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Analysis of Drainage System for Overcoming Floods on Untung Jawa Island, South Thousand Islands District, DKI Jakarta

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Abstract

In general, drainage can be used to reduce excess water, whether from rainwater, seepage, or excess irrigation water from an area, so that the function of the area is not disturbed. This study aims to analyze and examine the drainage problems that exist on Untung Jawa Island, South Seribu Islands District, DKI Jakarta, the drainage channels are poorly maintained and frequent flooding. The data used in this study are primary and secondary data, in planning the calculation of flood discharge a 2-year return period is used. For the calculation of flood discharge, the plan uses a rational method and is added to household flood discharge, and the results will be compared with the existing condition of the drainage channel on Untung Jawa Island, South Thousand Islands District, DKI Jakarta. The results obtained that the largest design flood discharge is 3.277 m3/second on channel A8 and the smallest design flood discharge is 0.094 m3/second on channel C5. for the existing condition of the drainage channel, there are 11 channels that fall into the unsafe category because the condition of the existing channel capacity is less than the planned flood discharge, namely channels A2, A3, A4, A5, A6, A7, A8, A10, B2, B3 and B4. Infiltration wells are planned to accommodate the excess flood discharge, and it takes 19 infiltration wells on channel B4, 13 pieces on channel B3, 9 pieces on channel A8, 6 pieces on channel A2, A3, A6 and B2, 4 pieces on channel A7 , 2 pieces on channel A10, 1 piece on channel A4 and A5.

Keywords:
Drainage, Hydrological Analysis, Infiltration Wells, Planned Flood Discharge.

1. Preliminary

Population growth in Indonesia is increasing every year and requires a lot of land to be used as housing, one of which is in the Thousand Islands area. The lack of land and the large number of residential developments and their supporting facilities make a lot of inappropriate land use. The impact of many human activities and the lack of attention to the environment in the Thousand Islands area causes problems, namely the presence of puddles when it rains. When the rainfall is quite high, it is not uncommon for water to stagnate on the roads, this can be due to the many clogged drainages or the unconnected drainage on the island. Stagnant water that occurs can also be caused by the lack of functioning of the drainage system or inadequate channels to accommodate water discharge. If no action is taken to overcome this problem, it can disrupt the activities of the community and tourists who are visiting the island.

Planning and maintenance of drainage channels is very necessary to maintain the flow of water and minimize the occurrence of inundation. According to (Suripin 2020), drainage has the meaning of draining, draining, throwing or diverting water. In general, drainage is defined as a series of water structures that function to reduce and/or remove excess water from an area or land, so that the land can be used optimally.

So in this case it is necessary to analyze the drainage system to deal with flooding on Untung Jawa Island, South Seribu Islands District, DKI Jakarta, which based on the zoning map of the South Thousand Islands District is a residential zone in the island region and it is not uncommon for the roads on Untung Jawa Island to be flooded with water. at times of high rainfall.

1.1 Research Purposes

Based on the introduction above, this research has the following objectives.

1. Knowing the condition of the existing drainage channel on Untung Jawa Island, South Thousand Islands District, DKI Jakarta.
2. Knowing the amount of flood discharge capacity on Untung Jawa Island, South Thousand Islands District, DKI Jakarta.
3. Knowing whether or not a new drainage system planning and its complementary buildings are needed on Untung Jawa Island, South Thousand Islands District, DKI Jakarta.

2. Literature Review

In the field of civil engineering, drainage can generally be defined as a technical action to reduce excess water, either from rainwater, seepage, or excess irrigation water from an area/land, so that the function of the area/land is not disturbed. Drainage can also be interpreted as an attempt to control the quality of groundwater in relation to salinity. (Suripin 2020)

2.1 Hydrological Cycle

Hydrology is the study of the intricacies of water, its occurrence and distribution, its physical and chemical properties, and its response to human behavior. While the Hydrological Cycle is a continuous process in which water moves from the earth to the atmosphere and then back to the earth again. (Triatmodjo 2016)

2.2 Frequency Analysis

The purpose of frequency analysis of hydrological data is related to the magnitude of extreme events related to the frequency of their occurrence through the application of probability distributions (Suripin 2020). The analyzed hydrological data is assumed to be independent and randomly distributed and stochastic. In statistics, there are several kinds of frequency distribution and four types of distribution that are widely used in the field of hydrology are the Normal Distribution, Log Normal Distribution, Log-Person III Distribution, and Gumbel Distribution. Then from the four distribution methods selected based on the requirements that must be met in table 1 as follows.

Table 1. Statistical Selection Conditions for a Distribution

Distribution Type	Distribution Terms
Normal Distribution	Cs = 0 and Ck = 3
Normal Log Distribution	Cs > 3 and Ck > 3
Gumbel Distribution	Cs = 1,139 and Ck = 5,402
Person III Log Distribution	Cs among 0 – 0,9

(Source : Hidrologi Terapan (2015:250)

Before analyzing rain data with one of the distributions above, it is necessary to approach with statistical parameters to determine the right distribution to use. These parameters include:

Coefficient of Variation (Cv)

$$\frac{S}{X} \quad (2.1)$$

Coefficient of Skewness (Cs)

$$\frac{n\sum(X_i-X)^3}{(n-1)(n-2)S^3} \qquad (2.2)$$

Coefficient of Kurtosis (Ck)

$$\frac{n^2\sum(X_i-X)^4}{(n-1)(n-2)(n-3).S^4} \qquad (2.3);$$

Standard Deviation (S)

$$\sqrt{\frac{\sum_{i=1}^{n}(X_i-X)^2}{n-1}} \qquad (2.4)$$

2.3 Rainfall Intensity

Rain intensity is the height or depth of rainwater or height of rainwater per unit time (Suripin 2020). If short-term rain data is not available, only daily rain data is available, then the rainfall intensity can be calculated using the Mononobe formula.

$$I = \frac{X_T}{24}\left(\frac{24}{tc}\right)^{\frac{2}{3}} \qquad (2.5)$$

2.4 Time Coefficient

The formula for the concentration time can be written as follows.

$$t_c = \left(\frac{0{,}87\ x\ L^2}{1000\ x\ S_0}\right)^{0{,}385} \qquad (2.6)$$

2.5 Design Plan Debit

(Suripin 2020) explains that the use of the rational method in drainage areas with several sub-drainage areas can be done by approaching the combined C value or average C and the rainfall intensity is calculated based on the longest concentration time (SNI 2415:2016).

Rational Method Formula:

Q = 0,278. C.I.A (2.7)

With:

Q = Design flood discharge (m3/second)

C = Flow coefficient

I = Rain intensity (mm/hour)

A = Watershed area (km2 or Ha)

2.6 Dirty Water Discharge

According to the Government Regulation of the Republic of Indonesia Number 82 of 2001, wastewater is the residue from a business and or activity in liquid form. Wastewater can come from household (domestic) or industrial (industrial). Discharge of dirty water is calculated based on (03-7065-2005) (Manfaat Serta Fungsi Struktur Organisasi Bagi Perusahaan - SNI Consulting n.d.)by calculating the total discharge of clean water usage multiplied by 80% and not tied to any coefficient, and the discharge of dirty water is discharged into the existing drainage channel using a mixed system.

2.7 Calculation of Drain Dimensions

The drainage channel capacity is calculated based on steady flow conditions using the Manning formula (Kustamar, 2019). The shape of the rectangular hydraulic cross section can be expressed in the following formula.

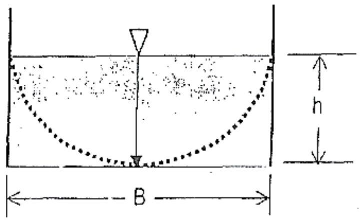

Figure 1. Rectangular drainage channel profile

(Source: Sistem Drainase Perkotaan yang Berkelanjutan, 2004:147)

Wide (A) = B.h (2.8)

Wet Around (P) = B+2h (2.9)

Hydraulic Radius = 1/2.h (2.10)

Peak Width (B) = 2.h (2.11)

Flow Speed (V) = $\frac{1}{n}.R^{\frac{2}{3}}.S^{\frac{1}{2}}$ (2.12)

Channel Discharge (Q)= A x V (2.13)

2.8 Infiltration Wells

Infiltration wells are a means to collect rainwater and seep it into the ground. Rainwater that falls on the roof of the house is not channeled into the gutter or yard, but is channeled using pipes or drains into the well so as to reduce the amount of runoff that occurs. (Lussiany 2019).

The procedure for planning rainwater infiltration wells refers to (SNI 03-2453-2002)To find the discharge of rainwater that falls to the roof surface, the Rational method mathematical equations are used which are expressed in the following form.

QIn= 0,278 x C x I x A (2.14)

With:

QIn = Design discharge that falls to the roof surface (m3/second)

C= Roof runoff coefficient

I = Roof area (ha)

A= Drainage area (m2)

3. Research Methodology

The method in writing this research is the library method and the field study method. The data used in this paper comes from several sources which are then analyzed and used to analyze the capacity of drainage waterways on Untung Jawa Island, South Thousand Islands Regency, DKI Jakarta. The steps in the preparation of this research are to collect data which includes data on the condition of existing waterways, rainfall data and population density data. After the data is collected, then data processing is carried out which includes hydrological analysis, calculation of the capacity of the existing drainage canal, calculation of planned discharge and planning of infiltration wells. As for the analysis of the planned flood discharge using the rational method, this is due to the small water catchment area.

Figure 2. Research Site Map

(Source: google Maps, 2021)

4. Results and Analysis

4.1 Selection of Distribution Type

Statistical parameters in selecting the type of distribution required are Standard Deviation (S), Skewness Coefficient (Cs), Kurtosis Measurement (Ck) and Coefficient of Variation (Cv). For the research that the researcher made, the researcher conducted an analysis through the four distribution methods presented in table 2.

Table 2. Parameters for Selection of Discharge Data Distribution

Spread Type	Criteria	Mark	Description
Log Normal	Cs > 3	0,555	unqualified
	Ck > 3	0,401	unqualified
Gumbel	Cs ≤ 1,1396	1,278	unqualified
	Ck ≤ 5,4003	0,476	unqualified
Log Pearson Type III	Cs≠0	0,555	Qualified
	Atau selain nilai diatas	0,401	Qualified
Normal	Cs = 0	1,278	unqualified
	Ck = 3	0,476	unqualified

(Source : Researcher Calculation Analysis, 2021)

4.2 Calculation of Concentration Time

The things that need to be considered in calculating the time of concentration of waterways are first to find the channel slope value (S), the crew hardness value (n) and the flow coefficient value (C). An example of the calculation of Channel A1, and the results of the complete concentration time calculation are presented in table 3.

$$S = \frac{14 - 13}{29,26} = 0,0342$$

Next look for the values of t0 and td:
L value = length of the farthest point to the drainage channel (m)

$$t_0 = \left[\frac{2}{3} \times 3,28 \times 29,26 \times \frac{0,017}{\sqrt{0,0342}}\right]$$

$$t_0 = 5,88 \text{ minutes}$$

Before looking for td, first find the value of the hydraulic radius (R) to get the value of the flow velocity (V):

$A = 0{,}5 \text{ x } 0{,}5 = 0{,}25 \text{ m2}$

$P = 0{,}5 + (2 \text{ x } 0{,}5) = 1{,}50 \text{ m}$

$$R = \frac{0{,}25}{1{,}50} = 0{,}167 \text{ m}$$

$$V = \frac{1}{0{,}017} 0{,}167^{\frac{2}{3}} . 0{,}034^{\frac{1}{2}} = 3{,}29 \text{ m/second}$$

$$t_d = \frac{29.26}{60 . (3{,}29)} = 0{,}15 \text{ minutes}$$

So that the concentration time is obtained as follows:

$t_c = 5{,}88 + 0{,}15 = 6{,}03$ minutes

The complete calculation of Channel Concentration Time (tc) is listed in table 3. as follows.

Table 3. waterway concentration time (tc)

Channel Number	L m	S	n	to menit	$A_{waterway}$ m2	A m2	P m	R m	V m/sec	td minutes	tc minutes
A1	29,26	0,034	0,017	5,88	0,25	0,25	1,50	0,167	3,29	0,15	6,03
A2	33,34	0,003	0,017	22,63	0,25	0,25	1,50	0,167	0,98	0,57	23,20
A3	22,84	0,004	0,017	12,83	0,25	0,25	1,50	0,167	1,18	0,32	13,15
A4	57,21	0,035	0,017	11,37	0,25	0,25	1,50	0,167	3,33	0,29	11,66
A5	48,10	0,021	0,017	12,40	0,25	0,25	1,50	0,167	2,57	0,31	12,71
A6	21,87	0,005	0,017	12,02	0,25	0,25	1,50	0,167	1,20	0,30	12,33
A7	20,68	0,048	0,017	3,50	0,25	0,25	1,50	0,167	3,92	0,09	3,58
A8	44,27	0,045	0,017	7,74	0,25	0,25	1,50	0,167	3,79	0,19	7,94
A9	53,84	0,019	0,017	14,69	0,25	0,25	1,50	0,167	2,43	0,37	15,06
A10	27,98	0,004	0,017	17,40	0,25	0,25	1,50	0,167	1,07	0,44	17,84
A11	25,70	0,039	0,017	4,84	0,25	0,25	1,50	0,167	3,51	0,12	4,97
A12	41,17	0,024	0,017	9,82	0,25	0,25	1,50	0,167	2,78	0,25	10,07
B1	170,43	0,006	0,017	82,71	0,25	0,25	1,50	0,167	1,36	2,08	84,79
B2	167,84	0,006	0,017	80,83	0,25	0,25	1,50	0,167	1,38	2,03	82,86
B3	163,67	0,006	0,017	77,84	0,25	0,25	1,50	0,167	1,39	1,96	79,80
B4	163,34	0,006	0,017	77,60	0,25	0,25	1,50	0,167	1,39	1,95	79,55
B5	164,18	0,012	0,017	55,30	0,25	0,25	1,50	0,167	1,97	1,39	56,69
C1	98,56	0,010	0,017	36,37	0,25	0,25	1,50	0,167	1,79	0,92	37,29
C2	92,93	0,011	0,017	33,30	0,25	0,25	1,50	0,167	1,85	0,84	34,14
C3	96,77	0,021	0,017	25,02	0,25	0,25	1,50	0,167	2,56	0,63	25,65
C4	100,23	0,030	0,017	21,54	0,25	0,25	1,50	0,167	3,08	0,54	22,08
C5	62,04	0,032	0,017	12,84	0,25	0,25	1,50	0,167	3,20	0,32	13,17
C6	63,87	0,031	0,017	13,42	0,25	0,25	1,50	0,167	3,15	0,34	13,75

(Source: Researcher Calculation Analysis, 2021)

4.3 Calculation of Rainfall Intensity

The return period that will be used in calculating rainfall intensity is a 2 year return period, because the catchment area is less than 10 hectares, and is located in a small town. The intensity of rainfall is calculated using the mononobe formula with the value of time of concentration (tc). The calculation of rainfall intensity on channel A1 is as follows:

$$I = \frac{136{,}64}{24} \text{x} \left(\frac{24}{6{,}03/60}\right)^{2/3} = 319{,}05 \text{ mm/jam}$$

4.4 Calculation of Drainage Rainwater Flow

Calculation of the flow of rainwater canal using the rational method, the parameters needed are equation 2.7.

The following is the calculation of the flow of rainwater from the ratio method on channel A1:

Calculation of A1 drains:

Wide (A) = 0,00898 km2

Drain Length (L) = 0,02926 km

The Slope of the Drain (S) = 0,034

Runoff Coefficient (C) = 0,40 (Village)

Concentration Time (tc) = 6,03 minutes = 0,1005 hour

Rain Intensity (I) $= \frac{523{,}85}{24} x \left(\frac{24}{0{,}18}\right)^{2/3} = 319{,}05$ mm/hour

Calculating flood discharge with rational method:

Q = 0,128 x C x I x A

Q = 0,128 x 0,40 x 219,10 x 0,00898 = 0,2189 m3/second

4.5 Dirty Water Discharge

The calculated dirty water discharge is the water discharge originating from household waste. The amount is influenced by the number of residents and the average water needs of the population. Estimated liquid waste disposal that is issued on average per person per day and concluded for the amount of waste water per person per day is 300 liters. The following is a calculation for channel B4.

Qak=Pn x 300 liter/person/day

Qak=Pn x 0,00347 liter/person/second

Qak=23 x 0,00347 liter/person/second

Qak=0,0784 m3/second

For channel B4 to get additional water discharge from stream A3, it will be added,

Qak B4+Qak A3=0,0784+0,4288

Qtotal B4=0,5072 m3/second

The recapitulation of flood discharge and dirty water discharge is presented in table 4. as follows.

Table 4. Planned Flood Discharge Recapitulation (Q)

Channel Number	Qp total m^3/sec	Qak total m^3/sec	Qr m^3/sec
A1	0,2189	0,2597	0,4786
A2	0,2505	0,3504	0,6010
A3	0,2902	0,4288	0,7190
A4	0,3933	0,6165	1,0099
A5	0,2012	0,6290	0,8301
A6	0,6216	1,5203	2,1419
A7	0,9814	2,0398	3,0212
A8	1,5537	3,0436	4,5974
A9	0,0513	0,1096	0,1609
A10	0,1125	0,2402	0,3528
A11	0,1844	0,3141	0,4984
A12	0,0383	0,0620	0,1004
B1	0,0388	0,2597	0,2985
B2	0,2583	0,5194	0,7776
B3	0,2655	0,4412	0,7067
B4	0,3034	0,5072	0,8106
B5	0,0371	0,1878	0,2249
C1	0,0287	0,1096	0,1383
C2	0,1143	0,2812	0,3955
C3	0,1362	0,3089	0,4451
C4	0,2124	0,3879	0,6004
C5	0,0327	0,0620	0,0947
C6	0,0701	0,1241	0,1942

(Source: Researcher Calculation Analysis, 2021)

4.6 Calculation of Drainage Channel Dimensions

The calculation of the dimensions of the existing drainage channel aims to determine whether the capacity of the channel is sufficient or not to accommodate the planned flood discharge. Furthermore, if there is an unsafe channel, a new drainage channel calculation will be carried out to determine the dimensions of the safe channel.

The following is a calculation for channel A1.

$$A = 0{,}5 \text{ x } 0{,}5 = 0{,}25 \text{ m2}$$

$$P = 0{,}5 + (2 \text{ x } 0{,}5) = 1{,}50 \text{ m}$$

$$R = \frac{0{,}25}{1{,}50} = 0{,}167 \text{ m}$$

$$V = \frac{1}{0{,}017} 0{,}167^{\frac{2}{3}} . 0{,}034^{\frac{1}{2}}$$

$$V = 3{,}29 \text{ m/second}$$

$$Q_{sal} = A \times V = 0{,}25 \times 3{,}29 = 0.8234 \text{ m}^3/\text{second}$$

The complete calculation of the dimensions of the existing drainage canal is presented in table 5, as follows:

Table 5. Calculation of Existing Drainage Channel Dimensions

Channel Number	b (m)	h (m)	A (m^2)	V (m/sec)	$Q_{waterway}$ (m^3/sec)	Q_{plan} (m^3/sec)	Description	Description
A1	0,50	0,50	0,25	3,29	0,8234	0,4786	$Q_{waterway} > Q_{plan}$	OK
A2	0,50	0,50	0,25	0,98	0,2439	0,6010	$Q_{waterway} < Q_{plan}$	Not Eligible
A3	0,50	0,50	0,25	1,18	0,2947	0,7190	$Q_{waterway} < Q_{plan}$	Not Eligible
A4	0,50	0,50	0,25	3,33	0,8327	1,0099	$Q_{waterway} < Q_{plan}$	Not Eligible
A5	0,50	0,50	0,25	2,57	0,6422	0,8301	$Q_{waterway} < Q_{plan}$	Not Eligible
A6	0,50	0,50	0,25	1,20	0,3012	2,1419	$Q_{waterway} < Q_{plan}$	Not Eligible
A7	0,50	0,50	0,25	3,92	0,9794	3,0212	$Q_{waterway} < Q_{plan}$	Not Eligible
A8	0,50	0,50	0,25	3,79	0,9466	4,5974	$Q_{waterway} < Q_{plan}$	Not Eligible
A9	0,50	0,50	0,25	2,43	0,6070	0,1609	$Q_{waterway} > Q_{plan}$	OK
A10	0,50	0,50	0,25	1,07	0,2663	0,3528	$Q_{waterway} < Q_{plan}$	Not Eligible
A11	0,50	0,50	0,25	3,51	0,8785	0,4984	$Q_{waterway} > Q_{plan}$	OK
A12	0,50	0,50	0,25	2,78	0,6941	0,1004	$Q_{waterway} > Q_{plan}$	OK
B1	0,50	0,50	0,25	1,36	0,3412	0,2985	$Q_{waterway} > Q_{plan}$	OK
B2	0,50	0,50	0,25	1,38	0,3438	0,7776	$Q_{waterway} < Q_{plan}$	Not Eligible
B3	0,50	0,50	0,25	1,39	0,3481	0,7067	$Q_{waterway} < Q_{plan}$	Not Eligible
B4	0,50	0,50	0,25	1,39	0,3485	0,8106	$Q_{waterway} < Q_{plan}$	Not Eligible
B5	0,50	0,50	0,25	1,97	0,4916	0,2249	$Q_{waterway} > Q_{plan}$	OK
C1	0,50	0,50	0,25	1,79	0,4486	0,1383	$Q_{waterway} > Q_{plan}$	OK
C2	0,50	0,50	0,25	1,85	0,4620	0,3955	$Q_{waterway} > Q_{plan}$	OK
C3	0,50	0,50	0,25	2,56	0,6403	0,4451	$Q_{waterway} > Q_{plan}$	OK
C4	0,50	0,50	0,25	3,08	0,7705	0,6004	$Q_{waterway} > Q_{plan}$	OK
C5	0,50	0,50	0,25	3,20	0,7997	0,0947	$Q_{waterway} > Q_{plan}$	OK
C6	0,50	0,50	0,25	3,15	0,7881	0,1942	$Q_{waterway} > Q_{plan}$	OK

(Source: Researcher Calculation Analysis, 2021)

4.7 Infiltration wells

Based on the calculation of the dimensions of the existing drainage channel in table 4.4, found channels that fall into the "unsafe" category, because the channel capacity is not sufficient to accommodate the planned flood discharge, namely in channels A2, A3, A4, A5, A6, A7, A8, A10 , B2, B3 and B4. In order to overcome this problem, infiltration wells will be planned.

Infiltration well planning is used to drain excess water discharge in several "unsafe" channels, by draining rainwater that falls from the roofs of residents' houses to seep into the ground by collecting the water in infiltration wells.

Infiltration Well Discharge Design Plan:

1. Infiltration = Discharge that can be absorbed by infiltration wells (m3/s)
2. Type of empty well circular view
3. The diameter of the well is planned to be 1 m = R = 0.5 m
4. F = geometric factor/circumference = $2\pi R$ = 2 x 3.14 x 0.5 = 3.14 m
5. H = Assumed depth of infiltration well = 1 m
6. K = For the value of soil permeability, it is assumed that the type of soil in Untung Jawa Island is sand with a value of K = 10-1 - 10-3 cm/s, the K value of 10-2 cm/s = 10-4 m/s is used.
7. The inlet/output channel uses a pralon pipe.
8. Well walls can use masonry without plastering
9. The bottom of the well and the gaps between the excavation and the wall where the water seeps are filled with fibers/gravel.

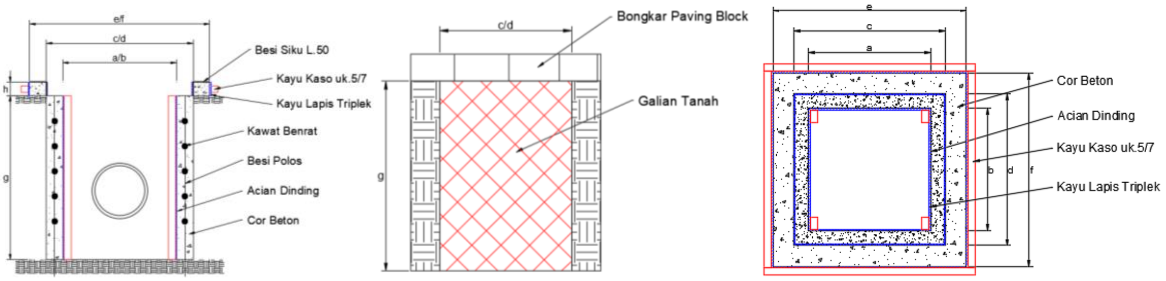

Figure 3. Infiltration Well Details
(Source: Researcher Calculation Analysis, 2021)

To find out the rain discharge that enters the infiltration well, it is necessary to first know the rain discharge that falls through the roofs of residents' houses. An example of a calculation using Channel A2 is as follows:

Known:
Croof = 0,75 (based on Roof Runoff Coefficient Standard)
IA2 = 89,25 mm/hour
Aroof = 0,00319 km2
Maka, Qin adalah:
Qin = 0,278 . 0,75 . 29,14 . 0,008 = 0,0593 m3/sec

The calculation of the rain discharge that falls to the roof surface will be presented in full in table 6. as follows:

Table 6. Calculation of Existing Drainage Channel Dimensions

Channel Number	C	I mm/hour	A_{roof} km^2	Q_{in} m^3/sec
A2	0,75	89,25	0,0032	0,0593
A3	0,75	130,28	0,0027	0,0744
A4	0,75	141,19	0,0066	0,1933
A5	0,75	133,28	0,0090	0,2507
A6	0,75	136,06	0,0032	0,0897
A7	0,75	310,01	0,0027	0,1768
A8	0,75	182,46	0,0065	0,2489
A10	0,75	106,35	0,0024	0,0536
B2	0,75	38,20	0,0093	0,0738
B3	0,75	39,17	0,0034	0,0281
B4	0,75	39,25	0,0030	0,0247

(Source: Researcher Calculation Analysis, 2021)

Furthermore, it is necessary to know the discharge of rainwater that enters the infiltration well (Qresapan). Calculation refers to Channel A2, as follows:

Q absorption = F . K. H
= 3,14 . 10-4 . 1
= 0,00031 m3/sec

The complete Qresapan calculation will be presented in table 7, as follows:

Table 7. Calculation of Existing Drainage Channel Dimensions

Channel Number	Rainwater infiltration discharge in Infiltration Wells			
	F (m)	K (cm/sec)	H (m)	Q absorption (m^3/sec)
A2	3,14	0,0001	1	0,000314
A3	3,14	0,0001	1	0,000314
A4	3,14	0,0001	1	0,000314
A5	3,14	0,0001	1	0,000314
A6	3,14	0,0001	1	0,000314
A7	3,14	0,0001	1	0,000314
A8	3,14	0,0001	1	0,000314
A10	3,14	0,0001	1	0,000314
B2	3,14	0,0001	1	0,000314
B3	3,14	0,0001	1	0,000314
B4	3,14	0,0001	1	0,000314

(Source: Researcher Calculation Analysis, 2021)

Furthermore, it will be found the difference in the remaining discharge from the rain discharge that has been accommodated into the infiltration well. After knowing the difference in the remaining discharge from the rain discharge that has been accommodated into the infiltration wells, it can be seen the number of infiltration wells needed in the house area in each channel. An example calculation refers to Channel A2:

Qin = 0,0593 m3/sec (table 6)
Qabsorption = 0,00031 (table 7)
Qaccommodate = Qin – Qabsorption
= 0,0593– 0,00031
= 0,0590 m3/sec

Excess Debit A2 = 0,3570 m3/sec
Qaccommodate = 0,0590 m3/sec

$$\text{Number of Infiltration Wells} = \frac{\text{Excess Debit}}{\text{Q accommodate}}$$
$$= \frac{0{,}2870}{0{,}0590}$$
$$= 6 \text{ pieces}$$

Calculation of the number of infiltration wells needs in full is presented in table 8 as follows:

Table 8. Calculation of Existing Drainage Channel Dimensions

Channel Number	Qexcess (m^3/sec) (3) = (2) - (1)	Qaccommodate (m^3/sec) (6) = (5) - (4)	Number of Infiltration Wells (7) = (2) : (6)
A2	0,3570	0,0590	6
A3	0,4243	0,0741	6
A4	0,1772	0,1930	1
A5	0,1880	0,2504	1
A6	0,5207	0,0894	6
A7	0,7219	0,1765	4
A8	2,3307	0,2486	9
A10	0,0865	0,0532	2
B2	0,4339	0,0735	6
B3	0,3586	0,0278	13
B4	0,4621	0,0244	19

(Source: Researcher Calculation Analysis, 2021)

From table 8, it is known that the number of infiltration wells needed is 73 points with details on channel B4 as many as 19 points, channel B3 as many as 13 points, channel A8 as many as 9 points, channels A2, A3, A6 and B2 as many as 6 points, channel A7 as many as 4 point, Channel A10 as much as 2 points and channel A4 and A5 as much as 1 point.

5. Conclusions

Based on the results of the discussion, the researcher can draw the following conclusions:

1. Based on the author's observations at the location, the condition of several drainage channels on Untung Jawa Island, Seribu Islands, is inadequate, the amount of organic waste such as leaves clogging the channel and sedimentation, one of which is caused by ROB water which carries grains of sand and some garbage from the sea into the water. ducts so that the ducts are difficult to clean.
2. In the calculation of the planned flood discharge which has been analyzed using the rational method of the drainage system on Untung Jawa Island, channel A8 is the channel that should accommodate the largest water discharge, which is 3.2774 M3/s, while channel C5 accommodates the least water discharge, which is 0.0947. M3/Second. However, after calculating the flood discharge capacity of the existing canal, channel A7 is the existing channel that has the largest water discharge capacity of 0.9794 M3/s while channel A2 is able to accommodate the least water discharge of 0.2439 M3/s. After comparing the existing channel discharge with the planned flood discharge, it turns out that there are 11 channels that are categorized as "unsafe" because the planned flood discharge is greater than the drainage capacity, namely A2, A3, A4, A5, A6, A7, A8, A10 channels. , B2, B3 and B4. the researchers provided a solution by building rainwater infiltration wells.
3. Based on the results of the author's analysis, the problem of flooding on Untung Jawa Island can be overcome, one of them by using infiltration wells at 72 points with details along the B4 channel as many as 19 points, along the B3 channel as many as 13 points, along the A8 channel as many as 9 points, along the There are 6 points along channel A2, A3, A6 and B2, 4 points along Channel A7, 2 points along Channel A10 and 1 point along Channel A4 and A5.

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