land use, soil texture, Rainfall and slope that can assist in the analysis of the study and the existence of coastal boundaries at settlement sites; (3) identification of recommendations for the function of settlement patterns/zones based on land suitability, regional spatial plan documents and settlement distribution, sustainable food agricultural land (LP2B) and protected rice fields (LSD).

2. Method

The research method used uses quantitative methods. The quantitative method is a method that has material in the form of numerical data, which is then tabulated to be used as comparison material (Hermawan, 2019). The quantitative approach is a form of research analysis using numerical or statistical data (Tan, 2021). The steps taken in applying quantitative research methods are as follows:

- a. Quantitative approach to the analysis of settlement characteristics;
- b. A quantitative approach to the suitability analysis of residential land in Balongan and Juntinyuat sub-districts, and
- c. Quantitative analysis approach recommendations for the function of ideal settlement patterns/zones in Balongan District and Juntinyuat District.

The data collection method used uses primary data and secondary data. Preliminary data were obtained from field observations using aerial photography using drones to observe the condition of the area studied in the study. Secondary data is collected through direct visits to related agencies to obtain data in hardcopy and softcopy files and documents to meet research needs.

Furthermore, there are three types of data analysis methods, including (1) Nearest neighbor analysis with the target of identifying the characteristics of settlement patterns around the Balongan KPI; (2) Superimpose technique method to analyze the level of suitability of residential land in KPI Balongan; (3) Method Superimpose analysis technique to formulate recommendations for the function of settlement patterns/zones in spatial plans that are by the potential development of the area.

3. Discussion

3.1 Research Results

a. Location and Administrative Boundaries of the Region

Balongan District and Juntinyuat District are the two administrative districts in Indramayu Regency, which are included in delineating the Balongan Industrial Designation Area (KPI). The location of the sub-district has the primary access to the national road connecting Indramayu Regency with Cirebon.

Geographically, Balongan District and Juntinyuat District have the closest distance to the city center of Indramayu, which has a relatively flat topography (0-3%) because it is on the coast of the Java Sea. Balongan District and Juntinyuat District are administratively bordered by other sub-districts, namely (1) North: Indramayu District, (2) South: Karangampel District, (3) West: Sliyeg District, and (4) East: Java Sea.

The Balongan Industrial Designation Area (KPI) is an area designated in the PSN (National Strategic Project). Balongan Industrial Designation Area (KPI) is one of 10 locations in the Indramayu regency, with a land area of 2.122 Ha located in 2 sub-districts of Balongan and Juntinyuat consisting of 12 villages.

b. Land-Use

Balongan sub-district and Juntinyuat sub-district are located in Indramyu regency, which has the following land uses:

Table 1. Proportion of Land Use Area

Classification	Area (Ha)
Industrial Buildings	430.27
Agriculture and plantations	654.07
Grassland, Reeds, Savanna	6.11
Sattlement	1.196.06
Rice field	6.069.28
Beach Border	179.69
River Border	98.23
Pond	303.16
Sum	8.936.88

Source: Indramayu Regency Base Map 2017

In the 2017 land use map document, both Balongan and Juntinyuat sub-districts have a residential land cover of 1,196 Ha, in addition to the dominance of the most extensive land cover in the two sub-districts, namely rice fields covering an area of 6,069 Ha.

c. Slope Area

Balongan District and Juntinyuat District exist on the Java Sea Coast with the following slope characteristics: The classification of slope slopes identified based on RTRW annex data of Indramayu Regency in 2011 – 2031 has two classification classes, namely 0 – 8% and 8 – 15 because, based on existing conditions, Balongan District and Juntinyuat District are on the coast of the Java Sea which dominates on a relatively flat land plot.

Table 2. Slope Area

Slove	Area (Ha)
0-8%	8100.35
8-15%	799.98
Sum	8,900.33

Source: RTRW Indramayu Regency 2011 – 2031

d. Soil Texture

Classification Soil texture is seen based on soil type data in the Balongan sub-district, and the Juntinyuat sub-district has the following soil type classification:

Table 3. Soil Type Classification

Soil Type	Soil texture	Area
Asosiasi Aluvial Kelabu & Coklat	Curently	6,279.76
Asosiasi Glei Humus	Fine	1,962.42
Asosiasi Latosol Merah & Litosol Coklat Kemerahan	Fine	681.83
Sum		8,924.00

Source: RTRW Indramayu Regency 2011 – 2031

The classification of soil types in both Balongan and Juntinyuat sub-districts has three types of soil and soil types that dominate into the two sub-districts, namely grey and brown alluvial soil types covering an area of 6,279 Ha, then low soil types, namely red Latosol & reddish-brown Latosol covering an area of 681 Ha.

e. Rainfall

The rainfall in the Balongan and Juntinyuat sub-districts has a rainfall classification of 14.3 mm/day, classifying it as low rainfall.

f. Spatial Planning Indramayu Regency 2011 2031

Balongan sub-district and Juntinyuat sub-district based on the allocation of the Indramayu Regency RTRW spatial pattern plan 2011-2031 as follows:

Table 4. Area of Space Pattern

Space Pattern	Area (Ha)
Community forest	60.07
Manufacturing	1.030.21
Aquaculture area	251.01
Pond	22.48
Rural settlement	1.471.81
Urban settlement	66.26
Food crop agriculture	6.026.87
Coastal border	0.19
River	30.72
Wetland food crops	1.82
Dryland food crops	0.66
Total	8.962.11

Source: Indramayu Regency (2012)

Based on the RTRW spatial pattern plan of Indramayu Regency 2011 – 2031, Balongan District and Juntinyuat District are included in 11 spatial pattern plan designations, including 6,026 food crop agricultural designations.

g. Protected paddy fields (LSD)

Based on Ministerial Decree ATR/Kepala BPN No.1589/SK-HK.02.01/XII/2021 About the Establishment of Protected Rice Field Maps (LSD) It is a paddy field determined to meet the availability of paddy fields to support national food security and control rapidly changing rice fields. This is a factor to become a limiting factor in this study. Indramayu Regency includes areas with protected rice fields; Balongan District and Juntinyuat District have protected rice fields spread across Balongan and Juntinyuat Districts with a total area of 5,834 Ha.

h. Population

The population in 2 (two) sub-districts, namely Balongan and Juntinyuat, in 2020 Balongan sub-district of 46,150 residents and Juntinyuat sub-district of 88,307 residents, in the overall percentage reviewed in one Indramayu district in the two sub-districts for Balongan sub-district 2.52% and Juntinyuat 4.81%.

3.2 Discussion

a. Nearest Neighbour Analysis

This analysis begins with essential data in settlement distribution maps in Balongan District and Juntinyuat District by utilizing GIS with settlement distribution data software obtained from related agencies in the form of parcels. In the stages of making the map, quoting based on Sutomo et al. (2020), The following locations: The first stage of GIS input is in the form of spatial data on the distribution of settlement parcels obtained with 2015 data that has been updated using Open Street Map in 2023, the next stage with tool boxes / Average Nearest Neighbor analysis which produces the form of nearest neighbor analysis results where settlement patterns in Balongan and Juntinyuat sub-districts are identified as follows:

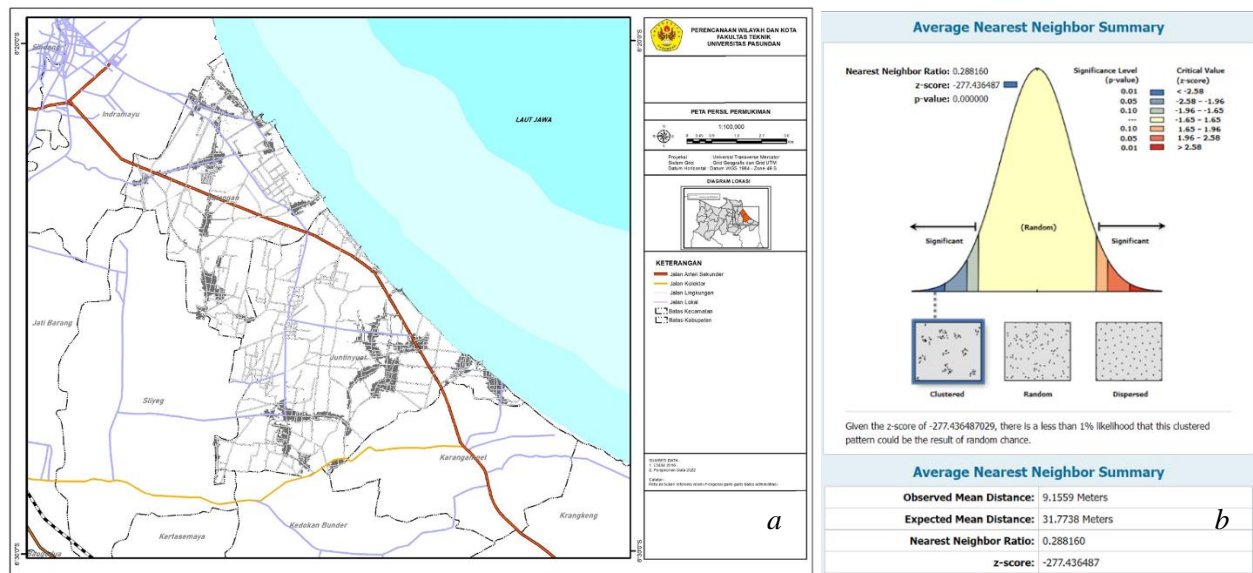


Figure 1. (a) map of the distribution of settlement Persil; (b) average nearest neighbor curve

Based on the Z-Score value, it has a value of - 277.43, which explains that the Average Nearest Neighbor calculation curve is significant in Balongan and Juntinyuat sub-districts, leading to the classification of clustered distribution patterns (see Fig 1. b). Based on the practice of the distribution of settlements based on the results of significant analysis, this is when viewed from the type based on residential occupancy; according to Sunarti (2019), the basic concept of residential housing is to provide settlements, so it consists of houses needed for low-income people, medium-income people, and high-income people. The classification of housing by size is divided into three as follows:

- Large size type house > 70 m²
- Medium-type house (54-70) m²
- Small type house (21 – 45) m²

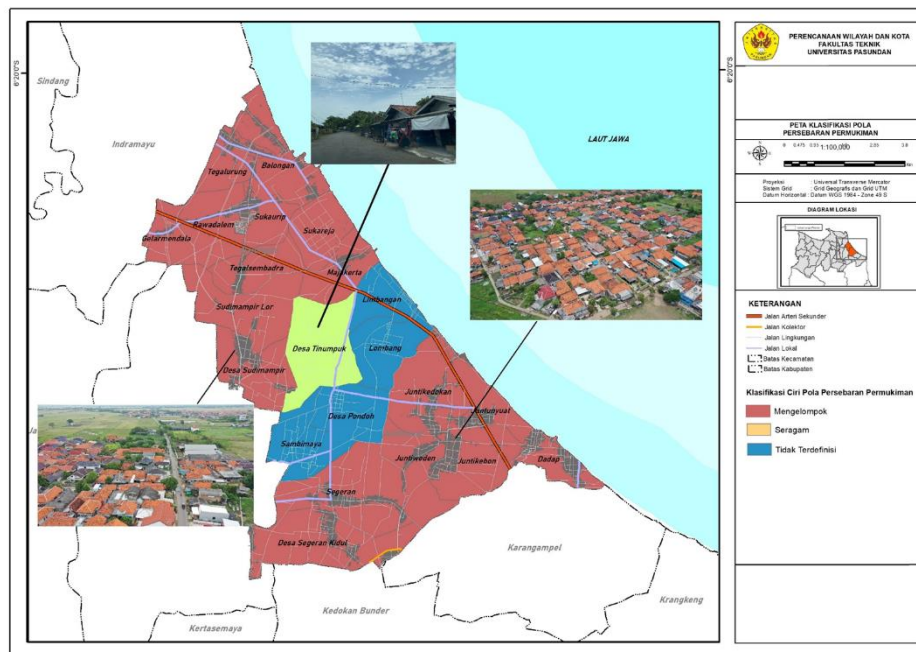


Figure 2. Distribution Map of Residential Settlement Types

Then, based on the classification table of residential types of settlements, Balongan and Juntinyuat sub-districts have three classifications of residential types consisting of large, medium, and small types spread across 22 villages and have a dominant distribution pattern characteristics in groups and uniformly, for towns that have a uniform distribution pattern are in Tinumpuk village, Juntinyuat sub-district and related to the dominance of

residential types dominating large type occupancy. The results of this field documentation were obtained based on field observations by looking directly at the existing conditions in the Balongan and Juntinyuat sub-districts.

b. Settlement Land Suitability Analysis

The analysis method used is the scoring method, overlay, to identify the level of land suitability. Multi-criteria methods with GIS to find the level of suitability of residential land are also used by (Madurika & Hemakumara, 2017), the next one is compared with the development of residential land around the Balongan Industrial Estate. Variable parameters for determining land suitability are needed, including slope, Rainfall, soil texture, and land use. These four parameters are suitable in settlement development because many settlement developments are outside the location designation for residence. The following parameters are used in the analysis of land suitability of Balongan and Juntinyuat sub-districts as follows:

- *Landuse*

Balongan and Juntinyuat sub-districts are located around the Balongan industrial allotment area (KPI). In the 2017 land use map document, both Balongan and Juntinyuat sub-districts have a residential land cover of 1,196 Ha, in addition to the dominance of the most extensive land cover in the two sub-districts, namely rice fields covering an area of 6,069 Ha (see fig 3. a).

- *Land Slope*

The classification of slope slopes identified based on RTRW annex data of Indramayu Regency in 2011 – 2031 has two classification classes, namely 0 – 8% and 8 – 15 because, based on existing conditions, Balongan District and Juntinyuat District are on the coast of the Java Sea which dominates on a relatively flat land plot (see fig 3. b).

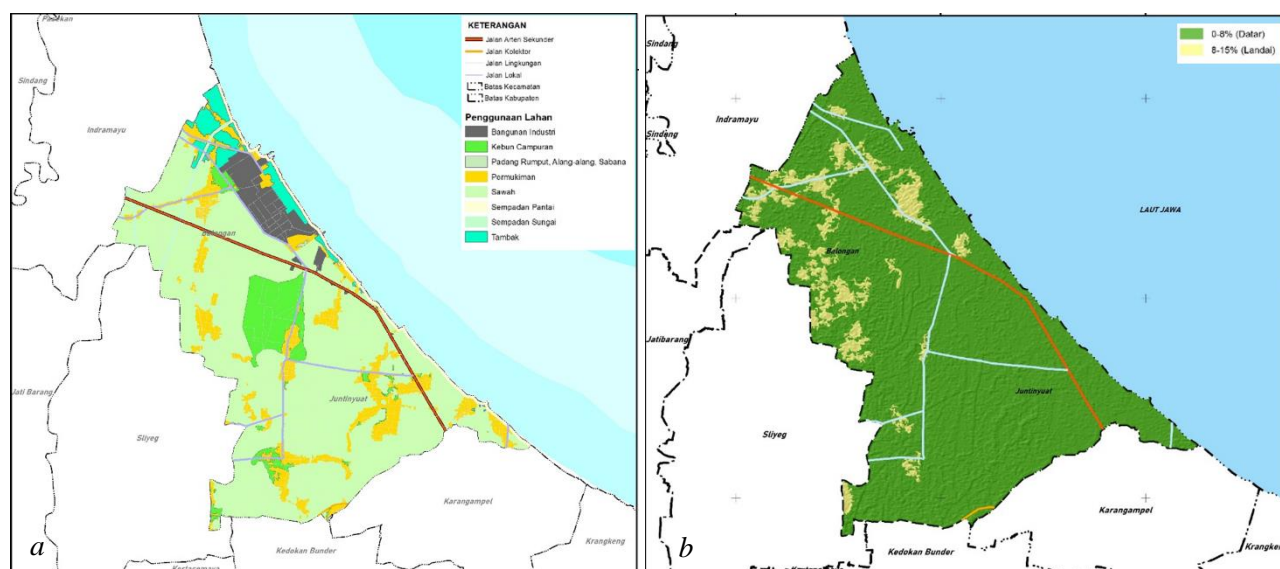


Figure 3. (a) land-use map; (b) slope map

- *Soil Texture*

The classification of soil types in both Balongan and Juntinyuat sub-districts has three types of soil and soil types that dominate into the two sub-districts, namely grey brown alluvial soil types covering an area of 6,279 Ha with medium soil texture, then low soil types, namely red Latosol & reddish-brown Latosol with fine soil texture covering an area of 681 Ha (see fig 4. a).

- *Rainfall*

Rainfall classification in Balongan sub-district and Juntinyuat sub-district has a rainfall classification with rainfall classification in both Balongan sub-district and Juntinyuat sub-district one rainfall classification of 14.3 mm/day, which classifies Low rainfall (see fig 4. b).

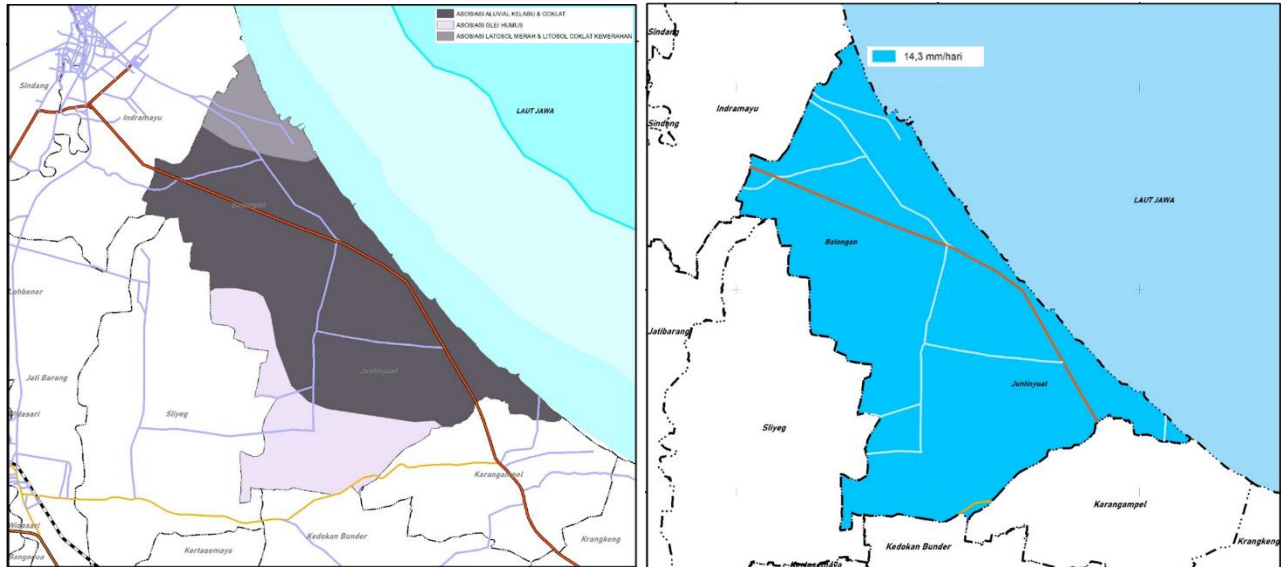


Figure 4. (a) land-use map; (b) rainfall map

c. Recommendations for ideal settlement functions with regional development potential.

In the analysis of settlement location recommendations in this study, the author is based on the journal Riski Kandriansari (2017), in which spatial analysis is carried out which an analysis of settlement distribution patterns is carried out on limiting factors, maps of protected rice fields (LSD), and sustainable food agricultural land (LP2B), regional spatial plans (RTRW), and the results of settlement land suitability analysis. The following is a map of the distribution of settlements in Balongan sub-district and Juntinyuat sub-district as follows:

- *Sustainable food farmland (LP2B)*

Based on regional regulation no. 16 of 2013 concerning sustainable food agricultural land protection, Indramayu district has sustainable agricultural rice fields (LP2B). Balongan sub-district and Juntinyuat sub-district are included in the sustainable food agricultural land (LP2B) area, which has an area of 3,785 hectares spread across the two sub-districts (see Fig 5. a).

- *Indramayu Regency RTRW Spatial Pattern Plan Document 2011 – 2031*

Based on the 2011 – 2031 Indramayu Regency RTRW spatial pattern plan, Balongan subdistrict and Juntinyuat subdistrict are included in 9 spatial pattern plan allocations, among which are dominated by the food crop area allocation of 3,780 square meters and the lowest area allocation, namely water bodies (see Fig 5. b).

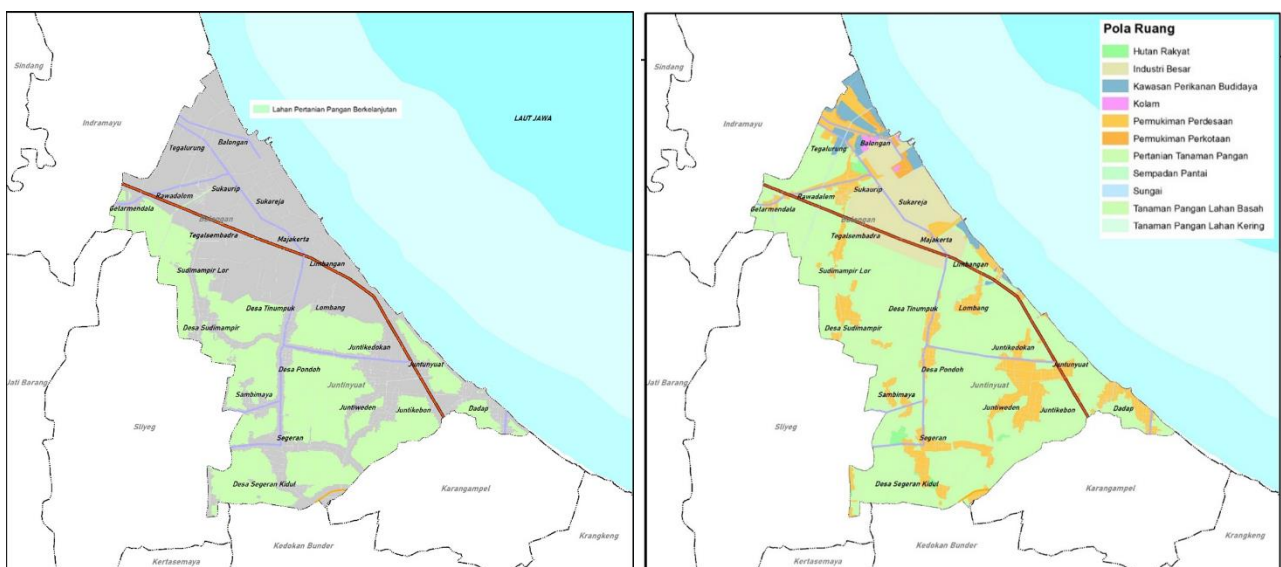


Figure 5. (a) agricultural rice fields; (b) Indramayu Regency Spatial Pattern Plan / RTRW 2011–2031 Suitability analysis of residential land availability is considered one of the most essential and practical approaches to identifying the best settlement locations (Aburas et al., 2016). The classification of the suitability of residential land in both Balongan and Juntinyuat sub-districts obtained four categories of land suitability, namely Not Suitable, Quite Appropriate, Appropriate, and Very Suitable, spread across 22 villages in both sub-districts (see Fig 6). Scientific planning and changes in land use structure to minimize the negative impacts of compatibility of land use for industrial activities with the lives of local communities is necessary and urgent (Dai et al., 2008).

However, what is no less critical is anticipating organizational developments due to new activities in suburban areas to avoid space inefficiencies (Firmansyah & Raharja, 2021). Balongan sub-district, the town that dominates the classification, is very suitable for settlements in Sukareja village, and for the appropriate category in Sudimampir lor village, then for Juntinyuat sub-district, the city that overlooks the type is very reasonable is in Juntikedokan village and the proper classification is in Segeran village. Based on the analysis of the suitability of settlement land for Balongan and Juntinyuat sub-districts classified as suitable locations for settlement development, the existing conditions are very supportive based on the four parameters used. Then, for land that is not suitable because the land is on ground that is not suitable for settlement, such as on the border.

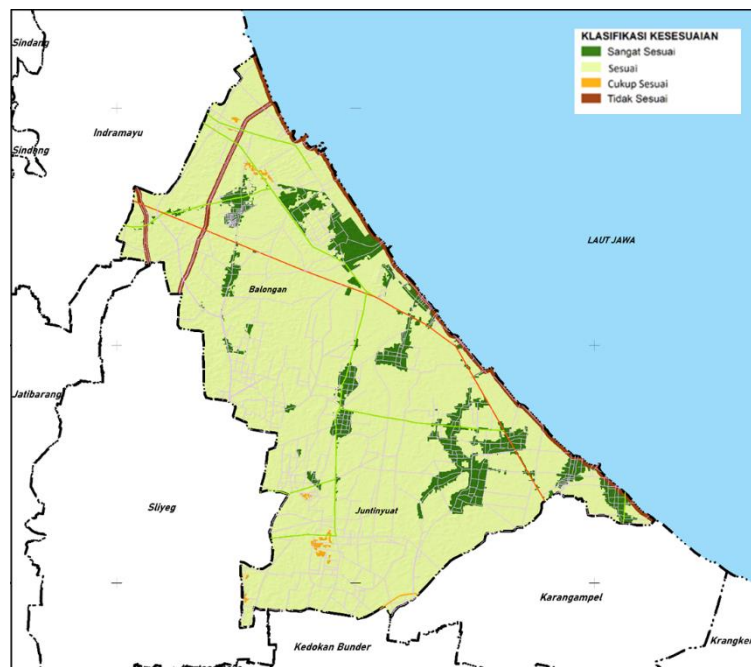


Figure 6. Settlement Land Suitability Map

This analysis uses an overlay technique with a settlement distribution pattern map and produces an ideal settlement development map based on settlement pattern distribution map data. The following is the result of the analysis of settlement distribution patterns on the protected rice field map (LSD), sustainable food agricultural land map (LP2B), and Indramayu Regency Regional Spatial Plan, and the results of the land suitability analysis classification consists of 3 categories, namely:

1. The ideal classification to develop is undeveloped and vacant land ideal for development as a settlement.
2. The ideal classification is a classification of land that has been developed, and the location is suitable for settlement construction.
3. Non-ideal classification is land or locations that have or have not been built, settlements that are not ideal for development, or are not recommended.

Based on the results of the analysis of the distribution of settlement patterns on the protected rice field map (LSD) document, the sustainable food agricultural land map (LP2B), and the Regional Spatial Plan of Indramayu Regency and the results of the land suitability analysis resulted in an ideal settlement location to be developed is excellent vacant land to be built covering an area of 250 Ha and for a perfect location area of

677 Ha then a non-ideal site covering an area of 7,997 Ha. The ideal settlement location to be developed dominates the Balongan sub-district in Balongan Village, covering an area of 20 Ha, and the Juntinyuat sub-district, which dominates the ideal location to be developed is in Juntikebon Village, covering an area of 31.93 Ha. The perfect settlement location for the Balongan sub-district is in Sudimampir village, covering an area of 49.94 Ha. In the Juntinyuat sub-district, there is Soonn village, covering an area of 76.71 Ha. A non-ideal location in the Balongan sub-district is dominated by Sudimampir Lor village; in the Juntinyuat sub-district, there is Segaran village (see Fig 7).

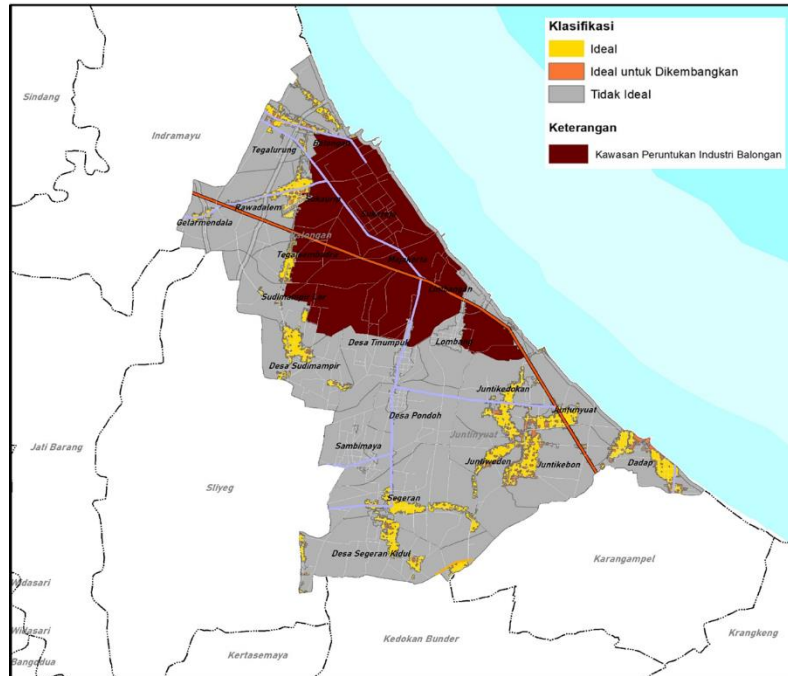


Figure 7. Ideal Settlement development map

4. Conclusion

Balongan and Juntinyuat sub-districts significantly lead to the classification of clustered distribution patterns. The category of settlement types for Balongan and Juntinyuat sub-districts has three classifications: large, medium, and small types spread across 22 villages. The classification of residential types of settlements for Balongan and Juntinyuat sub-districts has three classifications of residential types: large, medium, and small, spread across 22 villages. It has dominant distribution patterns in groups and uniformly. For towns with a uniform distribution pattern in Tinumpuk Village and Juntinyuat District, it is related to the supremacy of residential types, dominating large housing types. An assessment of land suitability of settlement land, the suitability classification of residential land in both Balongan and Juntinyuat sub-districts obtained four categories of land suitability, namely Not Suitable, Quite Appropriate, Appropriate, Very Suitable spread across 22 villages in both sub-districts.

Balongan sub-district, the town that dominates the classification, is very suitable for settlements in Sukareja village and for category according to Sudimampir lor village, then for Juntinyuat sub-district, the city that overlooks the type is very reasonable is in Juntikedokan village and the corresponding class is in Segaran village. Based on the analysis of the suitability of settlement land for Balongan and Juntinyuat sub-districts classified as suitable locations for settlement development, the existing conditions are very supportive based on the four parameters used. Then, for land that is not suitable because the land is on ground that is not suitable for settlement, such as on the border.

Recommendations for the function of the ideal settlement location pattern/zone (RTRW) with the potential for regional development: it can be concluded that the perfect settlement location for growth is in Balongan sub-district, located in Balongan Village as wide as 20 Ha and Juntinyuat sub-district which has a dominance of ideal sites to be developed is in Juntikebon Village covering an area of 31.93 Ha. The perfect settlement location for the Balongan sub-district is in Sudimampir village, covering an area of 49.94 Ha. In the Juntinyuat sub-district, Segaran town covers an area of 76.71 Ha. Sudimampir Lor village, the Juntinyuat sub-district, and Segeran village dominate a non-ideal location in the Balongan sub-district.

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