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Rainwater Harvesting System as an Alternative to Overcoming Drought in Safira Garden Housing District, Kec. Kaliwates District. Jember

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Abstract: Rainfall is the most important component in a rainwater harvesting system. This rainwater harvesting system integrated with infiltration wells is an effort to avoid the problem of drought. One of the reasons why rainwater harvesting systems are important for water conservation is that increasing water demand causes an increase in groundwater extraction, thereby reducing groundwater reserves. Data collection was obtained through direct surveys to research locations and related agencies. Next, technical planning or building design for Rainwater Harvesting with infiltration wells is carried out, including buildings for storing or harvesting rainwater (rainwater harvesting) and rainwater infiltration into infiltration wells in each house. This research analyzes the implementation of a rainwater harvesting system using infiltration wells, with the aim of finding out the volume of rainwater that can be accommodated in the rainwater harvesting system and the costs required in the rainwater harvesting system. The river basin (DAS) in the Safira Garden area, Kaliwates District, Jember Regency has an area of 16 hectares or 0.16 km ^{2}. The results of the research show that the volume of rainwater that can be collected in the rainwater harvesting system at Safira Garden Housing, namely that which is collected in the absorption wells throughout the house is 66.04 m ^{3} and the total volume in the storage pond is 5303.36 m ^{3}. Funding for the rainwater harvesting system is estimated at Rp. 9,253,000.00 for rainwater utilization facilities with infiltration wells and rainwater storage areas equipped with water pumps to provide upward pressure and water filters to filter rainwater before it is used for domestic needs.

Keywords: Rainwater harvesting system; infiltration wells; storage volume

INTRODUCTION

Providing clean water is a major concern in many developing countries, including Indonesia, because water is a basic need and is very important for human life and health. Meanwhile, on the other hand, the capacity of water sources is decreasing in quality due to environmental degradation. (Song Jaemin, 2009). The problem of water shortages has an impact not only on the current generation but also on future generations, especially in areas prone to drought. Some countries do not receive sufficient clean water, giving rise to the idea that rainwater is used to meet clean water needs in certain areas (Silviani & Safriani, 2018). In Indonesia, rain is a potential alternative water source that can be utilized to meet domestic water needs. With high rainfall every year (2000 – 30,000 mm), this country has the most potential for utilizing rainwater. That the large potential of rainwater has not been utilized wisely. Rainwater is often dumped directly into drainage channels without being reused, this is done considering the decreasing need for clean water. Rainwater runoff that can be reused, in this way, can be called rainwater harvesting (PAH) (Ahmad Saiful Fatih, 2014). In accordance with the general overview, previous studies mostly focused on how much potential rainwater can be accommodated in rainwater harvesting systems. However, this research has gaps or novelties such as the year of research, research location and data analysis techniques used. Based on this research, the rainwater harvesting system is equipped with a storage pond, in addition to hydrological analysis using HEC-HMS software.

This research aims to apply the Rainwater Harvesting method *by* utilizing the roof of a building as an alternative reservoir to obtain a water source. Safira Garden Housing Kaliwates District is one of the housing complexes in Jember Regency which has the possibility of water shortage problems. If it is during the dry season, this can hamper community activities in the housing complex. The housing planning for the source of clean water that will be used is through well water (ground water). The use of well water is also a form of major exploitation of groundwater so that it can create large cavities in the bowels of the earth (Sony Adiya Putra, 2022). Based on the identification of the problems above, research on the Rainwater Harvesting System (PAH) is expected to have a positive impact on the community in Safira Garden Housing, Kaliwates District, Jember Regency. The objectives to be achieved in writing research on Rainwater Harvesting Systems as an Alternative to Overcoming Drought in Safira Garden Housing, Kaliwates District , Jember Regency, namely calculating the water requirements needed in Safira Garden Housing, Kaliwates District, calculating the volume of rainwater that is collected and the percentage of water needs that can be obtained. saved from the Rainwater Harvesting System in Safira Garden Housing, Kaliwates District and calculating the Budget Plan (RAB) required for the Rainwater Harvesting System (PAH). The results of this research can be used by the community in Safira Garden Housing, Kaliwates District , Jember Regency as a reference in utilizing rainwater in designs such as Rainwater Harvesting (PAH). Apart from that, the results of this research can also be used as a reference in utilizing rainwater as a source of knowledge in implementing Rainwater Harvesting (PAH).

METHOD

The research location was carried out in the Safira Garden Jember Housing area in Tegal Besar Village, Kaliwates District, Jember Regency with coordinates 113 ^{0} 40'47.4" East Longitude and 8 ^{0} 12'13.5" South Latitude.

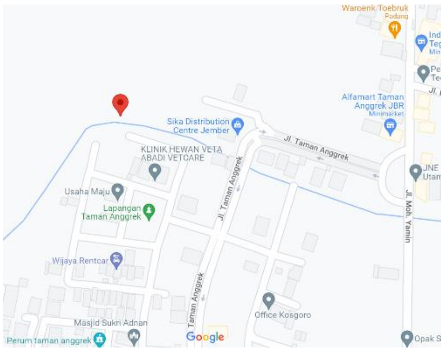


Figure 1Safira Garden Housing Location

(Source: Google Maps, 2022)

In research on rainwater harvesting systems as an alternative to overcoming drought in the Safira Garden housing complex, Kec. Kaliwates District. Jember for the data used as follows:

1. 10 year rainfall data
2. Topographic map of the area around the housing complex
3. Land use of the area around the housing complex
4. Residential site plan
5. Water Consumption Survey Data

Data analysis is the process of systematically searching for and organizing interview transcriptions, field notes and other materials that the researcher has collected. The research stages are as follows:

Data collection

1. Data Input
2. Calculation of Water Availability and Water Needs
3. Water Storage Calculation
4. In this analysis, the water storage calculation consists of hydrological analysis and hydraulic analysis.
5. Calculation of Cost Budget Plan

6. Results and Analysis
7. The following are the steps for planning analysis or research flow chart as follows.

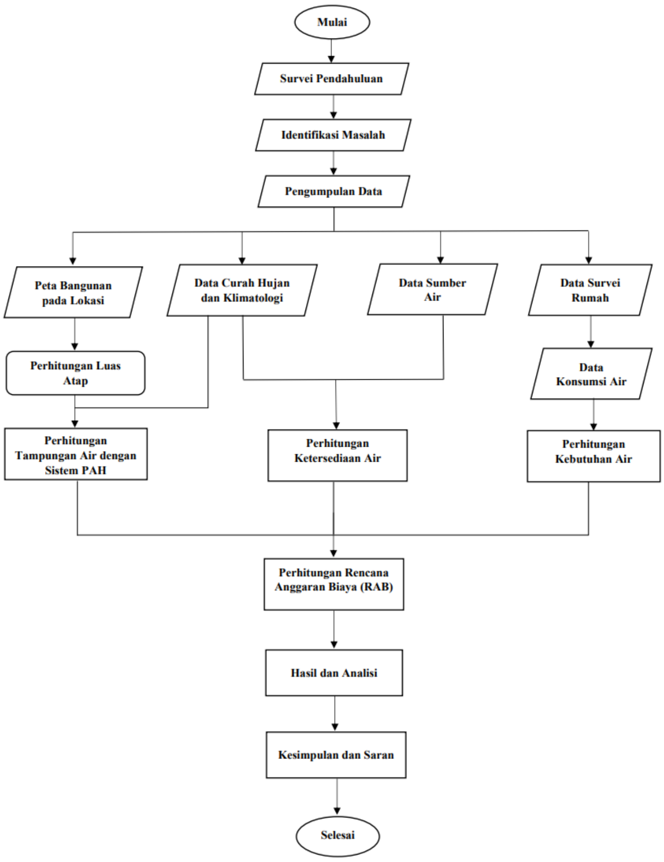


Figure 2Research Method Flow Diagram
(Source: Own Drawing Results)

RESULTS AND DISCUSSION

In the water usage analysis, survey data was obtained in the field with three sample houses. The first house has three family members, the second house has four people and the third house has five people. For the three houses, the hourly water usage was written down and added up for each house for 24 hours. Average usage is the sum of water usage per hour and averaged by dividing by three (the amount of survey data obtained). At 04.00 – 05.00:

House 1 = 28
House 2 = 18
House 3 = 6

Average usage= $\frac{(28+18+6)}{3} = 17.3\,\frac{liter}{hari}$

The calculation of water usage is obtained from the total sum of the average usage, namely 433 liters. Then the results are divided by the survey time, namely 24 hours, so the results of this division are the average results per hour, namely 18.0 liters. From the results of the average hourly calculation, the calculation of the usage factor at 04.00 – 05.00 is to divide the average usage, namely 17.3 liters, by the results of the average hourly usage, namely 18.0 liters. Calculation at 04.00 – 05.00:

Usage factor= $\frac{17.3}{17.8} = 0.96$

Based on SNI 03-1774-2004, it is assumed that the population of Safira Garden Housing is 2937 people. Based on survey results, the standard water requirement for each person is 110 liters/person/day. Calculating the need for clean water is as follows:

$Q_d = P \times q$ (liters/person/day)

$Q_d = 2937$ people × 110 (liters/person/day)

Q_d = 323064 liters/day

So the overall domestic water requirement of residents in the Safira Garden Housing project is 323064 liters/day. In this research, three rain stations were selected, namely Renes (Ajung), Wirolegi and Sembah. In calculating the average rainfall for this area using the Thiessen Polygon calculation.

Figure 3Thiessen Polygon Area Division

(Source: Google Maps, 2022)

Renes Station area = 9.4 m^2
The area of the Sembah Station = 12.2 m^2
Wirolegi Station area = 10.5 m^2
Total Area = 32.1 m^2
Station Area Coefficient $=\frac{9.4}{32.1} = 0.29$
Station Area Coefficient $=\frac{12.2}{32.1} = 0.38$
Station Area Coefficient $=\frac{10.5}{32.1} = 0.33$
Regional Average Rainfall (R_t)
R_t =121 x 0.29 + 67 x 0.33 + 117 x 0.38
R_t =123.9

Table 1Calculation of Log Person Type III and Log Normal Distribution Methods

IN 2012	
R_i	99.17
Log R_i	2.09
Log (R_i - R)	0.1232
Log(R_i - R) ^{2}	0.0152
Log(R_i - R) ^{3}	0.0019
Log (R_i - R) ^{4}	0.0002
Average	95.65
Standard Deviation	0.0665
Cs	0.2333
Tsk	3.9806
CV	0.0007

(Source: Calculation Results, 2023)

Standard Deviation (S_d)= $\sqrt{\frac{\sum(X-\bar{X}i)^2}{n-1}}$

$$S_d = \sqrt{\frac{0,0398}{10-1}}$$

$$S_d = 0.0665$$

Swekness Coefficient (C_s)

$$C_s = \frac{n \cdot \sum(X-\overline{X}i)^3}{(n-1)(n-2)S^3}$$

$$Cs = \frac{10 \,.\, 0{,}0006}{(10-1)(10-2)\ 0.0665^3}$$

$$Cs = 0{,}26325$$

Kourtosis Coefficient (C_k)

$$C_k = \frac{n^2 . \sum(x-\bar{x})^4}{(n-1)(n-2)(n-3)S^4}$$

$$Ck = \frac{10^2 \ .\ 0{,}0004}{(10-1)(10-2)(10-3)\ 0.07^4}$$

Ck = 3.9806

Coefficient of Variation

$$(C_v) = \frac{S_d}{\bar{x}}$$

$$Cv = \frac{0{,}0665}{95{,}65}$$

$$Cv = 0{,}0007$$

In the distribution test, what needs to be paid attention to is the statistical parameters of frequency analysis as shown in the following table:

Table 2Calculation of Distribution Selection Parameters

No	Distribution Type	The calculation results		Requirements		Information
1	Normal	Cs	0.32	Cs ≈ 0	0	Does not meet the
		Tsk	4.44	Ck = 3	3	Does not meet the
2	Gumbel	Cs	0.32	CS = 1.14	1.14	Does not meet the
		Tsk	4.44	Ck = 5.4	5.4	Does not meet the
3	Normal Logs	Cs	0.00	Cs = Cv ^{3} + 3Cv	2	Does not meet the
		Tsk	3.00	Ck = Cv ^{8} + 6 Cv ^{6} + 15 Cv ^{4} + 16 Cv ^{2} + 3	4	Does not meet the
4	Log Person III	Cs	0.26	CS ≠ 0		Fulfil

(Source: Calculation Results, 2023)

The results of these calculations show that Qcount = .38 > Qcritical with a probability of 95% = 1.14 so that the data is stated to be consistent. In comparison, Rcount = 0.59 < Rcritical with a probability of 95% = 1.28 so the data is declared consistent.

Table 3Calculation of Data Consistency Test (RAPS)

Lots of Data	N	10
Average	$\bar{R}$	95.65

Standard Deviation	elementary school	14.54
Sk** Max	1.48	
Sk** Min	-2.05	
Q = |Sk** Max|	1.48	
R = Sk** Max - Sk** Min	3.53	
Q/n^0.5	0.38	
R/n^0.5	0.59	

(Source: Calculation Results, 2023)

This planned rainfall calculation uses the Log Person Type III distribution method.

Standard Deviation (S_d)

$$S_d = \sqrt{\frac{\sum_{i=1}^{n} \text{Log}(Ri-R)^2}{n-1}}$$

$$S_d = \sqrt{\frac{0{,}0398}{10-1}}$$

$$Sd = 0{,}07 \text{ mm}$$

Swekness Coefficient ($_{Cs}$)

$$C_s = \frac{n\ .\ \sum(X-\overline{X}i)^3}{(n-1)(n-2)S^3}$$

$$Cs = \frac{10\ .0{,}0006}{(10-1)(10-2)\ 0.0665^3}$$

$$Cs = 0{,}26$$

Design Rainfall (R_{Tr})

$$R_{TR} = 10^{(Log\bar{R}+K_{TR}\times SLogR)}$$

$$R_{TR} = 10^{(1.98+1.3\times 0.07)}$$

$$R_{TR} = 115.51\text{mmm}$$

Table 4Chi Square Test Calculation

Class	**KTr**	**RTr**	**Limit Value for Each Class**			**Hey**	**Oh**	**((Ei-Oi) ^{2})/Ei**
1	0.83	107.43		>	107.43	2	1	0.5
2	0.10	96.14	96.14	-	107.43	2	5	4.5
3	-0.75	84.42	84.42	-	96.14	2	2	0.0
4	-1.63	73.77	73.77	-	84.42	2	2	0.0
5				<	73.77	2	0	2.0
		Amount				10	10	7

(Source: Calculation Results)

From the table results, the Chi-Square value is 7 and the critical Chi is 7.82. Comparison of these results shows that the Chi-Square of 7 is smaller than the critical Chi of 7.82 so that the frequency distribution is acceptable. If in the Smirnov Kolmogorof test the Dmax ratio is 0.121 ≤ Dcritical is 0.41 then the choice of method can represent or be accepted as the statistical distribution of the data being analyzed.

Table 5Smirnov Kolmogorof Test Calculations

In 2012	
n	10
α	0.05
Ri	99.17
Log Ri	1,996
P = m/(n+1)	0.364

F(t)=(Ri-Rreaver)/S	0.304
P'	0.360
ΔP=[P- P']	0.08
Amount	956.46
Average	95.65
S	0.07

(Source: Calculation Results)

Rain Intensity (mm/hour) can be derived from empirical daily rainfall data (mm) using the Talbot method proposed by Professor Talbot in 1881. The constants a and b are determined using fixed prices, the formula is as follows:

$$I = \frac{a}{t+b}$$

$$I = \frac{3740.33}{5+24}$$

$$I = 128.95\text{mm/hour}$$

Calculation of concentration time can be calculated using the following formula:

$$Tc = 0.0195\left(\frac{L}{\sqrt{S}}\right)^{0.7}$$

With :

Tc = Concentration time
L = Length of distance from the furthest point in the flow area to the observation point in Channel A (730 m)
ΔH = Difference in height between the farthest point and the observation point on channel A
S = Comparison of the difference in height between the furthest place and the observation place to L, namely ΔH : L, or the same as the average slope of the flow area = 6 / 730 = 0.008

$$T_c = 0.0195\left(\frac{730}{\sqrt{0{,}008}}\right)^{0.77}$$

$$T_c = 120.90 \text{ minutes}$$

$$T_c = 2.02 \text{ hours}$$

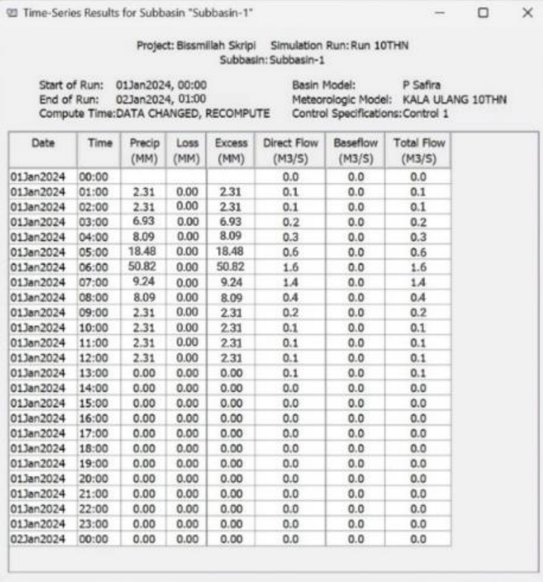
Based on the land use function, the land use coefficient at the housing location is presented in table 11 below:

Table 6Calculation of Land Use Coefficients

No	Parameter	Unit	I	II
1	Land Use Management	-	Housing area	Fasum
2	C grade	-	0.7	1
3	Area A	m^2	96000	64000
4	C.A	-	67200	64000
5	CA mean	-	65600	
6	C Composite	-	0.82	

(Source: Calculation Results, 2023)

The following are the hydrograph graph results and a summary of the planned flood discharge output in the HEC-HMS model.



Time-Series Results for Subbasin "Subbasin-1"

Project: Bissmillah Skripi Simulation Run: Run 10THN
Subbasin: Subbasin-1

Start of Run: 01Jan2024, 00:00 Basin Model: P Safira
End of Run: 02Jan2024, 01:00 Meteorologic Model: KALA ULANG 10THN
Compute Time: DATA CHANGED, RECOMPUTE Control Specifications: Control 1

Date	Time	Precip (MM)	Loss (MM)	Excess (MM)	Direct Flow (M3/S)	Baseflow (M3/S)	Total Flow (M3/S)
01Jan2024	00:00				0.0	0.0	0.0
01Jan2024	01:00	2.31	0.00	2.31	0.1	0.0	0.1
01Jan2024	02:00	2.31	0.00	2.31	0.1	0.0	0.1
01Jan2024	03:00	6.93	0.00	6.93	0.2	0.0	0.2
01Jan2024	04:00	8.09	0.00	8.09	0.3	0.0	0.3
01Jan2024	05:00	18.48	0.00	18.48	0.6	0.0	0.6
01Jan2024	06:00	50.82	0.00	50.82	1.6	0.0	1.6
01Jan2024	07:00	9.24	0.00	9.24	1.4	0.0	1.4
01Jan2024	08:00	8.09	0.00	8.09	0.4	0.0	0.4
01Jan2024	09:00	2.31	0.00	2.31	0.2	0.0	0.2
01Jan2024	10:00	2.31	0.00	2.31	0.1	0.0	0.1
01Jan2024	11:00	2.31	0.00	2.31	0.1	0.0	0.1
01Jan2024	12:00	2.31	0.00	2.31	0.1	0.0	0.1
01Jan2024	13:00	0.00	0.00	0.00	0.1	0.0	0.1
01Jan2024	14:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	15:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	16:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	17:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	18:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	19:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	20:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	21:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	22:00	0.00	0.00	0.00	0.0	0.0	0.0
01Jan2024	23:00	0.00	0.00	0.00	0.0	0.0	0.0
02Jan2024	00:00	0.00	0.00	0.00	0.0	0.0	0.0

Figure 4Summary of Planned Flood Discharge Output

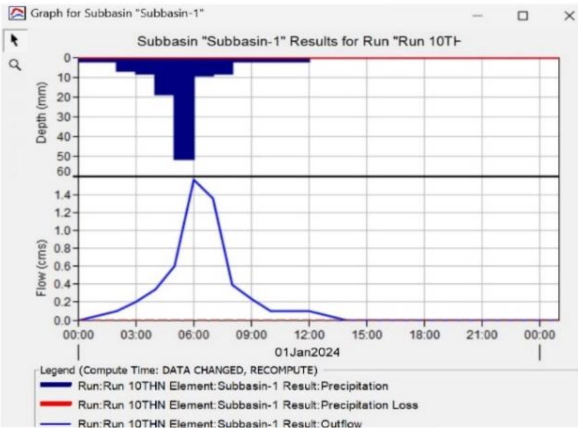


Figure 5Planned Flood Discharge Hydrograph Graph

The domestic waste discharge discharge from housing must also be taken into account, in calculating the total discharge discharge it is obtained from the total domestic waste discharge and the total rainwater discharge. Safira Garden housing complex has a total of 334 houses and the amount of water discharged is 1000 liters/day/person so the total domestic waste discharge is 0.0193 m3 / sec. If the total rainwater discharge based on the planned rain discharge analysis is found to be 0.9155 m ^{3} /sec. So the total water discharged at Safira Garden Housing is 1.4023 m ^{3} /sec. In analyzing the cross-sectional capacity of drainage channels, the stages or steps are as follows:

1. The width of the channel base (B) is the width of the base of the existing channel = 0.50 m
2. Flow depth (H) is the vertical distance from the lowest point on a channel cross-section to the free surface = 0.50.
3. The peak width (T) is the cross-sectional width of the channel on the free surface, because the channel is square so the value of T = B = 0.50
4. The wetted area (A) is the cross-sectional area of the flow perpendicular to the flow direction.

$$A = B \times H$$
$$= 0.5 \times 0.5$$
$$= 0.25 \text{ m}^2$$

5. The wet circumference (P) is the length of the line of intersection of the wet surface of the channel with the cross-sectional plane perpendicular to the flow direction.

$$P = B + 2H$$
$$P = 0.50 + 2(0.50)$$
$$P = 1.50 \text{ m}$$

6. Hydraulic radius (R) is the ratio of the wetted area to the wetted perimeter

   $R = \frac{A}{P}$

   $R = \frac{0.25}{1.50}$

   R = 0.17 m
7. According to existing data on channel walls using cemented masonry , the Manning roughness coefficient value is n = 0.01.
8. In evaluating drainage systems in urban areas, flow velocity uses the Manning method with the following equation:

   V = Flow speed in the channel (m/sec)
   n = Manning roughness coefficient, 0.01
   R = Hydraulic radius, 0.17
   S = Channel bottom slope, 0.0021

   $V = \frac{1}{n}$x R2/3 x S1/2

   $V = \frac{1}{0.01}$x 0.172/3 x 0.0012/3

   V = 0.958 m/s
9. To determine the type of flow is the ratio between gravitational force and inertial force, which is expressed by the *Froude number* (Fr) . The *Froude* number is defined as follows:

   V = Flow speed (m/sec)
   H = Depth of flow (m)
   g = Acceleration due to gravity (m/sec)

   $F_r = \frac{V}{\sqrt{g\,.\,H}}$

   $F_r = \frac{0,958}{\sqrt{9.81 \times 0.50}}$

   F_r = 0.43
10. Determine the debit of each channel using the formula:

   A = Wet cross-sectional area = 0.25 m^2
   V = Flow velocity in the channel= 0.958 m/s
   Q = V x A
   = 0.25 x 0.958
   = 0.239 m^3/s

In the analysis of storage ponds, the stages or steps are as follows:

1. The side of the storage pond is the length and width of the base of the existing channel, because the storage pond is square in shape

   P = L = 20.0 m
2. Depth (H) is the vertical distance from the lowest point on a section or storage pond to the free surface = 2.50 m.
3. Storage Pool Volume (V)

   V = L × W × H
   = 20 × 20 ×2.5
   = 1000 m^3
4. According to existing data on the type of soil in the area, the soil is clay, the soil permeability coefficient value is 0.0000001 m/sec.
5. Determine the discharge that can be absorbed in a storage pond using the formula:

   A = Cross-sectional area
   = L × L
   = 20 × 20
   = 400 m^2

   Q = k × A
   = 0.0000001 × 400
   = 0.00004 m^3/sec

This analysis resulted in the total volume of discharge discharged being 4982.20 m^3/hour and the design of the total volume of the storage pond being 5306.74 m^3/hour so that the remaining volume in the storage pond for more than 1 hour can still accommodate 324.54 m^3. The dimensions used in the storage pool are 20×20×2.5 m and 21×21×2.5 m.

The following are the stages or steps of infiltration well analysis as follows:

1. The side of the infiltration well is the length and width of the base of the existing channel, because the storage pond is square in shape
   L = L = 18.0 m
2. Depth (H) is the vertical distance from the lowest point on a section or infiltration well to the free surface = 3.0 m.
3. Infiltration Well Volume (V)
   V = L × W × H
   = 18.0 × 18.0 ×3.0
   = 932 m^3
4. According to existing data on the type of soil in the area, the soil is clay, the soil permeability coefficient value is 0.0000001 m/sec.
5. Determine the discharge that can be absorbed in an infiltration well using the formula:
   A = Cross-sectional area
   = L × L
   = 18.0 × 18.0
   = 324 m2
   Q = k × A
   = 0.0000001 × 324
   = 0.000032 m3/sec

Analysis of the table shows that the total volume of discharge collected in absorption wells throughout the house is 66.04 m^3 from the total discharge discharged at 5048.24 m^3/hour with the remaining discharge not being collected amounting to 4982.20 m^3/hour which will be channeled into the pond shelter.

Table 7Calculation of PAH Volume

Roof Area	Number of Family Members	Volume (liters/month)	Water usage	Water Requirements/month/liter/KK	Percentage saved
72	5	4616.89	550	16729.35	28%
90	5	5771.11	550	16729.35	34%
104.5	5	6700.90	550	16729.35	40%

(Source: Calculation Results, 2023)

The potential for rainwater to meet the water needs of 3 types of houses in the Safira Garden Housing area, Tegal Besar Village, Kaliwates District, Jember Regency is between 28% and 40% of the total water needs of each type of house within one month.

The budget plan for the construction of rainwater harvesting is as presented in the table below with a total planning amount for Rainwater Harvesting of Rp. 9,253,000.00.

Table 8Calculation of Budget Plan (RAB)

No	Job description	Unit	Volume	Unit Price (Rp)	Total Price (Rp)
1	2	3	4	5	6
I	**Rain Water Harvesting Works**				
1	Earth Excavation Work	m^3	2.3	72400	166520

No	Job description	Unit	Volume	Unit Price (Rp)	Total Price (Rp)
1	2	3	4	5	6
I	**Rain Water Harvesting Works**				
2	Work on filling up excavated land	m^3	0.4	24100	9640
3	Concrete Cover Pair T 10 cm 1:2:3	m^3	0.05	6199600	309980
4	Concrete Floor Pair 10 cm 1:2:3	m^3	0.05	6310100	315505
5	Concrete Column Pair 10/10 1:2:3	m^3	0.08	5452100	436168
6	Brick masonry 1/2 brick thick 1:4	m^3	0.8	117000	93600
7	Underground Tank 1000 L	fruit	1	2200000	2200000
8	10" Diameter Water Purification Filter	fruit	1	470000	470000
9	Construction of Infiltration Wells	units	1	2000000	2000000
10	Installation of 0.45 mm thick zinc gutters	m	9	193500	1741500
11	PVC Pipe Diameter 3"	m	5	64000	128000
12	PVC Pipe Diameter 1"	m	2	41000	82000
13	Procurement of Water Pumps	units	1	1300000	1300000
		Total			9252913
		Rounded			9253000

(Source: Calculation Results, 2023)

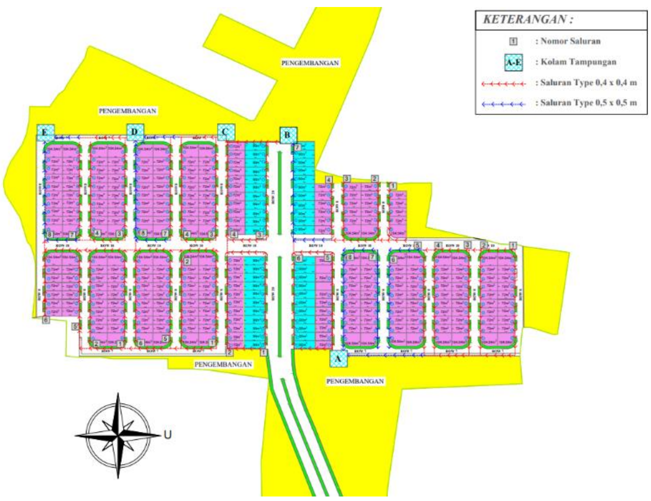


Figure 6Site Plan for Residential Storage Pool Points

CONCLUSION

Based on the results of the analysis of the implementation of the rainwater harvesting system in Safira Garden Housing, Kaliwates District, Jember Regency, the conclusion that can be drawn is that Safira Garden Housing has a total of 343 houses, the results of the analysis estimate the population is around 1,429 people and the results of field surveys regarding the standard water requirements for each person is 110 liters/person/day, so the total domestic clean water requirement for the entire population is 323,064 liters/day.

The results of the analysis regarding the potential for rainwater that can be harvested from the rainwater harvesting system is 66.04 m^3 in the total volume in the absorption wells throughout the house and the total volume in the entire storage pond is 5303.36 m^3. The potential of rainwater as an alternative water source with a rainwater harvesting system produces a water volume of 4616.89 liters/month to 6700.90 liters/month from the required water requirement of 16729.35 liters/month so that the percentage of water requirements saved is 28% to 40% of the total water requirement PDAM for each type of house within one month.

Based on the calculation results, the total amount for the construction of a Rainwater Harvesting System Installation is IDR. 9,253,000.00.

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