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Analysis of Clean Water Needs and Wastewater Management of Japfa Office Building

Yuli Sulistiyohadi[1], Agus Jumkhairul[2], Era Agita Kabdiyono[2]
Civil Engineering, Informatics Engineering, Dian Nusantara University, Indonesia

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Corresponding author*:
y.sulistiyohadi@dosen.undira.ac.id

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Abstract: Japfa Compeed Building is an office building managed by PT Ometraco Arya Samanta, has 7 floors and has just started operating and was inaugurated in January 2025. The building is located at Jalan Daan Mogot KM 12 No. 9, Cengkareng, West Jakarta. The building covers an area of approximately 29,272 m^2. To ensure employee comfort, an effective clean water and wastewater management system is required, complying with the latest Indonesian National Standard, SNI 8153:2015. To meet the clean water needs of a population of 662, 39.72 m^3 of clean water is required per day. The ground water tank capacity is 13.24 m3, while the roof water tank capacity is 2.92 m^3. This office building has a Wastewater Treatment Plant (WWTP) with a water discharge capacity of 40 m^3/day. Some of the wastewater is treated through a Wastewater Treatment Plant (WWTP), with a maximum capacity of 10 m^3/day of recycled water. The water discharge savings generated from the WWTP reach 101 m^3 per month, according to daily water discharge checks. The building also utilizes a Water Level Control (WLC) system for the distribution of clean and recycled water, enabling automatic water level control.

Keywords: Office Building, Clean Water, Wastewater, SNI 8153:2015

INTRODUCTION

Comfort is the top priority for employees in carrying out their work, allowing them to focus more on carrying out the company's tasks according to the goals set by the management. One of the aspects of convenience is the piping system for clean water and wastewater management. The Piping System is the most common and inexpensive method of moving fluids from one processing point to another horizontally or vertically between equipment or from one place to another so that a production process can take place (Firdaus et al., 2014).

Piping systems consist of many components that interact with each other, which are connected with several pieces of equipment, to achieve good fluid processing in a plant. The piping system is part of all physical facilities where fluid flow is transported including pipes, connections, valves, flanges, regulators, pressure vessels, relief valves, compressor units and other tools installed on pipes (Anindyta et al., 2018).

In wastewater management, the Japfa Compeed building uses the Wastewater Management Installation (WWTP) technology system. According to Indonesia's Ministry of Environment and Forestry (MoEF), 2020: "WWTP is a system used to treat wastewater into cleaner and safer water to be discharged into the environment. The main function of WWTP is to remove pollutants from wastewater so that the water can be discharged into the environment safely. WWTP has a very important role in preserving environmental cleanliness and ensuring the availability of clean water that is safe for reuse. WWTP is also known as Sewage Treatment Plant (STP).

RESEARCH METHODS

This research method uses a case study approach, where the method used is quantitative descriptive. This approach involves the collection and analysis of numerical data that includes water volume, number of users, and type of equipment, to understand the clean water and wastewater needs of a building. The descriptive method aims to describe in detail the needs of clean water and wastewater in a building without any manipulation or intervention. While the quantitative method, the data obtained and analyzed are numerical, such as the total liter of water needed per day, the number of sanitary devices, and the size of the room.

Data Source

Primary data is data without the use of intermediaries, collected or obtained directly from sources such as blackwater discharge, greywater characteristics, blackwater characteristics, available land area, and soil elevation measured directly using the Global Positioning System (GPS).

Secondary data is data from other parties, including processing and presenting the completeness of the data collected such as data on the number of employees and visitors, Graha Praba Samanta area plan data, shop drawing data, and sanitation data

RESULTS AND DISCUSSION

Determination of Clean Water Needs

To find out the amount of clean water needed used, it can be calculated with the following equation:

Qd = number of inhabitants x water consumption per person per day
Qd = 662 people x 50 liters/day/person
Qd = 33.100 liter/hari
Qd = 33.1 m^3/day

By adding 20% of the total clean water needs used (Sunarno, 2005), then:

Qdtotal = (100%+20%) x 33.1 m^3/day
Qdtotal = 120% x 33.1 m^3/day
Qdtotal = 39.72 m^3/day

So the water consumption per day with an addition of 20% is 39.72 m^3/day.

1) The average water requirement of working hours is calculated as follows:

$$Qh = \frac{Qd}{t}$$

Where:

Qh = average water consumption during operating hours (l/h)
Qd = average daily water consumption (l/day)
t = average water usage period in 1 day (8 hours/day)

So that:

$$Qh = \frac{39.720 \text{ l/hari}}{8 \text{ jam/hari}}$$

Qh = 4.965 l/h = 1.3791 l/sec

So the average water consumption per day in a period of 8 hours is 4,965 l/hour or 1.3791 l/second.

2) Water consumption during peak hours is calculated as follows:

$Q_{h\text{-maks}}$ = C1 . Qh

Where:

Qh-max = water consumption during peak hours (l/hour)
C1 = 1.75
Qh = 4.965 l/h

So that:

Qh-max = 1.75 x 4.965 l/ha
$Q_{h\text{-max}}$ = 8,688.75 l/h = 8,688 m^3/h

So the water consumption during peak hours is 8,688.75 l/hour, or equivalent to 8,688 m^3/hour.

3) Water consumption in peak minutes is calculated as follows:

Qm-maks = C2 . Qh

Where:

Qm-max = water consumption at peak minutes (l/minute)
C2 = 3.5
Qh = 4.965 l/h

So that:

$$\text{Qm-max} = (3.5 \times 4.965 \text{ l/h}) \times \frac{1 \text{ jam}}{60 \text{ menit}}$$

Qm-max = 289.625 l/min = 0.289 m^3/min

So the water consumption at peak minutes is 289.625 l/minute equivalent to 0.289 m^3/minute.

Determination of the Size of the Bottom Water Tub

The determination of the size of the bottom water basin is determined based on the following calculation by calculating the size of the capacity of the official pipe, with the following equation:

$$Qs = \frac{2}{3} \times Qh$$

Where:

Qh = 4,965 m^3/h
Qs = service pipe capacity (m^3/hour)

So that:

$$Qs = \times 4{,}965 \frac{2}{3} \text{ m3/h}$$

Qs = 3.31 m^3/h

The volume of the Ground Water Tank is calculated, with the following equation:

Volume GWT = [Qd - (Qs x t) x T]

Where:

Qd = 39.72 m^3/day
Qs = 3.31 m^3/h
T = 1 day
t = 8 hours/day

So that:

GWT volume = [39.72 - (3.31 x 8 hours/day)] x 1 day

GWT volume = [39.72 – 26.48 m^3/day] x 1 Day

Volume GWT = 13,24 m^3

So, the volume of the Ground Water Tank is 13.24 m^3.

Determination of the Size of the Top Water Tub

First, the capacity of the volume of water that must be accommodated in the basin must be determined. The determination of the volume capacity of the upper water tank using the equation can be determined through the calculation as follows:

Qp = Qm-max = 0.289m^3/min

Qh-max = 8,688 m^3/h

$= 8{,}688 \text{ m3/h} \times \frac{1 \text{ jam}}{60 \text{ menit}}$

= 0.144 m3/ min

In this design, the Qpu value is assumed to be Qh-max, so that:

Qpu = Qh-max = 0.289 m^3/min.

In addition, it is also assumed that:

Tp = 60 minutes

Tpu = 20 minutes

From these data, it can then be determined the effective volume for the upper water basin according to the formula in the previous chapter, namely:

VE = [(Qp – Qh-max) Tp - (Qpu x Tpu)]

Where:

VE = volume of upper water tank (m^3)

Qp = 0.289 m^3/min

Qh-max = 0.144 m^3/ min

Qpu = 0.289 m^3/min

Tp = 60 minutes

Tpu = 20 minutes

So that:

VE = [(0.289 m^3/min – 0.144 m^3/min) x 60 min – (0.289 m^3/min x 20 min)]

VE = [(0.145 m^3/ minute) x 60 minutes – 5.78 m^3]

VE = [8.7 m^3 – 5.78 m^3]

EV = 2.92 m^3

So, the effective volume of the upper water tank (Roof Tank) is: 2.92 m^3.

Determination of Wastewater Waste Capacity

Wastewater discharge is determined from 90% of clean water use, this is based on the Decree on Drinking Water SNI from the Ministry of Public Works. So that the amount of waste water produced can be calculated with the following formula:

Wastewater Discharge	= (39.72 clean water) x 0.9
Wastewater Discharge/day	= 35,748 liters/day
Duration of work in 1 day	= 8 hours of work/day
Wastewater Discharge/hour	= 4.4685 m^3/hour
Wastewater Discharge/minute	= 0.0745 m^3/min
Wastewater Discharge/sec	= 0.001241 m^3/sec

Clean Water Distribution Diagram In The Field

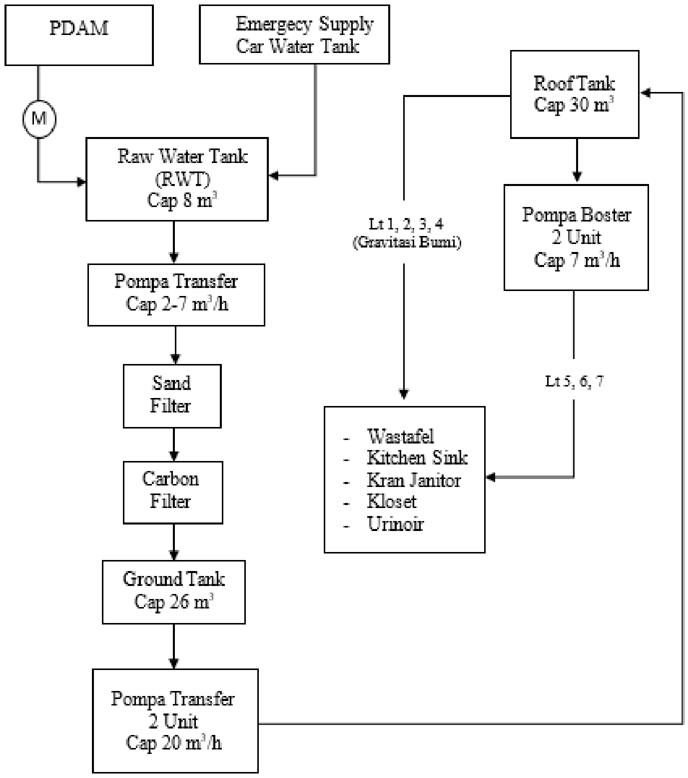

Figure 1. Clean Water Distribution Diagram

Source : Field Documentation, 2025

Dirty Water Distribution Diagram In The Field

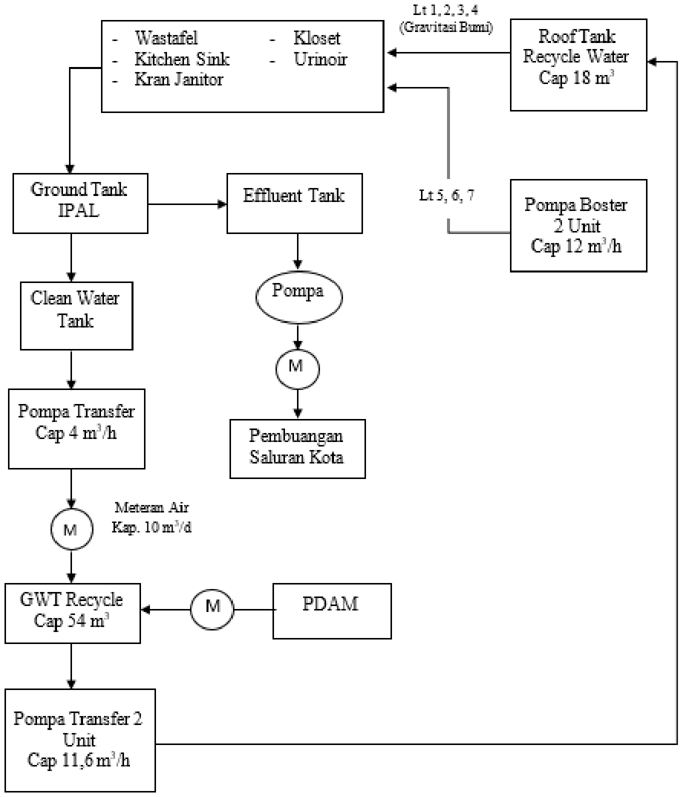

Figure 2. Dirty Water Distribution Diagram

Source : Field Documentation, 2025

Recycled Water Distribution Diagram

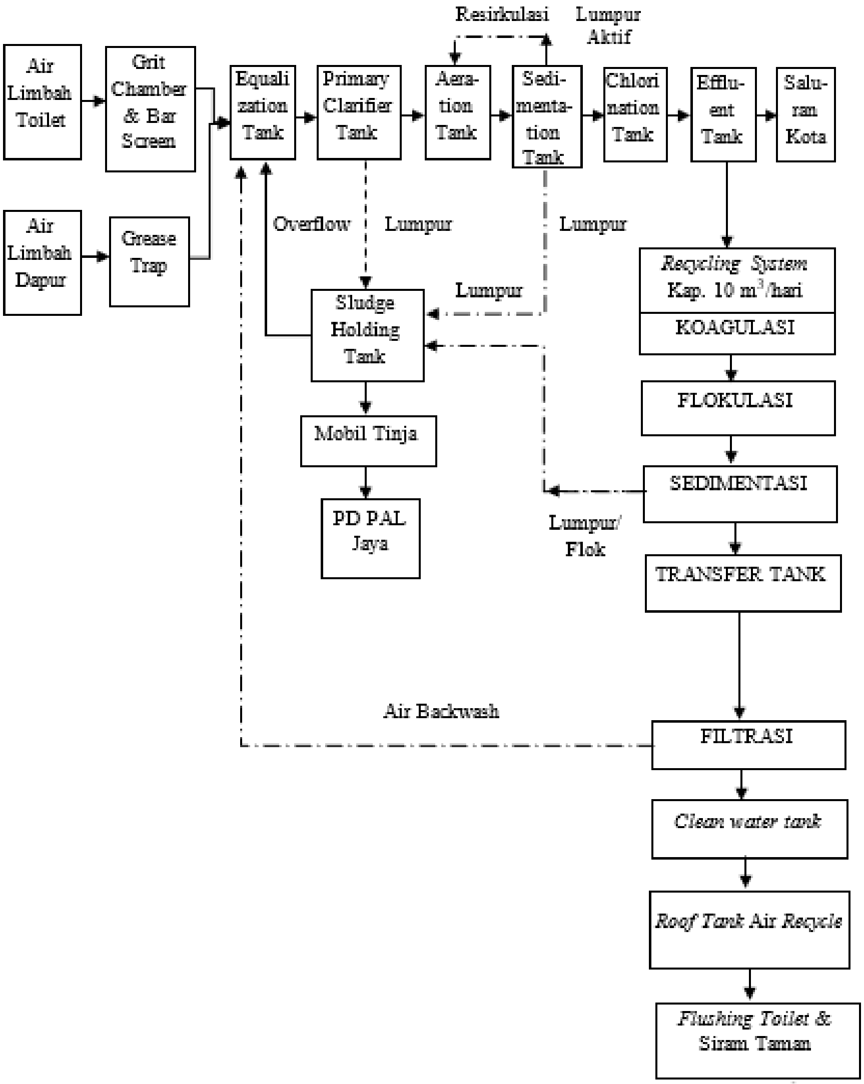

Figure 3. Recycled Water Distribution Diagram
Source : Field Documentation, 2025

Daily Discharge Check of WWTP in the Field

Table 1. Data on WWTP Water Discharge Discharged into City Channels and Wastewater Discharge Results Recycled for 1 Month

Yes	Date	WWTP discharge m3/day	Recycled Discharge (m3/day)	WWTP yield m3/day	Recycled Yield m3/day
1.	May 21, 2025	3397	665	0	0
2.	22 May 2025	3428,8	669	31,8	4
3.	23 May 2025	3460,9	673	32,1	4
4.	24 May 2025	3479,6	676	18,7	3
5.	25 May 2025	3488,8	676	9,2	0
6.	26 May 2025	3513,1	676	24,3	0
7.	27 May 2025	3540,4	676	27,3	0

8.	28 May 2025	3568,1	676	27,7	0
9.	29 May 2025	3578,1	677	10	1
10.	30 May 2025	3602,5	677	24,4	0
11.	31 May 2025	3615,3	677	12,8	0
12.	01 June 2025	3615,3	677	0	0
13.	02 June 2025	3634,3	681	19	4
14.	03 June 2025	3662,4	689	28,1	8
15.	04 June 2025	3683,6	696	21,2	7
16.	05 June 2025	3704,4	703	20,8	7
17.	06 June 2025	3709,3	710	4,9	7
18.	07 June 2025	3711	712	1,7	2
19.	08 June 2025	3711	712	0	0
20.	09 June 2025	3734,3	715	23,3	3
21.	10 June 2025	3756,7	723	22,4	8
22.	11 June 2025	3782,4	730	25,7	7
23.	12 June 2025	3808,2	736	25,8	6
24.	13 June 2025	3828,2	740	20	4
25.	14 June 2025	3841,5	742	13,3	2
26.	15 June 2025	3841,6	743	0,1	1
27.	16 June 2025	3868	744	26,4	1
28.	17 June 2025	3902,5	751	34,5	7
29.	18 June 2025	3936,3	757	33,8	6
30.	19 June 2025	3960,8	760	24,5	3
31.	20 June 2025	3991,8	766	31	6
AMOUNT of Water Discharge		**594,8 m^3**	**101 m^3**	**594,8 m^3**	**101 m^3**

Table 2. Self-monitoring data on WWTP Water Quality Standards in outlet pipes that are discharged into city channels and reused.

No	Date	PH in Effluent Tank 6-9	Residual Chlorine (mg/l) in Effluent Tank 0.9	PH in Clean Water Tank 6-9	Chlorine Residual Maximum 0.9
1.	21 May 2025	5,9	0,01	6,1	0,02
2.	22 May 2025	6,4	0	6,4	0
3.	23 May 2025	6,1	0	6,3	0,01
4.	26 May 2025	6	0	6,1	0
5.	27 May 2025	5,9	0	6,2	0,02
6.	28 May 2025	6,1	0,02	6,1	0
7.	30 May 2025	6,1	0	6,2	0,02
8.	02 June 2025	6	0	6,2	0
9.	03 June 2025	6	0	6,1	0
10.	04 June 2025	6	0	6,1	0
11.	05 June 2025	6	0	6,2	0,02
12.	09 June 2025	6	0	6,2	0
13.	10 June 2025	6	0	6,1	0,01
14.	11 June 2025	6,1	0	6,3	0,03
15.	12 June 2025	6	0	6,2	0,01
16.	13 June 2025	5,9	0	6,1	0
17.	16 June 2025	6	0,01	6,1	0,03
18.	17 June 2025	6,8	0,05	7,6	0,08

19.	18 June 2025	6,1	0,02	7,9	0,07
20.	19 June 2025	6,1	0	6,8	0
21.	20 June 2025	6,4	0,02	6,7	0,04

Note :
The date of checking the building's operating hours is Monday to Friday.
(Saturdays, Sundays and Public Holidays).

Table 3. Self-Monitoring Data of WWTP Water Quality Standards in Aeration Tanks

No	Date	Dissolved Oxygen/Do (mg/l) 7,5	SV30 (ml)
1.	21 May 2025	6	
2.	22 May 2025	5,9	0,4
3.	23 May 2025	6	
4.	26 May 2025	6	
5.	27 May 2025	6	
6.	28 May 2025	6,3	
7.	30 May 2025	6	
8.	02 June 2025	5,8	
9.	03 June 2025	5,9	
10.	04 June 2025	6,2	
11.	05 June 2025	6	1,5
12.	09 June 2025	6,3	
13.	10 June 2025	6,1	
14.	11 June 2025	6	
15.	12 June 2025	6,2	1,4
16.	13 June 2025	6	
17.	16 June 2025	6	
18.	17 June 2025	6,2	
19.	18 June 2025	6,1	0,6
20.	19 June 2025	6,3	
21.	20 June 2025	6	

Note :
The date of checking the building's operating hours is Monday to Friday.
(Saturdays, Sundays and Public Holidays). Sludge Deposit Check once a week on Thursdays.

Results of Clean Water Calculation Analysis

The results of the analysis obtained from the calculations for the design determine the volume capacity of the ground tank and roof of the clean water tank in the 7-storey office building. Getting clean water needs in one day with a clean water need capacity of 39.72 m^3/day from an estimated number of 662 people and this value has been added by 20% (according to Sunarno, 2005) unexpected water needs, namely water evaporation, water leakage, preventive maintenance of buildings and air conditioners, employee ablution needs, garden watering and others.

The estimated need for clean water in one hour requires 4,965 m^3/hour. Water consumption during peak hours requires 8,688 m3/hour, the value of this water requirement is greater plus C2 = 1.75 (based on the formula for office buildings) according to Soufyan

Moh. Noerbambang & Takeo Morimura. The need for a ground tank volume in a multi-storey office building with a capacity of 13.24 m^3 and the volume of the roof tank as a result of the calculation analysis requires a capacity of 2.92 m^3 (the result of Soufyan Moh's calculations. Noerbambang & Takeo Morimura). The analysis of wastewater calculations taken from the diagram in the table above shows the distribution of clean water, while the table above shows the distribution of dirty water that has been recycled. The source of clean water also comes from the PDAM that serves the multi-storey office building. A ground tank for clean water has been applied with a water storage capacity of 26 m^3, while a roof tank for clean water has a capacity of 30 m^3.

The volume of the ground tank is 26 m^3 (for clean water supply) + 54 m^3 (clean water + WWTP recycled water) = 70 m^3. In the clean water tank roof reservoir, the planning consultant designed with a capacity of 30 m^3 (specifically for clean water supply) + 18 m^3 (clean water + wastewater recycled water) = 48 m^3 (according to SNI 2015 standards). The next factor is the instability of clean water supply from the source, namely PDAM, which is a reference for planning consultants in designing the capacity of water storage volume ground tanks and roof tanks in the 7th floor office building.

CONCLUSION

Based on the results of the analysis conducted at PT Ometraco Arya Samanta Japfa Compeed West Jakarta building, the following conclusions can be drawn:

1. The results of the calculation of the need in the design of the plumbing system for the clean water installation of office buildings require water of 39.72 m^3/day, with a total capacity of 662 people in one building with a total of 7 floors. The results of the calculation of the use capacity of the ground water tank are 13.24 m^3. The upper clean water reservoir (Roof Water Tank) requires a capacity of 2.92 m^3.
2. The results of observations in the field of design which has a lower clean water reservoir capacity (Ground Water Tank) of 26 m^3, and has an upper water reservoir (Roof Water Tank) with a capacity of 32 m^3. The results of the interview with the building maintenance manager of the GWT storage capacity application were the result of the design of the calculation of the planning consultant based on SNI 8153:2015 which suggested a minimum GWT capacity of 1-2 days of water needs. For RWT storage capacity from SNI, it recommends a capacity of 1/2 day to 1 day of water needs. The design of water reservoirs that are applied is greater than the need for 1 day is indicated by the source of unstable PDAM water discharge per day.
3. Analysis of the calculation of the wastewater discharge produced and distributed at WWTP with a calculation of 90% of the clean water demand of 35.74m^3. This office building also has a Wastewater Management Plant (WWTP) which has a water discharge management capacity of 40 m^3/day so that the treated wastewater can remove contamination so that it is safe to be discharged into the city's canals so that the city's river ecosystem is not polluted by the domestic waste and part of it is returned to the clean water cycle that can be used for flushing toilets and garden flushes to save on clean water consumption. This process is very important to maintain air quality, public health, and reduce negative impacts on the environment. Some of the wastewater is treated through the Sewage Treatment Plant (STP) with a maximum recycled water capacity of 10 m^3/day. The clean

water savings generated from the water recycling process through STP in 1 month reach 101 m^3 from the results of checking the water discharge every day.

REFERENCES

Anaufal, F. (2022). Prototype of an Internet of Things Based Factory Wastewater Quality Detection System [Universitas Komputer Indonesia]. in Indonesian Computer University. Derived from https://elibrary.unikom.ac.id/id/eprint/4786/

National Standards Agency. (2005). Governor Regulation DKI-122-2002 on Domestic Wastewater Treatment in Jakarta Province.

Badaruddin, Sugiarto. (2023). A Review Study on Clean Water Plumbing System Planning (Case Study: Arabic Language Science College Building). Journal of Energy Mechanical Engineering. Obtained from https://doi.org/10.31963/sinergi.v21i1.4192

Ir. Wahadamaputera Shiley, MT and Ir. Pynkyawati Theresia, MT. (2015). Utility of Building Plumbing Modules. Jakarta: Griya Kreasi. Obtained from https://www.google.co.id/books/edition/Utilitas_Bangunan_Modul_Plumbing/Pg-oCgAAQBAJ?hl=id&gbpv=1&pg=PA22&printsec=frontcover

Ministry of Environment and Forestry (2020). Regulation of the Minister of Environment and Forestry on Wastewater Management.

Moh, Noerbambang, Soufyan and Morimura, Takeo. (2000). Planning and Maintenance of Plumbing System. Jakarta: PT Pradnya Paramita.

Muhamad, Fuad and Wardhani, Eka. (2021). Water Saving Study on Clean Water Plumbing System at Menara Cibinong Tower Mahogany Apartment. Bandung: National Institute of Technology. Juornal or Serambi Enggineering. Derived from https://doi.org/10.32672/jse.v6i4.3475

Indonesian National Standard (SNI) 8153-2015, Plumbing System in Buildings.

Indonesian National Standard (SNI) 2398-2017, Procedures for Planning Septic Tanks with Advanced Treatment (Infiltration Wells, Infiltration Fields, Up Flow Filters, Sanita Ponds).

Suhardiyanto, 2016. Design of Plumbing System for Clean Water and Wastewater Installation in the Construction of a Seven-Storey Office Building. Jakarta: Mercu Buana University. Journal of Mechanical Engineering. Retrieved from http://dx.doi.org/10.22441/jtm.v5i3.1208

Syamsuddin and Damayanti. (2011). Language Education Research Methods. Bandung: Remaja Rosdakarya.

Rinka, Dhea, Yafina, et al. (2014). Planning of Wastewater Plumbing System with the Application of Green Building Concept in Panghegar Resort Dago Golf-Hotel & SPA Building. National Institute of Technology. Journal of Environmental Design.
Retrieved from https://doi.org/10.26760/rekalingkungan.v2i2.%25p

Zihat Muhammad Abi Manyu, Shanti Shopia Meilani, and Masrida Reni. (2024). Evaluation of Wastewater Treatment Plant in the Rajawali Tower Office Building. Journal of Proceedings of the National Seminar on Engineering. Retrieved from https://ejurnal.ubharajaya.ac.id/index.php/PSFT/article/view/3103