STUDY ON DOMESTIC WASTEWATER TREATMENT PLANT WITH COMMUNAL SYSTEM IN SURABAYA TO ACHIEVING UNIVERSAL ACCESS (STUDY CASE: WONOCOLO DISTRICT)

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Abstract: The issues about sanitation have to consider properly, considering the target to adequate sanitation facilities reached 100% in 2019 (RPJMN 2015-2019). Decentralized wastewater treatment systems are preferred for areas with high population density such as Surabaya. Until 2015, the city of Surabaya has 2% of households with sanitary conditions are not feasible. It is necessary to analyze the development planning of wastewater treatment with the communal system (decentralization) in Surabaya. The method used is descriptive qualitative, the methods of field surveys, interviews, then compare with the regulations, standards and norms with some aspects, technical aspects, financial aspects, aspects of community participation and organization aspects. Methods field survey conducted by the relevant agencies, further interviews were conducted by asking a question to the officer cadre of environmental sanitation and then do the calculations and analysis in accordance with the regulations and standards.

Based on survey results obtained as many as 42 locations in 12 districts in the city of Surabaya that can be built with a communal system. Communal WWTP development planning studies in the Sub District Jemurwonosari Wonocolo with the number of defecation is 50 families. The unit processing using anaerobic baffled reactor (ABR) has dimensions of 14m x 2m x 1.8m with an investment cost of RP. 322.130.000,00. The operational cost per month is needed in the management of WWTP Rp 499.750. The willingness of citizens in building WWTP high enough so that the involvement in the planning and operation should be included.

Keyword: Anaerobic Baffled Reactor, Open defecation, Surabaya City, DEWATS**.**

INTRODUCTION

Sanitation issues regarding proper sanitation have address properly, given Indonesia in 2019 should reach the target of universal access in accordance with RPJMN 2015-2019 (Bappenas, 2015). That is, Indonesia people that live in urban or rural areas already have 100% access to adequate sanitation facilities and free of defecation (ODF). Indicators 100%, which mean that Indonesia could meet the 85% minimum is the local system (on-site) and 15% meet centralized system (off-site). The policy was confirmed by the Mayor of Surabaya through circulars mayor no. 443/310 / 436.6.3 / 2015, that in order to accelerate MDG's necessary sanitary hygiene behavior change through Community Based Total Sanitation (STBM) to prevent transmission of disease through healthy environments.

Surabaya is a city that supports building sanitation facilities, especially the provision of wastewater treatment with a decentralized system. It is stated in the sanitation sector program 2012-2016 memorandum explaining that the provision of sanitation systems, centralized processing domestic waste (off-site

system) is expected to further improve the quality of the environment. Gradually sanitary domestic wastewater treatment system will be upgraded to a communal system integrated with a domestic wastewater treatment system of urban sanitation. Parkinson and Tayler (2003) which states that the management of waste water with a decentralized system better suited for applications in peri-urban areas because in addition to the investment cost is cheaper compared with a centralized system
In achieving universal access by 2019 in accordance SDGs, required a study of domestic wastewater to reduce the number of household connections are still OPEN DEFECATE with the communal or decentralized system. According Gutterer et al (2009) explains that the decentralized system includes multiple approaches, not only technically, financing aspects, institutional aspects and the role of local communities need to be considered. For that planning is not independent from the assessment of the technical aspects, financing and community participation.

METHOD

Observation activities or field observations conducted to see and document the sanitary condition of the existing location. The interviews are intended to get deeper information about the condition of the existing sanitation through community leaders / sanitarian in the study area. While the questionnaire activity other than as a medium for seeking information related to social conditions for the behavior and the willingness of society to defecate. When linked with aspects of the research, the need for data can be explained as follows:

Technical Aspect:

a. Sanitary health centers: interviews regarding residential location information is still open defecation, how attitudes defecate in the area in general, why is defecation. Then performed a site survey to see the condition of the land means of support for domestic wastewater treatment. Observation and documentation of the field to see the condition of wastewater treatment infrastructure and condition of land available for waste treatment. Once known location suitable for the communal system, the next determination processing unit and area calculation WWTP.
b. Community leaders: interviews addressed to the RT or environmental cadres. Data retrieval is aimed to obtain information about the behavior of open defecation predetermined location. To know well how domestic wastewater community. To determine the willingness of people to do domestic wastewater treatment system with a communal.

- Financing Aspect
  Interview at the Department of Human Settlements and Urban Spatial Surabaya draft budget related costs and sources of funding are needed in accelerating the development of domestic wastewater with the communal system.

Aspects of community participation:

Sanitation in the clinic: This interview aims to obtain information on whether've done trigger to construction latrines and whether people know about the waste water treatment system circuitry communal. Furthermore, determining the location to do with the communal system seen from the number of households and the availability of land.

a. Community leaders: community leaders addressed to the head of the neighborhood or the environment cadres. This interview

aims to obtain any information it had done to treat domestic wastewater.

b. Residents of the community: giving questionnaires to residents to find out the identity of respondents, knowledge of wastewater treatment and impact when open defecation, defecation respondents, willingness to build wastewater treatment communally. The number of respondents for sampling can use the formula solvin. This formula determines the number of samples with a population that is already known with precision specified level (Riduan, 2010)

$$n = \frac{N}{1 + Ne^2}$$

n = jumlah responden

N = jumlah populasi

e = fakor keamanan (0,15)

$$n = \frac{400}{1 + (400x0{,}15^2)}$$

n = 40 KK

sehingga jumlah responden untuk kuisoner penelitian ini adalah 40 families.

RESULT AND DISCUSSION

Based on the data obtained from the City Health Office Surabaya (2015) are still as many as 15.859 households that do open defecation. This adversely affects the health of the environment. As for who still defecate at times, sewer, and directly into the ocean. Current conditions 90% of the people have latrines but the discharge pipe is directed toward a drainage channel. Domestic sewage is directly discharged without treatment, causes both pollution to water bodies and soil. Do not feel affected by pollution and lack of funds for the construction of a septic tank into the cause of the residents do not want to build. That requires planning in the processing of waste (black water). Communal wastewater treatment considered appropriate for areas that have a high population density.

Scale decentralized wastewater treatment presents opportunities for use in domestic wastewater. Wastewater characteristics will distinguish between types of wastewater management. With currently available technology, the ability to generate an appropriate waste water quality standard can be used back from irrigation plants and used for flushing toilets (Nelson, 2005).

1. Technical Aspect

a. Location Planning Decentralized Wastewater Treatment (DEWATS)

According to the Regulation of the Minister of Works and Housing The job of the People No. 47 Year 2015, the centralized waste water management system can serve between settlement 50-1000 people. Based on data obtained from the survey results, obtained location can be constructed by using a system of communal WWTP RT with the criteria of:The number of people who served a minimum of 40 households,

1. Residential areas prone to sanitation refer to the BPS, the white paper sanitary city / county,
2. There is a land for the construction of the WWTP. Land use is vacant land belonging to the village, the municipality, or private property donated,
3. Ease of accessibility for operation and maintenance in the future.
4. There are power source,
5. The presence of drainage channels / rivers / water bodies to drain / accommodating effluent wastewater treatment.

Based on the results of the survey, the location still open defecate most have a bathroom or toilet, it's just that they don't have a septic tank

or processing tank sludge and waste water from the bathroom. Sewer from the bathroom directly streamed into rivers or hole, so it is still said to be defecation careless. Several locations where sanitation conditions showed the society discarding do defecate directly in the ditch or on the river.

Sewage sludge the resulting stools society generally accommodated in some units there are septic tanks which each House in every or commonly called onsite. However, the unavailability of septic tanks for the processing of domestic waste from the bathrooms need held the construction of wastewater treatment research on the construction of sanitation facilities. In this condition is cause to look for alternatives that can be applied is to use offsite and onsite system. Limitations of land and population density on a settlement, then the creation of communal WWTP recommended for residential areas that don't yet have septic tanks. As for the locations that can be constructed for a region still WWTP open defecate in Surabaya city can be seen in Table 1

Tabel 1 Loation Development Plant in an Open Defecate Area Of Dewats Surabaya City

District	Sub District	RW	RT	Number of OD
Wonokromo	Ngagelrejo	6	12	73
Sawahan	Sawahan	2	1-4	80
	Petemon	5	1-3	62
Putat Jaya	Putat Jaya	1 5	3	45
Wonocolo	Jemur Wonosari	2	7	39
Gunung Anyar	rungkut Tengah	1	3	120
Tambaksari	Kapasmadya Baru	6	8	56
		8	2	40
			3	46
Gubeng	Kertajaya	2	4, 5 & 6	122
		8	2	70
Asemrowo	Tambak Sarioso	2	3,4	79
		3	3	184
		4	4	89
		5	5	64
	Asemrowo	6	6	66
		7	2	73
	Genting Kalianak	1	1	146
		2	1,2	173
Sukoma-nunggal	Sukomanunggal	4	1	59
			3	61
			4	46
		5	1	76
			2	41
			3	67
			4	57
			5	71
Krembangan	Dupak	2	8	52
			17	50
		3	8	56
		4	1	48
		5	19	63
Semampir	Pegirian	3	6	111
		9	4	42
	Sidotopo	5	3	50
		1 1	1,2, 3	72
Simokerto	Simokerto	2	4	51
			6	61
	Kapasan	5	7	61
	Tambakrejo	4	3	42
			5	58
		1, 9	1,3	42

Based on table 1 there are 12 districts and 42 locations which can decentralize. Most of the homes still open defecate into the settlement was haphazard times or drainage. The status of home

ownership can be divided into proprietary and belongs to the Department of irrigation or land company Railway Office (PJKA). The availability of the land location plan of WWTP is on the road environment, the Government of the city of Surabaya (public road), Department of waterworks, and the train service company (PJKA). Based on location can be built with a communal system, the required licensing service related to the location of land owned by the Department of WWTP waterworks, roads and City Government PJKA. Licensing is done to ensure that the location can be built WWTP.

The scope of the WWTP for communal houses that still use a scale open defecate. This is due to the location of the House open defecate are scattered in several sub-district to spread the present jiran. It is to facilitate the channelling of waste water in the system, then the scope of the services up to the scale of the settlement (RT). But there are several locations such as in one of the subdistricts of Petemon Village, Sawahan, RW 5 RT 1.2, and 3. This condition is due to the location of the House that is still very close together side by side, even open defecate, can planned for the processing of domestic waste together between RT.

A large number of homes that can be communally will have an impact on decreasing the percentage of open defecate and increased the percentage of domestic wastewater treatment with the communal system in the city of Surabaya. According to the data of the EHRA (2015) the percentage of management of communal waste water system with as much as 8% and data from the City Health Office Surabaya (2015) percentage of open defecate Surabaya as much as 2%. From, the number of KK. Number of connection 15,859 open defecate is still as much of a home connection 2,975 can be planned in processing domestic wastewater communally. It signifies as much as 0.4% decrease in the percentage of open defecate in Surabaya and can be managed with a communal system. So close to the target percentage of wastewater treatment with piping systems or communal be 8.4% felt it was far from the target government in the construction of wastewater treatment system with offset of 15% (RPJMN 2015-2019).

a. The planning of Domestic wastewater treatment in Jemurwonosari Sub-district Wonocolo District

Wonocolo is one of the districts in Surabaya who still have a home number of bowel movements. When viewed from a number of houses in the city of Surabaya open defecate there is still 512 home connection that defecation carelessly. One of the locations still defecate carelessly with a number of Heads of family who much is RT 02 RW 06 Kelurahan of Jemurwonosari. The site was the location of a dense population where there are 50 homes that can receive the benefits of WWTP with a population of as many as 400 people.

Keterangan side of location WWTP

Figure 1 Location map of construction of WWTP Jemurwonosari RT 2 RW 7

Processing unit that is suitable for WWTP in communal Wonocolo is to use anaerobic baffled reactor, where the processing unit has a high stage efficiency up to 87% 83% BOD and COD as well as 98% TSS. Wastewater treatment of the dimensions required for the construction of communal WWTP in RT 04 RW 06 Kelurahan Jemurwonosari is length = 14 m, width = 2 m, height 1, 8 m. As Layout of

domestic wastewater treatment can be seen in Figure 2.

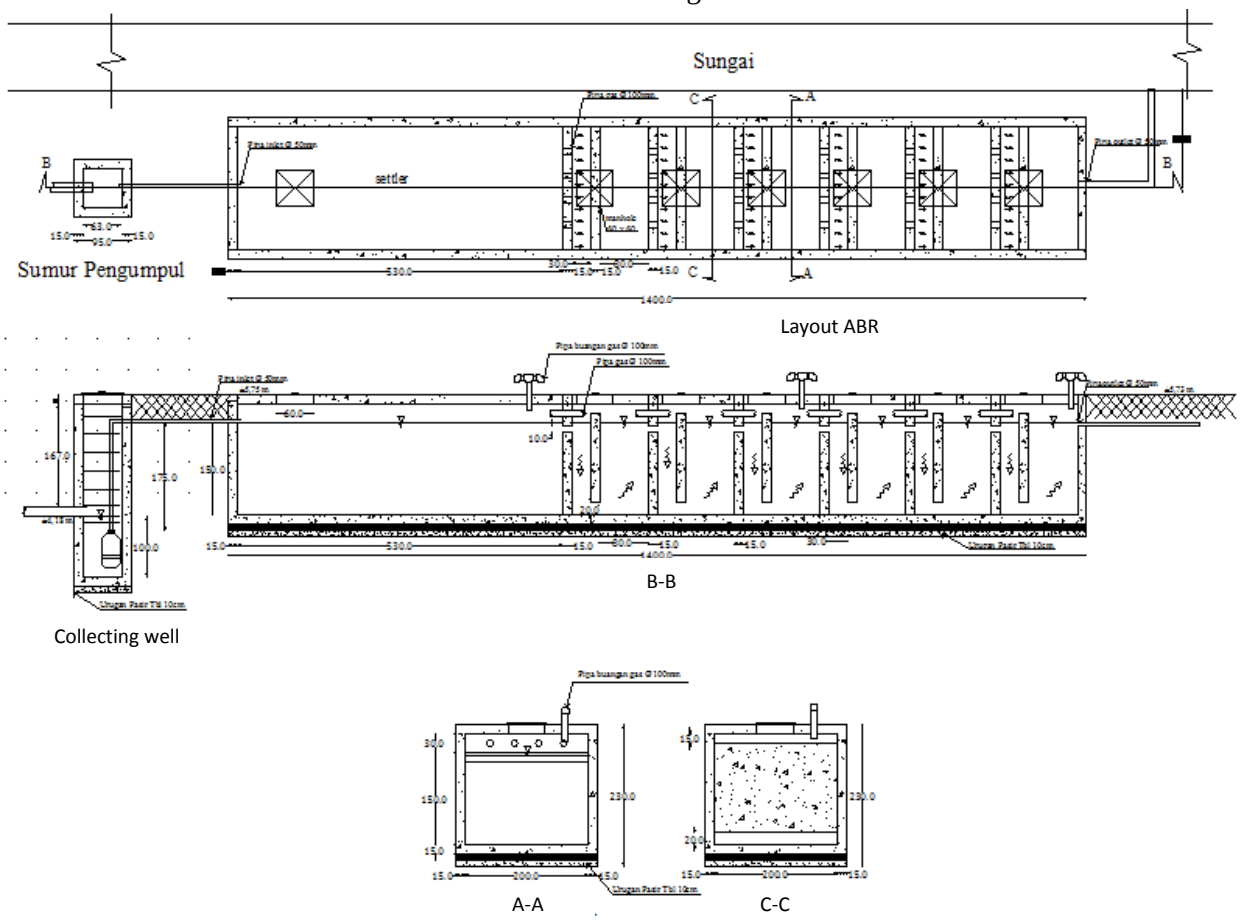

Figure 2 Layout of processing ABR units in the Jemurwonosari Sub-district, Wonocolo

2. Financing Aspect

a. Cost Budget

The budget costs for domestic wastewater treatment in RT 7 RW 2 subdistricts of Jemurwonosari, Wonocolo consists of construction works and waste water distribution system construction work installing wastewater treatment. Analysis price obtained from HSPK Surabaya, 2015. Following the results of the calculation of the draft budget environmental sanitation infrastructures work settlement for the location of RT 7 RW 2 Kelurahan Jemurwonosari.

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Table 2 The total construction cost budget WWTP

NO	Job Description	PRICE (Rp)
A	Pipe instalation	106.112.408,96
B	Suplay pipe and accessories	6.919.054,00
C	Supplay and instalation manhole	18.004.557,92
D	Anaerobic baffled reactor construction	143.472.360,94
E	Collecting well construction	18.523.061,00
	Total	**322.130.000,00**

Based on table 2 Note that needs investment for the construction of WWTP with its network in the Neighborhood 2 RW RT7 Jemurwonosari Subdistrict Wonocolo Surabaya city reached Rp. 322,130,000.00.

b. Benefit cost analysis

As for the benefits that can be gained from the development of communal WWTP is spared from diarrheal disease. According to Handayani (2012), the average total cost of the diarrheal disease that consists of treatment, hospitalization, lab fees and the cost of doctors amounted to Rp 610,445.00 per person. According to data from the City Health Office Surabaya 2015 Kelurahan Jemurwonosari have a number of sufferers of open defecate there average 11 people at each RT. Furthermore, in the community, build communal WWTP will be easier treatment than with the drain septic tanks. The average cost to drain septic tanks annually is Rp 450,000 per 3 years. So when accomplishing the development of communal WWTP will reduce diarrheal disease caused by the contamination of the environment due to bowel movements. The calculation of the benefits of using an interest rate of 10% age project is estimated to be up to 10 years. As for the details of benefit cost obtained and the cost of the fare is issued.

Benefit cost:			
Avoid diarrhea (treatment cost x number of people affected by diarrhea each year)	=	6.710.000	/year
Drain sludge in cesspool (Rp 450,000/3 years x 50 home	=	7.500.000	/year
Biaya ongkos:			
O&M cost	=	5.200.000	/year
WWTP Investation cost	=	322.130.000	

Next will calculate the feasibility of the project, construction of WWTP based on criteria of net present value (NPV) and benefit cost ratio (BCR). NPV is the criteria used in order to invest that much to gauge whether a project is feasible or not. To calculate the NPV of a project necessary data about the estimated cost of the investment, operation, maintenance and the estimated benefits of the planned project. BCR also used to determine if the planned project can be implemented or not. To find out the feasibility of the project, construction of the WWTP communal calculated by the method of NPV and BCR. The source of funding. Based on the criteria of BCR (benefit for 10 years/cost for 10 years) then:

Benefit = Rp 339,184,183

Cost = Rp 292,848,383 Idr

BCR = (339,184,183/292.848.383) = 1.15

That is, the cost of one unit of each reply issued the project was able to net benefits is 1.15. The value of BCR obtained amounted to 1.15 (> 1) then this project deserves to be implemented.

c. Participation of comunity Aspect

Aspects of the role of community review on the level of community awareness in domestic waste using the manage system of decentralization (communal), the availability of the public in the operation and the ability to pay retribution. Ownership by the citizens of latrines also means there is no wastewater treatment. Judging from the results of the survey only 9.01% who have septic tanks so that as much as 90.9% do not have a tank of septic as their waste processing. A variety of reasons residents don't have septic tanks for their domestic waste processing, including the absence of costs for the construction of the processing of the stool and yet so the priority of development for not thinking of it. However the final disposal of feces condition disungai causes the citizens feel uncomfortable because of the impact brought

about so that there is a willingness of citizens to revamp domestic wastewater treatment systems.

The communal system will emphasize community-based society to be more responsible for their domestic waste processing. For it in the management of domestic waste in communal note the willingness of the community to build communal WWTP. The results of the survey explained that about 72.73% of citizens want to build communal WWTP. Figure the percentage was communally willpower can be seen in Figure 3.

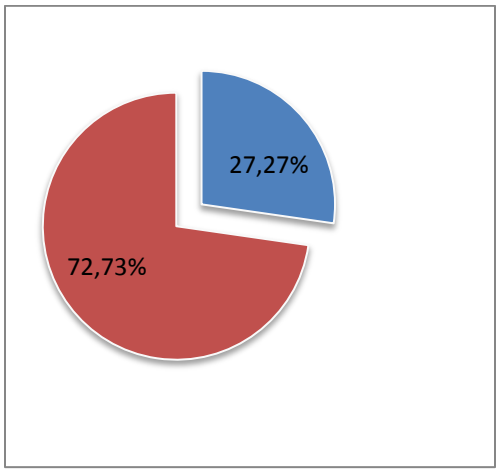

Figure 3 The percentage of the willingness of the citizens in the construction of WWTP in communal Wards Jemurwonosari

Community-based communal WWTP required also the willingness of the citizens to keep and another communal WWTP. As for the result of the percentage of the willingness of the citizens to be responsible for the maintenance of the WWTP of 70.45% declare willing to manage and maintain the communal WWTP. The graph of the percentage of the will of citizens in managing communal WWTP can be seen in Figure 4.

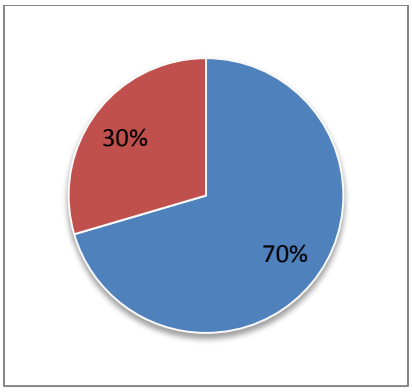

Figure 4 Percentage of the WWTP manage communal willingness in sub district of Jemurwonosari

3. Organizational Aspect

The process of institutional formation at the beginning of the planning or implementation of the proposed activities was accepted by the relevant agencies in order to implement physical progress. The Committee is representative of the citizens who are responsible for the management of Community funds accumulated through tang process NGOs or from donors who have helped up to complete the development process. The Committee will be instrumental in the mediator between the Government and the community, private parties with the public through a process of coordination. Plan organizational structure

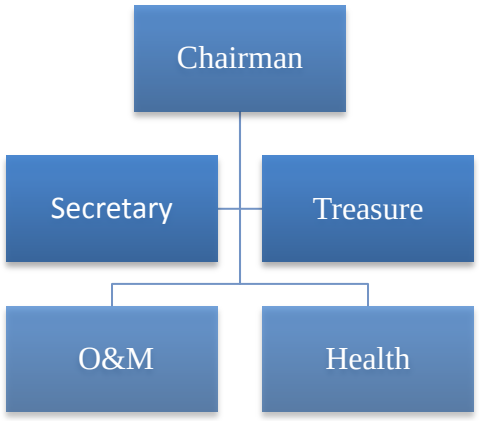

Figure 5 organizational structure palan

In planning the Organization of the necessary strategies to achieve the goals expected. The formulation of the strategy is structured efforts in achieving the goals or purposes of individual and joint. In achieving the targets in the field of domestic wastewater treatment required the formulation of a strategy using SWOT analysis. The objectives to be achieved, namely accomplishing the development of domestic wastewater treatment with a communal system. Determination of vision used to determine appropriate strategies factors sourced from internal and external. Based on the SWOT analysis the institutional plan positions are in quadrant II, quadrant II indicates the position where the strategy of diversification, namely maximizing the strength to cope with the threat. As for the strategy that gained include:

1. Building construction of domestic wastewater treatment with communal system
2. Dissemination by the existing regulations regarding human resources as well as policy benefits processing and management of domestic waste and the regulation and policy
3. Make use of human resources to find out about the standart operational procedure land acquisition land owned waterworks, the City Government or land PJKA obtaining permission for construction of the WWTP
4. The existence of socialization about rules and policies in domestic processing waste so that the community would like to connect the pipe from the drain pipe leading to the service.
5. Planning with saving for the construction of the WWTP or by doing the borrowing

CONCLUSION

The conclusions this analysis of domestic wastewater treatment planning is:

1. In achieving universal access in the year 2019 domestic waste water management in the area of OPEN DEFECATE in Surabaya city can be done with the system offsite or decentralization. As for the number of locations that can be built communally by as many as 42 locations in 12 sub communal scale. Development plan requires funds amounting to RP 13,229,244,000.00 which comes from government funding programs, special allocation fund, Non Govermens Organization and the private sector.
2. The construction of wastewater treatment in communal system using Wonocolo processing unit anaerobic baffled reactor (ABR) with debit 57.600 L/s has dimensions 11 x 9 m, 2 m x 1, 8 m. The cost of the required investments of Rp. 322,130,000.00 comes from government funding while the operational costs of Rp 499,750 each month comes from dues. The willingness of the citizens in building WWTP high enough so that involvement in the planning of the operation should be included.

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