**Proceeding of International**
Conference on Science and Technology
Lembaga Penelitian Pengabdian kepada Masyarakat dan Dakwah Islamiyah, Universitas Islam Kuantan Singingi, Indonesia, September 19th 2024
DOI : https://doi.org/10.36378/internationalconferenceuniks.v2i1
ISSN 2985-8739
**Page: 164-166**

# Determination Of Average Runoff Coefficient (CR) Of Land Use In Teluk Kuantan City

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***Abstract***

*Demographic changes and unplanned land use make inundation or flooding take a long time to infiltrate into the soil. The Kuantan Singingi Regency Government explained that the management and development of a drainage system that is directly connected to the river in the city of Teluk Kuantan will be planned, in addition to the city of Teluk Kuantan being the stage of development of existing drainage in the city in reducing the area of inundation. This analysis is carried out to determine the price of the average runoff coefficient (Cr) in Taluk Kuantan city based on the category and area of land use to calculate runoff discharge. Land use is divided into 6 categories, the Runoff Coefficient (C) on Residential land use is 0.57, The results using the calculation method of runoff discharge Q = F. Cs. Cr. A. I can be concluded that the greater the Cr value, the greater the runoff discharge.*

*Keywords: Runoff Discharge, Rainfall Intensity, Runoff Coefficient, Land Use*

## 1. Introduction

Drainage is one of the basic facilities designed as a sanitation system, to meet the needs of the community. The progress of an area can be judged by the condition of its drainage system, areas with poor drainage systems will be considered dirty, slovenly, shabby, and underdeveloped. Conversely, an area with a good drainage system will look beautiful, harmonious, and advanced. Drainage means to drain, drain, dispose of, or divert water. In general, drainage is defined as a series of water structures that function to reduce or remove excess water from an area or land, so that the land can be functioned optimally.

In Teluk Kuantan City, Riau, there are several locations where the drainage absorption capacity is not good, resulting in flooding due to heavy rain. The drainage channel in the Tugu Carano area has also been clogged due to heavy rain, the Teluk Kuantan city terminal area also has a poor drainage system and spatial layout resulting in a pile of water (Lidia et al., 2019).

Despite being on land and much higher than the river flow, the city of Teluk Kuantan is still a capital city that is always flooded when the rainy season arrives. This is a community complaint because of the lack of drainage along the axis of the capital city which is the cause of flooding, so that the streets are often submerged and enter people's homes.

Apart from the runoff of river water into roads and settlements, flooding occurs due to demographic and land use changes that make inundation or flooding take a long time to infiltrate into the soil. The change in land function from green areas to residential or office areas has an impact on the disruption of soil absorption so that the surface flow (runoff) becomes even greater. The runoff discharge value is directly proportional to the runoff coefficient value, so when the runoff coefficient value is closer to 1, the related land has a higher absorption area. According to Permen PU No. 12 of 2014, the drainage network in urban areas should be able to drain water properly, the service standard of the drainage network system does not allow puddles that occur more than 30 cm for 2 hours and no more than 2 times a year.

This research was conducted with several objectives, including analyzing the category and area of land use in Arcamanik District, determining the price of runoff coefficient (C) and calculating the average runoff coefficient (Cr), analyzing the effect of C on the ability of land cover to infiltrate rainwater and analyzing the effect of Cr on runoff discharge.

## 2. Research Methods

### 2.1 Research Type, Location and Time

Central Kuantan District, Kuantan Singingi Regency, especially in the city of Teluk Kuantan is the location of the research to be evaluated where Teluk Kuantan City is one of those in Riau Province. Teluk Kuantan City has an area of 291.74 km2 consisting of 20 villages, including the villages of Bandar Alai, Kedundung Island, Aro Island, Seberang TaluK, Pulau Baru, Koto Tuo, Kopah, Munsalo, Sawah, Koto Taluk, Koto Kari, Pintu Gobang, Jake, Godang Kari Island, Jaya, Beringin Taluk, Sitorajo, Seberang Taluk Hilir, Titian Modang Kopah, and Banjar Kari Island.

Some flood-prone areas in Central Kuantan District include Teluk Kuantan City Terminal, Carano Monument area, Teluk Kuantan Proclamation Road, Kuantan Riverbank areas such as Seberang Taluk, Bandar Alai, and Pulau Aro villages. The evaluation of the drainage system will be focused in Teluk Kuantan City to support the development planning of drainage improvements planned at the PUPR Office of the Kuantan Singingi Regency Government 2024.

### 2.2 Stage of Implementation

Determination of runoff discharge starts from determining the service zone which is done by describing the drainage channel path then obtaining the average coefficient calculated from the land use of the study area, rain intensity is also obtained from the calculation of rain duration and concentration time.

### 2.3 Data Collection and Processing

Data from the research results were obtained by collecting primary data and secondary data. Primary data is obtained from elevation and administrative data that occurs in the field. While secondary data is data obtained from land use data and aerial photographs or drone capture.

### 2.4 Data Analysis

Data analysis is carried out in the form of: Rainfall intensity with several methods namely; Van Breen Method, Tanimoto Bell Method, Hasper-Weduwen. Furthermore, the Intensity, Duration, Frequency (IDF) Curve which uses the Talbot, Sherman, and Ishiguro formulas in the event of limited equipment and no time available to observe rain intensity, then the runoff coefficient (C), and runoff discharge. Teluk Kuantan City is divided into several land uses. The area of each land use category can be seen in Table 1.

Table 1. Land Use

| No | Land Use | Luas (Km2) | % | Coefficient C or Flow Coefficient | Ultimate Flow Coefficient |
|---|---|---|---|---|---|
| 1 | Park | 0.044632211 | 3% | 0.25 | 0.01 |
| 2 | Swamp | 0.129679143 | 8% | 0.13 | 0.01 |
| 3 | Settlement | 0.960632714 | 57% | 0.7 | 0.40 |
| 4 | Grassland | 0.323153245 | 19% | 0.35 | 0.07 |
| 5 | Plantation | 0.103251449 | 6% | 0.2 | 0.01 |
| 6 | Road and Shoulder of the Road | 0.12491832 | 7% | 0.95 | 0.07 |
| | Total | 1.686.267.082 | 100% | **0.57** | |

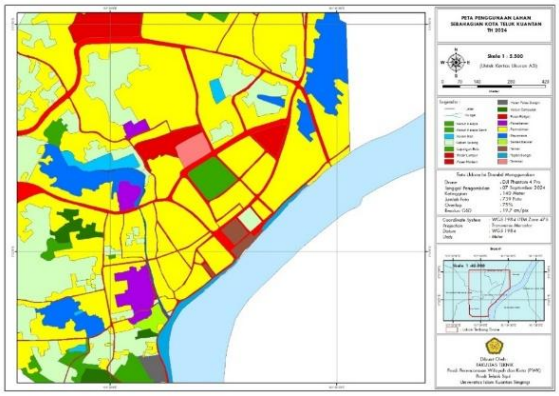

Figure 1. Land use map of Teluk Kuantan city

### Runoff Coefficient (C)

Determination of the amount of runoff coefficient (C) in conducting channel planning should be based on the type of existing land use. Land use in Arcamanik Sub-district is divided into 3 namely Settlement, Green Area, and Building. The runoff coefficient is the ratio between the peak surface flow to the rain intensity. The more impermeable a land surface is, the higher the runoff coefficient value. Example of runoff coefficient calculation:

### Runoff Discharge

For the calculation of channel dimensions requires a calculation of the runoff discharge that will enter the channel. Calculating the discharge plan is done in a way.

## 3. Results and Discussions

### 3.1 Increased Population and Land Use

This research found that an increase in population has an effect on land use. An increase in population can lead to changes in land use, such as land conversion from agriculture to settlements, offices, roads and other infrastructure. This is due to the increasing need for land as the population increases. Dense population and poor land use can lead to lack of infiltration and increased runoff. The increase in population makes land use require proper drainage to avoid surface water puddles and to channel excess water mass from an area.

### 3.2 Waste Treatment and Land Use

Ideal waste management will create a healthy land-use environment, basically waste services will greatly affect the functioning of drainage channels. Proper waste management is a form of prevention of decreased drainage function. Garbage entering the drains will cause blockages and also cause the flow of water to be obstructed, resulting in overflows and puddles, as well as unpleasant odors and becoming a hotbed of disease. It is necessary to

increase public awareness so as not to litter, especially in waterways that can pollute the environment and cause flooding.

### 3.3 Synchronize Infrastructure and Land Use

Infrastructure relations also affect land use, which is influenced by the pattern of land use and suitability systems, so that land use in the area is suitable or according to its designation and in accordance with directions or not. The existence of land use makes development in an area can run well and regularly, the community also gets various benefits, such as: Supporting economic development in an area. Leveling out good land functions while keeping existing natural resources from being damaged.

### 3.4 Other Variables

The study also found that several other factors such as lack of public awareness, soil subsidence, topography, building type, and rainfall intensity.

## 4. Conclusion

This study confirms that land use in Teluk Kuantan City includes several aspects including: roads, rivers, coconut plantations, oil palm plantations, fish ponds, vacant land, soccer fields, mud markets, modern markets, bungin island forests, mixed gardens, public markets, cemeteries, settlements, swamps, shrubs, parks, river banks and terminals. As taken using aerial photographs from a height of 140 meters with the coordinate system WGS 1984 UTM Zone 47S, thus, the greater the value of C, the less rainwater infiltrated into the soil due to diverse land cover depending on the land use in the existing location. The average runoff coefficient (Cr) is influenced by C and the area of each land use, the greater the C and the area, the greater the Cr value and the runoff discharge is influenced by the average runoff coefficient (Cr), where the greater the Cr value, the greater the runoff discharge.

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