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# Development of Land Capability-Based Settlement Areas in Banyuasin District

*Pengembangan Kawasan Permukiman di Kabupaten Banyuasin Berbasis Kemampuan Lahan*

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## ABSTRAK

Kurangnya tinjauan aspek kemampuan lahan dalam pengembangan kawasan permukiman dapat mempengaruhi kondisi daya dukung dan daya tampung lingkungan, Oleh karena itu, penelitian ini bertujuan untuk menganalisis kemampuan lahan di Kabupaten Banyuasin dan merumuskan arahan penggunaan lahan sesuai kelas kemampuannya. Metode Penelitian yang digunakan adalah dengan menggunakan metode deskriptif kuantitatif dengan menggunakan pendekatan analisis spasial dengan bantuan teknik SIG (Sistem Informasi Geografis) dan analisis skoring. Hasil dari penelitian ini didapatkan bahwa SKL morfologi diklasifikasikan kedalam SKL morfologi rendah 96,77% dan kurang 3,23%, SKL kemudahan dikerjakan tinggi 48,11% dan rendah 24,83%, SKL kestabilan lereng dengan klasifikasi kestabilan lereng tinggi 48,11% dan rendah 24,83%, SKL kestabilan pondasi dengan klasifikasi tinggi 48,11% dan rendah 24,83%, SKL ketersediaan air dengan klasifikasi tinggi 48,11% dan sangat rendah 24,83%, SKL drainase dengan klasifikasi tinggi 56,62% dan kurang 46,11%, SKL erosi dengan klasifikasi tinggi 31,80% dan sangat rendah 1,85%, SKL pembuangan limbah dengan klasifikasi cukup 46,11% dan kurang 56,62%, SKL rawan bencana dengan klasifikasi tinggi 48,11% dan rendah 24,83% Dalam penelitian ini dapat disimpulkan bahwa daerah penelitian terbagi menjadi 3 kelas kemampuan lahan pengembangan, yaitu kelas kemampuan lahan pengembangan sangat tinggi, kelas kemampuan lahan pengembangan agak tinggi, dan kelas kemampuan lahan pengembangan rendah.

Kata kunci: satuan kemampuan lahan, wilayah, spasial

## ABSTRACT

Lack study of land capability aspects in development of residential area affect the carrying capacity of environment. Therefore, this study aimed to analyze the land capability in Banyuasin District and formulate the land use directions according to its capability class. The research method used descriptive quantitative method using a spatial analysis approach with Geographic Information System and scoring analysis. The study

results found out that the LCU of morphology was classified into low morphological LCU of 96.77% and less morphological LCU of 3.23%, the LCU of ease of work was high 48.11% and low 24.83%, the LCU of slope stability with the classification of high slope stability of 48.11% nd low slope stability of 24.83%, the LCU of foundation stability with high classification of 48.11% and low classification of 24.83%, the LCU of water availability with high classification of 48.11 and very low classification of 24.83%, the LCU of drainage with high classification of 56.62% and less classification of 46.11%, the LCU of erosion with high classification of 31.80% and very low classification of 1.85%, the LCU of waste disposal with sufficient classification of 46.11% and less classification of 56.62%, the LCU of disaster prone with high classification of 48.11% and low classification of 24.83%. In conclusion, the research area was divided into 3 classes of very high, moderately high, and low land development capability.

Keywords: land capability unit, regional, spatial

## INTRODUCTION

Over four decades, cities in Indonesia have experienced dramatic population growth (Prihatin, 2016). The value of ecosystem services has been declining rapidly due to changes in land use/land cover driven by urbanization over the last few decades (Liu et al., 2019). Population growth is related to land use change (Leyk et al., 2020). The availability of space in urban areas that is fixed and limited causes the taking of space in suburban areas to meet space needs in urban areas (Tambani, 2018). The growth of settlements has an impact on environmental conditions which also change in line with changes in land use into residential land (Lambris et al., 2021). Based on (BPS Banyuasin, 2021) increasing of Banyuasin District population has gone up by a third in the last two decades, from 639,000 people in 2000 to 818,766 people in 2020, as a result, the need for housing will also increase. The area of Banyuasin District is 11,832.99 km², it is projected that the need for housing facilities in Banyuasin District in 2021 is 194,576.40 units and will continue to increase in 2032 to 227,776.20 units (Pemerintah Kabupaten Banyuasin, 2019). The increasing need for residential land and the limited availability of residential land require special attention in providing land for settlements (Bjørn et al., 2016). The capability of residential land is the one that can function as a permanent residence and form a settlement (Pasya, 2012). The land capability is a reflection of the physical capacity of the environment which is reflected by topography, soil, hydrology, and climate conditions, as well as the dynamics that occur, especially erosion, flooding and others (Duwila et al., 2019).

In some parts of Africa, predominantly rural communities are experiencing accelerated urban growth and a very visible boom in development (Goodfellow, 2017). According to (Agnar et al., 2020), the land capability analysis in the form of rock physical characteristics, slope, geological hazard, groundwater potential, drainage, and rainfall is very important in determining land suitability which will regulate residential land use. Optimization of land use plans can be done by classifying the land based on the capability and suitability of the land useful for the conservation of soil resources (De Feudis et al., 2021). The improved land capability classification methods produce land use arrangements usable in rural area management policies and help mitigate the current major global problem, namely land degradation (Costa et al., 2019).

The lack of of study land capacity aspect in the development of residential areas can affect the condition of the carrying capacity and capacity of the environment, therefore it is important to conduct a land capability study because the use of a land should be in accordance with the ability of the land (Suhairin, 2019). The land use that is not in

accordance with the designation of land capabilities will accelerate the decline in land productivity (Tscharntke et al., 2012). Land capability for the development areas in Banyuasin District City of Palembang has not been studied using an assessment of various parameters of the land capability unit. This needs to avoid the use of land irregularly, and not in accordance with the capability of the land. This study aimed to analyze the land capability in Banyuasin District and formulate land use directions according to the capability class.

## MATERIALS AND METHODS

The study was conducted in Banyuasin District which was an area that borders Palembang Metropolitan City, South Sumatra, Indonesia which was geographically located between $1^0$ 37′32.12″ to $3^0$ 09′15.03″SL and $104^0$ 02′21.79″ to $105^0$ 33′38.5″ EL. Banyuasin District consists of 21 subdistricts and has an area of 11,832.99 $km^2$. The topography condition of Banyuasin District is dominated by relatively flat and undulating areas of 0-45 MASL (Meter Above Sea Level) spread throughout the subdistricts. Judging from the slope, the mainland of Rambutan Subdistrict, Banyuasin District was in the range of slopes of 0-2% 2-15% and 15-25%.

The data used in this study were primary and secondary data. The primary data were taken from the field observation and the secondary data were taken from the agency in the forms of administrative maps and supporting maps related to topographic maps, morphological maps, slope maps, geological maps, rainfall maps, land use maps (Abdelrahman et al., 2016; Maroeto et al., 2019).

The research method was a descriptive quantitative method using a spatial analysis approach with GIS (Geographic Information System) technique and scoring analysis. The Geographic Information System (GIS) technique has proven to be a helpful and successful tool in studying, mapping, processing, and presenting spatial data, as well as being an effective tool for evaluating land physical capabilities and suitability (Fonataba et al., 2020; Habibie et al., 2021). Integrating remote sensing data with digital soil maps using GIS results in a well-defined elaboration of land capability classification mapping (Gad, 2015). To obtain the land suitability of an area, a land capability analysis was used as the basis for assessing the land suitability.

The land capability analysis was based on and referring to the Regulation of the Minister of Public Works No. 20 of 2007 concerning technical guidelines for analyzing physical and environmental, economic and socio-cultural aspects in the preparation of spatial plans (Ministry of Public Works, 2007). This land capability analysis was compiled based on the type of Land Capability Unit (LCU) in the planning area, including: LCU of morphology (landscapes), LCU of ease of work, LCU of slope stability, LCU of foundation stability, LCU of water availability, LCU of drainage, LCU of erosion, LCU of waste disposal, and LCU of natural disasters. The research variables used in the land capability (Table 1) were from the evaluation to the analysis of the LCU, then the calculation of the land capability map and the results of the superimposition of various previous LCU maps, using the weighted values for each LCU (Table 2).

Classification of land capability for urban areas was conducted by overlaying each unit of land capability that was already obtained by multiplying the final value (level of land capability in each LCU) with its weight one by one so that a map of the total final value multiplied by the cumulative weight of all LCU was obtained. The result of multiplying the final value by the weight of each unit referred to as the score (score = final value x weight).

The division of land capability class development classification was divided into five development classifications, namely: very low, low, medium, high, and very high land capability class (Table 3).

Table 1. Definition of operational variables

| Objectives | Variable | Indicators |
|---|---|---|
| Analysis of Land Capability | Land Capability | LCU of Morphology |
| | | LCU of Ease of Work |
| | | LCU of Slope Stability |
| | | LCU of Foundation Stability |
| | | LCU of Water Availability |
| | | LCU of Drainage |
| | | LCU of Erosion |
| | | LCU of Waste Disposal |

Note: Regulation of minister of public works number 20 of 2007 concerning techniques for analysis of physical & environmental, economic and socio-cultural aspects in the preparation of spatial planning

Table 2 Weighting of land capability unit

| Land Capability Unit | Indicators |
|---|---|
| LCU of Morphology | 5 |
| LCU of Ease of Work | 1 |
| LCU of Slope Stability | 5 |
| LCU of Foundation Stability | 3 |
| LCU of Water Availability | 5 |
| LCU of Drainage | 3 |
| LCU of Erosion | 5 |
| LCU of Waste Disposal | 0 |
| LCU of Disaster Prone | 5 |

Note: Regulation of minister of public works number 20 of 2007 concerning techniques for analysis of physical & environmental, economic and socio-cultural aspects in the preparation of spatial planning

Table 3. Classification of land capability

| Land Capability | Classification of Development |
|---|---|
| Class A | Very Low Development Cability |
| Class B | Low Development Capability |
| Class C | Medium Development Capability |
| Class D | High Development Capability |
| Class E | Very High Development Capability |

Note: Regulation of minister of public works number 20 of 2007 concerning techniques for analysis of physical & environmental, economic and socio-cultural aspects in the preparation of spatial planning

The overall analysis of the LCU was the analysis of land capability looking at the carrying capacity of land suitable for being developed as an urban area with the intensity of cultivation activities in it, be it settlements, agriculture, plantations and other cultivation activities.

## RESULTS

This chapter describes the results of the study in accordance with the research objective, namely to analyze the land capability for the development of residential areas in the Banyuasin District areas. The purpose of the land capability analysis was to identify the characteristics of environmental physical resources so that the land use in regional and regional development could be carried out optimally while taking into account the balance of the ecosystem.To obtain an overview of the level of land capability to be developed as an urban area, as a reference for the directions of land suitability at the analysis stage such as LCU of Morphology, LCU of Ease of Work, LCU of Slope Stability, LCU of Foundation Stability, LCU of Water Availability, LCU of Erosion, LCU of Drainage, LCU of Waste Disposal, and LCU of Natural Disasters.

### Unit of Morphological Land Capability

The unit analysis of morphological land capability aimed to sort out the shape of the landscape/morphology in the planning area

or area capable of being developed according to its function. The morphological LCU map was derived from the morphological and slope maps and was supported by the regional observations. The results of the analysis were to determine the extent of the Morphological LCU for the development of residential areas in the Banyuasin District (Table 4 & Figure 1).

**Land Capability Unit that is Easy to Work on**

Ease of conducting LCU analysis aimed to find out the level of ease of land in the region and/or area to be very well thought over in the area development process. The data needed for making LCU of maps were easy to work with, namely topographic maps, morphological maps, slope maps, geological maps, surface geological maps, and current land use maps. Topographical and morphological aspects determined the ease of access to the site.

The slope aspect determined the stability of the land and the thickness of the soil to be worked on. The geological and surface geology aspects determined the hardness of the land to be worked on and the current land use aspect was a reference for land work. The results of the analysis to find out the area of LCU of Ease of Work for the development of residential areas in Banyuasin District (Table 5 & Figure 2).

**Land Capability Unit of Slope Stability**

LCU of analysis of slope stability aimed to determine the level of slope stability in the development area in accepting the load. The slope stability was the area that could be said to have stable or unstable land condition by looking at the slope of the land. The topographical and morphological aspects determined the height of the place affecting the magnitude of the gravitational force.

The slope aspect determined the acceleration of gravity which affects the movement of soil or rock material. The aspects of geology and surface geology determined the hardness of materials and rocks affecting the consistency of the material against movement or pressure. The current land use was used as a reference to determine the appropriate buffer plants for an area. The rainfall data determined the amount of exogenous energy that played a very important role in the movement of soil or rock masses.

The characteristics of shallow groundwater determined the saturation of water in the soil or rock; the water-saturated materials were unstable and easily mobile materials. The data on the natural disasters, especially landslides, were a strong indication that an area had unstable slopes. The results of the analysis were to find out the area of LCU of Slope Stability for the development of residential areas in Banyuasin District (Table 6 & Figure 3).

**Land Capability Unit for Foundation Stability**

LCU of analysis of foundation stability was determined mainly by the type and physical properties of the bedrock, the presence of geological structures in the form of joints and/or faults, and slope stability in the planning area. An area that has a steep slope (a slope of more than 15%) will have problems with the stability of the area's foundation because it was vulnerable to soil erosion under the building used as the foundation. Planning areas having unstable slopes made it difficult to support heavy buildings because the additional load would reduce their stability.

The land use was currently used as a reference to determine the ability of an area to support existing heavy buildings. Shallow groundwater characteristics determined the saturation of water in soil or rock, water-saturated materials were unstable and easy to move as a result they were not recommended to be built with heavy buildings. The results of the analysis were to find out the area of LCU of Slope Stability for the development of residential areas in Banyuasin District (Table 7 & Figure 4).

**Land Capability Unit of Water Availability**

LCU of water availability analysis aimed to find out the level of water availability and the ability of water supply at each level for regional development. The data needed in the preparation of map of the LCU of water availability were: morphological maps, slope maps, geological maps, surface geological maps, current land use maps, rainfall maps, hydrological data, and climatological data. The results of the analysis were to find out the area of LCU of Water Availability for the development of residential areas in Banyuasin District (Table 8 &Figure 5).

**Land Capability Unit of Drainage**

The LCU analysis for drainage aimed to find out the level of land ability to regulate rainwater naturally so that the possibility of inundation, both local and widespread, could be avoided. To avoid the possibility of inundation or flooding, both local and widespread throughout the planning area, it was necessary to pay attention to the ability of the area to accelerate the drainage.

The studied drainage capability was mainly its natural ability, namely the process of flowing water in the drainage system channel naturally following the force of gravity. The factors that would have a strong influence on the drainage process were the slope of the soil, the physical properties of the soil, the magnitude of the land cover coefficient (LCC), and the availability of surface water (rivers). The results of the analysis were to find out the area of the LCU of Drainage for the development of residential areas in Banyuasin District (Table 9 & Figure 6).

Table 4. Morphological land capability unit area

| Subdistrict | Less Morphology | Low Morphology | Total |
|---|---|---|---|
| Air Kumbang | - | 328.56 | 328.56 |
| Air Saleh | 6.95 | 304.62 | 311.57 |
| Banyuasin I | 3.42 | 183.27 | 186.69 |
| Banyuasin II | 142.20 | 3,350.44 | 3,492.64 |
| Banyuasin III | 26.38 | 267.82 | 294.20 |
| Betung | 27.30 | 327.11 | 354.41 |
| Karang Agung Ilir | 0.38 | 139.39 | 139.76 |
| Makarti Jaya | 8.33 | 291.95 | 300.28 |
| Muara Padang | 1.15 | 916.45 | 917.60 |
| Muara Sugihan | 10.36 | 686.04 | 696.40 |
| Muara Telang | 2.70 | 338.87 | 341.57 |
| Pulau Rimau | 2.71 | 473.95 | 476.66 |
| Rambutan | 20.54 | 429.50 | 450.04 |
| Rantau Bayur | 46.01 | 510.90 | 556.91 |
| Selat Penuguan | 1.13 | 410.84 | 411.98 |
| Sembawa | 17.17 | 178.97 | 196.14 |
| Suak Tapeh | 20.34 | 292.36 | 312.70 |
| Sumber Marga Telang | 1.31 | 173.58 | 174.89 |
| Talang Kelapa | 6.09 | 433.34 | 439.43 |
| Tanjung Lago | 10.65 | 791.77 | 802.42 |
| Tungkal Ilir | 27.63 | 620.51 | 648.14 |
| Total | 382.74 | 11,450.25 | 11,832.99 |
| Percentage (%) | 3.23 | 96.77 | 100.00 |

Note: Analysis results

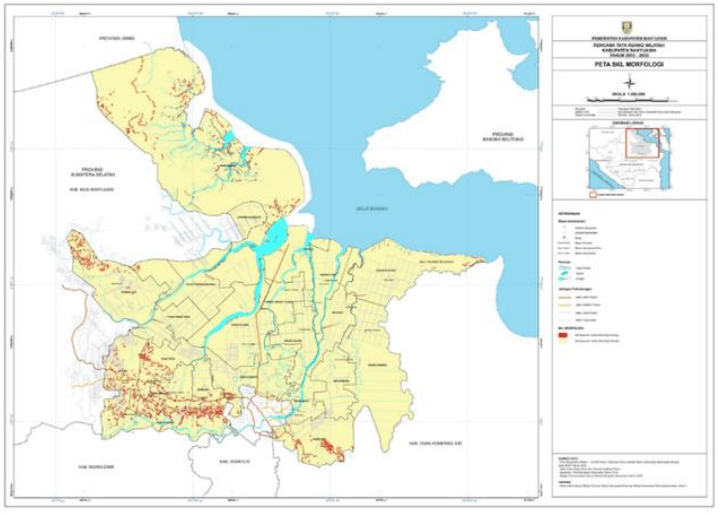

Figure 1. Map of morphological land capability unit

Table 5. The unit area of land capability easy to work on

| Subdistrict | Less Ease of Work | Low Ease of Work | High Ease of Work | Total |
|---|---|---|---|---|
| Air Kumbang | 101.86 | 79.71 | 146.99 | 328.56 |
| Air Saleh | 19.24 | 30.66 | 261.68 | 311.57 |
| Banyuasin I | 26.01 | 48.43 | 112.25 | 186.69 |
| Banyuasin II | 1,708.40 | 1,258.17 | 526.06 | 3,492.64 |
| Banyuasin III | 11.63 | 35.29 | 247.28 | 294.20 |
| Betung | 116.72 | 15.62 | 222.07 | 354.41 |
| Karang Agung Ilir | 14.11 | 27.07 | 98.58 | 139.76 |
| Makarti Jaya | 23.76 | 32.64 | 243.83 | 300.28 |
| Muara Padang | 47.55 | 299.53 | 570.52 | 917.60 |
| Muara Sugihan | 200.23 | 79.26 | 416.90 | 696.40 |
| Muara Telang | 44.86 | 9.18 | 287.50 | 341.57 |
| Pulau Rimau | 122.94 | 95.55 | 258.17 | 476.66 |
| Rambutan | 113.28 | 169.37 | 425.56 | 450.04 |
| Rantau Bayur | 47.08 | 36.61 | 473.22 | 556.91 |
| Selat Penuguan | 25.09 | 66.92 | 319.96 | 411.98 |
| Sembawa | 92.83 | 25.92 | 77.40 | 196.14 |
| Suak Tapeh | 101.50 | 45.83 | 165.37 | 312.70 |
| Sumber Marga Telang | 32.30 | 28.88 | 113.70 | 174.89 |
| Talang Kelapa | 100.56 | 163.57 | 175.30 | 439.43 |
| Tanjung Lago | 265.86 | 208.85 | 327.67 | 802.42 |
| Tungkal Ilir | 244.91 | 180.60 | 222.63 | 648.14 |
| Total | 3,460.74 | 2,937.65 | 5,692.64 | 11,832.99 |
| Percentage (%) | 29.25 | 24.83 | 48.11 | 100.00 |

Note: Analysis results

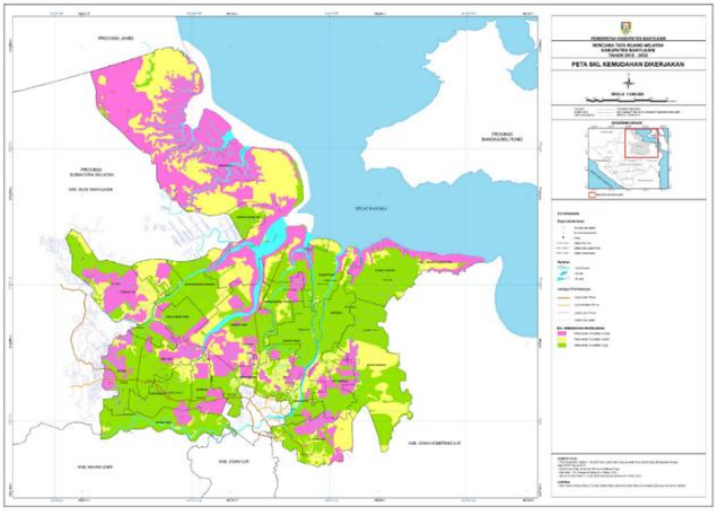

Figure 2. Map of land capability unit easy to work on

Table 6. The unit area of land capability of slope stability

| Subdistrict | Less Slope Stability | Low Slope Stability | High Slope Stability | Total |
|---|---|---|---|---|
| Air Kumbang | 101.86 | 79.71 | 146.99 | 328.56 |
| Air Saleh | 19.24 | 30.66 | 261.68 | 311.57 |
| Banyuasin I | 26.01 | 48.43 | 112.25 | 186.69 |
| Banyuasin II | 1,708.40 | 1,258.17 | 526.06 | 3,492.64 |
| Banyuasin III | 11.63 | 35.29 | 247.28 | 294.20 |
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| Makarti Jaya | 23.76 | 32.64 | 243.83 | 300.28 |
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| Rambutan | 113.28 | 169.37 | 425.56 | 450.04 |
| Rantau Bayur | 47.08 | 36.61 | 473.22 | 556.91 |
| Selat Penuguan | 25.09 | 66.92 | 319.96 | 411.98 |
| Sembawa | 92.83 | 25.92 | 77.40 | 196.14 |
| Suak Tapeh | 101.50 | 45.83 | 165.37 | 312.70 |
| Sumber Marga Telang | 32.30 | 28.88 | 113.70 | 174.89 |
| Talang Kelapa | 100.56 | 163.57 | 175.30 | 439.43 |
| Tanjung Lago | 265.86 | 208.85 | 327.67 | 802.42 |
| Tungkal Ilir | 244.91 | 180.60 | 222.63 | 648.14 |
| Total | 3,460.74 | 2,937.65 | 5,692.64 | 11,832.99 |
| Percentage (%) | 29.25 | 24.83 | 48.11 | 100.00 |

Note: Analysis results

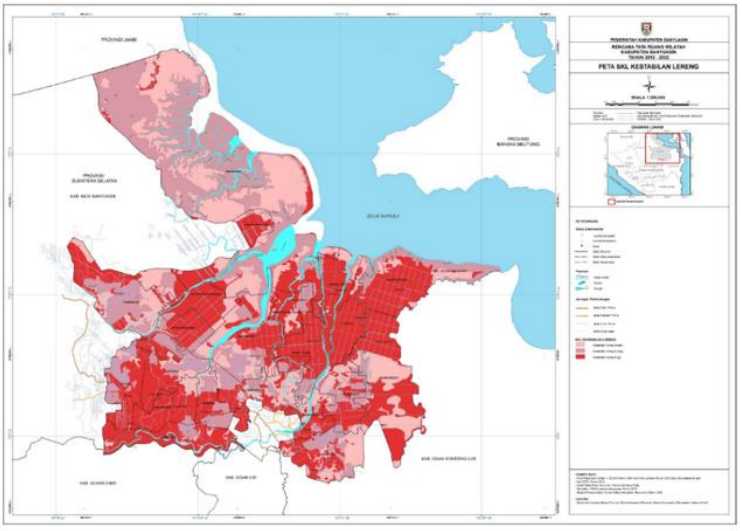


Figure 3. Map of land capability unit of slope stability

Table 7. The unit area of the land capability of the foundation stability

| Subdistrict | Less LCU of Foundation Stability | Low LCU of Foundation Stability | High LCU of Foundation Stability | Total |
|---|---|---|---|---|
| Air Kumbang | 101.86 | 79.71 | 146.99 | 328.56 |
| Air Saleh | 19.24 | 30.66 | 261.68 | 311.57 |
| Banyuasin I | 26.01 | 48.43 | 112.25 | 186.69 |
| Banyuasin II | 1,708.40 | 1,258.17 | 526.06 | 3,492.64 |
| Banyuasin III | 11.63 | 35.29 | 247.28 | 294.20 |
| Betung | 116.72 | 15.62 | 222.07 | 354.41 |
| Karang Agung Ilir | 14.11 | 27.07 | 98.58 | 139.76 |
| Makarti Jaya | 23.76 | 32.64 | 243.83 | 300.28 |
| Muara Padang | 47.55 | 299.53 | 570.52 | 917.60 |
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| Sembawa | 92.83 | 25.92 | 77.40 | 196.14 |
| Suak Tapeh | 101.50 | 45.83 | 165.37 | 312.70 |
| Sumber Marga Telang | 32.30 | 28.88 | 113.70 | 174.89 |
| Talang Kelapa | 100.56 | 163.57 | 175.30 | 439.43 |
| Tanjung Lago | 265.86 | 208.85 | 327.67 | 802.42 |
| Tungkal Ilir | 244.91 | 180.60 | 222.63 | 648.14 |
| Total | 3,460.74 | 2,937.65 | 5,692.64 | 11,832.99 |
| Percentage (%) | 29.25 | 24.83 | 48.11 | 100.00 |

Note: Analysis results

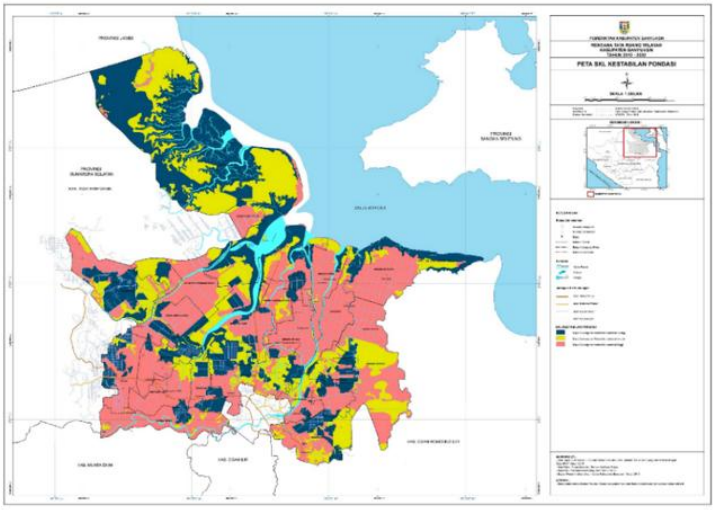

Figure 4. Map of land capability unit of foundation stability

Table 8. The unit area of the land capability of water availability

| Subdistrict | Very Low Water Availability | Low Water Availability | High Low Water Availability | Total |
|---|---|---|---|---|
| Air Kumbang | 79.71 | 101.86 | 146.99 | 328.56 |
| Air Saleh | 30.66 | 19.24 | 261.68 | 311.57 |
| Banyuasin I | 48.43 | 26.01 | 112.25 | 186.69 |
| Banyuasin II | 1,258.17 | 1,708.40 | 526.06 | 3,492.64 |
| Banyuasin III | 35.29 | 11.63 | 247.28 | 294.20 |
| Betung | 15.62 | 116.72 | 222.07 | 354.41 |
| Karang Agung Ilir | 27.07 | 14.11 | 98.58 | 139.76 |
| Makarti Jaya | 32.64 | 23.76 | 243.83 | 300.28 |
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| Sembawa | 25.92 | 92.83 | 77.40 | 196.14 |
| Suak Tapeh | 45.83 | 101.50 | 165.37 | 312.70 |
| Sumber Marga Telang | 28.88 | 32.30 | 113.70 | 174.89 |
| Talang Kelapa | 163.57 | 100.56 | 175.30 | 439.43 |
| Tanjung Lago | 208.85 | 265.86 | 327.67 | 802.42 |
| Tungkal Ilir | 180.60 | 244.91 | 222.63 | 648.14 |
| Total | 2,937.65 | 3,460.74 | 5,692.64 | 11,832.99 |
| Percentage (%) | 24.83 | 29.25 | 48.11 | 100.00 |

Note: Analysis results

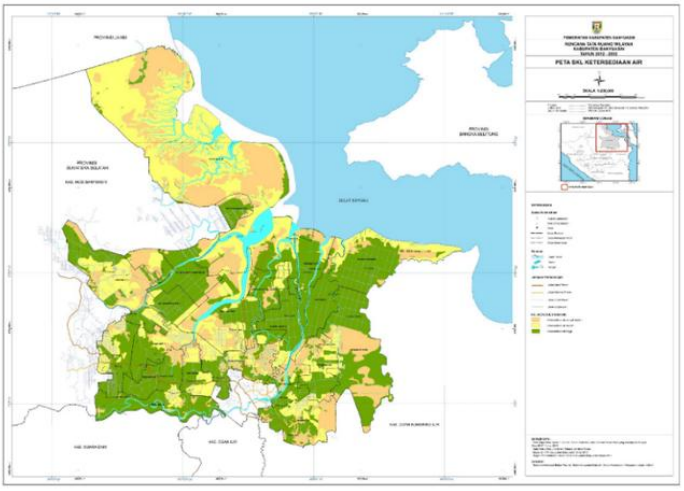

Figure 5. Map of land capability unit of water availability

Table 9. Unit area of drainage land capability

| Subdistrict | Less Drainage | High Drainage | Total |
|---|---|---|---|
| Air Kumbang | 146.99 | 181.57 | 328.56 |
| Air Saleh | 261.68 | 49.89 | 311.57 |
| Banyuasin I | 112.25 | 74.44 | 186.69 |
| Banyuasin II | 526.18 | 3,268.34 | 3,492.64 |
| Banyuasin III | 247.28 | 46.92 | 294.20 |
| Betung | 222.07 | 132.34 | 354.41 |
| Karang Agung Ilir | 98.58 | 41.19 | 139.76 |
| Makarti Jaya | 243.89 | 56.39 | 300.28 |
| Muara Padang | 570.52 | 347.08 | 917.60 |
| Muara Sugihan | 416.90 | 279.50 | 696.40 |
| Muara Telang | 287.53 | 54.04 | 341.57 |
| Pulau Rimau | 279.14 | 218.49 | 476.66 |
| Rambutan | 167.39 | 282.65 | 450.04 |
| Rantau Bayur | 473.22 | 83.69 | 556.91 |
| Selat Penuguan | 319.96 | 92.02 | 411.98 |
| Sembawa | 77.40 | 118.74 | 196.14 |
| Suak Tapeh | 165.37 | 147.33 | 312.70 |
| Sumber Marga Telang | 113.71 | 61.18 | 174.89 |
| Talang Kelapa | 175.30 | 264.13 | 439.43 |
| Tanjung Lago | 327.71 | 474.71 | 802.42 |
| Tungkal Ilir | 222.63 | 425.51 | 648.14 |
| Total | 5,455.69 | 6,700.16 | 11,832.99 |
| Percentage (%) | 46.11 | 56.62 | 100.00 |

Note: Analysis results

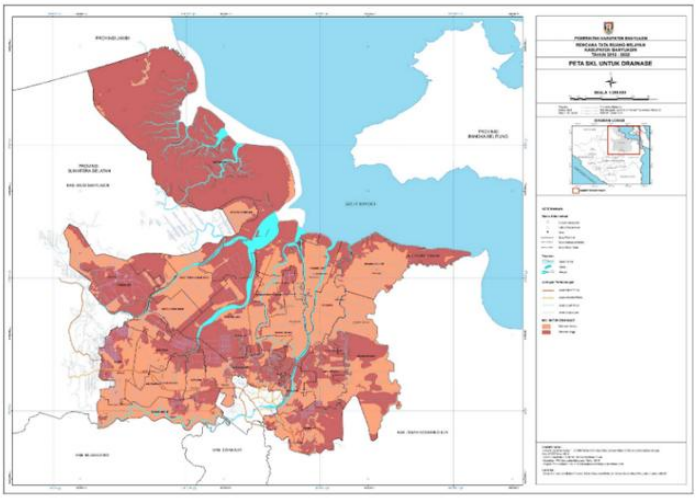

Figure 6. Map of land capability unit of drainage

**Land Capability Unit of Erosion**

The LCU of analysis on erosion aimed to find out the areas having soil erosion so that the level of land resistance to erosion could be identified and the impacts on more downstream areas could be anticipated as well. The data needed to compile an LCU map against the erosion were: morphological maps, slope maps, geological maps, surface geological maps, current land use maps, rainfall maps, hydrological data, and climatological data. The results of the analysis were to find out the area of LCU of Erosion for the development of residential areas in Banyuasin District (Table 10 & Figure 7).

**Land Capability Unit of Waste Disposal**

The LCU analysis of waste disposal aimed to find out the areas that could be occupied as final storage locations and waste treatment, both solid and liquid waste. The data needed for the map preparation of the LCU of waste disposal were: morphological maps, slope maps, topographic maps, geological maps, surface geological maps, current land use maps, rainfall maps, hydrological data, and climatological data. The results of the analysis to find out the area of the LCU of Waste Disposal for the development of residential areas in Banyuasin District (Table 11 & Figure 8).

**Land Capability Unit of Disaster-Prone**

LCU of disaster-prone analysis aimed at the level of land capability to accept natural disasters, especially from a geological perspective, to avoid/reduce losses and victims due to the disaster. The results of the analysis were to find out the area of LCU of disaster-prone for the development of residential areas in Banyuasin District (Table 12 & Figure 9).

**Analysis of Land Development Capability**

The results of the analysis were to find out the calculation of land capability class for the development of residential areas in Banyuasin District (Table 13 & Figure 10). Based on the results of the analysis of morphological LCU, the LCU of ease of work, LCU of slope stability, LCU of foundation stability, LCU of water availability, LCU of drainage, LCU of erosion, LCU of waste disposal, and LCU of disasters-prone, which were classified into the land capability classes as follows: very high land development capability class with an area of 3,617.15 $km^2$ or about 30.57% of the total area of Banyuasin District, for a rather high development land capability class with an area of 3,066.62 $km^2$ or about 25.92% of the total area of Banyuasin District, and for low development land capability class with an area of 16.64 $km^2$ or about 0.14% of the total area of Banyuasin District. Different

results according showed that the land use that was not in accordance with the land capability in Tabo-Tabo Village of Bungoro Subdistrict is 100.48 ha (16.12%) while the land use that is in accordance with the land capability is 522.95 ha (83.80%).

Table 10. Unit area of erosion land capability

| Subdistrict | Quite High Erosion | High Erosion | Very Low Erosion | No Erosion | Total |
|---|---|---|---|---|---|
| Air Kumbang | 101.86 | 79.71 | - | 146.99 | 328.56 |
| Air Saleh | 19.24 | 30.66 | 5.78 | 255.90 | 311.57 |
| Banyuasin I | 26.01 | 48.44 | 3.09 | 109.16 | 186.69 |
| Banyuasin II | 2,010.17 | 1,258.28 | 42.74 | 483.32 | 3,492.64 |
| Banyuasin III | 11.63 | 35.29 | 24.60 | 222.68 | 294.20 |
| Betung | 116.72 | 15.62 | 17.92 | 204.15 | 354.41 |
| Karang Agung Ilir | 14.11 | 27.07 | - | 98.58 | 139.76 |
| Makarti Jaya | 23.76 | 32.69 | 6.38 | 237.45 | 300.28 |
| Muara Padang | 47.55 | 299.53 | 1.15 | 569.36 | 917.60 |
| Muara Sugihan | 200.23 | 79.26 | 2.09 | 414.82 | 696.40 |
| Muara Telang | 44.86 | 9.21 | 2.63 | 284.87 | 341.57 |
| Pulau Rimau | 122.94 | 95.55 | 1.55 | 277.60 | 476.66 |
| Rambutan | 113.28 | 169.37 | 14.24 | 153.16 | 450.04 |
| Rantau Bayur | 47.08 | 36.62 | 36.35 | 436.87 | 556.91 |
| Selat Penuguan | 25.09 | 66.92 | 0.96 | 319.00 | 411.98 |
| Sembawa | 92.83 | 25.92 | 3.83 | 73.57 | 196.14 |
| Suak Tapeh | 101.50 | 45.83 | 17.57 | 147.80 | 312.70 |
| Sumber Marga Telang | 32.30 | 28.89 | 1.31 | 112.39 | 174.89 |
| Talang Kelapa | 100.56 | 163.57 | 6.00 | 169.31 | 439.43 |
| Tanjung Lago | 265.86 | 208.89 | 7.34 | 320.34 | 802.42 |
| Tungkal Ilir | 244.91 | 180.60 | 23.15 | 199.48 | 648.14 |
| Total | 3,762.51 | 2,937.90 | 218.67 | 5,236.77 | 11,832.99 |
| Percentage (%) | 31.80 | 24.83 | 1.85 | 44.26 | 100.00 |

Note: Analysis results

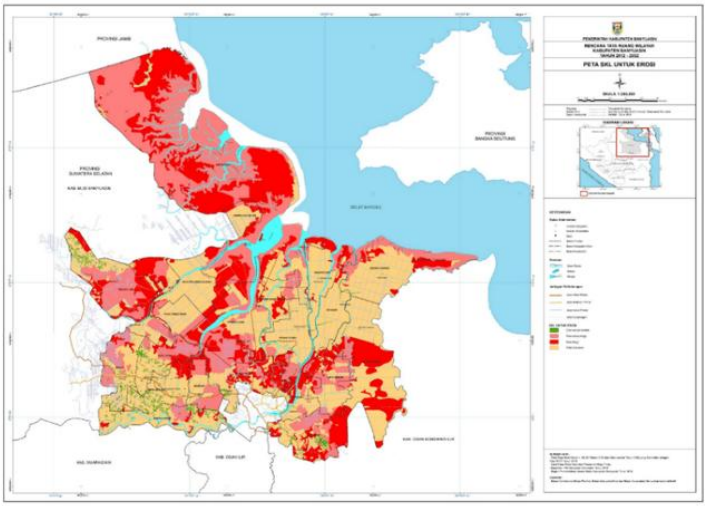

Figure 7. Map of land capability unit of erosion

Table 11. Unit area of land capability for waste disposal

| Subdistrict | Sufficient Waste Disposal | Less Waste Disposal | Total |
|---|---|---|---|
| Air Kumbang | 146.99 | 181.57 | 328.56 |
| Air Saleh | 261.68 | 49.89 | 311.57 |
| Banyuasin I | 112.25 | 74.44 | 186.69 |
| Banyuasin II | 526.18 | 3,268.34 | 3,492.64 |
| Banyuasin III | 247.28 | 46.92 | 294.20 |
| Betung | 222.07 | 132.34 | 354.41 |
| Karang Agung Ilir | 98.58 | 41.19 | 139.76 |
| Makarti Jaya | 243.89 | 56.39 | 300.28 |
| Muara Padang | 570.52 | 347.08 | 917.60 |
| Muara Sugihan | 416.90 | 279.50 | 696.40 |
| Muara Telang | 287.53 | 54.04 | 341.57 |
| Pulau Rimau | 279.14 | 218.49 | 476.66 |
| Rambutan | 167.39 | 282.65 | 450.04 |
| Rantau Bayur | 473.22 | 83.69 | 556.91 |
| Selat Penuguan | 319.96 | 92.02 | 411.98 |
| Sembawa | 77.40 | 118.74 | 196.14 |
| Suak Tapeh | 165.37 | 147.33 | 312.70 |
| Sumber Marga Telang | 113.71 | 61.18 | 174.89 |
| Talang Kelapa | 175.30 | 264.13 | 439.43 |
| Tanjung Lago | 327.71 | 474.71 | 802.42 |
| Tungkal Ilir | 222.63 | 425.51 | 648.14 |
| Total | 5,455.69 | 6,700.16 | 11,832.99 |
| Percentage (%) | 46.11 | 56.62 | 100.00 |

Note: Analysis results

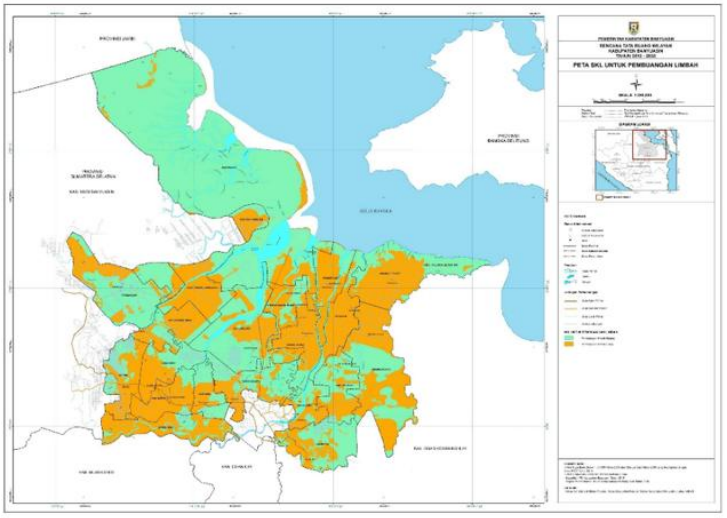


Figure 8. Map of land capability unit of waste disposal

Table 12. Areas of land capability unit of disaster-prone

| Subdistrict | Less Disaster-Prone | Low Disaster-Prone | High Disaster-Prone | Total |
|---|---|---|---|---|
| Air Kumbang | 101.86 | 79.71 | 146.99 | 328.56 |
| Air Saleh | 19.24 | 30.66 | 261.68 | 311.57 |
| Banyuasin I | 26.01 | 48.43 | 112.25 | 186.69 |
| Banyuasin II | 1,708.40 | 1,258.17 | 526.06 | 3,492.64 |
| Banyuasin III | 11.63 | 35.29 | 247.28 | 294.20 |
| Betung | 116.72 | 15.62 | 222.07 | 354.41 |
| Karang Agung Ilir | 14.11 | 27.07 | 98.58 | 139.76 |
| Makarti Jaya | 23.76 | 32.64 | 243.83 | 300.28 |
| Muara Padang | 47.55 | 299.53 | 570.52 | 917.60 |
| Muara Sugihan | 200.23 | 79.26 | 416.90 | 696.40 |
| Muara Telang | 44.86 | 9.18 | 287.50 | 341.57 |
| Pulau Rimau | 122.94 | 95.55 | 258.17 | 476.66 |
| Rambutan | 113.28 | 169.37 | 425.56 | 450.04 |
| Rantau Bayur | 47.08 | 36.61 | 473.22 | 556.91 |
| Selat Penuguan | 25.09 | 66.92 | 319.96 | 411.98 |
| Sembawa | 92.83 | 25.92 | 77.40 | 196.14 |
| Suak Tapeh | 101.50 | 45.83 | 165.37 | 312.70 |
| Sumber Marga Telang | 32.30 | 28.88 | 113.70 | 174.89 |
| Talang Kelapa | 100.56 | 163.57 | 175.30 | 439.43 |
| Tanjung Lago | 265.86 | 208.85 | 327.67 | 802.42 |
| Tungkal Ilir | 244.91 | 180.60 | 222.63 | 648.14 |
| Total | 3,460.74 | 2,937.65 | 5,692.64 | 11,832.99 |
| Percentage (%) | 29.25 | 24.83 | 48.11 | 100.00 |

Note: Analysis results

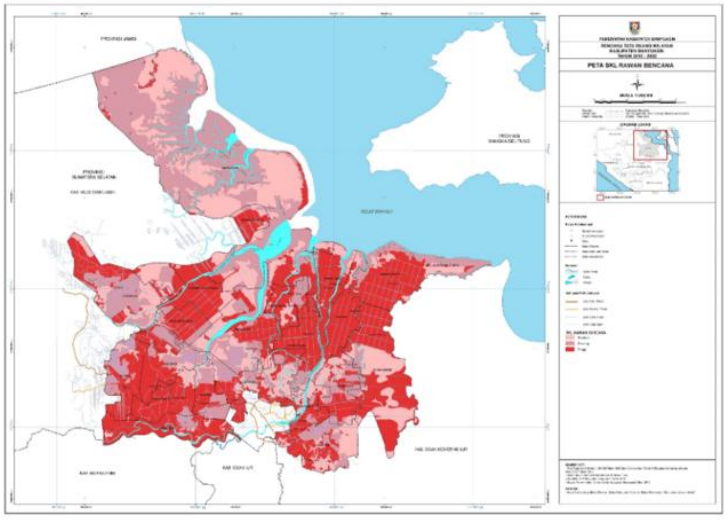

Figure 9. Map of land capability unit of disaster-prone

Table 13. Results of the calculation of land capability class for the development

| Subdistrict | Low Development Capability | Quite High Development Capability | Very High Development Capability | Total |
|---|---|---|---|---|
| Air Kumbang | 79.71 | 101.86 | 146.99 | 328.56 |
| Air Saleh | 31.45 | 18.44 | 261.68 | 311.57 |
| Banyuasin I | 48.53 | 25.91 | 112.25 | 186.69 |
| Banyuasin II | 1,346.98 | 1,921.48 | 526.06 | 3,492.64 |
| Banyuasin III | 37.07 | 9.85 | 247.28 | 294.20 |
| Betung | 25.00 | 107.34 | n22.07 | 354.41 |
| Karang Agung Ilir | 27.44 | 13.74 | 98.58 | 139.76 |
| Makarti Jaya | 34.40 | 22.05 | 243.83 | 300.28 |
| Muara Padang | 299.53 | 47.55 | 570.52 | 917.60 |
| Muara Sugihan | 87.54 | 191.96 | 416.90 | 696.40 |
| Muara Telang | 9.20 | 44.87 | 287.50 | 341.57 |
| Pulau Rimau | 96.06 | 122.43 | 279.14 | 476.66 |
| Rambutan | 174.44 | 108.20 | 167.39 | 450.04 |
| Rantau Bayur | 45.59 | 38.11 | 473.22 | 556.91 |
| Selat Penuguan | 67.10 | 24.92 | 319.96 | 411.98 |
| Sembawa | 39.00 | 79.74 | 77.40 | 196.14 |
| Suak Tapeh | 48.33 | 99.00 | 165.37 | 312.70 |
| Sumber Marga Telang | 28.88 | 32.31 | 113.70 | 174.89 |
| Talang Kelapa | 163.57 | 100.56 | 175.30 | 439.43 |
| Tanjung Lago | 211.63 | 263.11 | 327.67 | 802.42 |
| Tungkal Ilir | 181.81 | 243.70 | 222.63 | 648.14 |
| Total | 16.64 | 3,066.62 | 3,617.15 | 11,832.99 |
| Percentage (%) | 0.14 | 25.92 | 30.57 | 100.00 |

Note: Analysis results

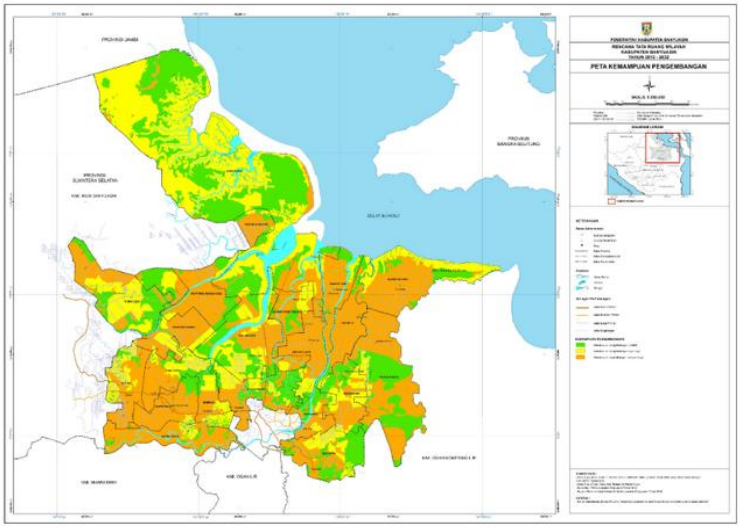


Figure 10. Map of land capability unit of development

## DISCUSSION

Based on the results of the morphological/landscape LCU analysis in Banyuasin District, the morphological land capability unit was classified into: low morphological land capability unit with an area of 11,450.25 km$^2$ or about 96.77% of the total area of Banyuasin District with the category of morphological land capability unit partly low, meaning that the morphological conditions were not complex. This indicates that the region of Banyuasin District has very flat land so it has a high ability to develop cultivation areas. Furthermore, the morphological land capability unit was less with an area of 382.74 km$^2$ or about 3.23% of the region of Banyuasin District with the category of morphological land capability unit being mostly less, meaning that the morphological conditions were not complex. This indicates that the Banyuasin District region has relatively flat land so that it able to develop of cultivation area.

The results of the LCU of ease of work analysis in the region of Banyuasin District showed that the unit of ease of work of land capability was generally classified into LCU of high ease of work with an area of 5,692.64 km$^2$ or about 48.11% of the total region of Banyuasin District.

The results of the LCU analysis of slope stability in Banyuasin District were classified into high slope stability unit characterized by flat morphology with slope conditions ranging from 0-2%, 2%-15% and the land conditions having high slope stability with an area of 5,692.64 km$^2$ or about 48.11%. This land condition having high slope stability is a very potential area to support the development of urban cultivation areas because the land is stable and not prone to landslides, the unit of slope stability capability was not characterized by hilly and mountain morphology with slope conditions ranging from 25-40%, the condition of the land having less slope stability was about 29.25. The condition of the land having less slope stability was an area that was less stable, meaning that it had land that was prone to landslides so that for the development of cultivation areas there had to be technological engineering, but for a land slope of 40% it was not recommended for regional development. The cultivation should be directed as a protected area, and the unit of low slope stability capability is characterized by hilly and high land morphology with slope conditions ranging from > 40%, the land conditions having low slope stability was around 24.3 8%, the land conditions that had low slope stability; therefore the condition of the area was unstable. Being unstable means easy to slide, easy to move which means it is not safe to be developed for buildings or settlements and cultivation. Instead, this area could be used for forests, plantations and water catchment.

Based on the basic physical conditions and characteristics of the planning area, it was identified that the unit of foundation stability capability in Banyuasin District includes: high foundation stability of LCU of about 48.11% of the Banyuasin District area, meaning that the area would be stable for any building foundation or for any type of foundation, the LCU of less foundation stability was around 29.25% meaning that the area was less stable, but maybe for certain types of foundations, it could be more stable, for example the chicken claw foundations, and the LCU of low foundation stability was around 24.83% meaning that the area was less stable for the foundations of various buildings.

The results of the LCU analysis of Water Availability, Banyuasin District tended to have high water availability of around 48.11% and the rest had low and very low LCU of water availability. In a rainfed agricultural system, the ability of the soil to hold water is very important in dealing with drought events (Cornelis et al., 2019), therefore the ability of the land to provide water for agricultural areas had to tend to be high. This is in contrast to the results of research (Ippolito et al., 2021) where more

than 90% of land in the Dosso region of Niger is susceptible to drought.

The results of the LCU analysis for drainage in Banyuasin District had a high drainage LCU of around 56.62 and a less drainage LCU of about 46.11%, less drainage LCU due to relatively flat land slope conditions that the water flow pattern would get obstacles in the drainage process so it has the potential for frequent inundation or flooding. The results of the partially lacking drainage capacity were almost the same as the research on the ability of the drainage area in the former bauxite mine area in Sanggau, West Kalimantan (Purwanto & Andrasmoro, 2021), showing that poor soil drainage cause a limiting factor for class IV capability, in contrast to the condition of the capability of the drainage area for agriculture land according to (Kabanda, 2017) showing that only 21% of the land drainage capacity lacked.

The results of the calculation of the LCU found that Banyuasin District, the erosion rate was in the category of High erosion LCU with an area of 2,937.90 $km^2$ or about 31.80%, the erosion LCU was quite high with an area of 31.80 $km^2$ or about 24.83%, the very low erosion LCU with an area of 218.67 $km^2$ or about 1.85% and there were areas that did not have the potential for erosion, which was 5,236.88 $km^2$ or about 44.26%. In contrast to (Teshome et al., 2020) the results of the classification of erosion severity and land capability, 61% of the watershed area is for agricultural land and 27.7% is not suitable for cultivation.

The results of the calculation of LCU of Waste Disposal in Banyuasin District showed that the level of erosion was in the LCU category for adequate waste disposal with an area of 5,455.9 $Km^2$ or about 46.11%, LCU of waste disposal was less with an area of 6,700.16 $Km^2$ or about 56.62%. The results of the calculation of the LCU of disaster-prone in Banyuasin District were categorized as the LCU of high disaster-prone of around 48.11%, LCU of disaster-prone of less than 29.25% and LCU of low disaster-prone of around 24.38%.

## CONCLUSION

Land capability class in Banyuasin District is heavily influenced by topographic factors in the form of plains and morphological conditions tending to be influenced by the slopes. This supporting factor could be seen in the process of identifying land capability units in the previous discussion. The land capability class also shows differences in land characteristics. Through a weighting system based on the secondary data already analyzed based on the land capability units, it could be seen that the research area was divided into 3 classes of land development capability, namely very high land development capability class, moderately high development land capability class, and low development land capability class. The areas with the low land development capability class does not have the potential to be developed as a residential area.

## ACKNOWLEDGEMENTS

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