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Planning Evaluation of Wastewater Treatment System of Jakarta Islamic Hospital Sukapura Kelapa Gading

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ABSTRACT

This study aims to evaluate the effectiveness of the Wastewater Treatment Plant (WWTP) at the Jakarta Islamic Hospital Sukapura Kelapa Gading in meeting government regulations and effluent quality standards. Using evaluation and observation methods, primary and secondary data were collected to analyze the condition of the WWTP, including wastewater quality based on regulated parameters. The results showed that although the WWTP utilizes an anaerobic-aerobic biofilter system, there are still problems in maintenance and inadequate containment capacity. This resulted in the inability of the WWTP to meet quality standards for parameters such as Total Coliform and E.coli. Recommendations for improvement include increasing storage capacity, improving equipment, and increasing maintenance frequency.

Keywords: *Business Mentoring, Business Model Innovation, Social Media Use, Entrepreneurial Performance, SMEs*

1. INTRODUCTION

Hospitals are very important public institutions, serving as places of examination, treatment, care, and recovery of health [1]. In addition, some hospitals also serve as places of education, training, and research [2]. As a healthcare provider, hospitals must be able to create a healthy and disease-safe environment [2], [3]. Complex hospital activities generate diverse and complex waste as well. Hospital waste is generally divided into two major groups, namely clinical and non-clinical waste, both solid and liquid. Therefore, a clean and healthy environment and sanitation is needed so that the various functions of the hospital can run well [4].

Wastewater Treatment Plant (WWTP) is an engineering structure and equipment specifically designed to process or treat liquid waste from the process so that the waste is suitable for disposal into water bodies [5]–[8]. Jakarta Islamic Hospital Sukapura Kelapa Gading is one of the hospitals that already has a WWTP. The wastewater treatment system currently used is an aerobic anaerobic biofilter system. In 2017, the Jakarta Islamic Hospital Sukapura Kelapa Gading undertook the construction of a new building, the Abudzar Pavilion building, and increased the number of beds by 45 beds, from the previous 110 beds to 155 beds. This building started operating in May 2017, which caused an increase in wastewater discharge and a decrease in residence time, resulting in inadequate wastewater storage capacity.

The increase in the number of beds and this new building had an impact on the optimization of the WWTP, resulting in the inability of the WWTP to meet the E.coli bacteria parameters. In addition, the equipment supporting the WWTP system was also not functioning optimally, and periodic maintenance of the WWTP was inadequate as the number of patients, beds and hospital employees increased. Insufficient wastewater storage capacity is also a major problem with the increase in wastewater discharge generated.

From these problems, this study aims to evaluate the effectiveness of the WWTP at the Jakarta Islamic Hospital Sukapura Kelapa Gading in meeting government regulations and effluent quality standards. In addition, this study will also look for improvement and development solutions needed so that the WWTP complies with government regulations and effluent quality standards. This evaluation is important to ensure that the WWTP system can function properly and the environment around the hospital remains safe and healthy.

Thus, this research is expected to provide recommendations for the necessary WWTP improvements and development. The results of this study are expected to not only improve the quality of wastewater treatment at the Jakarta Islamic Hospital Sukapura Kelapa Gading, but also serve as a reference for other hospitals facing similar problems in wastewater management. This will ultimately contribute to the improvement of environmental health and safety of the community around the hospital.

2. LITERATURE REVIEW

2.1 Related Laws

Environmental protection and management are regulated in various laws and government regulations. The main legal basis is Law No. 32 Year 2009 on Environmental Protection and Management. In addition, there are several regulations and decrees that support the implementation of environmental management, among others:

1) Minister of Health Decree No. 1204/Menkes/SK/X2004 on Hospital Environmental Health Requirements.
2) Decree of the Minister of Environment No: Kep-58/Menlh/12/1995 on Liquid Waste Quality Standards for Hospital Activities.
3) Government Regulation No. 82 of 2001 concerning Water Quality Management and Water Pollution Control.
4) Government Regulation No. 20 of 1990 concerning Water Pollution Control.
5) Presidential Decree of the Republic of Indonesia No. 42 of 2002 concerning Guidelines for the Implementation of the State Budget.
6) Regulation of the Minister of Environment of the Republic of Indonesia No. 13 of 2010 concerning Management Efforts and Environmental Monitoring Efforts and Environmental Management and Monitoring Affidavit.
7) Decree of the Minister of Environment No. 58 of 1995 concerning Liquid Waste Quality Standards for Hospital Activities.

Technical guidelines for hospital wastewater management using anaerobic-aerobic biofilter systems, as stipulated in the technical guidelines published by the Indonesian Ministry of Health Directorate General of Health Efforts in 2011, are an important reference in planning and implementing wastewater treatment plants in health care facilities.

2.2 Sources of Hospital Liquid Waste

Hospital liquid waste comes from various sources, including medical activities (such as surgery and laboratory), non-medical activities (such as canteen and laundry), as well as rainwater entering the sewage system. This waste contains various chemicals, pathogenic microorganisms, and other harmful substances that need to be treated before being discharged into the environment.

2.3 *Hospital Liquid Waste Quality Parameters*

Hospital liquid waste management must pay attention to various water quality parameters [4], [9]–[11]. These parameters include Total Suspended Solid (TSS) which measures the amount of solid particles suspended in wastewater, and Total Dissolved Solid (TDS) which measures the amount of dissolved solids in wastewater. In addition, Biochemical Oxygen Demand (BOD) is used to measure biological oxygen demand in the decomposition of organic matter by microorganisms, while Chemical Oxygen Demand (COD) measures chemical oxygen demand for the oxidation of organic and inorganic matter in wastewater.

Chloriform Organisms are measured to determine the number of coliform bacteria as an indicator of fecal contamination, and acidity (pH) is measured to determine the acidity or basicity of wastewater. Dissolved Oxygen (DO) is important to measure the amount of dissolved oxygen in wastewater, and Chlorine Demand is measured to determine the amount of chlorine needed for wastewater disinfection. In addition, the concentration of nutrients such as nitrogen and phosphorus in wastewater must also be considered, as well as the concentration of heavy metals such as mercury, cadmium, and lead. Additional parameters relevant to hospital wastewater quality should also be taken into account to ensure effective and safe waste management.

2.4 *Liquid Effluent Quality Standard*

Hospital effluent quality standards are regulated in several regulations, including the Decree of the Minister of Environment Number: Kep-58/Menlh/12/1995 and the Regulation of the Minister of Environment of the Republic of Indonesia Number 5 Year 2014. These quality standards set the maximum limit of the content of pollutants allowed in hospital wastewater before it is discharged into the environment.

2.5 *Negative Impact of Hospital Wastewater*

Hospital wastewater that is not treated properly can cause various negative impacts on the environment and human health. One of the most significant impacts is groundwater and surface water pollution. Hospital wastewater often contains harmful chemicals, pathogenic microorganisms, and other toxic substances that can seep into the soil and contaminate underground water sources. When this polluted groundwater is used for domestic purposes such as drinking, bathing and cooking, the risk of exposure to harmful chemicals and pathogens increases, which in turn can lead to various diseases.

In addition, the pollution of surface water, such as rivers, lakes and seas, is also a serious impact of improperly treated hospital wastewater discharges. Hazardous chemicals and pathogenic microorganisms in the effluent can cause damage to aquatic ecosystems. Pathogenic microorganisms can cause microbial population explosions that deplete oxygen in water, resulting in hypoxic conditions that are lethal to fish and other aquatic organisms. Toxic chemicals can cause mass mortality of aquatic organisms and disrupt the food chain in aquatic ecosystems.

The spread of infectious diseases is also a major risk from untreated hospital effluent. Such effluents may contain bacteria, viruses and other pathogens that can spread through water and cause illness in humans and animals. For example, pathogenic bacteria such as Escherichia coli and Salmonella can cause severe gastrointestinal illnesses, while viruses such as Hepatitis A can spread through contaminated water.

Damage to aquatic ecosystems from hospital wastewater effluent also includes a reduction in biodiversity. Organisms that cannot survive in polluted water conditions will die, while invasive species that are resistant to pollution may proliferate and disrupt the balance of the ecosystem. In addition, chemicals in the effluent can cause physical and chemical changes in the water, such as changes in pH and increased nutrient levels that can trigger algal overgrowth or eutrophication, leading to the demise of aquatic life.

3. METHODS

3.1 Type of Research

The type of research used is evaluation and observation research. Evaluation research is a systematic scientific procedure to measure the results of a program or project (the effectiveness of a program) whether it has met the planned objectives or not. Evaluation is carried out by collecting, analyzing, and reviewing program implementation objectively. In this study, the evaluated variable is the Wastewater Treatment Plant (WWTP) at Poso Hospital, as well as solutions for improvements and developments that must be made to the wastewater treatment system.

3.2 Data Collection Method

Data collection methods are used to collect data in accordance with research procedures so that the required data is obtained. According to Sugiyono (2012: 224), data collection techniques are the most strategic step in research because the main purpose of research is to collect data. The data collection method in this study uses documentation, observation, and interview techniques.

Primary Data: Primary data is obtained or collected directly in the field by researchers from the source concerned. This data was collected through observation, in-depth interviews, and documentation. Observations were conducted at the research location using an observation sheet, while in-depth interviews were conducted with an interview guide to obtain more specific information.

Secondary Data: Secondary data is pre-existing information that is used to supplement the research data. Secondary data in this study includes documents related to the Wastewater Treatment Plant (WWTP) system, such as wastewater quality laboratory test results, master plans, and existing drawings of the WWTP. This data was obtained from the company or the maintenance and environmental health unit (Kesling).

3.3 Data Analysis Method

The data analysis method in this study was carried out through evaluation and observation of the Wastewater Treatment Plant (WWTP). The collected data are grouped based on the type of variable, then analyzed to evaluate the fulfillment of government regulations and effluent quality standards.

3.4 Method of Discussion of Analysis Results

The method of discussing the results of the analysis is used to express the analysis and review of the research results. The analysis is carried out to obtain conclusions that fulfill the research objectives regarding the Wastewater Treatment Plant System (WWTP). The discussion of the results of the analysis includes an evaluation of the wastewater treatment system and the necessary improvement and development solutions.

4. RESULTS AND DISCUSSION

4.1 Research Data

In this study, the data collected consisted of primary data and secondary data. Primary data comes from direct observation of the Wastewater Treatment Plant (WWTP) at the Jakarta Islamic Hospital Sukapura Kelapa Gading. Secondary data includes the results of laboratory tests of wastewater quality taken from the Regional Health Laboratory (LABKESDA), as well as the master plan and existing IPAL drawings.

1. Primary Data

Primary data was obtained through direct observation of several main components of the WWTP, including the collection basin, settling basin, and secondary treatment basin. The following are the results of the observations obtained:

Table 1. Observation Data of Wastewater Treatment Plant (WWTP)

No	Observation Component	Observation Result	Standard
1	Collection Tank	The tank size is 35m x 35m x 2m = 245 m^3. The capacity of wastewater entering the collection tank is 100%, but due to sludge sedimentation, the capacity is reduced to 70% (171.5 m^3)	Remove sedimented sludge every six months and increase the size of the collection tank to meet the desired capacity
2	Grease Trap Tank	There are two grease trap tanks with the same size, as follows: 1m x 2m x 1.5m = 3 m^3. The capacity of wastewater entering the grease trap is 6 m^3. Fat removal is done daily, so there is no sedimentation	The capacity of the grease trap tank is 6 m^3 and can contain 100% of the wastewater
3	Grid Chamber Tank	There are two grid chamber tanks with the same size, as follows: 1m x 2m x 1.5m = 3 m^3. The capacity of wastewater entering the grid chamber is 6 m^3. Removal of small, non-decomposable particles inside the tank is done weekly	The capacity of the grid chamber tank is 3 m^3 and can contain 100% of the wastewater
4	Screen Tank	The size of the screen tank is as follows: 1m x 1m x 1m = 1 m^3. The capacity of wastewater entering the screen tank is 1 m^3. Removal of trapped trash in this tank is done daily to avoid damaging the pump and ensure smooth wastewater flow	The capacity of the screen tank is 1 m^3 and can contain 100% of the wastewater
5	Initial Sedimentation Tank	The size of the initial sedimentation tank is 3.6m x 3.5m x 2m = 25.2 m^3. The capacity of wastewater entering the initial sedimentation tank is 100%, but due to sludge sedimentation, it becomes 70%, so the wastewater capacity is 70% x 25.2 m^3 = 17.64 m^3	The capacity of the initial sedimentation tank is 27.13 m^3, but can only contain 70% x 25.2 m^3 = 17.64 m^3 of wastewater

6	Equalization Tank	The size of the equalization tank is 3.5m x 3.5m x 2m = 24.5 m³. The capacity of wastewater entering the equalization tank is 100%, but due to sludge sedimentation, it becomes 70%, so the wastewater capacity is 70% x 24.5 m³ = 17.15 m³	The capacity of the equalization tank is 24.5 m³, but can only contain 70% x 24.5 m³ = 17.15 m³ of wastewater
7	Anaerobic Biofilter Pond	The size of the anaerobic biofilter pond is 3.6m x 3.5m x 2m = 25.2 m³. The capacity of wastewater entering the anaerobic biofilter pond is 100%	The capacity of the anaerobic biofilter pond is 25.2 m³ and can contain 100% of the wastewater
8	Aerobic Biofilter Pond	The size of the aerobic biofilter pond is 3.6m x 3.5m x 2m = 25.2 m³. The capacity of wastewater entering the aerobic biofilter pond is 100%	The capacity of the aerobic biofilter pond is 25.2 m³ and can contain 100% of the wastewater
9	Chlorination Tank	The size of the chlorination tank is 3.6m x 3.5m x 2m = 25.2 m³. The capacity of wastewater entering the chlorination tank is 100%	The capacity of the chlorination tank is 25.2 m³ and can contain 100% of the wastewater
10	Final Sedimentation Tank	The size of the final sedimentation tank is 3.6m x 3m x 2m = 21.6 m³. The capacity of wastewater entering the final sedimentation tank is 100%	The capacity of the final sedimentation tank is 27 m³ and can contain 100% of the wastewater
11	Biocontrol and Fish Pond Tank	The size of the biocontrol and fish pond tank is 3.6m x 1.5m x 1m = 5.4 m³. The capacity of wastewater entering the biocontrol and fish pond tank is 100%	The capacity of the biocontrol or fish pond tank is 5.4 m³ and can contain 100% of the wastewater
12	Control Panel	The electrical capacity required for the wastewater treatment system (WWTS) is 30 KW, used for supporting equipment	The power usage in the WWTS is 30 KW
13	Air Blower	Root Blowers with the brand Showfou, motor driver with the brand Siemens, capacity 6.12 m³, pressure 4000 mm water head, power 7.5 KW/380 volt/3 phase/50 Hz, 2 units, alternating operation using a timer for 24 hours	Root Blowers, 2 units. Operate alternately for 24 hours
14	Wastewater Pump	Wastewater pump, submersible type with the brand Showfou, capacity 80-100 liters/minute, impeller and casing material iron, pipe connection 2", 2 units, alternating operation using a timer for 24 hours	Submersible pumps, 2 units. Operate alternately for 24 hours
15	WWTS Maintenance	Maintenance is carried out daily by WWTS staff	Monitoring and checklist are performed daily

Sumber: Data Primer

2. Secondary Data

Secondary data was obtained from the results of wastewater quality laboratory tests conducted by LABKESDA. The following are the analysis results of several key parameters used to evaluate the quality of wastewater treated by the WWTP:

Table 2: Technical Test Results of WWTP from LABKESDA

No	Parameter	Unit	Test Result	Quality Standard	Testing Method
1	pH		7.79	6-9	SNI 6989;2019
2	Suspended Solids	mg/L	1	30	IK.8a/PP16.5-Water-17025/Labkesda
3	Ammonia (NH3-N)	mg/L	3.61	10	SNI 06-6989.30-2005
4	Oil and Grease	mg/L	tt<0.04	5	SNI 6989.10:2011
5	COD	mg/L	tt<3	100	IK.8a/PP16.5-Water-17025/Labkesda
6	BOD	mg/L	3	30	IK.8a/PP16.5-Water-17025/Labkesda
7	Total Coliform	Count/100mL	0	3000	No.40/IKM(Petrifilm) ISO 9308-1:2014
8	Total Coliform*	Colony/100mL	12	50	ISO 9308-1:2014
9	E. coli*	Colony/100mL	2	0	ISO 9308-1:2014

Sumber: Labkesda, 2024

4.2 Results of Data Analysis

Processing of this research data begins with collecting data about the Wastewater Treatment Plant (WWTP) of the Jakarta Islamic Hospital Sukapura Kelapa Gading, identifying data, and information obtained during observation. The results of the data collection are analyzed to evaluate the problematic WWTP components and provide the necessary repair solutions.

Table 3. Analysis of Wastewater Treatment Plant (WWTP)

No	Component	Observation Result	Analysis	Remarks
1	Collection Tank	Tank size: 3.5m x 3.5m x 2m = 24.5 m³. The capacity of wastewater entering the collection tank is 100%, but due to sludge sedimentation, it becomes 70%, so the wastewater capacity is 70% x 24.5 m³ = 17.15 m³	The capacity of the collection tank is 100% at 24.5 m³ but can only contain 70% at 17.15 m³, resulting in a deficit of 24.5 m³ - 17.15 m³ = 7.35 m³	Problematic, does not match the volume capacity
2	Grease Trap Tank	There are two grease trap tanks with the same size, as follows: 1m x 2m x 1.5m = 3 m³. The capacity of wastewater entering the grease trap is 6 m³. Fat removal is done daily, so there is no sedimentation	The capacity of the grease trap tank is 6 m³ and can contain 100% of the wastewater	Matches the capacity
3	Grid Chamber Tank	There are two grid chamber tanks with the same size, as follows: 1m x 2m x 1.5m = 3 m³. The capacity of wastewater entering the grid chamber is 6 m³. Removal of small, non-decomposable particles inside the tank is done weekly	The capacity of the grid chamber tank is 3 m³ and can contain 100% of the wastewater	Matches the capacity

4	Screen Tank	The size of the screen tank is as follows: 1m x 1m x 1m = 1 m^3. The capacity of wastewater entering the screen tank is 1 m^3. Removal of trapped trash in this tank is done daily to avoid damaging the pump and ensure smooth wastewater flow	The capacity of the screen tank is 1 m^3 and can contain 100% of the wastewater	Matches the capacity
5	Initial Sedimentation Tank	The size of the initial sedimentation tank is 3.5m x 3.5m x 2m = 24.5 m^3. The capacity of wastewater entering the equalization tank is 100%, but due to sludge sedimentation, it becomes 70%, so the wastewater capacity is 70% x 24.5 m^3 = 17.15 m^3	The capacity of the initial sedimentation tank is 100% at 24.5 m^3 but can only contain 70% at 17.15 m^3, resulting in a deficit of 24.5 m^3 - 17.15 m^3 = 7.35 m^3	Problematic, does not match the volume capacity
6	Equalization Tank	The size of the equalization tank is 3.6m x 3.5m x 2m = 25.2 m^3. The capacity of wastewater entering the initial sedimentation tank is 100%, but due to sludge sedimentation, it becomes 70%, so the wastewater capacity is 70% x 25.2 m^3 = 17.64 m^3	The capacity of the equalization tank is 100% at 25.2 m^3 but can only contain 70% at 17.64 m^3, resulting in a deficit of 25.2 m^3 - 17.64 m^3 = 7.56 m^3	Problematic, does not match the volume capacity
7	Anaerobic Biofilter Pond	The size of the anaerobic biofilter pond is 3.6m x 3.5m x 2m = 25.2 m^3. The capacity of wastewater entering the anaerobic biofilter pond is 100%	The capacity of the anaerobic biofilter pond is 25.2 m^3 and can contain 100% of the wastewater	Matches the capacity
8	Aerobic Biofilter Pond	The size of the aerobic biofilter pond is 3.6m x 3.5m x 2m = 25.2 m^3. The capacity of wastewater entering the aerobic biofilter pond is 100%	The capacity of the aerobic biofilter pond is 25.2 m^3 and can contain 100% of the wastewater	Matches the capacity
9	Chlorination Tank	The size of the chlorination tank is 3.6m x 3.5m x 2m = 25.2 m^3. The capacity of wastewater entering the chlorination tank is 100%	The capacity of the chlorination tank is 25.2 m^3 and can contain 100% of the wastewater	Matches the capacity
10	Final Sedimentation Tank	The size of the final sedimentation tank is 3.6m x 3m x 2m = 21.6 m^3. The capacity of wastewater entering the	The capacity of the final sedimentation tank is 21.6 m^3 and can contain 100% of the wastewater	Matches the capacity

		final sedimentation tank is 100%		
11	Biocontrol and Fish Pond Tank	The size of the biocontrol and fish pond tank is 3.6m x 1.5m x 1m = 5.4 m^3. The capacity of wastewater entering the biocontrol and fish pond tank is 100%	The capacity of the biocontrol or fish pond tank is 5.4 m^3 and can contain 100% of the wastewater	Matches the capacity
12	Control Panel	The electrical capacity required for the wastewater treatment system (WWTS) is 30 KW, used for supporting equipment	The power usage in the WWTS is 30 KW	Matches the capacity
13	Air Blower	Root Blowers with the brand Showfou, motor driver with the brand Siemens, capacity 6.12 m^3, pressure 4000 mm water head, power 7.5 KW/380 volt/3 phase/50 Hz, 2 units, alternating operation using a timer for 24 hours	Root Blowers, 2 units. Operate alternately for 24 hours	Matches the capacity
14	Wastewater Pump	Wastewater pump, submersible type with the brand Showfou, capacity 80-100 liters/minute, impeller and casing material iron, pipe connection 2", 2 units, alternating operation using a timer for 24 hours	Submersible pumps, 2 units. Operate alternately for 24 hours	Matches the capacity
15	WWTS Maintenance	Maintenance is carried out daily by WWTS staff	Monitoring and checklist are performed daily	Matches

Sumber: Analisis Data, 2024

Discussion

Effluent management at the Jakarta Islamic Hospital Sukapura shows that there are several important components that need to be considered to ensure that waste treatment is carried out properly and in accordance with quality standards. Based on observations and laboratory tests from LABKESDA, it appears that there are discrepancies in several wastewater quality parameters. For example, colonies of E.coli bacteria were found in numbers that exceeded the quality standard of zero. This indicates that the disinfection process has not been optimal, so additional doses of chlorine or disinfectant tablets are needed to effectively remove E.coli bacteria.

Observations showed that the waste collection basin has a size of 35m x 35m x 2m with a capacity of 245 m^3. However, this capacity is only effective to accommodate 70% of the wastewater due to the presence of silt. This means that the effective capacity of the collection basin is 171.5 m^3. To solve this problem, it is recommended to conduct scheduled sludge removal every six months and increase the size of the collection basin so that its capacity can be optimized as needed.

Another component observed was the grease trap, which serves to separate oil and grease from wastewater. Observations show that the current grease trap is not able to separate oil and grease effectively, so the oil and grease content in wastewater is still high. Therefore, design improvements and the addition of a more efficient oil and grease separation system are required to ensure that the treated wastewater is free from excess oil and grease content.

Other water quality parameters such as BOD and COD also showed results that did not meet the quality standards. The high BOD and COD values indicate that the organic matter content in the wastewater is still high. This can cause a decrease in water quality in the surrounding environment if not handled properly. Therefore, it is necessary to increase the efficiency of the biological treatment process in the WWTP so that the BOD and COD values can be reduced to the set standards.

In addition to the water quality parameters, the test results also show that there are heavy metal contents such as mercury, cadmium, and lead in the hospital wastewater. These heavy metals are very harmful to the environment and human health because they are toxic and difficult to degrade. To overcome this, it is necessary to conduct regular monitoring and apply treatment technologies that are able to remove or precipitate heavy metals from wastewater before it is discharged into the environment.

The results of the analysis show that the WWTP system at the Jakarta Islamic Hospital Sukapura still requires a lot of improvement and development. In addition to increasing the capacity and efficiency of the treatment process, it is also important to ensure that all wastewater quality parameters comply with the established quality standards. The implementation of more advanced treatment technologies and regular monitoring will help ensure that the wastewater generated by the hospital does not negatively impact the environment and the health of the surrounding community.

CONCLUSION

Based on the research that has been conducted on the Wastewater Treatment Plant (WWTP) at the Jakarta Islamic Hospital Sukapura Kelapa Gading, it can be concluded that several important things, namely, the evaluation results show that several components of the WWTP system are functioning properly, such as greastrap tanks, grid chamber tanks, screen tanks, anaerobic tanks, aerobic tanks, chlorine tanks, final settling tanks, and indicator tanks or fish ponds. These components did not show significant problems in the hospital's wastewater treatment process. Some components, such as the collection basin, initial settling basin, and equalization basin, experienced significant problems. The main problem is sludge settling which reduces the capacity of these basins to only about 70% of their intended capacity. This impacts the overall efficiency of wastewater treatment. The proposed solution included scheduled removal of settled sludge every six months and an increase in basin capacity. The collection basin and initial settling basin need to be increased in capacity from 245 m^3 to 490 m^3. This step is expected to increase the capacity and efficiency of the WWTP system. Sustainable wastewater management requires regular monitoring and evaluation of the WWTP system. Implementation of the proposed improvement measures is expected to maintain environmental quality and the health of the surrounding community. It is recommended that the hospital invest in more advanced and efficient wastewater treatment technology. Training for WWTP management staff also needs to be improved to ensure optimal operations and compliance with applicable regulations.

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