EVALUATION STUDY OF DRAINAGE CHANNELS AS AN EFFORT TO MANAGE FLOODS IN BADRAN ASRI KARANGANYAR REGENCY

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ABSTRACT

Badran Asri Hamlet in Cangakan Village, Karanganyar District, often experiences flooding and inundation, this is due to the drainage channels being classified as poor and starting to experience a decline in the quality of the drainage channels so that they are unable to accommodate runoff water. This is caused by many channels being blocked by sediment and rubbish thrown into the waterways, causing the channels to not work optimally. So it is necessary to evaluate the existing drainage channels because this is the most effective way to implement it at the moment and will not reduce the width of the existing road. The aim of this research is to evaluate flood management efforts and the problems that exist in the area. The method used in this research is quantitative descriptive, namely by first conducting a survey at the research location and then analyzing the data obtained. After evaluating the 10-year flood discharge of 25 channels in Badran Asri Hamlet, Cangakan Subdistrict, there were 13 channels that did not meet domestic flood discharge capacity and 12 channels that still met domestic flood discharge capacity. As an alternative, improvements need to be made by re-planning by increasing the capacity of the drainage channel in the form of new channel dimensions as a flood control solution so that a channel discharge is obtained that is able to meet the domestic flood discharge capacity.

Keywords: *Drainage Channel, Flood, puddle, alternative*

1. INTRODUCTION

Water is an important element in human life. However, water can be a dangerous enemy for humans if it is not managed properly as happens in many countries in the world, including Indonesia. Environmental problems that are often encountered are floods in the rainy season, one of the efforts to overcome floods is to create drainage channels that are able to collect rainwater well (Iqbal, Ariyanto, & Rahmi 2019). Flooding is a natural phenomenon caused by high rainfall that results in water overflowing beyond the capacity of the drainage system in a certain area. This results in inundation in the surrounding area, posing a significant threat to the community.

One of the areas that often occurs floods and inundation in Indonesia is Badran Asri Hamlet, Cangakan Village, Karanganyar District, Karanganyar Regency. Flooding and waterlogging in this area is a complex and worrying problem that is a shared responsibility of the government and local communities. Some drainage channels in the Badran Asri Hamlet area, Cangakan Village, are classified as poor and the quality of drainage channels has begun to decline, so that they are unable to accommodate runoff water and cause inundation and flooding. This is due to the large number of channels that are covered by sediment and garbage that is thrown into the waterways causing the channels not to work optimally.

Based on direct surveys in the field, the drainage channels at several points have soil deposits and light sedimentation, although there are several channels that have been cleaned are still unable to accommodate water discharge optimally during rain. The drainage channel in the Badran Asri Hamlet area, Cangakan Village, Karanganyar District, is not able to accommodate rainwater discharge which results in flooding. Therefore, it is necessary to evaluate the existing drainage channels because this method is the most effective at this time and will not reduce the width of the existing road. This research is expected to be able to evaluate and overcome the problems that exist in the area.

The objectives of this final project are as follows:
1. Knowing the amount of domestic flood discharge for 10 years at the study location.
2. Knowing the capacity of the existing channel in Badran Asri Hamlet, Cangakan Village.
3. Knowing the evaluation of drainage channels in Badran Asri Hamlet, Cangakan Village which is unable to accommodate domestic flood discharge.
4. To find out the alternatives that will be used in flood management in Badran Asri Hamlet, Kelurahan.

Drainage

Drainage is a system created to deal with the problem of excess water above and below the soil surface (Wesli, 2008). Drainage can be interpreted as an effort to control groundwater quality. The drainage process includes groundwater quality control, which includes groundwater and surface water. When it rains, the water flowing on the surface must be disposed of immediately so that there is no puddle that interferes with activities and can even cause losses, in accordance with the principle of the discharge line. (Fairizi, 2015)

In general, drainage is a field of science that studies how to drain excessive water in a certain context of use. Urban or applied drainage is a field of drainage that specializes in the study of urban areas that are closely related to the conditions of the social and cultural environment in urban areas. (Hasmar, 2012)

Drainage system

A drainage system is a series of water buildings that function to reduce and/or remove excess water from an area or land, so that it can function optimally. Traced from the upstream, the drainage system building consists of an interceptor drain, a collector drain, a conveyor drain, a main drain, and a receiving water. Along the system we often find other buildings, such as culverts, siphons, water bridges (aquaducts), overflows, sluices, waterfall buildings, tando ponds, and pumping stations. In a complete system, before entering the receiving water body, the water is treated first at the Wastewater Treatment Plant (WWTP), especially for mixed systems. Only the receiving body, so it does not damage the environment (Suripin, 2004).

In road projects, the main drainage needs are divided into two categories, namely, subsoil drainage, and road body drainage (traffic lanes). Underground drainage handles the water in the ground and to ensure that the water level can be kept low enough not to allow saturation of the road structure and the surrounding soil. Excessive water of this type will cause the structure and soil to become plastic and unable to withstand the weight of traffic. Underground drainage also helps prevent freezing damage to road structures and keeps road structures dry. Meanwhile, the drainage of the road body (traffic lane) is often connected to the same piped drainage system or open ditch where water is discharged to a safe distance from the road body (traffic lane). (Admindpu, 2022)

2. RESEARCH METHODS

The location of this research was carried out in the Badran Asri Hamlet area, Cangakan Village, which is administratively located in Karanganyar District, Karanganyar Regency as shown in Figure 1.

Source: Esri, 2024

Figure 1. Map of the Research Location

Data collection

The data collection needed includes topographic maps and land use obtained from the Karanganyar Regency Public Works Office. Rainfall data was obtained from the Bengawan Solo River Region Center (BBWS) for 10 years (2014 - 2023) at the Delingan Reservoir rain station. Population data was obtained from the Central Statistics Agency (BPS) of Karanganyar Regency.

Research stages

The preparation stage is carried out by taking care of the letters needed for administrative completeness that will be used to request data data to the relevant agencies, namely rainfall data, topographic maps and land use, population data, and existing drainage data. Field surveys are carried out by field review to find out the existing state of drainage channels by referring to existing situation maps. Literature study using guidebooks and highway drainage planning.

Stages of data analysis

The stages of research to evaluate drainage channels are as follows:

1. Testing Data Homogeneity, using Thiessen's Polygon method
2. Selection of distribution test with statistical principles
3. Calculating the planned rainfall, the calculation was carried out using the Gumbel, Normal, Normal Log and Pearson Type III Log methods. For distribution suitability testing, there are two types, namely the Smirnov-Kolmograph Test and the Chi-Squared Test.
4. Calculating the area of the flow area, calculated using the ArcGIS 10.8 application using data in the form of format (.shp), namely sub-district administrative data, and drainage channel data.
5. Calculating the intensity of rainfall is calculated using the planned rainfall that has been obtained by the mononobe method.
6. Calculating the flow coefficient, the calculation is carried out based on the land use map created in the ArcGIS 10.8 application.
7. Calculating the planned flood discharge, the calculation is carried out using the Rational formula.
8. Calculating the discharge of dirty water, calculated by multiplying the percentage of the population by the amount of clean water use, and the number of people in accordance with the area of their respective areas.
9. Calculating the discharge of domestic channels, obtained by adding the planned flood discharge with the discharge of dirty water.
10. Calculating the capacity of excision drainage channels
11. Calculating alternatives in the form of planning new channels

3. RESULTS AND DISCUSSION

Identify the cause of inundation

Based on the results of the survey, the condition of the drainage channel in Badran Asri Hamlet, Cangakan Village is a lot of sediment deposits that make the channel not function properly so that the drainage channel cannot drain water into the river. Drainage channels experience a condition of garbage that causes the channel to be clogged and the existing dimensions of the channel change in shape and size due to changes in land use.

Hydrological analysis

1. Rain Data Consistency Test

Rainfall data consistency test can be carried out by the RAPS (*Rescale Adjusted Partial Sums*) method using rainfall data for the last 10 years obtained from the Delingan Reservoir Rain Station. The results of the consistency test for the Delingan Reservoir Rain Station with the RAPS Method are consistent so that they can be directly used for further analysis.

2. Selection of Distribution Type

To strengthen the estimate of the selection of the frequency distribution taken, the type of distribution was selected using statistical principles. So the result of the limit requirement for determining the type of distribution that meets is the distribution of the Pearson Type III Log.

3. Pearson Type III Log Method Frequency Analysis

The rain of the 10-year recurrence period for rain in the Delingan Reservoir Station area was 148.52 mm

$$\text{Log Xt} = \log \bar{X} \cdot K \cdot S \log Xi$$
$$= 2.0444 \cdot 1{,}212 \cdot 0{,}11$$
$$= 2.1718$$

$$\text{Xt} = \text{Antilog (Log Xt)} = 148.52 \text{ mm}$$

4. Frequency Distribution Test

This test is usually carried out with the aim of finding out the correctness of the hypothesis that has been taken with the appropriate frequency distribution.

- Smirnov-Kolmogorov *test method*, the sum of data n = 10 and the degree of confidence α = 5%. So the critical ΔP = 0.41 and the maximum ΔP deviation = 0.1229. Provided that the maximum ΔP < critical ΔP is acceptable.
- The Chi-Squared *test method*, then it can be = X^2 $hitung$ 1.20 and = 3.841 with dk = 1 and the degree of confidence α = 5%. Acceptably.X^2 $tabel X^2$ $hitung < X^2$ $tabel$

Flood discharge plan

1. Area of the drainage area (A). To find out the area of the drainage area and also the length of the channel in this study, it was assisted by ArcGIS 10.8 software.
2. Rainfall intensity (I). Rainfall intensity is the height of rainfall that occurs during a period of time when the water is concentrated. The calculation of rainfall intensity uses the mononobe method.
3. Conduction Coefficient (C).

For the calculation of the planned flood discharge with the rational method of re-aging 10 years on Jalan Cangakan, it can be seen below:

Qplan = 0.278 x C x I x A
Qplan = 0.278 x 0.425 x 113.633 x 0.073
Qplan = 0.985 m3/sec

Table 1. Results of Planned Flood Discharge Calculation

No	Name	Long (m)	Area (km2)	C	Tc (jam)	Intensity (mm/jam)	Qplan (m3/det)
1	Jl. Cangakan	720	0,073	0,425	0,307	113,194	0,982
2	Jl. Cangakan II	220	0,019	0,607	0,127	204,293	0,656
3	Jl. Cik Ditiro	331	0,037	0,499	0,265	124,879	0,640
4	Jl. Daleman I	320	0,019	0,429	0,254	128,324	0,285
5	Jl. Daleman II	76	0,005	0,521	0,048	387,217	0,258
6	Jl. Demak	283	0,018	0,625	0,169	168,255	0,524
7	Jl. Jungke Permai	342	0,018	0,475	0,210	145,665	0,344
8	Jl. K.H.A Dahlan I	300	0,025	0,292	0,155	178,598	0,355
9	Jl. K.H.A Dahlan II	139	0,004	0,453	0,074	291,597	0,155
10	Jl. K.H.A Dahlan III	310	0,031	0,311	0,160	174,362	0,464
11	Jl. K.H.A Dahlan IV	97	0,011	0,558	0,049	384,365	0,652
12	Jl. K.H.A Dahlan V	319	0,020	0,467	0,253	128,657	0,335
13	Jl. Captain Mulyadi	930	0,053	0,528	0,359	101,878	0,786
14	JL. b. Equality came	373	0,024	0,579	0,199	151,050	0,585
15	JL. b. Samanhudi II	202	0,015	0,620	0,149	182,976	0,464
16	JL. b. Samanhudi IIII	78	0,005	0,622	0,050	381,827	0,360
17	Jl. Lawu	1051	0,027	0,415	0,414	92,714	0,290
18	JL. Fish Manchur	306	0,023	0,367	0,185	158,545	0,370
19	Jl. Mataram	321	0,038	0,479	0,255	127,957	0,655
20	Jl. Pajang I	210	0,012	0,610	0,156	177,600	0,369
21	Jl. Pajang II	432	0,020	0,611	0,193	153,978	0,523
22	Jl. Pajang III	125	0,010	0,606	0,086	263,772	0,465
23	Jl. Pajang IV	101	0,014	0,604	0,067	311,140	0,714
24	Jl. Raya Papahan	1012	0,037	0,616	0,564	75,471	0,480
25	Jl. Suharso	130	0,005	0,398	0,090	256,419	0,151
22	Jl. Pajang III	125	0,010	0,606	0,06	263,772	0,465

Source: Calculations, 2024

Dirty water discharge

The calculation of the dirty water discharge in Badran Asri Hamlet, Cangakan Village is as follows:

1. Average clean water needs/person = 100 lt/day/org
2. Amount of wastewater = 80% x Total clean water needs
   = 80% x 100
   = 80 lt/day/org = 1 day : 86400 seconds
   = 0,000926 lt/dt/org
3. Population in 2033 (Pn)= 7475.45 people
4. Dirty water discharge in Badran Asri Hamlet
   Qak = $80\%\ Kebutuhan\ Air \times Pn$
   Qak = $0{,}000926 \times 7475{,}45$
   Qak = 6,922 lt/dt
   Qak = 0.007 m3/det

Dirty water discharge

The calculation of domestic flood discharge is the sum of the planned flood discharge (Qrenc) with the gross water discharge (Qak). An example of calculating the domestic flood discharge of the Cangakan Road channel is as follows:
Qplan = 0.985 m3/det (obtained from the calculation of planned flood discharge)
Qak = 0.007 m3/det

So the magnitude of Qdomestic is calculated by the following formula:
Qdomestic = Qrenc + Qak
Qdomestic = 0.985+0.007
Qdomestic = 0.989 m3/det

For the calculation of the amount of discharge of each other channel, it can be seen in Table 2.

Table 2. Domestic Flood Discharge Per Channel

No	Name	Qplan (m3/det)	Qak (m3/det)	Qdomestik (m3/det)
1	Jl. Cangakan	0,982	0,007	0,989
2	Jl. Cangakan II	0,656	0,007	0,663
3	Jl. Cik Ditiro	0,640	0,007	0,647
4	Jl. Daleman I	0,285	0,007	0,292
5	Jl. Daleman II	0,258	0,007	0,265
6	Jl. Demak	0,524	0,007	0,531
7	Jl. Jungke Permai	0,344	0,007	0,351
8	Jl. K.H.A Dahlan I	0,355	0,007	0,362
9	Jl. K.H.A Dahlan II	0,155	0,007	0,162
10	Jl. K.H.A Dahlan III	0,464	0,007	0,471
11	Jl. K.H.A Dahlan IV	0,652	0,007	0,659
12	Jl. K.H.A Dahlan V	0,335	0,007	0,341
13	Jl. Captain Mulyadi	0,786	0,007	0,793
14	JL. b. Equality came	0,585	0,007	0,591
15	JL. b. Samanhudi II	0,464	0,007	0,471
16	JL. b. Samanhudi IIII	0,360	0,007	0,367
17	Jl. Lawu	0,290	0,007	0,297
18	JL. Fish Manchur	0,370	0,007	0,377
19	Jl. Mataram	0,655	0,007	0,662
20	Jl. Pajang I	0,369	0,007	0,376
21	Jl. Pajang II	0,523	0,007	0,530
22	Jl. Pajang III	0,465	0,007	0,472
23	Jl. Pajang IV	0,714	0,007	0,721
24	Jl. Raya Papahan	0,480	0,007	0,486
25	Jl. Suharso	0,151	0,007	0,158

Source: Calculations, 2024

Hydraulic analysis

The calculation of the capacity of the existing channel on Jalan Cangakan is as follows:

- Channel width (b) = 0,55 m
- Channel height (H) = 0,60 m
- Channel Slope (S) = 0,010
- Roughness of manning (n) = 0,02

1. Cross-sectional area (A) using the formula (2.40)
   A = b x H
   A = 0,55 x 0,60
   A = 0,33 m2
2. Wet circumference (P) using the formula (2.41)
   P = b + 2H
   P = 0,55 + 2 . 0,60

P = 1,75 m

3. Hydraulic radius (R) using formula (2.42)
   R = A / P
   R = 0,33 / 1,75
   R = 0,58 m
4. Flow velocity (V) using formula (2.37)
   V = 1/n × R^(2⁄3) × S^(1⁄2)
   V = 1/10 × (0,58)^(2⁄3) × (0,010)^(1⁄2)
   V = 3.42 m/det
5. Existing channel discharge (Qeks) using the formula (2.36)
   Qeks = A . V
   Qeks = 0,33 . 3,42
   Qeks = 1,128 m3/det

The complete calculation of the existing channel capacity can be seen in Table 3.

Table 3. Existing Channel Capacity

No	Name	n	S	High (m)	Width (m)	Qeks (m3/det)
1	Jl. Cangakan	0,02	0,010	0,60	0,55	1,128
2	Jl. Cangakan II	0,02	0,009	0,50	0,55	0,742
3	Jl. Cik Ditiro	0,02	0,003	0,60	0,60	0,740
4	Jl. Daleman I	0,02	0,003	0,70	0,80	1,799
5	Jl. Daleman II	0,02	0,013	0,40	0,60	0,664
6	Jl. Demak	0,02	0,007	0,35	0,55	0,313
7	Jl. Jungke Permai	0,02	0,006	0,45	0,35	0,204
8	Jl. K.H.A Dahlan I	0,02	0,010	0,50	0,35	0,334
9	Jl. K.H.A Dahlan II	0,02	0,014	0,50	0,25	0,218
10	Jl. K.H.A Dahlan III	0,02	0,010	0,80	0,50	1,752
11	Jl. K.H.A Dahlan IV	0,02	0,021	0,40	0,40	0,382
12	Jl. K.H.A Dahlan V	0,02	0,003	0,50	0,45	0,299
13	Jl. Captain Mulyadi	0,02	0,011	0,50	0,60	0,954
14	JL. b. Equality came	0,02	0,008	0,30	0,35	0,101
15	JL. b. Samanhudi II	0,02	0,005	0,50	0,40	0,301
16	JL. b. Samanhudi IIII	0,02	0,013	0,50	0,40	0,486
17	Jl. Lawu	0,02	0,010	0,60	0,60	1,315
18	JL. Fish Manchur	0,02	0,007	0,40	0,35	0,167
19	Jl. Mataram	0,02	0,003	0,40	0,50	0,227
20	Jl. Pajang I	0,02	0,005	0,45	0,35	0,184
21	Jl. Pajang II	0,02	0,012	0,25	0,40	0,108
22	Jl. Pajang III	0,02	0,008	0,25	0,40	0,090
23	Jl. Pajang IV	0,02	0,010	0,25	0,40	0,100
24	Jl. Raya Papahan	0,02	0,004	0,50	0,55	0,490
25	Jl. Suharso	0,02	0,008	0,50	0,35	0,293

Source: Calculations, 2024

Evaluation of drainage channel capacity

The results of the evaluation of 25 drainage channels in Badran Asri Hamlet, Cangakan Village, are that there are 12 channels that are able to accommodate domestic flood discharge and there are 13 channels that are not able to accommodate domestic floods.

Table 4. Channels that need to be repaired

No	Channel Name	Socket size (m3/det)		Qeksisting (m3/det)	Evaluation Results	Information
1	Jl. Demak	0,531	>	0,313	Flood	Needs Improvement
2	Jl. Jungke Permai	0,351	>	0,204	Flood	Needs Improvement
3	Jl. K.H.A Dahlan I	0,362	>	0,334	Flood	Needs Improvement
4	Jl. K.H.A Dahlan IV	0,659	>	0,382	Flood	Needs Improvement
5	Jl. K.H.A Dahlan V	0,341	>	0,299	Flood	Needs Improvement
6	JL. b. Equality came	0,591	>	0,101	Flood	Needs Improvement

No	Channel Name	Socket size (m3/det)		Qeksisting (m3/det)	Evaluation Results	Information
7	JL. b. Samanhudi II	0,471	>	0,301	Flood	Needs Improvement
8	JL. Fish Manchur	0,377	>	0,167	Flood	Needs Improvement
9	Jl. Mataram	0,662	>	0,227	Flood	Needs Improvement
10	Jl. Pajang I	0,376	>	0,184	Flood	Needs Improvement
11	Jl. Pajang II	0,530	>	0,108	Flood	Needs Improvement
12	Jl. Pajang III	0,472	>	0,090	Flood	Needs Improvement
13	Jl. Pajang IV	0,721	>	0,100	Flood	Needs Improvement

Source: Calculations, 2024

Table 4. Safe Channels

No	Channel Name	Socket size (m3/det)		Qeksisting (m3/det)	Evaluation Results
1	Jl. Demak	0,989	<	1,128	Safe
2	Jl. Jungke Permai	0,663	<	0,742	Safe
3	Jl. K.H.A Dahlan I	0,647	<	0,740	Safe
4	Jl. K.H.A Dahlan IV	0,292	<	1,799	Safe
5	Jl. K.H.A Dahlan V	0,265	<	0,664	Safe
6	JL. b. Equality came	0,162	<	0,218	Safe
7	JL. b. Samanhudi II	0,471	<	1,752	Safe
8	JL. Fish Manchur	0,793	<	0,954	Safe
9	Jl. Mataram	0,367	<	0,486	Safe
10	Jl. Pajang I	0,297	<	1,315	Safe
11	Jl. Pajang II	0,486	<	0,490	Safe
12	Jl. Pajang IV	0,158	<	0,293	Safe

Source: Calculations, 2024

New channel planning

After an evaluation of 25 channels in Badran Asri Hamlet, the results were obtained that 13 drainage channels did not meet the existing domestic flood discharge capacity. Therefore, it is necessary to make improvements by replanning by increasing the capacity of drainage channels as a flood control solution so that channel discharge is obtained that is able to meet the domestic flood discharge capacity.'

Table 4. Recapitulation of New Channel Calculations

No	Channel Name	Length (m)	Socket size (m3/det)	New Dimensions (m)		
				B	h	in
1	Jl. Demak	283	0,531	0,55	0,59	0,20
2	Jl. Jungke Permai	342	0,351	0,35	0,77	0,20
3	Jl. K.H.A Dahlan I	300	0,362	0,35	0,54	0,20
4	Jl. K.H.A Dahlan IV	97	0,659	0,40	0,69	0,20
5	Jl. K.H.A Dahlan V	319	0,341	0,45	0,57	0,20
6	JL. b. Equality came	373	0,591	0,35	1,75	0,20
7	JL. b. Samanhudi II	202	0,471	0,40	0,78	0,20
8	JL. Fish Manchur	306	0,377	0,35	0,90	0,20
9	Jl. Mataram	321	0,662	0,50	1,17	0,20
10	Jl. Pajang I	210	0,376	0,35	0,92	0,20
11	Jl. Pajang II	432	0,530	0,40	1,23	0,20
12	Jl. Pajang III	125	0,472	0,40	1,32	0,20
13	Jl. Pajang IV	101	0,721	0,40	1,81	0,20

Source: Calculations, 2024

4. CONCLUSION

Based on the formulation of the problem and the results of the calculation with the following data:

1. The magnitude of the 10-year domestic flood discharge in 25 channels at the study site includes Jalan Cangakan

0.989 m^3/sec, Jalan Cangakan II 0.663 m^3/sec, Jalan Cik Ditro 0.647 m^3/sec, Jalan Daleman I 0.292 m3/sec, Jalan Daleman II 0.265 m3/sec, Jalan Demak 0.531 m^3/sec, Jalan Jungke Permai 0.351 m^3/det, Jalan K.H.A Dahlan I 0.362 m3/sec, Jalan K.H.A Dahlan II 0.162 m3/sec, Jalan K.H.A Dahlan III 0.471 m3/sec, Jalan K.H.A Dahlan IV 0.659 m3/sec, Jalan K.H.A Dahlan V 0.341 m3/sec, Jalan Kapten Mulyadi 0.793^{m3}/sec, Jalan KH. Samanhudi I 0.591 m^3/sec, Jalan KH. Samanhudi II 0.471 m^3/sec, Jalan KH. Samanhudi III 0.367 m^3/sec, Jalan Lawu 0.297 m^3/sec, Jalan MAS Mansur 0.337 m3/sec, Jalan Mataram 0.662 m^3/sec, Jalan Pajang I 0.376 m^3/sec, Jalan Pajang II 0.530 m^3/sec, Jalan Pajang III 0.472 m^3/sec, Jalan Pajang IV 0.721 m^3/sec, Jalan Raya Papahan 0.486 m^3/sec, Jalan Suharso 0.158 m^3/sec.

2. Kapasitas saluran eksisting sebanyak 25 saluran yaitu Jalan Cangakan 1,128 m^3/det, Jalan Cangakan II 0,742 m^3/det, Jalan Cik Ditro 0,740 m^3/det, Jalan Daleman I 1,799 m3/det, Jalan Daleman II 0,664 m3/det, Jalan Demak sebesar 0,313 m^3/det, Jalan Jungke Permai 0,204 m^3/det, Jalan K.H.A Dahlan I 0,334 m3/det, Jalan K.H.A Dahlan II 0,218 m3/det, Jalan K.H.A Dahlan III 1,752 m3/det, Jalan K.H.A Dahlan IV 0,382 m3/det, Jalan K.H.A Dahlan V 0,299 m3/det, Jalan Kapten Mulyadi 0,954 m^3/det, Jalan KH. Samanhudi I 0,101 m^3/det, Jalan KH. Samanhudi II 0,301 m^3/det, Jalan KH. Samanhudi III 0,486 m^3/det, Jalan Lawu 1,315 m^3/det, Jalan MAS Mansur 0,167 m3/det, Jalan Mataram 0,227 m^3/det, Jalan Pajang I 0,184 m^3/det, Jalan Pajang II 0,180 m^3/det, Jalan Pajang III 0,090 m^3/det, Jalan Pajang IV 0,100 m^3/det, Jalan Raya Papahan 0,490 m^3/det, Jalan Suharso 0,293 m^3/det.
3. Evaluation of drainage channels in Badran Asri Hamlet, Cangakan Village, namely that there are 12 channels that are able to accommodate domestic flood discharge and there are 13 channels that are not able to accommodate floods including Jalan Demak, Jalan Jungke Permai, Jalan K.H.A Dahlan I, Jalan K.H.A Dahlan IV, Jalan K.H.A Dahlan V, Jalan KH. Samanhudi I, Jalan KH. Samanhudi II, Jalan MAS Mansur, Jalan Mataram, Jalan Pajang I, Jalan Pajang II, Jalan Pajang III, Jalan Pajang IV.
4. An alternative that will be used in flood management in Badran Asri Hamlet, Kelurahan is to replan by increasing the capacity of drainage channels in the form of new channel dimensions as a flood management solution so that channel discharge is obtained that is able to meet the domestic flood discharge capacity.

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