A COMPREHENSIVE ASSESSMENT OF SEPTAGE MANAGEMENT IN BANTUL, YOGYAKARTA

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ABSTRACT

Aim: This study aims to assess the entire process of septage management comprising regulation, operational procedures, finance, community involvement, and water quality analysis to maximize the initial and hugest human fecal sludge treatment called Faecal Sludge Treatment Plant (IPLT) in Yogyakarta. Methodology and Results: The Modified EHRA (Environmental Health Risk Assessment) method was applied which focused only on wastewater treatment aspect. Several regulations including standard quality methods (SNI) were utilized and made a comparison between baseline rules and obtained results. Furthermore, quality assessment was accomplished by observation and interview. The results showed that the human sector needs to improve not only the amount of operators but also urgently put up protective personal equipment during the suction process. The dissemination of attractive information about sludge suction service done by PUPKP as a representation of the local government among the dwellers ought to upgrade a lot. Technologies employed which are carriage transportation and vacuum machine, are good enough. Contrarily, septage treatment plants require extra-effort to enhance it as most water quality parameters barely meet the standard quality. BOD, COD, ammonia, total coliform, oil and grease do not meet the third class of water quality (Government Regulation of Republic of Indonesia No. 82/2001). Subsequently, the effectiveness of each unit i.e. anaerobic tank and stabilization ponds are under 50% and the loading rate has a maximum capacity of 87.5m³/day, and 60m³/day minimum capacity. Conclusion, significance and impact of study: Therefore, almost all aspects of septage management in Bantul Yogyakarta are required to improve.

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- Septage management
- Stabilization ponds
- Wastewater treatment
1. INTRODUCTION

In accordance with the evaluation of National Mid-term Development Plan 2015-2019 (BAPPENAS, 2017), Indonesian Government still faces abundant obstacles in the management of Wastewater Treatment Plant (WWTP), especially in the sanitation circumstances. From 2014 to 2016, enhancing of accessing wastewater services only reached up 6.97%. It can be analyzed from the baseline data in 2014 was 69.40% even though in 2016 was 76.37% of 100% plan in 2019. The main issue related to the understanding of society about the substantial of good hygiene and healthy reflects low demand and society-involvement for wastewater treatment plant sustainability. On the other hand, both central and local government is much inadequate institutional management.

Septage Treatment Plants (STPs) is part of on-site sanitation system to treat the tractus digestus and urinal of human metabolite systems. Research of Strande et al., (2014), approximately 65 - 100% of urban dwellers in Asia and Africa are served by on-site sanitation systems. Supported by AECOM engineering company and Sandec (2010), about 90% of septage management in the developing countries, such as Indonesia, India, Philippines, Thailand, Sri Lanka, etc. are closed and barely operated. In Thailand, outlet of septage wastewater treatment plant shows unsatisfactory results. Meanwhile, in the Philippines, process is stagnant because of little awareness of septage management among local government and utilities, also lack of septage management expertise.

In Indonesia, the findings firmed by Anggraini et al., (2014), in the thick of 507 faecal sludge installations in Indonesia, only 134 that already have operated, and the rest is directly dumped to the river or backyard. Furthermore, excess than 80% of them are running into idle capacity due to under debit criteria, lack of treatment facilities, and sludge removal service that is still based on consumer demands. Moreover, deficiency of maintenance on operating system leading ineffective management of Supit Urang faecal sludge installation in Malang (Starina et al., 2010).

In this case, the initial of septage treatment plant, namely Faecal Sludge Treatment Plant (IPLT) in Yogyakarta is IPLT Sewon. IPLT Sewon was built on 2014-2015 in Bantul, Yogyakarta. Recently, IPLT Sewon Bantul has the largest covered service area in Yogyakarta including Yogyakarta City, Kulonprogo Regency, Gunungkidul Regency, and Bantul Regency itself whereas Sleman Regency had already taken over by IPLT Madurejo. Within a short time, Kulonprogo and
Gunungkidul are able to operate faecal sludge independently (DPU Kulonprogo, 2020; BAPPEDA Gunungkidul, 2019).

Pointed by numerous serviced areas of IPLT Sewon, it challenges several obstructions during the operation which generates other environment pollution matters. For instance, the post treatment of IPLT Sewon is relatively high and has not yet met the Government criteria standard, which is Regulation of Minister of Environment and Forestry (Permen LHK) Number 68/2016 (Arlina, 2018). The loading rate of wastewater treatment plant (IPAL), called IPAL Sewon, exhibited not optimum performance operation owing to the debit mixing from domestic wastewater and human faecal sludge (Zhein, 2015). In addition, Suwerda (2007) explained the fish, as bio-indicator at IPAL Sewon accumulated Fe inside the organs exceeded the limit of consumption.

The septage management problem is inaccuracy resolved because most of solutions focus on the operational problem as demonstrated by Mega and Herimurti (2016), Starina et al., (2016) and Purba et al., (2020). The investigation occupied for IPLT that own 10-20 years performing. On the contrary, the studying for non-operational aspects, for example human resources, institution, funding, and so on, are relatively scarce to correlate with technical aspects. The comprehensive examination exemplified by Anggraini and Nuraeni (2015). They study several factors of conditions from upstream to downstream and the quality input to output septage management systems. However, the factor analysis method applied is suitable for many samples to simplify the decision-making process, specially mapping assessment of septage management in Indonesia. Notwithstanding, each region possesses distinct and complexity management therefore it is required integrated evaluation.

Not many inspections conduct about inclusive assessment of faecal sludge installation for region in Indonesia. Exclusively, Wardhana and Karunia (2009) described the evaluation and optimization IPLT Degayu in Pekalongan, Central Java that exhibited numerous aspects needed to improve. Additionally, Darojat (2017) evaluated IPLT Blitar City utilizing integrated SWOT method for operational, institution, and financing aspects. In case of Special Region of Yogyakarta, the integrated-assessment of septage treatment plants had not yet reviewed. The detail objection adopted from UNESCAP (United Nation Economic and Social Commission for Asia and Pacific), called THIO, which collaborated Techno, Human, Info, and Orgaware (Nuraeni and Anggraini, 2010). To minimize and to prevent repeated ineffective management system for
other septage in Yogyakarta, this study put on comprehensive evaluation consisting regulation, technical transportation, funding, community involvement, and technical operation.

2. METHODOLOGY

2.1 Data and Sample

The data observed from two locations, which were Center for Water Infrastructure and Sanitation Management Urban Drinking (PISAMP) and General Housing and Residential Areas (PUPKP) Yogyakarta city. While for effluent quality analysis is executed in the Environmental Quality Laboratory in Universitas Islam Indonesia. The desludging operational service is started at 9 AM to 4 PM, from Monday to Friday. Besides, the septage sludge treatment plant is operated every day in 24 hours. Data are collected consisting of observation, interview, water sampling, and water quality analysis.

2.2 Study Method

This study refers to the Environmental Health Risk Assessment (EHRA) method. However, EHRA focuses on many aspects, for instance hygiene facilities and its behavior so that required to modify EHRA guidelines which only assess aspects of domestic sewerage and domestic wastewater management. An interview is done by questioning of service scheme, specification and condition of truck, vacuum pump criteria, suction activities, maintenance processes, technical trouble, retribution charges, and deliver period in a month. Furthermore, government and society roles also investigated regarding to their rules. Then, data are interpreted by descriptive analysis compared to the regulation or appropriate standard.

2.3 Water Quality Analysis

All the apparatus are prepared referring to Indonesian National Standard (SNI) 06:698910 2008, such as pH-meter, thermometer, Dissolved Oxygen (DO)-meter, and sample bottles. Samples are taken three repetitions for every unit in three times, 8.00 AM, 11.00 AM, and 2.00 PM. After that, the samples are mixed to become composite therefore it is called composite sampling. Sampling procedures address to SNI 6989:59:2008 including preservation samples using acid and refrigerator. Entire steps are sampled in 2 months in 2018.
The water samples are analyzed at Environmental Quality Laboratory in Universitas Islam Indonesia referring to SNI 6989 and APHA Method. Particularly, for pH based on SNI 06-6869.11-20014 uses pH-meter, BOD (Biochemical Oxygen Demand) of SNI 6869.72-2009 applies iodometric method (Winkler method). Moreover, COD (Chemical Oxygen Demand) of SNI 06-6869.2-2004 utilizes closed reflux method, also ammonia of SNI 06-6869.30-2005 use phenate method then both of them measured in AAS (Atomic Absorption Spectroscopy). On the other hand, Total Suspended Solids (TSS) and oil and grease employ gravimetric method in SNI 06-6869.3-2004 and SNI 6869.10-2011, respectively. Additionally, total coliform is counted by CFU and MPN according to APHA Method 9221-1992. The percentage of unit effectiveness is calculated by this formulation:

\[ \% R = \left( \frac{C_o - C_a}{C_o} \right) \times 100 \]  

\( C_a \) is an outlet concentration whereas \( C_0 \) is an initial concentration for each unit of septage sludge treatment, i.e. inlet, primary anaerobic tank, secondary anaerobic tank, facultative pond, and maturation pond. Furthermore, the criteria classify \( R < 20\% \) is not effective; \( 21\% \leq R \leq 60\% \) is less effective; \( 61\% \leq R \leq 80\% \) is much effective, and more than 80\% is greatly effective.

3. RESULTS AND DISCUSSION

3.1 Regulation Evaluation

The assessment refers to the regulations from center to local government. Regulation of Minister of Public Works and Public Housing (Permen PUPR) Number 4/2017 describes the arranging of domestic wastewater treatment management, Regulation of Minister Environment and Forestry (Permen LHK) Number 68/2016 explains the standard quality of domestic wastewater, Regional Regulations (Perda) of Province of Daerah Istimewa Yogyakarta (DIY) Number 2/2013 and Regional Regulations (Perda) of District Bantul Number 10/2013 narrate local domestic wastewater treatment management, specialty for Yogyakarta City and Bantul Region, respectively.

According to Table 1, the study highlights to differences among those rules. The determination of septage management is regulated in Regulation of Public Works and Public Housing (Permen PUPR) Number 4/2017 comprising technical sludge drained and scheduled
maintenance of facility and infrastructure. Furthermore, it can be seen that the strict rule is Regional Regulation of District of Bantul Number 10/2013 due to the regulation application based on the locations of wastewater producing and the punishment is given to the producer of wastewater directly. On the other hand, for public service retribution is governed by Regional Regulation (Perda) of District of Bantul Number 9/2011 in Article 60 that states the retribution rate for the one sludge suction process is IDR 167,500 for the first-ten kilometers. According to those regulations, it is rather difficult to find regulations that control the operational and effluent quality monitoring of IPLT.

**Table 1 Evaluation of some aspects concerning to septage management**

| Aspects          | Results                                                                                                                                                                                                 | Comparison references                                                                 |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Regulations      | Equivalences:                                                                                                                                | 1. Permen PUPR Number 4/2017                                                         |
|                  | 1. All regulations guided wastewater treatment                                                                                           | 2. Permen LHK Number 68/2016                                                         |
|                  | 2. Oblige each activity or business producing wastewater to treat and to conduct scheduled observation                                 | 3. Perda Province DIY Number 2/2013                                                   |
|                  | 3. The outlet of treatment plant has to meet quality standard                                                                           | 4. Perda District Bantul Number 10/2013                                               |
|                  | 4. The wastewater discharging activity must own permission                                                                              |                                                                                       |
|                  | Distinctions:                                                                                                                                |                                                                                       |
|                  | 1. Permen PUPR Number 4/2017 focused on infrastructure regulation, for instance septage maintenance procedures |
|                  | 2. Quality standard of treated water among the regulations                                                                              |                                                                                       |
|                  | 3. Perda District Bantul Number 10/2013 is the most strict regulation concerning to penalty                                              |                                                                                       |
|                  | 4. Service charge regulations only described in Perda District Bantul Number 9/2011 Article 60                                          |                                                                                       |
| Operational      | Standard Operational Procedures (SOP)                                                                                                    | Permen PUPR 4/2017                                                                    |
| conveyence       | Finding discrepancies of desludging officer:                                                                                              |                                                                                       |
|                  | 1. No using Personal Protective Equipment (PPE), such as booth, helmet, gloves, mask, etc.                                               | 1. Permen PUPR 4/2017                                                                |
|                  | 2. Not show the letter of assignment to the house or building owner                                                                    | 2. USAID, 2016                                                                       |
|                  | 3. Not mixed the rest of faecal sludge still left residual mud                                                                            |                                                                                       |
| Detail transportation | The trucks had already fulfilled the standards consisting of tank capacity, vacuum pump, water hose, and maintenance                |                                                                                       |
| Funding          | 1. The faecal sludge drawn will be charge IDR 167,500 for ≤ 10 km, additional charge is given as much as IDR 50,000 for ≥ 10 km                  | Perda District Bantul Number 9/2011 Article 60                                       |
|                  | 2. The salary of truck driver adhered to non-government officer salary standard, i.e. IDR 1,700,000                                       |                                                                                       |
|                  | 3. Expenses for faecal truck maintenance for one year spent for about IDR 38 million/unit                                               |                                                                                       |
|                  | 4. The total benefit is accepted by PISAMP around IDR 57,91 million/year                                                                  |                                                                                       |
|                  | 5. A three-months or six-months reports is regularly compiled and submitted to Local of Public Works Agency                               |                                                                                       |
| Community         | The non-governmental carriage service is more dominated than governmental (PUPKP) itself.                                               | PUKPK agency data                                                                     |
| involvement      |                                                                                                                                              |                                                                                       |
3.2 Operational Service

Detail of operational service is divided by several aspects, which are desludging service system, transportation, tools, and the suction process. This investigation is defined only to local government service, PUPKP Bantul. Fleets are driven just by on-calling from customers or demand system from the society. The monthly target reaches up 10 times of carrying process. Accordance with interview results analyzing, a small amount of mobilization is caused by the minimum quantity both operator and lorry. Additionally, there is still inadequate information and advertisement regarding to PUPKP Bantul’s faecal sludge pump services among the urban dwellers. Previous listed problem is summarized on the Table 1.

Another essential point, operational standard system (SOP) that already generated by PUPKP is compared to Permen PUPR Number 4/2017. Many operators not well-mixed the rest of fecal sludge and also abandoned residual mud in the base tank. Its step is actually pivotal procedures in order to maximize septic tank capacity and to withdraw non-degradable waste, for instance women sanitary pads. Next, the examination finds out that mostly workers are not utilized of Personal Protective Equipment (PPE), such as helmet, mask, gloves, booth, and so on. Even though application of PPE is clamant requirement to reduce the potential risk disease caused by direct exposure to fecal sludge, for instance pathogen bacteria, virus, and parasite worm. As well as in Malaysia, faeclal sludge drained activity is mandatory for their operators to use PPE as occupational safety equipment (Shrestha, 2016).

Despite this, the lorry meets the criteria from Permen PUPR Number 4/2017 and USAID (2016). The volume capacity of tank own 4,000 liters and supported with suction pump and specific hoses (3” and 4”). For weekly maintenance is accomplished to remove sand, gravel, ladies pad, and others. Thus, mainly resistance during faecal sludge emptied is stoppage inside the hoses and vacuum pump due to presence of debris. Then, the inlet of septic tank is hard to access because numerous customers covered it with permanent cement. Occasionally, the way of location of house or building is too tight for transportation mobile accessing.

Financing aspect of PUPKP Bantul was detailed in Perda District Bantul Number 09/2011 in Article 60, specialty the levies. Based on Table 1, for the first- ten kilometers, charge is paid IDR 167,500. The additional fee of IDR 50,000 was compensated for more than 10 kilometers. All cost was summated with IDR 66,400 for discharging fee service to IPLT Sewon in PISAMP unit. Besides, the salary of a truck driver was based on local and non-governmental officer payment.
which was IDR 1.7 million per month. By audience with suction operator, maintenance fee was spent for pump and transportation periodically checked including the fuel, lubricant, tire cost and annual wages. A year, approximately 38 million was expended for maintenance fee per truck. Equally important, the benefit obtained from PUPKP and PISAMP services, totally more than 55 million each year. Funding activities were summarized and given in to Local of Public Work Agency every three or six months ordinarily as clarity report. Those good findings contributed to rise up the regional income. Overtime, numerous septage treatment plants had not yet contributed for improving of regional income even tended to burden a debt used to build the plants (Anggraini et al., 2014).

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### 3.4 Community Involvement

By comparing to PUPKP service as government representation, private services are dominance to provide desludging utility through the society. The majority in discharging fecal sludge in PISAMP come from non-governmental unit reached up 35 to 40 trucks every day. Contrary, PUPKP only supplies 2 until 3 lorries in a week. As assumed, notable main reason of private
sector achievement is the advertisement more attractive than PUPKP. Also, inadequate of technical and human resources is influencing indeed. Notwithstanding, those particular sectors contribute to provide job vacancies among the societies. Nasrullah (2007) stated that the better skilled-human resources, the more increasing management system. Also, enormous and interesting information about septage suction service need to make an improvement through the community.

3.5 Septage Treatment Plant

Human fecal sludge treatment plant is located in PISAMP Unit in Sewon, Bantul Yogyakarta operated since 2015 as initial and the most immense septage processing. As illustrated in Figure 1, septage treatment plant (IPLT) is not single-operation dispute integrated with wastewater treatment plant (IPAL) owing to the outlet quality was not yet fulfilled criteria standards. By field inspection, the process is begun with sludge acceptance plant using Hubber as pretreatment machine to separate between mud, water, and trash. The trash is moved to Piyungan Landfill while water and sludge are flowed to primary anaerobic tank. Subsequently, it is continued to secondary anaerobic plant, stabilization pond consisting of facultative and maturation ponds, and out-gate assimilated to grit chamber unit of IPAL Sewon. As regulated by SNI CT/AL/RETC/001/98, for treating low to medium-strength faecal sludge applied pre-treatment, anaerobic pond, and stabilization ponds (Oktarina and Haki, 2013).

![Figure 1: Fecal sludge treatment process](image-url)
3.5.1 Water Quality Analysis

As baseline standard, Government Regulation (PP RI) Number 82/2001 classifies four water quality classes that are secured to discharge safely into open-drains or in the bush of water bodies. This study picks the third class of water quality level of PP 82/2001 so that treated water is able to utilize for fish-farming, consumed-livestock, and plant-watering.

As written in Table 2, only three parameters are qualified to water quality standard, i.e. pH, temperature, and TSS. pH is stable in a range of 6 to 8 whereas temperature reaches 29 to 31°C and TSS is 127 mg/L. The rest parameters, such as BOD, COD, TSS, Ammonia, oil and grease are extremely surpassed the minimum benchmark. In addition, during treatment process water’s variables tend to be fluctuated in each unit, specialty in facultative pond exhibits dramatically increase those parameters which previously in the secondary anaerobic tank has dropped. Regularly maintenance, for instance takes off the debris and algae which settles and covers the aerobic unit was proper to be done for optimizing performance every unit (Purba et al., 2020).

| Parameters          | Inlet | Primary anaerobic tank | Secondary anaerobic tank | Facultative pond | Maturation pond | Outlet | Reference** |
|---------------------|-------|------------------------|--------------------------|------------------|-----------------|--------|-------------|
| pH                  | 6-7   | 6-7                    | 6-8                      | 7-7.5            | 7-8             | 7-8    | 6-9         |
| Temperature (°C)    | 29-30 | 31                     | 29-31                    | 31               | 31              | 30-31  | -           |
| BOD (mg/L)          | 199.2 | 733.9                  | 492.8                    | 712.9            | 482.3           | 136.3  | 6           |
| COD (mg/L)          | 28,366.7 | 35,866.7            | 46,033.2                 | 87,366.7        | 4,503.3         | 2,736.7 | 50          |
| TSS (mg/L)          | 1,357 | 951.5                  | 605                      | 614              | 292             | 127    | 400         |
| Ammonia (mg/L)      | 1,079.2 | 747.9               | 958.7                    | 1272.8          | 868.3           | 846.8  | <0.5        |
| Oil and grease (mg/L) | 425.5 | 371                    | 284.5                    | 721              | 452.5           | 314.5  | 1           |
| Total coliform (MPN /100mL) | 205.10³ | 128. 10³         | 74.10³                   | 48.10³          | 30. 10³         | 17. 10³ | 10. 10³   |

*Most Probable Number per 100 mill-liter
** Government Regulation of Republic of Indonesia (PP RI) Number 82/2001 3rd type

Maximum value of third level is 6 mg/L of BOD and 50 mg/L of COD. The results is 20 times above standard limit (136.3 mg/L) and 50 times (2,736.7 mg/L) higher for BOD and COD, respectively. The more rising of BOD and COD, the higher and more challenging organic compound should be degraded, biologically and chemically. In a fact, the raising of organic matter in water bodies initiates water pollution and depletion of oxygen demand for aquatic organism. Furthermore, it conducts respiration disturbance and death for them
Moreover, ammonia (NH$_3$-N) concentration is extremely peaked result here. Water standard quality required less than 0.5 mg/L for first class and severely slight amount (<< 0.02 mg/L) for other water quality levels because of the living sensitivity of aquatic organisms, for fish-farming particularly. A thousand times concentration higher peak at 846.6 mg/L. The condition indicates nitrification process is disrupted badly. The depletion of dissolved oxygen brings on non-optimum degraded process, has potency to be toxic for microorganism, and create unpleasant odor (Dewi et al., 2019).

Another, oil and grease is mainly produced from kitchen and food-cooking activities that mixed and carried away to septic tank possess quite effortful decomposition form by microorganisms inside the sludge. The average concentration is 314.5 mg/L in spite of basic rules need strict to 1 mg/L for third water quality levels. The abundant oil and grease in water resources prevent light sun to penetrate into water surface so triggers photosynthesis difficulty for underwater organisms. Then, it messes up the oxygen diffusion which decrease dissolved oxygen level. Based ideas of Zhein (2015), the study suggest to be applied a Solid Separation Chamber (SSC) or Imhoff tank in the pretreatment unit in order to separate oil and grease with water and its sludge.

Unlike other parameters, total coliform almost meets wastewater standard rules that is $17.10^3$/100 mL out of $10.10^3$/100 mL MPN method. Ideally, Coliform and E. coli exists in the human digestion and human fecal. The presence in the environment indicates one of hygiene indicators. Hence, when surrounding environment is plentiful by E. coli suggests hygiene condition is polluted. Based on the findings of Widiyanti (2019), it can be argued that the depressed quality of environment, especially in water resources can be driven by poor sanitization like water percolate from domestic wastewater or septic tank.

### 3.5.2 Units Efficiency

As explained in 3.5.1, almost all parameters have not yet met the basic rule standard of PP RI Number 82/2001. Because of that, the effluent is transferred to pretreatment process of wastewater treatment plant. Units of septage plant likely performed are not optimum and ineffective treatments. However Table 3 states that whole units exhibit under than 50% of efficiency or is able to be declared less than effective. Primary anaerobic tank and facultative
pond present not effective criteria (<20%), which are 14% and 6.94%, respectively. Then, secondary anaerobic tank points to 30% and maturation pond spots to 47%. Several studies presented by Anggraini et al., (2014) that assessed septage treatment plant in Indonesia, includes less than effective performance, which are IPLT Kalimulya (37.5%), IPLT Keputih (37.5%), and IPLT Cilik Riwut (6.25%). As cited on TTPS (2020), performance unit necessarily working up to 60 – 80%.

Table 3 The evaluation of septage treatment plant design

| Units                  | Primary anaerobic tank | Secondary anaerobic tank | Facultative pond | Maturation pond |
|------------------------|------------------------|--------------------------|------------------|-----------------|
|                        | D¹ | ID² | D¹ | ID² | D¹ | ID² | D¹ | ID² |
| Width (m)              | 11 | 9   | 8  | 6   | 13 | 9   | 18 | 8   |
| Length (m)             | 22 | 17  | 16 | 13  | 22.75 | 18 | 9  | 16  |
| Depth (m)              | 2.5 | 1.5-2.5 | 2.5 | 1.5-2.5 | 1.5 | 1.5-2.5 | 1.1 | 1.5-2.5 |
| Freeboard (m)          | 0.3 | 0.3-0.5 | 0.3 | 0.3-0.5 | 0.3 | 0.3-0.5 | 0.3 | 0.3-0.5 |
| BOD-In (mg/L)          | 199.2 | 1280 | 733.9 | 512 | 492.8 | 204.8 | 712.9 | 40.96 |
| Performance unit (%)   | 14 | 60  | 30 | 60  | 6.94 | 80 | 47 | 60  |
| BOD-out (mg/L)         | 733.9 | 512 | 492.8 | 204.8 | 712.9 | 40.96 | 136.3 | 16.38 |
| Detention time (days)  | 15 | 4   | 15 | 2   | 18 | 6   | 3  | 3   |

¹ D is design
² ID is ideal design, based on Indonesian Sanitation Sector Development Program (TPPS), 2010

More importantly, the detention time each unit passes over the ideal criteria. Some conditions inform the longer detention time, the more effective treatment. Rarely, too long detention time induces the opposite condition. Presumably, ineffective unit operations are caused by saturated degradation process, specialty for microorganism life-cycle. Similarly, the appropriate of detention time is required for specific process, as an example start up, acclimatization, and running. Since it is too short or long form not optimal conditions for microbes (Ivontianti et al., 2016).

Other obstacles that have to face is overload condition of Sludge Drying Bed (SDB). One SDB is capable collect 4,000 m³ of drying-sludge. Recently, about 22 units of SDB are operated to dry the sludge from each unit that requires 1-2 weeks depend on the sludge width. Moreover, inappropriate effluent of septage treatment plant causes the acceleration loading rate volume of wastewater treatment which is 1.73% (from 15,295 m³ to 15,560 m³). On the other hand, baseline criteria set by local government says suitable debit for wastewater treatment plant is
15,500 m$^3$. Somehow, along with higher loading rate if it is not handled immediately, the condition establish extra-loading rate for wastewater treatment plant. Further, it is possible to create new effluent disturbance of wastewater treatment.

Every day, around 30-40 trucks discharge their septage into fecal treatment plant that carry 2500-3000 liters of sludge per tank. After examining maximum debit that is capable to accommodate is only 60m$^3$/day whereas input sludge reaches up to 87.5m$^3$/day. Those cause miss-matched between unit dimension and sludge discharge volume therefore surface loading rate still exceed the criteria design. Thus, for a long-term planning, the units of septage treatment likely required to be redesigned, for instance IPLT Sumur Batu in Bekasi as comparison that applies dewatering units and its performance shows more efficient and less area required (Madonna et al., 2019).

### 4. CONCLUSION

In conclusion, it is theorised that participating in community gardening could offset the impacts of urbanisation on the cities and its population, therefore decreasing the likelihood of social isolation and loneliness.

To sum up, the obstacles of septage management that have already identified are existence of debris inside septic tank; effortful desludging process, specially to find septic tank and access way to grab it; and insufficient information regarding to the important of human fecal sludge suction process and information service from PUPKP Bantul. Besides, carriage service of PUPKP Bantul is good enough overall. However, several aspects are required to improve, which are further understanding about standard operational procedures of septage suction; criteria standard of carriage transportation; applying personal protective equipment; but also quantity and quality of operators for suction process. Furthermore, concerning to septage treatment plant, generally, all the units necessitate for enhancing performance effectiveness because most of parameters; BOD, COD, ammonia, total coliform, oil and grease exceed water standard quality (PP RI Number 82/2001). Also, loading rate of fecal sludge transferring to septage treatment plant point to 87.5m$^3$/day overpasses the minimum capacity of basic design criteria standard.
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