SELECTION OF UNIT DESIGN FOR TELUK BUYUNG 4 WATER TREATMENT PLANT (WTP), BEKASI CITY, WEST JAVA, INDONESIA

Sharmaina Fadhilah Nasution, Riana Ayu Kusumadewi*, Widyo Astono

Environmental Engineering Department, Universitas Trisakti, Indonesia

Abstract

The city of Bekasi is experiencing rapid development so the demand for water is increasing. To increase service coverage and meet the drinking water needs of the people of Bekasi City with a quality that meets the Minister of Health Regulation No. 492 of 2010, it is planned to up rate the capacity that the Teluk Buyung 4 WTP has a capacity of 300 L/second with a raw water source, namely the West Tarum Secondary Channel. The Teluk Buyung 4 WTP is planned to use the design criteria from the Equivalent WTP evaluation, namely Teluk Buyung 3 WTP and literature studies. Teluk Buyung 4 WTP uses processing units, intake unit, hydraulic coagulation, hydraulic flocculation, plate settler sedimentation, rapid sand filtration, disinfection, and reservoir. The data used in the planning process is divided into two, namely primary data and secondary data. The intake unit has several components, namely a barscreen, sluice gate, carrier channel, and collecting well. The pre-sedimentation unit consists of 2 tanks and is channeled to a collection well and then pumped to the WTP. The coagulation unit uses hydraulic coagulation with a plunge of 1 tub. The coagulant used was PAC at a dose of 25 mg/L. The flocculation unit uses hydraulic flocculation with up and down flow with 2 tubs. The sedimentation unit uses a plate settler with 2 tanks. The filtration unit uses a rapid sand filter with dual media, namely anthracite media and sand media and has 7 tubs. Disinfection process uses NaOCl with a dose of 41.67 mg/L. The reservoir unit uses 1 tub with a ground reservoir type.

Keywords: *water treatment plant, Teluk Buyung WTP, water quality, drinking water*

Introduction

Water is an element that has a major role in life on earth and one of the most important needs for the survival of humans and other living things. Water is known as a renewable natural resource in terms of quality and quantity that requires effort and time to run well. The current need for water requires more attention, especially for urban areas given the very dynamic activities of urban life. The urban community's need for drinking water will increase in line with the increase in population in the future. The availability of drinking water that is suitable for consumption for the community is often not proportional to the level of drinking water needed. This can be overcome by treating drinking water so that water must be available with good quality, quantity and continuity and meet quality standards. To meet these requirements, this has been regulated by the Minister of Health Regulation no. 492 of 2010 concerning Drinking Water Quality Requirements.

In Bekasi City, the local government has recompiled the Bekasi City Medium-Term Development Plan 2018-2023 which seeks to provide drinking water services by continuously increasing service coverage in line with SDGs (Sustainable Development Goals) goal 6, namely targeting decent drinking water for basic

*)Corresponding Author:
E-mail: rianaayu.kusumadewi@trisakti.ac.id

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human needs and ensure the availability and sustainable management of drinking water for all by 2030.

One of the drinking water supply services in Bekasi City is Perumda Tirta Patriot. Perumda Tirta Patriot Bekasi City has 2 service branches, namely Teluk Buyung and Jatiasih. At the Teluk Buyung branch, there are 3 Water Treatment Plants (WTP) with a total production capacity of 650 L/second which has a total of 32,527 active customers and 3,277 inactive customers. Service coverage covers 32.06%, this number is smaller than the planned service coverage in the Bekasi City Drinking Water Supply System Master Plan in 2020 which has a target of 100%. To achieve the predetermined targets, it is planned to uprating capacity a Drinking Water Treatment Plant (WTP) Teluk Buyung 4 in Marga Mulya District with a capacity of 300 L/second with raw water source from the West Tarum Secondary Canal to meet water needs and increase coverage drinking water service.

Methodology

In the Planning of the Drinking Water Treatment Building for the Teluk Buyung 4 Water Treatment Plant (WTP), a systematic planning method is needed and will be used as a guide to carry out the planning in order to obtain optimal results and meet the design criteria so as to produce drinking water of good quality and quantity.

Research Stages

The stages of activities in the Planning of the Drinking Water Treatment Building for the Teluk Buyung 4 Water Treatment Plant (WTP) include the initial survey, literature review, data collection, determination of alternative treatment units, calculation and design of treatment units, and preparation of the budget plan.

Data Collection

The data used in the planning process is divided into two, namely primary data and secondary data. Primary data is carried out to obtain data from direct observations in the field such as the dimensions of each unit which are measured directly at the installation. Secondary data is carried out to obtain data from the results of previous studies and observations such as the average processing flow rate and the quality of raw water and water produced in turbidity. Both data are carried out to support and support the planning process.

Data Analysis

The calculation of the dimensions of the selected unit is carried out using the design criteria obtained from the evaluation of the existing WTP, namely Teluk Buyung 3 WTP. Evaluation for Teluk Buyung 4 WTP can calculated by the equation below (Qasim, 2000):

Velocity $$v = \frac{Q}{A} \quad (1)$$

Detention Time $$t_d = \frac{V}{Q} \quad (2)$$

Gradien $$G = \sqrt{\frac{P}{\mu \times V}} \quad (3)$$

Hydraulic Gradien $$Gt_d = G \times t_d \quad (4)$$

Reynolds Number $$N_{Re} = \frac{V_p \times R}{\upsilon} \quad (5)$$

Froude Number $$N_{Fr} = \frac{{V_p}^2}{g \times R} \quad (6)$$

Whereby,

Q = flow rate (m^3/s)
A = area (m^2)
P = power ($kg.m^2/s^3$)
V = volume (m^3)
V_p = settling velocity on settler (m/s)
R = hydraulic radius (m)
μ = absolute viscosity (kg/m.s)
ν = kinematic viscosity (m/s^2)

Operational system analysis is carried out by comparing the design parameter values between the calculation results with actual conditions and design criteria obtained from the literature. Analysis of water quality produced by comparing water turbidity parameters produced with drinking water quality standards as

stipulated in the Regulation of the Minister of Health Regulation No. 492 of 2010.

An analysis of the quality of raw water sources is first carried out to determine the parameters that meet the applicable drinking water quality requirements, namely Government Regulation of the Republic of Indonesia No. 22 of 2021 concerning Quality Standards for River Water and Regulation of the Minister of Health No. 492 of 2010 concerning Drinking Water Quality Requirements.

Results and Discussion

Water Quality

In the planning of the Teluk Buyung 4 WTP, the raw water source used is the West Tarum Secondary Channel which is a mixture of Bekasi River and Kalimalang Channel or West Tarum Main Channel and is planned with a raw water production capacity of 300 L/second. The West Tarum Secondary Canal has the availability of raw water that is still sufficient for the tapping capacity plan and the raw water quality of the West Tarum Secondary Channel still meets the requirements as a source of drinking water.

The results of the analysis of the quality of raw water sources will be used as a determination of alternative treatment that will be used in the planned WTP.

The raw water quality test of the West Tarum Secondary Canal was carried out once in the rainy and dry seasons. This is done to determine the difference in raw water quality during the rainy season and dry season conditions. The raw water quality test was carried out at the Environmental Laboratory of PT. Mutuagung Lestari and sampling was conducted on March 10, 2022 to represent the rainy season and June 16, 2022 to represent the dry season. The results of testing the quality of raw water for both seasons that have been carried out by the Environmental Laboratory of PT. Mutuagung Lestari. The results of the analysis of raw water quality is shown in Table 1 and Table 2.

Table 1. Comparison of Raw Water Quality with Government Regulation of the Republic of Indonesia No. 22 of 2021

Parameters	Unit	Criteria	Results		Elimination	Efficient
			10/03/2022	16/06/2022		
TSS	mg/L	40	190	14	150	79%
BOD	mg/L	2	10.6	3.88	8.6	81%
COD	mg/L	10	30.4	14.7	20.4	67%
DO	mg/L	6	3.15	4.7	1.3	28%

Based on the comparison of raw water quality from the applicable water quality standards, namely Government Regulation of the Republic of Indonesia No. 22 of 2021 concerning Quality Standards for River Water and the Like, then obtained parameters that do not meet the quality standards, namely TSS, BOD, COD, and DO. The TSS, BOD, and COD parameters must be set aside while the DO parameter must be increased to meet the existing quality standards.

Table 2. Comparison of Production Water Quality with Minister of Health No. 492 of 2010

Parameters	Unit	Criteria	Results		Elimination	Efficiency
			10/03/2022	16/06/2022		
Turbidity	NTU	5	128	44	123	96%
Fecal Coliform	MPN/100 mL	0	34,000	2,400	34,000	100%
Total Coliform	MPN/100 mL	0	52,000	9,200	52,000	100%

Based on the comparison of the quality of production water from the applicable water quality standards, namely the Minister of Health Regulation No. 492 of 2010 concerning Drinking Water Quality Standar, the parameters that do not meet the quality standards are obtained, namely turbidity, fecal coliform, and total coliform. On the turbidity parameters, fecal coliform, and total coliform must be set aside in order to meet the existing quality standards.

Drinking Water Treatment Alternatives

The selection of treatment units is carried out based on the characteristics and quality of the raw water sources. However, there are several parameters that still above the maximum limit for drinking water quality standards according to the Minister of Health Regulation No. 492 of 2010 and Government Regulation of the Republic of Indonesia No. 22 of 2021. Parameters that do not meet the quality standards in the West Tarum Secondary Canal are Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), turbidity, fecal coliform, and total coliform. Alternative water treatment plants in Teluk Buyung 4 WTP can be seen in Table 3.

Table 3. Alternative Water Treatment Plants in Teluk Buyung 4 WTP

Parameters	Unit	Quality Standards*	Analysis Results	Treaments							
				PS	CT	MF	RSF	SE	C	CP	P
TSS	mg/L	40[1]	190	V[a,b]	V[c]			V[b]			
BOD	mg/L	2[1]	10,6	V[b]	V[c]			V[b]			
COD	mg/L	10[1]	30,4	V[b]	V[c]			V[b]			
DO	mg/L	6[1]	3,15		V[c]						
Turbidity	NTU	5[2]	128		V[c]	V[d]	V[a]			V[e]	V[e]
Fecal Coliform	MPN/100 mL	0[2]	34.000		V[c]	V[d]	V[a]		V[a]	V[e]	V[e]
Total Coliform	MPN/100 mL	0[2]	52.000		V[c]	V[d]	V[a]		V[a]	V[e]	V[e]

Remarks :

* The Maximum Value Based On The Results Of The Analysis Of Raw Water Quality In The Rainy Season And Dry Season
[1] Government Regulation of the Republic of Indonesia No. 22 of 2021
[2] Minister of Health Regulation No. 492 of 2010
[a] Sanks, 1980
[b] Qasim, 1985
[c] Fair *et al*., 1968
[d] Crittenden *et al*., 2012
[e] SNI 7508 : 2011
V Treatment can be used
PS Plain Settling (Pre-sedimentation)
CT Convetional Treatment (Coagulation, Flocculation, Sedimentation, Filtration)
MF Membrane Filtration
RSF Rapid Sand Filter
SE Sedimentation
P = Post Chlorination

In general, the treatment unit uses conventional surface water treatment, including coagulation, flocculation, sedimentation, filtration, and disinfection processes. The selected types of treatment will be assembled into a process unit and a water treatment plant operation unit that can process raw water into water that meets the quality standard requirements. Based on the analysis result, the type of complete drinking water treatment or conventional water treatment at the Teluk Buyung 4 WTP will use intake, pre-sedimentation, coagulation, flocculation, sedimentation, rapid sand filtration, disinfection, and reservoir units.

There are 3 alternatives for selecting the type of processing unit for the construction of the Teluk Buyung 4 WTP.

A. Drinking Water Treatment Alternative 1

Alternative 1 has a series of treatment types: intake, pre-sedimentation, hydraulic coagulation

with a plunge, hydraulic flocculation with up and down flow, plate settler sedimentation, rapid sand filtration, disinfection, and reservoir.

B. Drinking Water Treatment Alternative 2
Alternative 2 has a series of treatment types: intake, pre-sedimentation, hydraulic coagulation by plunge, mechanical flocculation with vertical shaft paddle wheel, tube settler sedimentation, rapid sand filtration, disinfection, and reservoir.

C. Drinking Water Treatment Alternative 3
Alternative 3 has a series of treatment types: intake, pre-sedimentation, coagulation with in-line static mixers, mechanical flocculation with vertical shaft paddle wheel, tube settler sedimentation, rapid sand filtration, disinfection, and reservoir.

Multi-criteria Analysis in Selecting Water Treatment Units

The selection of treatment units at Teluk Buyung 4 WTP has several factors to consider such as reliability, flexibility, contaminant removal, maintenance, operation, construction, land requirements, and costs.

In the assessment of the three alternatives, it was found that the processing of alternative 1 got a score of 79%, alternative 2 was 50%, and alternative 3 was 38%. It can be concluded that the selected processing alternative is alternative 1. In addition, the Teluk Buyung 3 WTP has almost the same type of treatment as in alternative 1 and has been proven to be able to treat raw water properly and meet the drinking water quality standards according to the requirements.

Design of Teluk Buyung 4 Water Treatment Plant

A. Intake

Intake is a building for the collection of raw water that will be flowed to a clean water treatment plant. (Bhaskoro and Ramadan, 2018). The intake used at the Teluk Buyung 4 WTP uses a canal intake type with a carrier channel to a collecting well that functions to drain and collect raw water. The intake canal is used based on the raw water source, the West Tarum Secondary Channel which is an irrigation channel. The intake is planned to have a capacity of 300 L/second and consists of a conveyance channel, a barscreen, a sluice gate, and a collecting well. The intake design can be seen in Table 4 and the intake sketch in Figure 1.

Table 4. Design of Intake in Teluk Buyung 4 WTP

Parameters	Value	Unit
Carrier Channel		
Carrier channel width	2.1	m
Carrier line length	18	m
Carrier line height	2	m
Sluice Gate		
Number of sluice gate	2	pcs
Sluice gate width	1	m
Sluice gate height	0.48	m
Collecting Well		
Number of collecting wells	1	pcs
Well Width	2.18	m
Well length	10.92	m
Well water depth	3	m
Detention time	1.96	minute

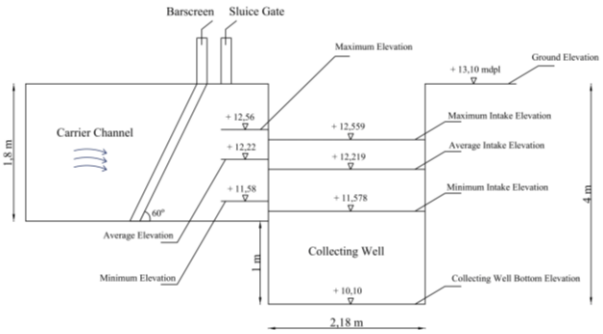

Figure 1. Intake Unit Sketch in Teluk Buyung 4 WTP

Barscreen on the intake serves to prevent the entry of debris and large materials to be sucked in by the pump which can cause damage to the pump and interfere with other processing processes (Reynolds and Richards, 1996).

Design of barscreen can be seen in Table 5 and barscreen unit sketch can be seen in Figure 2.

Table 5. Design of Barscreen in Teluk Buyung 4 WTP

Parameters	Value	Unit
Barscreen		
Number of screens	2	pcs
Angle to horizontal	60	
Width 1 barscreen	1	m
Screen aperture width	6.35	cm
Screen bar width	1.27	cm
Number of bar	13	bar
Width of the screen opening	1.67	m
Barscreen width	0.1651	m
Barscreen height	2.15	m
Barscreen length	2.48	m

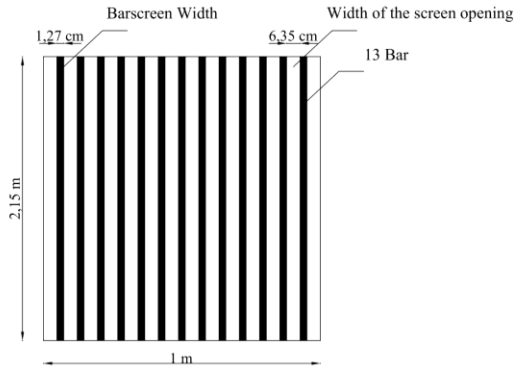

Figure 2. Barscreen Unit Sketch in Teluk Buyung 4 WTP

B. Pre-sedimentation

Pre-sedimentation unit is a separation process between suspended solids from a liquid. Sedimentation is designed to remove almost all solids by gravity (Kawamura, 2000). The pre-sedimentation unit functions to prevent discrete particles/coarse materials from entering the processing plant (Montgomery, 1985). The purpose of that is to separate the dirt and mud with raw water, lighten the work unit filter load, and expand the working filter (Gustinawati, 2018). The pre-sedimentation unit at Teluk Buyung 4 WTP is planned to use 1 unit with 2 pre-sedimentation tanks. One pre-sedimentation tank has a processing water discharge capacity of 150 L/second. The pre-sedimentation unit at the Teluk Buyung 4 WTP consists of a deposition zone, a slidge zone, an inlet zone, and an outlet zone. The deposition zone in the pre-sedimentation unit is where the suspended particles are deposited and the water is at rest. The outlet zone of the pre-sedimentation unit is a place for water to collect which no longer contains discrete particles (Yusuf and Kezia, 2020). The mud zone in the pre-sedimentation unit is a place for the accumulation of discrete particles that have settled and for the inlet zone in the pre-sedimentation unit serves to distribute water throughout the pre-sedimentation basin uniformly, reduce the kinetic energy of the incoming water, as well as to facilitate the transition from high water velocity to low water velocity which is suitable for the precipitation process in the sedimentation zone (Pradita, 2012). The pre-sedimentation unit based on the turbidity data obtained of 2,822 NTU in 2021 so that a pre-sedimentation unit is needed to reduce the load on the next processing unit, namely the coagulation unit and reduce the dose of coagulant used. In addition, based on SNI 7508:2011 for processing raw water turbidity above 600 NTU requires a pre-sedimentation unit. Design of pre-sedimentation can be seen in Table 6 and pre-sedimentation unit sketch can be seen in Figure 3.

Table 6. Design of Pre-sedimentation in Teluk Buyung 4 WTP

Parameters	Value	Unit
Deposition Zone		
Zone length	22.05	m
Zone width	2.45	m
Zone height	1.9	m
Freeboard	0.6	m
Surface loading	240	$m^3/m^2.s$
Detention time	11.4	minute
Horizontal velocity	0.032	m/s
Reynolds number	2369.56	
Froude number	0.000142	

Parameters	Value	Unit
Sludge Zone		
Sludge zone height	1.2	m
Number of sludge chamber	4	chamber
Upper length	5.51	m
Upper width	2.45	m
Down length	2.60	m
Lower width	1.30	m
Volume	8.39	m^3
Inlet Zone		
Zone length	2.20	m
Hole diameter	0.1	m
Number of holes	70	holes
Outlet Zone		
Number of gutters	5	pcs
Number of V Notch	90	pcs
Well length	40	m
Well width	3.2	m
Well water height	1.60	m

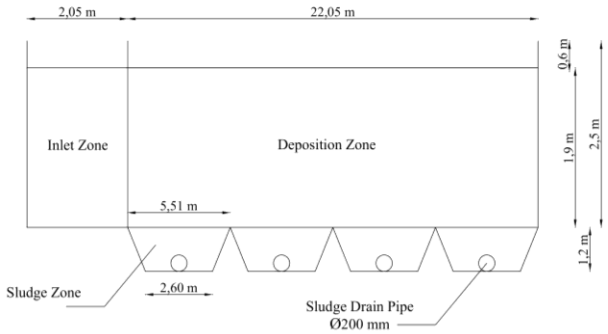

Figure 3. Pre-sedimentation Unit Sketch in Teluk Buyung 4 WTP

C. Coagulation

Coagulation unit is a chemical treatment that is used to destabilize colloidal particles in water by adding a chemical called a coagulant. Coagulants cause the destabilization of colloids and suspended solids (Qasim, 2000). The Teluk Buyung 4 WTP coagulation unit consists of a receiving well, a coagulation tank, and a U Notch weir. The coagulation unit is planned with 1 receiving well tub and 1 coagulation tub. One coagulation tank has a processing water discharge capacity of 300 L/second. The coagulation tub in the coagulation unit is a place to mix coagulant substances in the water treatment process, the process of stabilizing colloidal particles with chemicals or coagulant substances so that the particles will combine into small lumps in the water (Harmiyati, 2018). This coagulation unit has a hydraulic type with a plunge as a rapid mixing unit. The coagulation unit used at Teluk Buyung 4 WTP is hydraulic coagulation with a plunge as a fast stirrer using weir. Hydraulic coagulation is an effective type of coagulation because it is easy to maintain and operate and has a high level of reliability. This type of hydraulic coagulation is also very important compared to other types of coagulation (Kawamura, 2000). In addition, hydraulic coagulation does not use electricity, so it can save costs. The coagulant used is Poly Alummunium Chloride (PAC) at a dose of 25 mg/L which has a liquid form. Design of coagulation can be seen in Table 7 and coagulation unit sketch can be seen in Figure 4.

Table 7. Design of Coagulation in Teluk Buyung 4 WTP

Parameters	Value	Unit
Receiving Well Tub		
Number of receiving wells	1	pcs
Tub length	7.18	m
Tub width	3.59	m
Tub water height	1.8	m
Tub height	2.4	m
Freeboard	0.6	m
Detention time	155	second
Coagulation Tub		
Number of coagulation tub	1	pcs
Tub length	4	m
Tub width	4	m
Tub water height	0.98	m
Tub height	1.4	m
Freeboard	0.42	m
Plunge height	1.20	m
Gradient	507	/second

Parameters	Value	Unit
Detention time	52	second
G.Td	26,466	

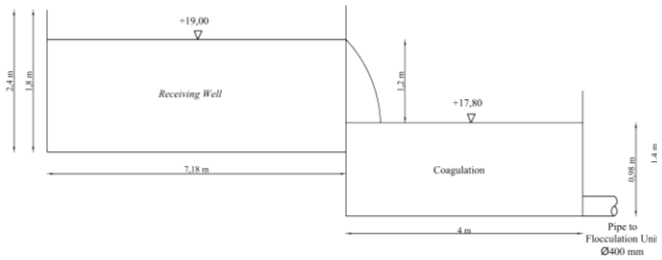

Figure 4. Coagulation Unit Sketch in Teluk Buyung 4 WTP

D. Flocculation

The flocculation unit is a slow stirring that aims to accelerate the collision between particles which will cause agglomeration of the destabilized colloids to settle down and can be filtered in the next processing unit, namely the filtration unit (Kawamura, 2000). The flocculation process is also a process of floc formation by combining the formed flocs into larger sizes so that they are easily deposited (Radityaningrum, 2017). The flocculation unit used in Teluk Buyung 4 WTP is hydraulic flocculation with 6 compartments. Hydraulic flocculation is an effective type of flocculation because it is easy to maintain and operate and has a more efficient cost compared to other types of flocculation. The type of flocculation used is up and down flow. Design of flocculation can be seen in Table 8 and the flocculation unit sketch in Figure 5.

Table 8. Design of Flocculation in Teluk Buyung 4 WTP

Parameters	Value	Unit
Number of tubs	2	pcs
Number of compartments	6	pcs
Compartment length	4	m
Compartment width	3,2	m
Tub height	5,4	m
Gradient		
Compartment 1	36.5	/second
Compartment 2	32.77	/second
Compartment 3	30.76	/second
Compartment 4	26.08	/second
Compartment 5	23.37	/second
Compartment 6	16.55	/second
Detention Time		
Compartment 1	413	second
Compartment 2	409	second
Compartment 3	405	second
Compartment 4	403	second
Compartment 5	400	second
Compartment 6	399	second
Total detention time	40,48	minute
G.Td		
Total G.Td	67,213	

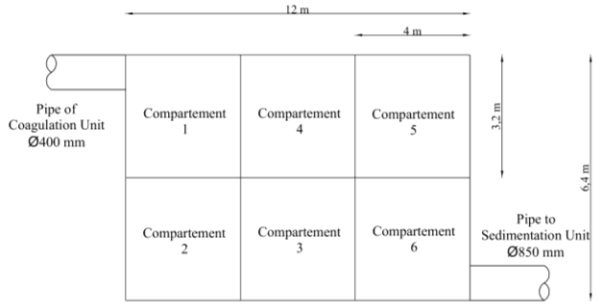

Figure 5. Flocculation Unit Sketch in Teluk Buyung 4 WTP

E. Sedimentation

The sedimentation unit used in the Teluk Buyung 4 WTP is a high rate settler sedimentation with a rectangular plate settler with horizontal flow. The type of sedimentation used is based on the removal efficiency which can be more stable and higher than other types. In addition, the rectangular type of sedimentation has a constant removal efficiency,

is easy to maintain and can save land use. The plate settler uses a horizontal angle with a slope of 60°. Design of sedimentation can be seen in Table 9 and the sedimentation unit sketch in Figure 6.

Table 9. Design of Sedimentation in Teluk Buyung 4 WTP

Parameters	Value	Unit
Number of tubs	2	pcs
Tub length	15.87	m
Tub width	7	m
Deposition Zone		
Zone length	15.87	m
Zone height	4	m
Tub width	0	m
Detention time	49	minute
Plate Settler		
Surface loading plate settler	0.00169	$m^3/m^2.s$
Number of compartments	6	pcs
Plate settler slope	60	
Plate length	2.00	m
Plate width	1	m
Plate chamber height	1.73	m
Reynolds number	61.45	
Froude number	1.41×10^{-5}	
Sludge Zone		
Sludge zone height	2	pcs
Number of sludge chamber	1	m
Upper length	7	m
Upper width	7.93	m
Down length	3.55	m
Lower width	3.73	m
Volume	25.92	m^3
Outlet Zone		
Gutter		
Number of gutters	5	pcs
Gutter width	0.2	m
Gutter length	15.87	m
Gutter height	0.156	m
V Notch		
Number of V Notches per gutter	40	pcs
Collection Channel		
Channel length	24	m
Channel width	2.4	m
Channel height	0.903	m

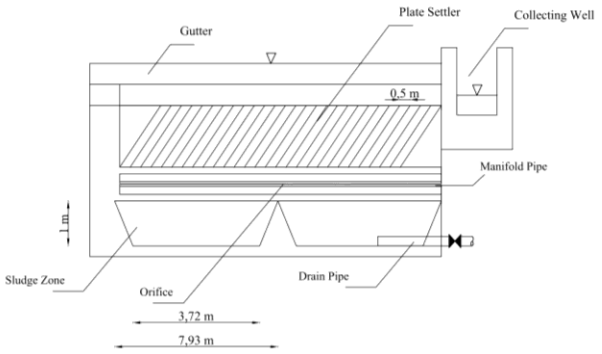

Figure 6. Sedimentation Unit Sketch in Teluk Buyung 4 WTP

F. Filtration

Unit filtration is the separation between solutions and solids by using a porous medium or porous material to remove as much of the suspended fine particles as possible from the solution. This filtration aims to filter water that has gone through the process of coagulation, flocculation and sedimentation in order to produce high quality drinking water and can significantly remove suspended particles and bacteria that live in water (Reynolds, 1982). The filtration unit used at the Teluk Buyung 4 WTP is rapid sand filtration or rapid sand filter with dual media, namely filter media and buffer media. The use of dual media can increase the filtering ability and have a higher filtration speed. In washing the filter media, backwash is carried out using a pump. Design of filtration can be seen in Table 10 and the filtration unit sketch in Figure 7.

Table 10. Design of Filtration in Teluk Buyung 4 WTP

Parameters	Value	Unit
Number of tubs	7	pcs

Parameters	Value	Unit
Filtration speed	0.0012	$m^3/m^2.s$
Backwash debit	0.17	m^3/s
Tub length	10.35	m
Tub width	3.45	m
Tub height	3.767	m
Gravel thickness	25	cm
Sand thickness	35	cm
Anthracite thickness	45	cm
Media expansion	48	%
Manifold pipe diameter	0.5	m
Manifold pipe length	9.55	m
Lateral pipe diameter	0.13	m
Lateral pipe length	0.98	m
Number of lateral pipes	20	pcs
Orifice diameter	0.06	m
Number of orifices	100	pcs

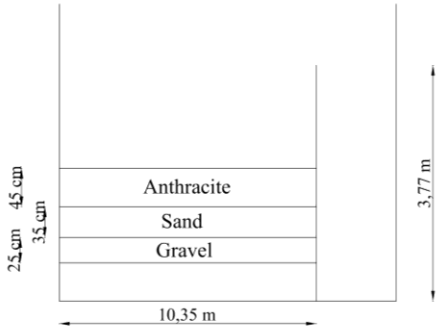

Figure 7. Filtration Unit Sketch in Teluk Buyung 4 WTP

G. Reservoir

The reservoir in the clean water supply system functions as a water reservoir to be distributed to the public or consumers. Clean water is said to be clean, i.e. water that is safe (healthy) and good for drinking, colorless, smells good, with a fresh taste (Pratama, 2021). Reservoir holds water when the use of water is less than the water that flows into the reservoir. Water that has been treated in the pre-sedimentation, coagulation, flocculation, sedimentation, filtration, and disinfection units that have met the quality standards as drinking water will be accommodated in the reservoir. The reservoir used in the Teluk Buyung 4 WTP is a ground tank type with 1 reservoir which has a capacity of 576 m^3. The Reservoir can be seen in Table 11 and the reservoir unit sketch in Figure 8.

Table 11. Design of Reservoir in Teluk Buyung 4 WTP

Parameters	Value	Unit
Disinfectant		
Number of tubs	2	pcs
Tub capacity	1,000	L
Tub diameter	1.07	m
Tub height	1.35	m
Disinfectant Tank		
Number of tanks	3	tanks
Tank diameter	1.85	m
Tank height	2.21	m
Tank capacity	5,100	L
Reservoir		
Tub length	12	m
Tub width	12	m
Tub water height	4	m
Freeboard	0.5	m
Tub height	4.5	m
Detention time	32	minute
Reservoir volume	540	m^3

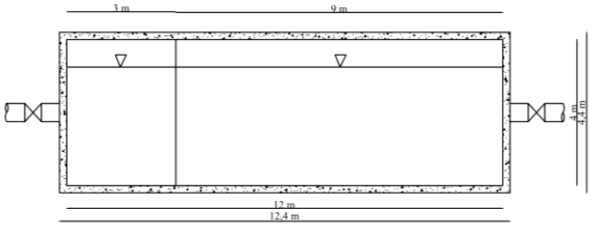

Figure 8. Reservoir Unit Sketch in Teluk Buyung 4 WTP

Conclusion

The source of raw water used in the Teluk Buyung 4 WTP is the West Tarum Secondary Canal a mixture of the Bekasi River and the West Tarum Main Channel. The Teluk Buyung 4 WTP is planned to have a processing water discharge capacity of 300 L/second. The processing units at the Teluk buyung 4 WTP are intake, pre-sedimentation unit, hydraulic

coagulation unit with plunge, hydraulic flocculation unit, plate settler sedimentation unit, rapid sand filtration unit with dual media, disinfection unit, and reservoir. The coagulant used was Poly Alummunium Chloride (PAC) liquid with a dose of 25 mg/L and the disinfectant used was sodium hypochlorite (NaOCl) with a dose of 41.67 mg/L. 7. The pumping system is used in the flow of raw water at the intake to the pre-sedimentation unit and the flow of water from the collecting well of the pre-sedimentation unit to the coagulation unit. The flow of water from the coagulation unit to the reservoir uses a gravity system.

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