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Analysis of Annual Rainfall Distribution and Planned Rain Intensity at 11 (Eleven) Rain Post Stations in Serang District

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ABSTRACT

Purpose: This research aimed to find the best rainfall probability model and planned rain intensity using the Mononobe formula for 11 rain stations in Serang Regency.

Methodology: Annual rainfall data is processed and evaluated as secondary data using the rain data consistency test method, the Gumbel probability distribution, the Normal probability distribution, the Log Normal probability distribution, and the Pearson Type III Log probability distribution.

Findings: The consistency test results reveal that the rainfall data is consistent. The Gumbel probability distribution is used to examine the design rain intensity based on the analysis. This study is intended to guide estimating the design rainfall intensity to develop the design flood discharge and run-off calculations. Suggestions for future research include improving the accuracy of rain data processing and making longer-term data available to provide a more accurate frequency analysis.

Paper type: Research paper

Keyword: *Rainfall, Probability Distribution, Planned Rain Intensity.*
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I. INTRODUCTION

A. Background

Serang Regency is made up of 29 sub-districts and 326 settlements. Cinangka sub-district is the largest, covering 111.47 km2 or 7.60 per cent of Serang Regency's total size. Meanwhile, Bandung District has the smallest area, with 25.18 km3 or 1.72 per cent of the entire region. The subdistrict with the most villages is the Cikeusal subdistrict, which oversees 17 villages. In contrast, the subdistrict with the fewest villages is the Binuang subdistrict and Gunungsari subdistrict, each of which supervises seven villages. Furthermore, in Serang Regency, various islands are lying in territorial seas, with a total of 17 islands documented.

According to the BNPB, (2014) Indonesian Disaster Risk Index (IRBI), Serang Regency is in a high disaster-risk area. It is ranked three (three) out of eight (eight) districts/cities in Banten Province in terms of disaster potential. Nonetheless, all regencies/cities in the Province are listed as disaster-prone zones. Natural catastrophes that may occur in the Serang Regency area include the following:

a. Flood disasters with a high level of risk;
b. Earthquake disasters with a high level of risk;
c. Tsunami disaster with a high level of risk;
d. Forest and land fire disasters with a high level of risk;
e. Landslide disaster with moderate risk level;
f. Extreme wave and abrasion disasters with a high level of risk;
g. Drought disaster with a high level of risk;
h. Severe weather disasters with a high level of risk.

According to Serang Regency BPS data, the maximum number of rainy days in 2016 was 242, while the lowest was 147 in 2015. Looking at average rainfall, 2017 and 2016 have the highest and lowest average rainfall,

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respectively. There were 185 rainy days in 2018, with a total rainfall volume of 7.56 mm. June has the most increased average precipitation of 17.90 mm across 11 days. The lowest average rainfall of 3.00 mm between 1 and 10 days occurred in July and September. In 2018, the average monthly rainfall was 7.56 mm. In 2019, there was a 125-day drop-in day and rain, with an average rainfall of 3.44 mm/month. Following a reduction in rainfall in 2019, the number of days and average rainfall climbed in 2020 to 159 days and 3.45 mm/month, respectively.

According to the 2019 Serang Regency RKPD document, the climate of Serang Regency is divided into three categories: the northern Tropical Monsoon (Ama), the southern Tropical Rain Forest (Afa), and parts of the Subtropical climate (Cfa). As a result, the northern hemisphere has a dry month at least once a year. There is no such thing as a dry month in the country's southern half. Rainfall patterns in portions of the Cfa climate are comparable to those in the south region. In August, the lowest temperature in Serang Regency in 2014 was 22.2 degrees Celsius. The highest temperature was 34.1 degrees Celsius in October, with a temperature range of 23.6 degrees Celsius to 32.2 degrees Celsius with 81 per cent relative humidity.

Climate change, which constantly recurs, increases the number of flash floods, which impact people and infrastructure and should be minimized based on historical evidence. Efforts to overcome this can be made by modelling the rainfall process in order to better understand the changes and characteristics of rainfall in the past, including projecting rainfall distribution. According to Zufrimar & Zainal, (2020). there are statistical parallels between previous and future rainfall events. It is significant because it may be used to plan water resources and increase the sensitivity of a region's rainfall system.

B. Research Purposes

The purpose of this study is to find the best rainfall probability model based on the analysis of the Kolmogorov-Smirnov and Chi-squared appropriateness tests and to plan the rain intensity using the Mononobe Formula at 11 (eleven) rain stations in Serang Regency.

C. Benefits of Research

This research can contribute to identifying the method of rain intensity and type of distribution based on annual rainfall data characteristics. It can be used as a guide or a comparison when determining design rainfall intensity, flood discharge, and run-off.

D. Review of Literature and Theory

1. Rain Data Consistency Test

A consistency test was performed to determine the consistency of rain data. (Sri Harto, 1999) describes the RAPS (Rescaled Adjusted Partial Sum) approach as one way to test it.

2. Probability Distribution

Rain and other hydrological phenomena are stochastic processes that cannot be predicted naturally. As a result, probability theory and frequency analysis are used to comprehend and describe occurrences (Alabekee et al., 2015) Furthermore, according to (Mohit Al, 2010) a collection of daily rainfall or sub-rainfall data is extensively employed for predicting severe rainfall, particularly daily sub-rainfall. However, due to a shortage of data, research in Indonesia often uses an annual maximum daily rainfall data set. SNI 2451:2016 is referenced in a national standard in Indonesia. It describes 8 (eight) probability distributions of Indonesia's annual maximum rainfall. In Indonesia, only four probability distributions are typically used: Log Normal, Normal, Log-Pearson III, and Gumbel (Abas et al., 2019). Zainal & Zufrimar, (2021) states that each region has a unique probability distribution for rain occurrences. Table 1 describes the formula for each probability distribution.

Distribution	Distribusi Probabilitas	Range	Parameter
Normal	$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\left[\frac{-1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right]}$	$-\infty < x < +\infty$	μ = mean σ = standard deviasi (σ > 0)
Log Normal	$f(x) = \frac{e^{\left[\frac{-1}{2}\frac{(\ln(x)-\mu)^2}{\sigma}\right]}}{(x)\sigma\sqrt{2\pi}}$	$\gamma < x < +\infty$	μ = shape parameter (μ > 0) σ = skala parameter (σ > 0) γ = lokasi parameter (γ = 0)
Log-Pearson III	$f(x) = \frac{1}{\lvert\beta\rvert\Gamma(\alpha)}\left[\frac{\ln(x)-\gamma}{\beta}\right]^{\alpha-1} e^{\left[-\frac{\ln(x)-\gamma}{\beta}\right]}$	$0 < x < e^{\gamma}$ $e^{\gamma} \le x < +\infty$	α = shape parameter (α > 0) β = skala parameter (β ≠ 0) γ = lokasi parameter
Gumbel	$f(x) = \alpha . e^{-\alpha(x-\mu)-e^{-\alpha(x-\mu)}}$	$-\infty < x < +\infty$	α = skala parameter μ = lokasi parameter

Sumber : Mohita dkk. (2010)

Figure 1. Probability Distribution

A nonparametric test can be used to choose the most acceptable probability distribution given a series of rainfall data. Its goal is to assess the relationship between observed and theoretical frequencies. The Kolmogorov-Smirnov and Chi-square appropriateness tests can be employed in hydrology.

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II. METHODS

A. Research Location

The research site is in 11 (eleven) Rain Station Posts in Serang Regency, with a 10-year data set (2010 - 2019) available. The Rain Station Posts are distributed as follows:

1. Anyar
2. Cinangka
3. Ciomas
4. Ciruas
5. Keramatwatu / Pegadingan
6. Pabuaran
7. Padarincang
8. Pamarayan
9. Pontang
10. Regas Hilir
11. Walantaka

B. Data Collection and Analysis Techniques

Secondary data from annual rainfall data was gathered from linked agencies. The available data is then processed and examined using the data consistency test method, and the probability distribution is performed using the Gumbel, Normal, Normal Log, and Pearson Type III Log Probability Distribution methods. The Mononobe formula is used in the final stage of planning rain intensity assessments.

III. RESULTS AND DISCUSSION

A. Rain Data Consistency Test Results

The RAPS consistency test findings reveal that the rainfall data is CONSISTENT. The table below summarizes the consistency test findings.

No.	Pos Staisiun Hujan	D_y	$Q_{terhitung}$	Q_{kritis}	Hasil Uji	Keterangan		
1	Anyar	30,72	3,12	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
2	Cinangka	33,26	2,05	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
3	Ciomas	20,07	2,36	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
4	Ciruas	19,28	2,70	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
5	Keramatwatu/ Pegadingan	19,67	3,22	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
6	Pabuaran	17,18	3,53	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
7	Padarincang	28,42	2,69	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
8	Pamarayan	16,68	1,96	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
9	Pontang	26,21	1,87	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
10	Regas Hilir	21,26	2,04	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}
11	Walantaka	11,93	2,25	3,60	Konsisten	$Q_{terhitung}$	<	Q_{kritis}

Figure 2. Consistency Test Analysis Results

1. Analysis Results of Determining the Probability Distribution of Anyar Rain Station Posts

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 3. Results of the Analysis of Determining the Probability Distribution

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The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	96,81
2	5	135,46
3	10	161,05
4	15	175,48
5	50	217,36
6	100	241,17
7	200	264,89
8	500	296,18
9	1000	319,84

Figure 4. The planned rain intensity of Anyar Rain Station Post

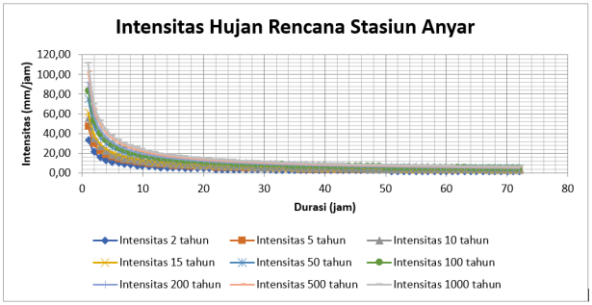

Figure 5. The planned rain intensity of Anyar Rain Station Post

2. Analysis Results of Determining the Probability Distribution of Cinangka Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 6. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

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Hujan Rencana

No.	Periode Ulang T (tahun)	Hujan Rencana (mm)
1	2	115,05
2	5	156,89
3	10	184,59
4	15	200,22
5	50	245,56
6	100	271,33
7	200	297,01
8	500	330,89
9	1000	356,50

Figure 7. The planned rain intensity of Cinangka Rain Station Post

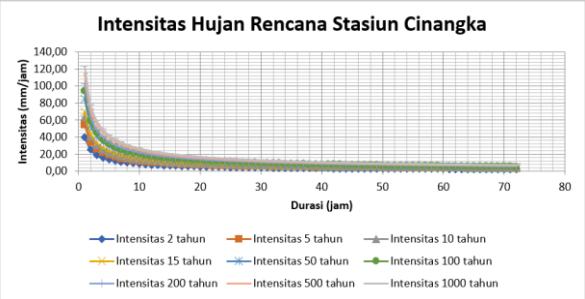

Figure 8. The planned rain intensity of Cinangka Rain Station Post

3. Analysis Results of Determining the Probability Distribution of Ciomas Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (x^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 9. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang T (tahun)	Hujan Rencana (mm)
1	2	98,28
2	5	123,53
3	10	140,24
4	15	149,67
5	50	177,03
6	100	192,58
7	200	208,08
8	500	228,52
9	1000	243,97

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Figure 10. The planned rain intensity of Ciomas Rain Station Post

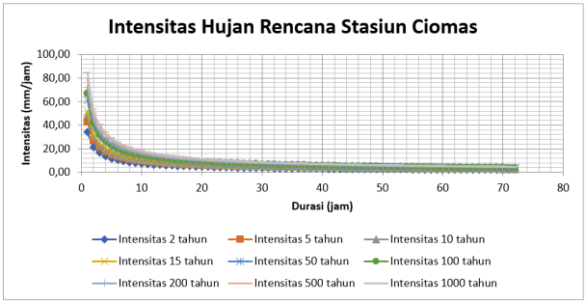

Figure 11. The planned rain intensity of Ciomas Rain Station Post

4. Analysis Results of Determining the Probability Distribution of Ciruas Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 12. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	70,25
2	5	94,50
3	10	110,55
4	15	119,61
5	50	145,89
6	100	160,83
7	200	175,71
8	500	195,35
9	1000	210,19

Figure 13. The planned rain intensity of Ciruas Rain Station Post

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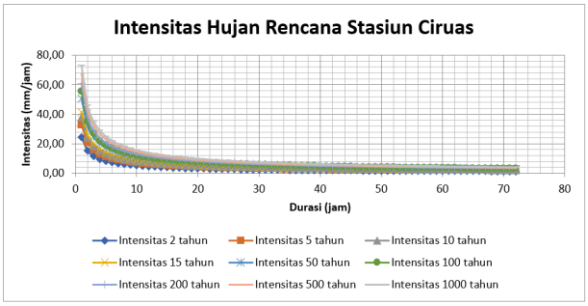

Figure 14. The planned rain intensity of Ciruas Rain Station Post

5. Analysis Results of Determining the Probability Distribution of Kramatwatu / Pegadingan Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

22. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 15. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	75,29
2	5	100,04
3	10	116,43
4	15	125,67
5	50	152,49
6	100	167,74
7	200	182,93
8	500	202,97
9	1000	218,11

Figure 16. The planned rain intensity of Kramatwatu / Pegadingan Rain Station Post

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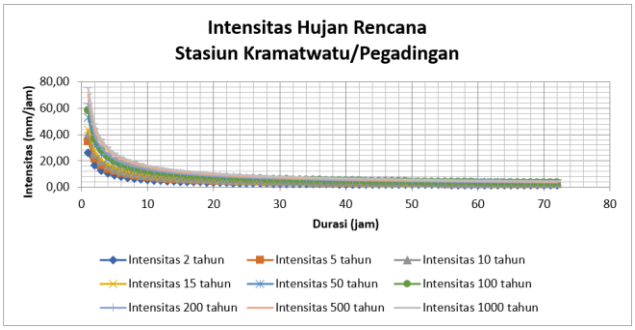

Figure 17. The planned rain intensity of Kramatwatu / Pegadingan Rain Station Post

6. Analysis Results of Determining the Probability Distribution of Pabuaran Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 18. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	78,15
2	5	99,76
3	10	114,06
4	15	122,13
5	50	145,55
6	100	158,86
7	200	172,12
8	500	189,62
9	1000	202,84

Figure 19. The planned rain intensity of Pabuaran Rain Station Post

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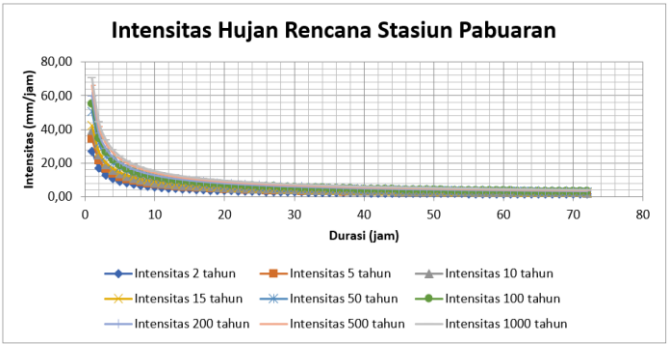

Figure 20. The planned rain intensity of Pabuaran Rain Station Post

7. Analysis Results of Determining the Probability Distribution of Padarincang Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 21. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	123,89
2	5	159,64
3	10	183,31
4	15	196,66
5	50	235,39
6	100	257,41
7	200	279,35
8	500	308,30
9	1000	330,18

Figure 22. The planned rain intensity of Padarincang Rain Station Post

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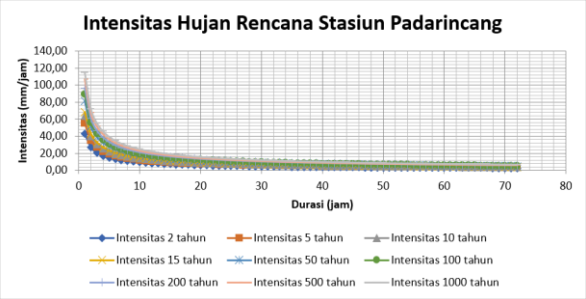

Figure 23. The planned rain intensity of Padarincang Rain Station Post

8. Analysis Results of Determining the Probability Distribution of Pamarayan Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 24. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	86,21
2	5	107,19
3	10	121,09
4	15	128,93
5	50	151,67
6	100	164,59
7	200	177,48
8	500	194,47
9	1000	207,31

Figure 25. The planned rain intensity of Pamarayan Rain Station Post

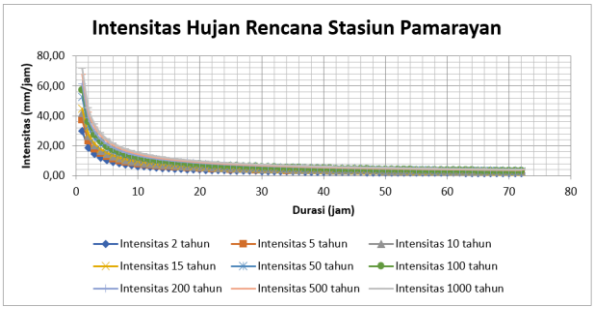

Figure 26. The planned rain intensity of Pamarayan Rain Station Post

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9. Analysis Results of Determining the Probability Distribution of Pontang Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (x^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 27. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	75,56
2	5	108,53
3	10	130,35
4	15	142,67
5	50	178,39
6	100	198,70
7	200	218,94
8	500	245,64
9	1000	265,81

Figure 28. The planned rain intensity of Pontang Rain Station Post

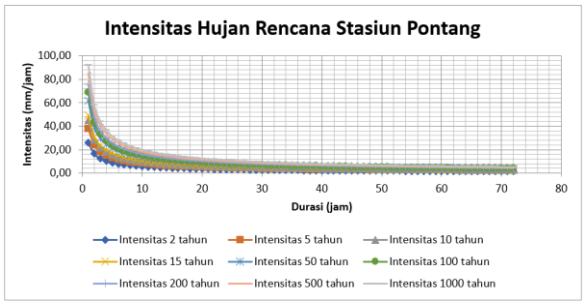

Figure 29. The planned rain intensity of Pontang Rain Station Post

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10. Analysis Results of Determining the Probability Distribution of Regas Hilir Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 30. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	73,06
2	5	99,81
3	10	117,51
4	15	127,50
5	50	156,48
6	100	172,95
7	200	189,37
8	500	211,02
9	1000	227,39

Figure 31. The planned rain intensity of Regas Hilir Rain Station Post

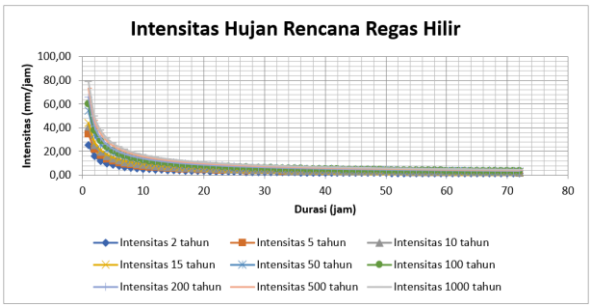

Figure 32. The planned rain intensity of Regas Hilir Rain Station Post

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11. Analysis Results of Determining the Probability Distribution of Walantaka Rain Station Post

1. Penentuan jenis distribusi probabilitas yang sesuai dengan mencocokkan parameter data:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Dapat Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Dapat Diterima

2. Penentuan jenis distribusi probabilitas dengan Metode Chi-Kuadrat (χ^2) adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Tidak Diterima
2	Normal	Tidak Diterima
3	Log Normal	Tidak Diterima
4	*Log Pearson Type III*	Tidak Diterima

3. Penentuan jenis distribusi probabilitas dengan Metode Smirnov-Kolmogorof adalah sebagai berikut:

No.	Distribusi	Penentuan Jenis Distribusi
1	Gumbel	Diterima
2	Normal	Diterima
3	Log Normal	Diterima
4	*Log Pearson Type III*	Tidak Diterima

Berdasarkan perhitungan yg telah dilakukan, hujan rencana yang digunakan adalah dari:
DISTRIBUSI GUMBEL*

Figure 33. Results of the Analysis of Determining the Probability Distribution

The following presents a graph of the planned rain intensity using the Gumbel Distribution, Using the Mononobe Formula:

Hujan Rencana

No.	Periode Ulang *T* (tahun)	Hujan Rencana (mm)
1	2	78,70
2	5	93,71
3	10	103,65
4	15	109,26
5	50	125,53
6	100	134,78
7	200	143,99
8	500	156,15
9	1000	165,34

Figure 34. The planned rain intensity of Walantaka Rain Station Post

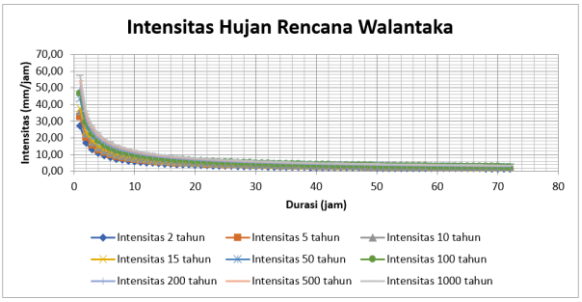

Figure 35. The planned rain intensity of Walantaka Rain Station Post

IV. CONCLUSION

1. The rainfall data utilized is short-term and is the annual maximum series;
2. The RAPS approach yielded CONSISTENT findings for the data consistency test at 11 (eleven) Rain Station Posts in Serang Regency**;**
3. The Gumbel Distribution was used in the computations to determine the planned intensity of the rain.

Some suggestions for future similar studies to improve results are as follows:

1. If the amount of data obtained from observation stations is significant, accuracy in processing rain data is required.

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2. A longer duration of rain data is required for a more accurate frequency analysis. As a result, the appropriate agencies must examine the availability of data over a more extended period.

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