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Analysis of Environmental Drainage Capacity in Pasar Melintang Village, Lubuk Pakam District, Deli Serdang Regency

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ARTICLE INFO	ABSTRACT
Article History : Article entry : 01-07-2026 Article revised : 28-07-2026 Article received : 19-08-2026 Keywords: drainage capacity, design flood discharge, Rational Method, Manning, GPM. IEEE Style: Y. Pratama and Y. Hanova, "Analysis of Environmental Drainage Capacity in Pasar Melintang Village, Lubuk Pakam District, Deli Serdang Regency", <i>CVL</i>, vol. 11, no. 2, pp. 236–245, Sep. 2026.	Waterlogging caused by increased surface runoff is a major challenge for drainage infrastructure in semi-urban areas. This study aims to analyze design flood discharge, evaluate the hydraulic capacity of existing drainage channels, and formulate management recommendations in Pasar Melintang Village, Lubuk Pakam Subdistrict, Deli Serdang Regency. A descriptive-quantitative methodology was applied by integrating primary measurement data of notched trapezoidal channels with secondary rainfall data from Global Precipitation Measurement (GPM) satellite (2015–2024). Frequency analysis using the Log Pearson Type III distribution yielded a design rainfall of $R_{24} = 73.279$ mm/day ($T = 2$ years), rainfall intensity of $I = 181.083$ mm/hour (Mononobe method), and design flood discharge of $Q = 0.224$ m³/second (Rational method, $C_w = 0.464$, $A = 0.96$ ha). Evaluation using Manning's Equation indicates an existing channel capacity of $Q_s = 0.219$ m³/second. The capacity deviation of 2.23% is well below the 5% technical tolerance threshold, confirming that the channel's geometric design is adequate. The capacity deficit stems from physical obstructions (15 cm sedimentation, wild vegetation, and household waste) rather than geometric design errors. A structured periodic maintenance program is recommended to restore full hydraulic capacity.

1. Introduction

Community drainage is critical infrastructure for controlling surface runoff in densely populated residential areas. With the growth of urban areas and massive changes in land use, the capacity of existing drainage systems is often unable to keep pace with the increase in runoff volume [1]. This condition has become a major issue in various regions across Indonesia, including Deli Serdang Regency, North Sumatra Province [2].

Pasar Melintang Village, Lubuk Pakam Subdistrict, is a semi urban area that has experienced significant land use conversion from agricultural to residential and commercial areas. This land use change has increased the combined runoff coefficient of the catchment area, resulting in a substantial increase in both the volume and velocity of surface runoff [3]. Consequently, the existing neighborhood drainage channels are subjected to hydraulic pressures that exceed those anticipated during their initial design.

The flooding problem in Pasar Melintang Village is not solely caused by insufficient channel dimensions but also by a 15 cm thick accumulation of sediment, the growth of wild vegetation, and the



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buildup of household waste within the channel bed, which collectively reduce the channel's effective hydraulic capacity [4]. Sedimentation in open drainage channels is a common problem when periodic maintenance programs are not consistently implemented [5].

Evaluating drainage capacity requires an integrated approach that includes hydrological analysis to determine the design flood discharge and hydraulic analysis to measure the storage capacity of existing channels. Given the limited coverage of the conventional rain gauge network in the study area, Global Precipitation Measurement (GPM) satellite rainfall data serve as a reliable alternative, and their validity has been proven through various studies [6].

Among the available GPM IMERG products, the Final Run V06 dataset was specifically selected because it undergoes a rigorous monthly gauge based bias correction, in contrast to the Early and Late runs; this correction process carries a latency of approximately 3.5 months but yields a bias corrected precipitation estimate at a 0.1° spatial and 30 minute temporal resolution, making it particularly suitable for micro scale, village level hydrological analysis [7]. Recent validation studies over Southeast Asia confirm that GPM IMERG V06 effectively captures extreme rainfall patterns in North Sumatra, reinforcing its reliability as a proxy for rainfall estimation in ungauged micro catchments such as Pasar Melintang Village [8].

From a design philosophy standpoint, the notched trapezoidal, or "low flow channel," configuration reflects a broader principle of Sustainable Urban Drainage Systems (SUDS), which seek to balance peak flow conveyance capacity with low flow hydraulic efficiency. By incorporating a bottom notch, the channel geometry increases the hydraulic radius during non peak conditions, thereby sustaining a self cleansing velocity that helps prevent early stage sedimentation [9]. This compound cross section therefore functions as both a biological and physical sediment management mechanism, aligning conventional hydraulic engineering with contemporary eco drainage principles that pursue ecological performance alongside hydraulic adequacy [10].

Furthermore, recent literature on Southeast Asian hydrology emphasizes that climate change has increasingly challenged the assumption of hydrological stationarity underlying many conventional drainage design standards; shifting Intensity Duration Frequency (IDF) relationships, marked by more frequent high intensity rainfall events, reinforce the need for bias corrected satellite rainfall products such as GPM IMERG V06 in assessing the future resilience of small scale drainage infrastructure [11] [12].

The Rational Method is widely used in drainage planning for small catchment areas ($< 5 \text{ km}^2$) due to its ease of application and suitability for field conditions. Meanwhile, the Log Pearson Type III distribution is recommended by Ministry of Public Works Regulation No. 12/PRT/M/2014 as the method for analyzing rainfall frequency in urban drainage system planning.

Although prior studies have examined drainage capacity degradation from various perspectives, including channel dimensioning, land use change, and system prioritization or modeling [13], most attribute waterlogging primarily to structural deficiencies in channel design. Comparatively few studies have quantitatively verified, at the scale of village level neighborhood drainage, whether waterlogging can persist even when the existing channel geometry itself remains hydraulically adequate, such that the underlying cause must instead be sought in non design, physical obstruction factors such as sedimentation, wild vegetation, and solid waste accumulation. This gap matters because a paradigm that equates waterlogging with insufficient structural capacity risks directing interventions toward unnecessary channel redesign or reconstruction, when routine channel normalization and maintenance may in fact be the more appropriate, cost effective, and rapid solution [14]. The present study addresses this gap by providing empirical evidence at the micro scale of neighborhood drainage in Pasar Melintang Village, Lubuk Pakam Subdistrict, a setting not specifically examined by prior research.

The novelty of this study lies in empirically distinguishing design factors (geometric hydraulic) from non design factors (physical operational) as causes of drainage function degradation at the scale of a village level residential channel, a unit of analysis rarely addressed specifically by studies that tend to focus on city wide or watershed scale systems, or on channels that have undergone significant land use change. Through an integrated hydrological analysis (Log Pearson Type III distribution verified with the Smirnov Kolmogorov and Chi Square goodness of fit tests), Mononobe rainfall intensity, Rational Method design discharge, and Manning based evaluation of existing channel capacity, this study shows that the existing channel capacity deviates by less than 5% from the design

discharge, a result that is hydraulically adequate. Yet field observations reveal that flooding still occurs, driven predominantly by an average of 15 cm of sedimentation, wild vegetation growth on the channel walls, and solid-waste accumulation. This finding underscores that, at the scale of village level environmental drainage, capacity evaluation cannot rely on geometric analysis alone but must be accompanied by verification of the channel's actual physical condition, since the two forms of evaluation can lead to fundamentally different diagnoses and management recommendations.

This study aims to: (1) analyze design flood discharge using 10 year GPM data with the Log Pearson Type III distribution and the Rational Method; (2) evaluate the capacity of existing drainage channels using Manning's Equation; and (3) recommend appropriate mitigation measures based on field findings in Pasar Melintang Village, Lubuk Pakam Subdistrict, Deli Serdang Regency.

2. Research Method

2.1 Location and Type of Research

The study was conducted in the neighborhood drainage channels of Pasar Melintang Village (3°33'42" N – 98°51'48" E), Lubuk Pakam Subdistrict, Deli Serdang Regency, North Sumatra Province. The study employed a descriptive quantitative approach, integrating direct on site measurements of channel dimensions as primary data with an analysis of satellite rainfall data as secondary data.

2.2 Research Stages

The research stages included: (1) preparation and literature review; (2) collection of primary data (channel dimensions) and secondary data (GPM); (3) processing and analysis of hydrological and hydraulic data; (4) evaluation of channel capacity; and (5) formulation of conclusions and recommendations.

3. Description and Technical

3.1 Population and Sample

The study population consists of the entire drainage system in Pasar Melintang Village, with a specific sample comprising a 110 meter long channel section (STA 0+000 to STA 0+110) and annual maximum daily rainfall data over a 10 year observation period (January 2015–December 2024).

3.2 Sampling Techniques

Primary data were obtained through field surveys to measure the channel base width (b), water depth (y), water surface width (T), low flow channel notch dimensions, and channel bed slope (S). Measurements were taken using a steel tape at several observation points representative of the channel's geometric conditions along the 110 meter section. The channel bed slope (S) was determined using a steel measuring the elevation difference (H) between the upstream and downstream ends of the 110 m channel segment, from which S was calculated as the ratio of elevation difference to horizontal channel length. Secondary data were obtained by extracting NASA/JAXA GPM IMERG Final Run V06 products at the study location coordinates via the NASA GES DISC/Earthdata platform, comprising daily rainfall data for the period 2015–2024. The GPM IMERG Final Run product provides global precipitation estimates at a spatial resolution of $0.1^\circ \times 0.1^\circ$ (approximately 11 km) and a temporal resolution of 30 minutes, and is made available free of charge through the official portal (gpm.nasa.gov) approximately 3.5 months after observation, once the data have undergone monthly gauge-based bias correction .

Table 1. Summary GPM Monthly Average Daily Rainfall Data (mm/day)

Year	Rainfall Data (mm/day)												Maks
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2015	46,02	45,31	20,52	28,94	22,49	30,08	16,38	33,80	45,97	30,87	40,54	47,83	47,83
2016	43,91	61,67	40,75	16,31	29,89	47,14	35,76	44,61	71,53	88,93	41,12	40,97	88,93
2017	30,86	45,54	25,49	31,50	44,50	52,43	50,07	47,81	75,96	68,82	34,61	53,67	75,96
2018	46,74	29,69	18,61	33,63	43,65	59,91	27,89	49,67	28,43	62,43	31,61	25,33	62,43
2019	22,32	52,83	26,65	23,47	41,86	32,79	15,70	30,08	36,74	38,58	40,21	57,83	57,83
2020	61,63	33,89	26,74	32,28	38,40	40,44	32,53	34,19	45,18	31,38	43,62	43,22	61,63
2021	67,32	24,90	42,17	74,39	21,20	41,77	44,76	41,96	56,07	96,54	50,65	104,76	104,76
2022	38,91	61,90	50,65	18,68	34,03	85,69	42,56	49,18	41,21	58,76	60,82	73,18	85,69
2023	53,46	32,34	60,65	18,61	47,46	58,94	34,57	48,58	25,66	49,11	70,19	44,38	70,19
2024	56,71	90,96	29,09	28,09	45,68	61,22	23,83	57,40	47,81	44,03	33,92	22,11	90,96

Source: NASA and JAXA's GPM Satellite, 2026

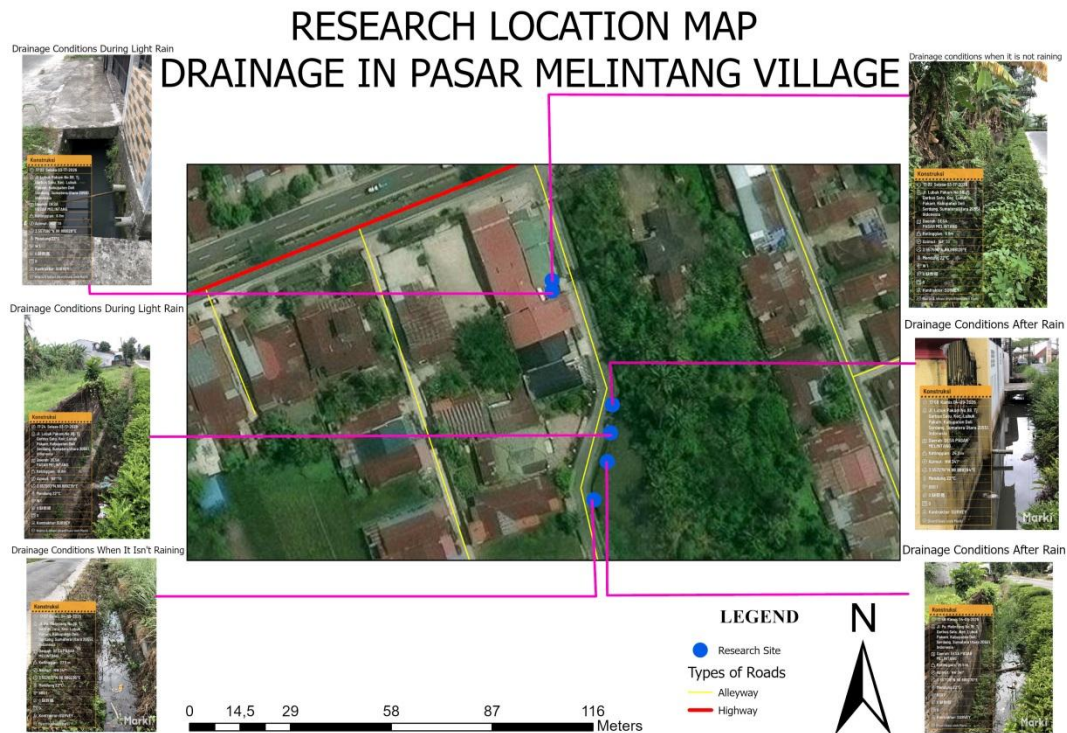


Figure 1. Map of the Study Location.

3.3 Operational Definitions of Variables

The main variables used in this study include: rainfall intensity (I , mm/hour), runoff coefficient (C), catchment area (A , ha), Manning roughness coefficient (n), hydraulic radius (R , m), channel bed slope (S , m/m), water depth (y , m), and top width of the water surface (T , m). The symbol y is used consistently to denote water depth, while the symbol T is used to denote the top width of the water surface, in accordance with open-channel hydraulic conventions.

3.4 Analysis Tools

The tools used include: field measuring instruments (steel tape measure), spreadsheet data processing software, GPM satellite imagery from NASA Earthdata, Google Earth Pro, and ArcGIS Pro for spatial analysis of the catchment area.

The overall data integration workflow followed four sequential stages: (1) extraction of point-coordinate rainfall estimates for Pasar Melintang Village from the NASA GES DISC / Earthdata platform; (2) verification of the bias correction procedure associated with the GPM IMERG Final Run V06 product, given its multi satellite and gauge fusion basis; (3) spatial delineation of the 0.96 ha sub watershed and computation of the weighted runoff coefficient (C_w) using ArcGIS Pro; and (4) field survey to directly measure channel base width (b), water depth (y), Manning roughness (n), and channel bed slope (S) using steel tape and elevation leveling. This staged workflow ensured consistency between the satellite-derived hydrological inputs and the field-based hydraulic parameters used in the subsequent analysis.

3.5 Data Analysis Techniques

Data analysis was conducted in stages as follows:

- a) Frequency Analysis: The Log Pearson Type III distribution method was used to determine the design rainfall based on the statistical parameters C_S , C_V , and C_K , with verification through the Chi Square and Smirnov Kolmogorov goodness of fit tests. In accordance with the hydrological planning criteria set out in Ministry of Public Works Regulation No. 12/PRT/M/2014, a design return period of $T = 2$ years was adopted for this study. This selection reflects the area typology (a small scale residential/neighborhood drainage system) and the limited size of the catchment

area (0.96 ha), consistent with the Regulation's provision that a 2 year return period is appropriate for tertiary/neighborhood drainage channels serving small catchments (< 10 ha).

Mathematically, the Log Pearson Type III distribution operates on the logarithmically transformed rainfall series $Z = \log X$, and is characterized by three log space statistics: the mean of logarithms, the standard deviation, and the skewness coefficient, from which a frequency factor K is obtained from standard Pearson Type III tables based on C_s and the selected return period T , such that the design rainfall is computed as $\log(XT)$ [15]. This log space formulation is what gives the distribution its robustness for the right skewed rainfall data typically observed in tropical, ungauged micro catchments.

- b) Rainfall Intensity, calculated using the Mononobe method with the equation:

$$I = \left(\frac{R_{24}}{24} \right) \times \left(\frac{24}{t_c} \right)^{\frac{2}{3}} \dots (1)$$

Description:

I = Rainfall intensity (mm/hour)
 R_{24} = Maximum daily rainfall (mm/day)
 t_c = Concentration time (hours)

- c) Design Flood Discharge, calculated using the Rational Method with the equation:

$$Q = 0,278 \times C \times I \times A \dots (2)$$

Description:

Q = Design flow rate (m³/s)
 C = Surface flow coefficient
 A = Catchment area (km²)

- d) Channel Capacity, calculated using Manning's Equation as follows:

$$V = \left(\frac{1}{n} \right) \times R^{\frac{2}{3}} \times S^{\frac{1}{2}} \dots (3)$$

Description:

V = Flow velocity (m/s)
 n = Manning roughness coefficient
 R = Hydraulic radius (m)
 S = Channel bed slope (m/m)

Channel capacity is calculated as $Q_s = V \times A$, where A is the wet cross sectional area (m²) [5].

4. Results and Discussions

4.1 Overview of the Existing Channel Conditions

The existing drainage channel in Pasar Melintang Village is trapezoidal in shape with a low flow channel at the bottom, constructed of plastered river stone masonry. The channel extends for approximately 110 m (STA 0+000 to STA 0+110) with the following primary dimensions: base width $b = 0.54$ m, water depth $y = 0.25$ m, water surface width $T = 0.60$ m, and wall slope $m = 0.0625$. The low flow channel notch at the bottom of the channel has a width of $b = 0.08$ m and a depth of $y = 0.09$ m; this notch depth is calculated as the difference between the total channel wall depth (57 cm) and the depth of the main trapezoid (48 cm), such that $57 \text{ cm} - 48 \text{ cm} = 9 \text{ cm} = 0.09 \text{ m}$.

Field observations identified four types of physical obstructions within the channel: (1) soil and silt deposits with an average height of 15 cm along the channel bed; (2) growth of weeds and vegetation on the left side of the channel; (3) rocks and loose material in the STA 0+000–0+025 segment; and (4) household waste scattered evenly along the channel. Collectively, these four physical obstructions significantly reduce the channel's effective hydraulic capacity.

These obstructions affect channel performance not only by physically occupying the wetted cross-section but also by increasing the effective Manning roughness coefficient along the affected reach, particularly where wild vegetation and household waste line the channel walls; both effects act jointly to reduce the available flow area and impede smooth, laminar conveyance of runoff [16].

4.2 Statistical Analysis of GPM Rainfall Data

Annual maximum daily rainfall data extracted from the GPM IMERG Final Run V06 product for the period 2015–2024 were statistically analyzed. A summary of the statistical parameters is presented in Table 2.

Table 2. Summary of Statistical Parameters for GPM Rainfall Data (2015–2024).

Statistical Parameters	Notation	Value	Unit
Number of data points	N	10	years
Average value	$\bar{X}$	74.62	mm
Standard deviation	S	17.77	mm
Coefficient of variation	Cv	0.24	–
Skewness coefficient	Cs	0.20	–
Kurtosis coefficient	Ck	2.41	–

Source: Calculations, 2026.

A Cs value of 0.20, which is close to zero, indicates a relatively symmetric data distribution, while a Cv value of 0.24 indicates low to moderate data variability. A Ck value of 2.41, which is close to 3, confirms that the data distribution does not deviate significantly from a normal distribution. These statistical parameters are then used as the basis for selecting the best distribution through a series of goodness of fit tests.

4.3 Frequency Analysis and Distribution Selection

All tested distributions Normal, Log Normal, Gumbel, and Log Pearson Type III were deemed acceptable in both the Chi Square Test and the Smirnov Kolmogorov Test. The Log Pearson Type III distribution was selected as the preferred distribution because it had the smallest $\Delta_{\max}$ value (0.10) in the Smirnov Kolmogorov test and the lowest calculated χ^2 value ($0.40 < \chi^2_{\text{critical}} = 3.841$), in accordance with the criteria Ministry of Public Works Regulation No. 12/PRT/M/2014. The design rainfall for various return periods is presented in Table 3.

Table 3. Design Rainfall – Type III Pearson Log-Normal Distribution.

Return Period (T)	K Factor	R_{24} (mm/day)
2 years	–0.033	73.279
5 years	0.850	89.718
10 years	1.282	97.380
25 years	1.751	105.746
50 years	2.054	111.134

Source: Calculations, 2026.

Based on the typology of the residential area and a catchment area of 0.96 ha, the design return period established in accordance with Ministry of Public Works Regulation No. 12/PRT/M/2014 is $T = 2$ years with a design rainfall intensity $R_{24} = 73.279$ mm/day. This value serves as the primary input for calculating rainfall intensity using the Mononobe Method. The concentration time (t_c) is calculated based on a drainage runoff length of 110 meters and the topographic characteristics of the catchment area, resulting in $t_c = 0.053$ hours and a design rainfall intensity $I = 181.083$ mm/hour.

4.4 Calculation of Design Flood Discharge (Rational Method)

The 0.96 ha catchment area consists of three land-use types: residential (0.46 ha; $C = 0.50$), unmanaged land (0.40 ha; $C = 0.30$), and paved roads (0.10 ha; $C = 0.95$). The weighted combined runoff coefficient obtained is $C_w = 0.464$. Substituting these values into Equation (2) yields the design flood discharge as follows:

$$Q = 0.278 \times 0.464 \times 181.083 \times 0.96 = 0.224 \text{ m}^3/\text{second} \dots (4)$$

4.5 Evaluation of Existing Channel Capacity (Manning's Equation)

The calculation of the hydraulic parameters of the existing channel was performed based on the dimensions obtained from field measurements. The main trapezoidal cross-section and the low flow channel notch were calculated separately and then summed to obtain the total wetted cross sectional area. The channel wall slope (m) was obtained from the ratio of the horizontal difference to the vertical height of the wall: with the width difference $(T - b)/2 = (0.60 - 0.54)/2 = 0.03$ m and a

vertical height of 0.48 m, we obtain $m = 0.03/0.48 = 0.0625$. A summary of the hydraulic parameters is presented in Table 4.

Table 4. Hydraulic Parameters of the Existing Channel.

Hydraulic Parameters	Notation	Value	Unit
Total wet cross-sectional area	A	0.1497	m ²
Total wet perimeter	P	1.2236	m
Hydraulic radius	R	0.1223	m
Wall slope	m	0.0625	–
Flow velocity	V	1.46	m/s
Existing channel capacity	Q _s	0.219	m ³ /sec

Source: Calculation results, 2026.

The flow velocity $V = 1.46$ m/sec falls within the permissible range for the construction of plastered river stone masonry ($V_{\min} = 0.60$ m/sec; $V_{\max} = 3.00$ m/sec), so it does not have the potential to cause sedimentation or erosion on the channel walls under clean conditions [8].

4.6 Comparison of Design Discharge and Channel Capacity

A comparison between the design flood discharge (Q) and the existing channel capacity (Q_s) is presented in Table 5.

Table 5. Comparison of Design Discharge and Existing Channel Capacity.

Design Q (m ³ /s)	Existing Q _s (m ³ /s)	ΔQ (m ³ /sec)	Deviation (%)	Status
0.224	0.219	0.005	2.23	ADEQUATE

Source: Calculation results, 2026.

The capacity deviation of 2.23% is well below the 5% technical tolerance threshold established in drainage design standards. Thus, the existing drainage channel is deemed ADEQUATE in terms of geometric design. It should be emphasized that the value of $Q_s = 0.219$ m³/sec was obtained under conditions where the channel was obstructed by 15 cm of sediment, wild vegetation, and debris. If all these physical obstructions were removed through a maintenance program, the channel's effective capacity is projected to potentially exceed the design flow rate of $Q = 0.224$ m³/sec by a significant margin.

This finding is consistent with various previous studies that concluded that the degradation of drainage capacity in residential areas is primarily caused by a lack of maintenance rather than hydraulic design errors [17], [18]. Specifically, the 15 cm of channel bed sedimentation identified in the field directly contributes to reducing the effective wet cross sectional area and increasing the active Manning roughness coefficient, thereby causing the flow capacity to decrease from its initial design condition. A periodic maintenance program that includes dredging sediment at least twice a year and clearing vegetation every three months is projected to restore the channel's capacity to its optimal condition [19].

It is worth emphasizing that the relationship between sediment accumulation and capacity loss in Manning's Equation is not linear but highly sensitive, since flow velocity V is proportional to the hydraulic radius R raised to the power of $2/3$. Consequently, even a moderate reduction in effective channel depth such as the 15 cm of sedimentation observed at Pasar Melintang, which represents roughly 60% of the 25 cm design water depth can produce a disproportionately large reduction in both flow velocity and discharge capacity if the sediment layer is allowed to accumulate further [20]. This non-linear sensitivity reinforces the urgency of routine dredging, since allowing sedimentation to progress unchecked risks a steeper decline in hydraulic performance than a linear extrapolation would suggest.

Framed this way, the flooding experienced in Pasar Melintang Village is best characterized as an operational rather than a structural failure: reconstructing or enlarging the channel would address a deficiency that, based on the present hydraulic evaluation, does not actually exist, while diverting resources away from the comparatively simple and cost effective task of restoring the channel to its as built condition [21]. This distinction is consistent with recent findings that emphasize separating maintenance-driven capacity loss from genuine design under-sizing before committing to infrastructure redesign.

Beyond restoring existing capacity, longer-term resilience in Pasar Melintang Village and similar semi urban settlements in Lubuk Pakam Subdistrict would benefit from complementary source-control measures. Integrating biopores and household scale infiltration wells within the residential catchment could gradually reduce the weighted runoff coefficient C_w below its current value of 0.464, providing an additional buffer against the more intense rainfall events anticipated under projected climate trends, while advancing the eco-drainage philosophy that underlies the notched trapezoidal channel design itself [20], [22]

5. Conclusion and Suggestion

5.1 Conclusion

Based on the hydrological and hydraulic analyses conducted on the local drainage system in Pasar Melintang Village, Lubuk Pakam Subdistrict, Deli Serdang Regency, the following conclusions can be drawn:

GPM satellite rainfall data for the period January 2015–December 2024 yielded a design rainfall $T = 2$ years of $R_{24} = 73.279$ mm/day using the Log Pearson Type III distribution. The design rainfall intensity obtained using the Mononobe Method is $I = 181.083$ mm/hour, resulting in a design flood discharge based on the Rational Method of $Q = 0.224$ m³/second ($C_w = 0.464$; $A = 0.96$ ha).

Evaluation of the capacity of the existing trapezoidal channel using the Manning Equation with parameters $y = 0.25$ m, $T = 0.60$ m, $y_{\text{takikan}} = 0.09$ m, $n = 0.025$, and $S = 0.022$ m/m—yields a design capacity of $Q_s = 0.219$ m³/second ($A = 0.1497$ m²; $V = 1.46$ m/second). The deviation of 2.23% from the design flow rate is below the 5% technical tolerance threshold; therefore, the channel is deemed ADEQUATE in terms of geometric design.

The measured capacity deficit is temporary and caused by physical obstructions such as 15 cm of soil sedimentation, wild vegetation, loose rocks, and household waste not by design dimension errors. The flooding problem in Pasar Melintang Village stems more from a lack of routine maintenance than from insufficient hydraulic design capacity.

5.2 Suggestion

The village government or relevant agencies should immediately implement a scheduled drainage maintenance program, which includes: (a) dredging sediment at least twice a year (at the beginning and end of the rainy season) to restore the 15 cm of effective depth lost due to sedimentation; (b) clearing wild vegetation every 3 months; and (c) periodically removing loose material and trash.

Monthly visual inspections of the channels are necessary for early detection of blockages before they develop into more serious problems. The residents of Pasar Melintang Village need to be actively involved through community service programs facilitated by the village government to foster a sense of ownership of the local drainage infrastructure.

Should significant land-use changes occur in the future which have the potential to substantially increase the runoff coefficient policy makers should seriously consider reevaluating the channel dimensions and implementing eco-drainage concepts (infiltration wells, biopores, or retention ponds) as long-term flood mitigation strategies.

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