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Analysis of Drainage Capacity in Cimanggis Hill Clove II Housing Area Depok City

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Abstract

Generally, Drainage could be defined as technical measures to reduce excessive water, either from rainwater, permeation, or excessive irrigation water from a region, therefore the land function not disrupted. The purpose of this study are to analyze, learn and evaluate the drain condition and capacity in the Bukit Cengkeh II Residential, Cimanggis Sub-district, Depok City specifically in block house G, H and I to the flood discharge that occurred. The data and information used for this study are primary data (personal research data collected by author) and secondary data (rainfall from BMKG and nearest Irrigation Center). Flood discharge study methods are uses two methods, i.e. Rational method and Haspers method. From this two methods, we used the largest volume of the flood discharge. The results of the Flood discharge planning in block G are 2,39 m3/sec, block H are 5,42 m3/sec, and block I 1,12 m3/sec. There found 10 drains identified as runoff or unsecured. The alternative solutions to runoff or unsecured drains problem are create a new drains dimension plan or construct an infiltration wells.

Keywords: Drainage, Flood, Hidrology.

1. Introduction

Indonesia as a tropical country has 2 seasons, the dry season and the rainy season. Based on data from the Meteorology, Climatology and Geophysics Agency (BMKG), rainfall in Indonesia ranges from 2,000-3,000 mm / year. This figure is quite high for the size of rainfall. Especially in several cities in Indonesia, such as the city of Depok. Cities with high rainfall require residents to always pay attention to the ability to control rainwater, including by using drainage drains.

Depok is a city that has high rainfall. According to the Meteorology, Climatology and Geophysics Agency (BMKG), rainfall in Depok has a monthly rainfall of 200-400 mm per year. Seeing these figures, it is not surprising that Depok needs adequate and adequate water catchment areas. This requires a good and adequate drainage system.

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Increasing the intensity of rainwater in the rainy season can increase floods in several regions in Indonesia. One area that was flooded when the rainy season came was Bukit Cengkeh II Cimanggis Housing, Depok City, West Java. From field data and news broadcast by the media, we see that the impact of the flood is enormous. This residential area is always flooded if rainfall is high. The height of the puddle reaches 50-100 cm when it is the rainy season. If allowed to continue, the flood will continue to spread, and the intensity will be even greater, as a result community activities will be disrupted

Housing Bukit Cengkeh II Cimanggis Depok City, West Java is an area prone to flooding during the rainy season especially in blocks G, H & I. The drainage system is the most important part in planning the construction of a residential area. A good drainage system must be able to accommodate and drain the flow flow at an ideal speed so that no puddles occur when it rains on a residential location. To overcome the problem of flooding above. Thus, sufficient rainfall analysis is needed in realizing the system and cross-sectional capacity of a drainage as the best solution to break down a flood inundation in a residential area.

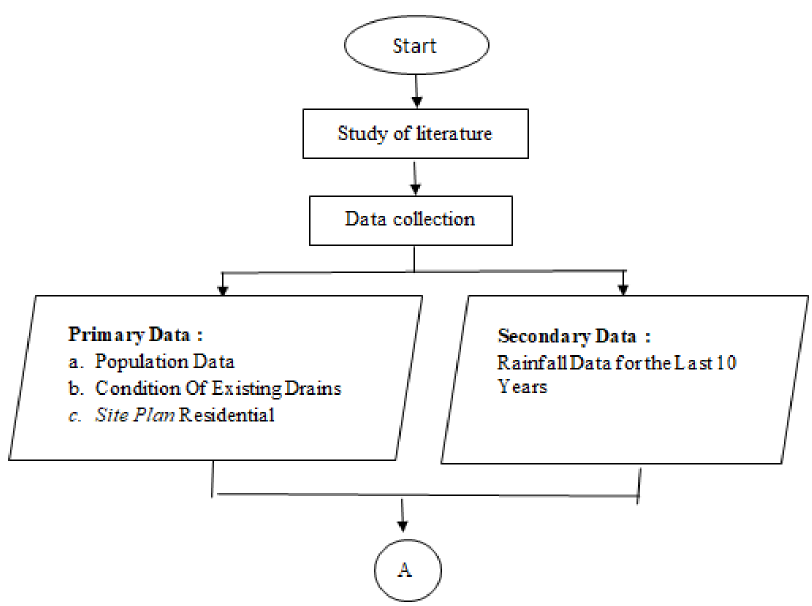
The purpose of this study was to determine the condition of drainage drains in the Cimanggis II Clove housing area Block G, H & I Depok City, Know the magnitude of flood discharge in the housing area Clove Clove II Block G, H & I Cimanggis Depok City and determine the need for planning dimension of the new drainage drain in the Bukit Cengkeh II residential area Block G, H & I Cimanggis Depok City.

2. Method

The research methodology used in this thesis is an evaluative descriptive analysis, a method that evaluates objective conditions in a situation that is the object of research, and the object of the research is the drainage drain in the Bukit Cengkeh II housing Block G, H & I Depok.

2.1. Study of Literature

At this stage, what is done in this research is to identify problems in the drinase system that occur in Bukit Cengkeh II Block G, H & I Depok and literature study on the drinase system as reference material and knowledge in the process of data collection, data processing, research results, to get conclusions in this study.



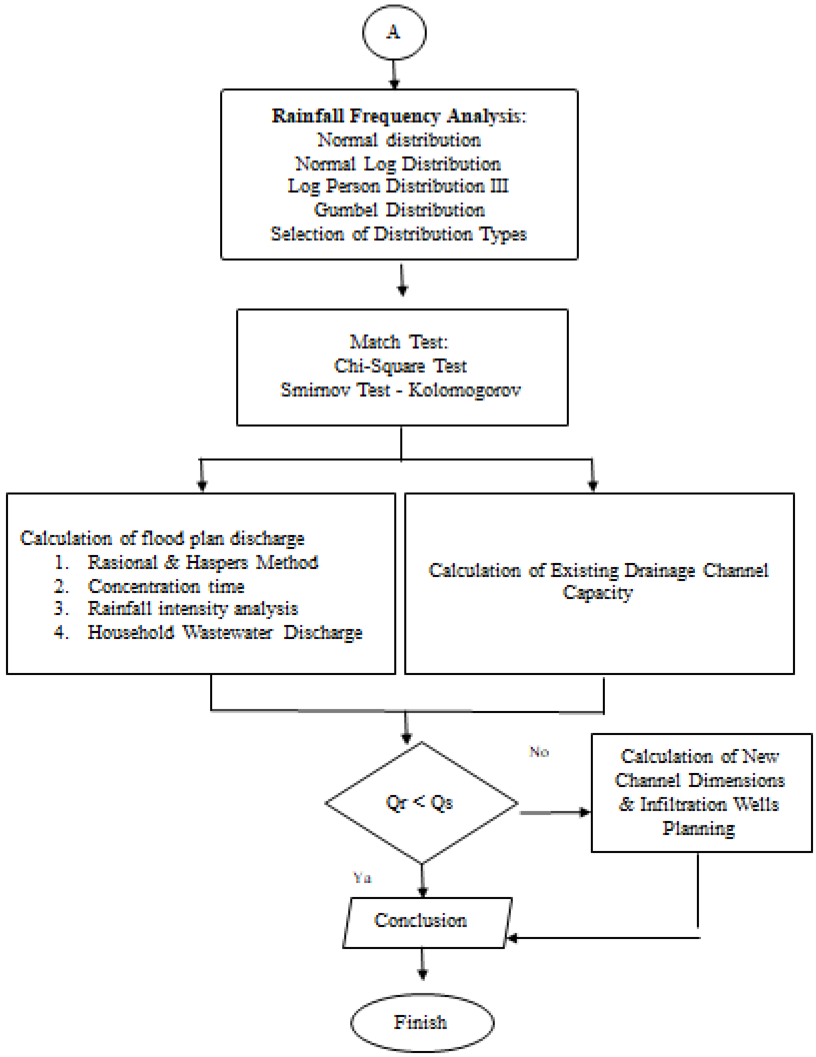


Figure 1 Flowchart of Research

2.2. Data Collection

The data needed in this study are primary data and secondary data, which will be explained as follows:

a. Primary data

Primary Data, is data that is obtained directly from the source, observed, and recorded for the first time. Primary data of this study are population data to determine household wastewater discharge for the purpose of calculating flood discharge plans, and existing conditions of drainage drains including drain length, drain width, depth, drain elevation, drain type and drain catchment area to determine drain capacity requirements in accommodating incoming water discharge.

b. Secondary Data

Secondary data is data obtained by researchers in a direct way. Secondary data of this study is in the form of minimum daily maximum rainfall for the last 10 years obtained from the relevant agencies for the purpose of calculating flood discharge plans.

2.3. Data Processing Results

At this stage after all the necessary data has been collected, data processing will be carried out with the stages of the calculation of flood discharge plans and the calculation of the capacity of existing drainage drains.

2.4. Calculation of Flood Discharge Plans

There are several methods for estimating peak flow rates (flood discharge). The method used at a location is more determined by the availability of data. In general, one method commonly used is the Haspers and Rational methods.

2.5. Household Waste Water Discharge

According to Government Regulation of the Republic of Indonesia Number 82 of 2001, wastewater is the residue from a liquid form of business and or activity. Waste water can come from households (domestic) and industry (industry).

3. Result and Discussion

3.1. Hydrological Analysis

The hydrological analysis calculation is used to get the flood discharge entering the drainage drain being evaluated. The stages of the hydrological analysis calculation are as follows:

1. Calculate regional rainfall
2. Analysis of the frequency of rainfall plans
3. Selection of distribution types
4. Test data compatibility

3.1.1. Regional Rainfall Analysis

Rainfall data used is rainfall data for 10 years, namely from 2009 to 2018, rainfall data are obtained from 3 rainfall stations around Depok. Analysis of average rainfall data at 3 rain stations using the algebraic average method for maximum rainfall data each month for 10 years.

Table 1 : Daily / Year Maximum Rainfall Data (mm / day)

Years	Maximum Rainfall
2009	102,8
2010	109,5
2011	101,7
2012	111,1
2013	93,4
2014	133,9
2015	107,7
2016	128,4
2017	78,4
2018	59,1

Source: Calculation Analysis Results

3.1.2. Analysis of Frequency of Rainfall Plans

Rainfall analysis of this plan is carried out to find out the maximum daily rainfall that will be used to calculate the flood discharge plan. The calculation uses four distributions, namely: Normal Distribution, Normal Log Distribution, Log-Person III Distribution, and Gumbel Distribution. Following is the calculation of rainfall frequency using log person distribution III.

Table 2: Calculation of Person Log Distribution III

No	Year	X	Log X	Log $\overline{X}$	Log X - Log $\overline{X}$	(Log X - Log $\overline{X}$)^2	(Log X – Log $\overline{X}$)^3	(Log X - Log $\overline{X}$)^4
1	2009	102,77	2,01	2,001	0,01	0,000118	0,000001	0,000000
2	2010	109,50	2,04	2,001	0,04	0,001476	0,000057	0,000002
3	2011	101,67	2,01	2,001	0,01	0,000038	0,000000	0,000000
4	2012	111,07	2,05	2,001	0,04	0,001988	0,000089	0,000004
5	2013	93,40	1,97	2,001	-0,03	0,000940	-0,000029	0,000001
6	2014	133,87	2,13	2,001	0,13	0,015794	0,001985	0,000249
7	2015	107,67	2,03	2,001	0,03	0,000966	0,000030	0,000001
8	2016	128,37	2,11	2,001	0,11	0,011546	0,001241	0,000133
9	2017	78,40	1,89	2,001	-0,11	0,011386	-0,001215	0,000130
10	2018	59,13	1,77	2,001	-0,23	0,052518	-0,012035	0,002758
	Σ	1025,83	20,01		-0,002	0,096768	-0,009877	0,003278

Source: Calculation Analysis Results

(1) Calculate the average price (log $\overline{X}$)

$$\text{Log}\,\overline{X} = \frac{\Sigma\,\text{Log}\,X}{n}$$

$$\text{Log}\,\overline{X} = \frac{20{,}01}{10} = 2{,}001\ \text{mm/day}$$

(2) Calculating the Standard Deviation Price (S)

$$S = \left[\frac{\sum_{n=1}^{n}(\text{Log}X_i - \text{Log}\overline{X})^2}{n-1}\right]^{0,5} = \left[\frac{0{,}09678}{9}\right]^{0,5} = 0{,}121$$

(3) Calculate the coefficient of skewness

$$G = \frac{\sum_{n=1}^{n}(\text{Log}X_i - \overline{\text{Log}X})^3}{(n-1)(n-2)s^3}$$

$$G = \frac{10\ x - 0{,}009877}{9 \times 8 \times 0{,}104^3} = -1{,}22$$

(4) Calculate The logarithm of rain or flood with a return period T

The value of K (Interpolation) is a standardized variable for X, the amount of which depends on the coefficient of gravity G.

Table 3: K values (Interpolation)

Re-Period	G		
	-1,4	-1,22	-1,2
	K		
1,25	-0,732	-0,7346	-0,758
1,67	-0,32412	-0,32694	-0,3523
2	0,195	0,1919	0,164
2,5	0,7358	0,7360	0,7373
5	0,8440	0,8448	0,8520
10	1,086	1,0902	1,128
25	1,282	1,2904	1,366
50	1,379	1,3903	1,492

Source: Calculation Analysis Results

$$\text{Log } X_T = \text{Log}\overline{X} + K.s$$
$$\text{Log } X_T = 2{,}001 + 0{,}1919 \times 0{,}104$$
$$\text{Log } X_T = 2{,}021$$
$$X_T = 104{,}94 \text{ mm/day}$$

Table 4: XT calculation

Re-Period	Skewness	K	Log X_T	X_T
2		0,1919	2,021	104,944
5		0,8448	2,089	122,704
10	-1,22	1,0902	2,114	130,131
25		1,2904	2,135	136,522
50		1,3903	2,146	139,827

Source: Calculation Analysis Results

3.1.3. Selection of Distribution Types

Statistical parameters in the selection of this type of distribution needed are Standard Deviation (S), Skewness Coefficient (Cs), Kurtosis Measurement (Ck) and Variation Coefficient (Cv).

Standard Deviation

$$S = \sqrt{\frac{\sum_{i=1}^{n}\left(\text{Log } X_i - \text{Log } \overline{X}\right)^2}{n-1}}$$

$$S = \sqrt{\frac{0{,}096768}{10-1}} = 0{,}104$$

Skewness Coefficient (Cs)

$$C_s = \frac{n\sum(\text{Log}\,X_i - \text{Log}\,\bar{X})^3}{(n-1)(n-2)S^3}$$

$$C_s = \frac{10\,(-0{,}009877)}{(10-1)(10-2)0{,}04^3} = -1{,}22$$

Measurement of Kurtosis (Ck)

$$C_k = \frac{n^2\sum_{i-1}^{n}(\text{Log}\,X_i - \text{Log}\,\bar{X})^4}{(n-1)(n-2)(n-3)S^4}$$

$$C_k = \frac{10\,(0{,}003278)}{(10-1)(10-2)(10-3)0{,}104^4} = 0{,}556$$

Variation Coefficient (Cv)

$$C_v = \frac{S}{\overline{\text{Log}\,X}}$$

$$C_v = \frac{0{,}104}{2{,}001} = 0{,}052$$

Table 5: Distribution Selection Parameters

Distribution Type	Terms	Results
Normal	$C_s \approx 0$	C_s = -0,629
	$C_k \approx 3$	C_k = 0,285
Log Normal	$C_s = C_v^3 + 3C_v$	C_s = -1,22
	$C_k = Cv^8 + 6Cv^6 + 15Cv^4 + 16Cv^2 + 3$	C_k = 0,556
Gumbel	$C_s \approx 1{,}14$	C_s = -0,629
	$C_k \approx 5{,}40$	C_k = 0,285
Log Person III	$C_s \neq 0$	C_s = -1,22
	Or besides the values above	C_k = 0,556

Source: Calculation Analysis Results

3.1.4. Calculation of Rainwater Flow Discharge Using Haspers Method

In this study the authors also used the calculation of the flow of rainwater flow not only using one method, the writer also used the haspers method as a comparison. The haspers method is used in the watershed area <300 〖km〗 ^ 2. The following is an example of calculating rainwater flow debit using the haspers method, namely B2 drain calculation.

We known :

- area DAS (A) : 0,00031 km^2
- drain length (L) : 0,035 km
- Slope of the drain (i) : 0,03
- Rainfall return period (R) : 104,94 mm/day

Haspers method formula

$$Q = \alpha \; x \; \beta \; x \; q \; x \; A$$

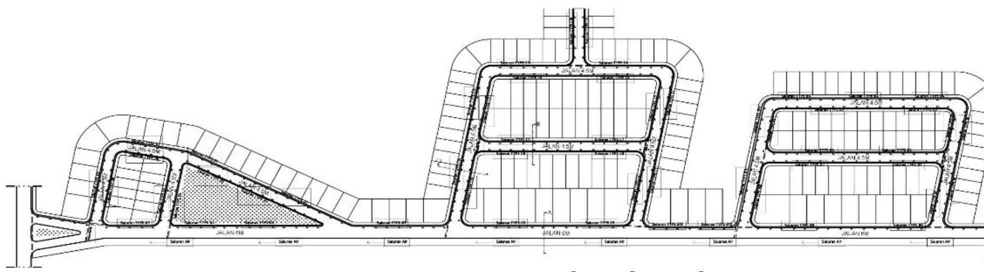


Figure 2 : Residential Siteplan

Concentration time (tc)

$$tc = 0{,}1 \; x \; L^{0{,}8} \; x \; i^{-0{,}30}$$
$$tc = 0{,}1 \; x \; 0{,}035^{0{,}8} \; x \; 0{,}03^{-0{,}30}$$
$$tc = 0{,}0199 \; hour$$
$$tc = 1{,}18 \; minute$$

Reduction coefficient (α)

$$\alpha = \frac{1 + (0{,}012 \; x \; A^{0{,}70})}{1 + (0{,}075 \; x \; A^{0{,}70})}$$
$$\alpha = \frac{1 + (0{,}012 \; x \; 0{,}00031^{0{,}70})}{1 + (0{,}075 \; x \; 0{,}00031^{0{,}70})}$$
$$\alpha = 0{,}9998$$

Reduction coefficient (β)

$$\frac{1}{\beta} = 1 + \frac{tc + (3{,}7 \; x \; 10^{-0{,}4t})}{tc^2 + 15} \; x \; \frac{A^{0{,}75}}{12}$$
$$\frac{1}{\beta} = 1 + \frac{0{,}0196 + (3{,}7 \; x \; 10^{-0{,}4x0{,}0196})}{0{,}0196^2 + 15} \; x \; \frac{0{,}00031^{0{,}75}}{12}$$
$$\frac{1}{\beta} = 1{,}00047$$
$$\beta = 0{,}999953$$

For t <2 hours the formula is used

$$r = \frac{tc \; x \; r}{tc + 1 - 0{,}0008 \; (260 - R)(2 - tc)^2}$$
$$r = \frac{0{,}0196 \; x \; 104{,}94}{0{,}0196 + 1 - 0{,}0008 \; (260 - 104{,}94)(2 - 0{,}0196)^2}$$
$$r = 9{,}008$$

Maximum intensity of average rain fall ($m^3/s/km$)

$$q = \frac{r}{3,6\ x\ t}$$
$$q = \frac{9,008}{3,6\ x\ 0,0196}$$
$$q = 127,66 m^3/s/km$$

Flood discharge plan

$$Q = \alpha\ x\ \beta\ x\ q\ x\ A$$
$$Q = 0,9998\ x\ 0,999953\ x\ 127,66\ x\ 0,00031$$
$$Q = 0,9998\ x\ 0,999953\ x\ 127,66\ x\ 0,00031$$

Q = 0,04

For drain B2 getting additional water discharge from the B3 flow it will be added,

$$QB2 + QB3 = 0,04 + 0,027$$
$QtotalB2 = 0,067$ m^3/seconds.

3.1.5. Calculation of Dirty Water Discharge

The calculated dirty water discharge is the water debit that comes from household waste, and other buildings. The amount is affected by the large number of residents and the average population's water needs. Estimates for the average disposal of liquid waste per person per day are presented in table 2.9, and it is concluded that the amount of wastewater per person per day is 400 liters. Following are the calculations for drain B1.

$$Q_{ak} = Pn\ x\ 400\ liter/person/day$$
$$Q_{ak} = Pn\ x\ 0,00463\ liter/person/s$$
$$Q_{ak} = 55\ x\ 0,00463\ ; liter/person/s$$
$Q_{ak} = 0,2547\ liter/org/det$ = 0,0000255 m^3/s

Table 7: Dirty Water Discharge

No. Drain	Number of Houses	Number Of People	Qak m^3/s
River			
A1	56	280	0,0001296
Komplek Blok G			
B1	11	55	0,0000255
B2	2	10	0,0000046
B3	2	10	0,0000046
B4	13	65	0,0000301
B5	11	55	0,0000255
B6	11	55	0,0000255
B7	10	50	0,0000232
B8	8	40	0,0000185
B9	2	10	0,0000046
B10	2	10	0,0000046

B11	0	0	0,0000000
B12	4	20	0,0000093
Komplek Blok H			
C1	13	65	0,0000301
C2	2	10	0,0000046
C3	2	40	0,0000185
C4	6	10	0,0000046
C5	4	50	0,0000232
C6	8	10	0,0000046
C7	8	25	0,0000116
C8	9	10	0,0000046
C9	7	20	0,0000093
C10	4	25	0,0000116
C11	6	45	0,0000208
C12	2	10	0,0000046
C13	2	35	0,0000162
C14	13	25	0,0000116
Komplek Blok I			
D1	20	100	0,0000463
D2	0	0	0,0000000
D3	0	0	0,0000000
D4	0	0	0,0000000
D5	5	25	0,0000116
D6	2	10	0,0000046
D7	2	10	0,0000046
D8	5	25	0,0000116
D9	5	25	0,0000116
D10	2	10	0,0000046

Source : Calculation Analysis Results

3.1.6. Calculation of Dirty Water Discharge

The following is a calculation on drain B1.

$$Q_r = Q_{total} + Q_{ak}$$
$$Q_r = 0.12 + 0.00002547$$
$$Q_r = 0.120282 \text{ m}^3/\text{s}$$

The complete calculation for flood discharge has been presented in the table below:

Table 8: Flood Discharge Plans

No Drain	Qptotal m^3/s	Qak m^3/s	Qr m^3/s
River			
A1	4,005	0,0012964	4,00592
Komplek Blok G			
B1	0,120	0,0002547	0,120282
B2	0,066	0,0000463	0,066283
B3	0,027	0,0000463	0,027221
B4	0,159	0,0003010	0,158984
B5	0,144	0,0002547	0,144307
B6	0,171	0,0002547	0,171482
B7	0,202	0,0002315	0,201768
B8	0,345	0,0001852	0,345078
B9	0,171	0,0000463	0,171273
B10	0,727	0,0000463	0,727150
B11	0,178	0,0000000	0,177643
B12	0,080	0,0000926	0,080434
Komplek Blok H			
C1	0,147	0,0003010	0,147392
C2	0,194	0,0000463	0,194014
C3	0,041	0,0001852	0,041078
C4	0,116	0,0000463	0,115656
C5	0,054	0,0002315	0,054665
C6	0,165	0,0000463	0,165337
C7	0,254	0,0001158	0,254176
C8	0,855	0,0000463	0,854963
C9	0,642	0,0000926	0,641841
C10	0,054	0,0001158	0,054549
C11	0,301	0,0002084	0,300713
C12	0,567	0,0000463	0,567151
C13	1,316	0,0001621	1,315723
C14	0,714	0,0001158	0,714311
Komplek Blok I			
D1	0,265	0,0004630	0,265307
D2	0,026	0,0000000	0,026403
D3	0,033	0,0000000	0,033191
D4	0,073	0,0000000	0,073467
D5	0,065	0,0000116	0,064831
D6	0,029	0,0000046	0,029231
D7	0,096	0,0000046	0,096468
D8	0,101	0,0000116	0,100634

No Drain	Qptotal m^3/s	Qak m^3/s	Qr m^3/s
D9	0,353	0,0000116	0,352617
D10	0,079	0,0000046	0,078684

Source : Calculation Analysis Results

3.1.7. Calculation of Existing Drainage Drain Dimensions

After knowing the planned flood discharge on the Bukit Cengkeh II Block G, H & I housing, the dimensions of the existing drainage drain will be calculated to determine whether or not the drain is sufficient to accommodate the planned flood discharge. Furthermore, if there is an unsafe drain, a new drainage drain will be calculated to determine the dimensions of the safe drain.

Table 9: Calculation of Existing Drainage Drain Dimensions

No Drain	b (m)	h (m)	A (m^2)	V (m/s)	Qsal (m^3/s)	Qrencana (m^3/s)	Information
Rivers							
A1	3,25	1,2	3,90	5,70	22,24	4,00592	Secure
Komplek Blok G							
B1	0,38	0,4	0,15	3,51	0,53	0,120282	Secure
B2	0,35	0,4	0,14	3,35	0,47	0,066283	Secure
B3	0,35	0,4	0,14	4,04	0,57	0,027221	Secure
B4	0,3	0,4	0,12	1,90	0,23	0,158984	Secure
B5	0,3	0,4	0,12	2,01	0,24	0,144307	Secure
B6	0,3	0,4	0,12	2,01	0,24	0,171482	Secure
B7	0,3	0,4	0,12	2,01	0,24	0,201768	Secure
B8	0,35	0,42	0,15	2,17	0,32	0,345078	Runoff
B9	0,35	0,4	0,14	4,04	0,57	0,171273	Secure
B10	0,35	0,4	0,14	3,35	0,47	0,727150	Runoff
B11	0,6	0,7	0,42	4,90	2,06	0,177643	Secure
B12	0,4	0,4	0,16	3,54	0,57	0,080434	Secure
Komplek Blok H							
C1	0,38	0,4	0,15	3,14	0,48	0,147392	Secure
C2	0,35	0,4	0,14	3,13	0,44	0,194014	Secure
C3	0,35	0,4	0,14	2,37	0,33	0,041078	Secure
C4	0,3	0,4	0,12	2,02	0,24	0,115656	Secure
C5	0,3	0,4	0,12	2,39	0,29	0,054665	Secure
C6	0,3	0,4	0,12	2,07	0,25	0,165337	Secure
C7	0,3	0,4	0,12	2,07	0,25	0,254176	Runoff
C8	0,3	0,4	0,12	2,07	0,25	0,854963	Runoff
C9	0,4	0,45	0,18	2,41	0,43	0,641841	Runoff

No Drain	b (m)	h (m)	A (m^2)	V (m/s)	Qsal (m^3/s)	Qrencana (m^3/s)	Information
C10	0,3	0,35	0,11	2,32	0,24	0,054549	Secure
C11	0,3	0,4	0,12	2,02	0,24	0,300713	Runoff
C12	0,35	0,4	0,14	3,13	0,44	0,567151	Runoff
C13	0,35	0,4	0,14	3,35	0,47	1,315723	Runoff
C14	0,3	0,35	0,11	2,75	0,29	0,714311	Runoff
Komplek Blok I							
D1	0,4	0,4	0,16	2,56	0,41	0,265307	Secure
D2	0,3	0,4	0,12	2,14	0,26	0,026403	Secure
D3	0,3	0,4	0,12	2,14	0,26	0,033191	Secure
D4	0,35	0,4	0,14	3,35	0,47	0,073467	Secure
D5	0,35	0,4	0,14	3,31	0,46	0,064831	Secure
D6	0,3	0,4	0,12	3,53	0,42	0,029231	Secure
D7	0,42	0,45	0,19	2,97	0,56	0,096468	Secure
D8	0,35	0,4	0,14	2,21	0,31	0,100634	Secure
D9	0,3	0,4	0,12	1,85	0,22	0,352617	Runoff
D10	0,45	0,5	0,23	3,11	0,70	0,078684	Secure

Source : Calculation Analysis Results

3.1.8. Calculation of New Drainage Drain Dimensions

Furthermore, new dimensions will be calculated for unsafe drains, to find out safe dimensions. Determination of the dimensions of the drainage drain is done by trial and error or trial and error.

Table 10: Calculation of New Drainage Drain Dimensions

No. Drain	b (m)	h (m)	S	A (m^2)	P (m)	R (m)	n	V (m/dt)	Qsal (m^3/det)	Qaliran (m^3/det)
B8	0,40	0,45	0,01	0,18	1,08	0,17	0.014	2,34	0,42	0,345
B10	0,40	0,50	0,03	0,20	1,15	0,17	0.014	3,74	0,75	0,727
C7	0,35	0,40	0,01	0,14	0,95	0,15	0.014	2,21	0,31	0,254
C8	0,50	0,65	0,01	0,33	1,48	0,22	0.014	2,90	0,94	0,855
C9	0,45	0,55	0,01	0,25	1,28	0,19	0.014	2,66	0,66	0,642
C11	0,35	0,45	0,01	0,16	1,03	0,15	0.014	2,22	0,35	0,301
C12	0,40	0,45	0,03	0,18	1,08	0,17	0.014	3,41	0,61	0,567
C13	0,50	0,65	0,03	0,33	1,48	0,22	0.014	4,38	1,42	1,316
C14	0,40	0,55	0,02	0,22	1,23	0,18	0.014	3,47	0,76	0,714
D9	0,40	0,45	0,01	0,18	1,08	0,17	0.014	2,16	0,39	0,353

Source: Calculation Analysis Results

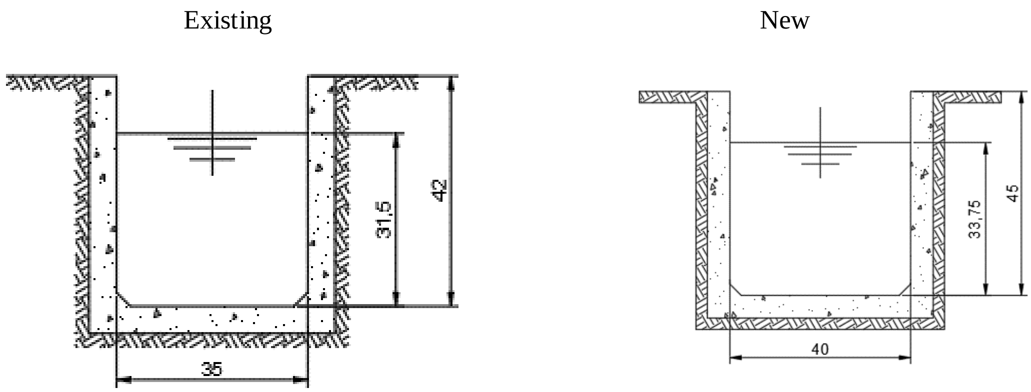


Figure 3: Drain B8 Cutout Image
Source : Drawing Personal

3.1.9. Infilltration Well Planning

The infiltration well planning is used in draining excess water discharge in several unsafe drains as an alternative solution besides planning the dimensions of the new canal, construction of the infiltration well will be built at the base of the drainage drain.

Table 11: Calculation of Infiltration Wells Needs

No. Drain	Qsal m^3/s	QPlanning m^3/s	Advantages m^3/s	Well Needs
B8	0,32	0,35	0,03	1
B10	0,47	0,73	0,26	9
C7	0,25	0,25	0,01	1
C8	0,25	0,85	0,61	20
C9	0,43	0,64	0,21	7
C11	0,24	0,30	0,06	2
C12	0,44	0,57	0,13	5
C13	0,47	1,32	0,85	27
C14	0,29	0,71	0,43	14
D9	0,22	0,35	0,13	5

Source: Calculation Analysis Results

From the table 11, we get the number of absorption well points along the drain in each type of drain that has excess flood discharge. For example in drain C8 requires 20 absorption well points along the drain.

4. Conclusion

From the results of the analysis and discussion in the previous chapter and answer from the formulation of the problem, the following conclusions can be drawn:

1. The condition of the canals in the Cimanggis II Cimanggis housing estate in Depok, especially in blocks G, H & I, are poorly maintained, a lot of garbage has accumulated and thick sedimentation is in the drain.
2. The need for driainage capacity or flood discharge issued at the Cimanggis Hill Clove II housing in Depok City in Block G is .2.39 m3 / second, Block H is 5.42 m3 / second and Block I is 1.12 m3 / second

3. There are 10 drains identified as runoff or unsafe due to the drain flood discharge being less than the planned flood discharge. The drains are drains B8, B10, C7, C8, C9, C11, C12, C13, C14, D9 and alternative solutions from 10 drains that have runoff, namely planning the dimensions of new drains or making infiltration wells.

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