MAPPING WATER AND SANITATION CONDITION TO IMPROVE UNIVERSAL ACCESS IN BANDUNG CITY

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Abstract

Many developing countries lack the necessary infrastructure for clean water supply and sanitation facilities, especially in urban areas. Cities in Indonesia are also facing this problem. The rapid growth of urban areas puts a strain on existing water and sanitation infrastructure, making it difficult to meet the increasing demand for services. This can lead to inadequate mapping and planning for future needs. Water and sanitation mapping is an important tool for monitoring access to clean water and sanitation facilities to gather accurate data and improving access to clean water and sanitation. The purpose of this study is mapping water and sanitation condition and calculate the sanitation index. The mapping carried out includes source of drinking water, wastewater, drainage system, and solid waste disposal. The study was conducted in RW 06 Pasirluyu, a community neighbourhood in Bandung City. The methods used are questionnaire interviews and direct observation. The total respondents of study locations were 225 houses, but only 101 houses were willing to participate in the study. The study results show that 89% of respondents clean water source comes from deepwell groundwater for cooking and washing, whereas main source for drinking water is from bottled water, 89% of respondents use septic tank for their wastewater, 11% of respondents dispose their wastewater into open channels or conduct open defecation, 89% of the drainage is open drainage system, and 61% of the respondents conducted solid waste separation. Sanitation index assessment in RW 06 Pasirluyu calculated scored 1.25 for drinking water aspect, 1.23 domestic wastewater aspect. 1.21 drainage aspect, 1.02 domestic waste aspect. Overall, based on the sanitation index assessment results, the RW 06 Pasirluyu is classified as good.

Keywords: *drinking water, index, mapping, sanitation, risk*

Introduction

Many developing countries face challenges in securing adequate and safe water supplies and sanitation access. Cities in Indonesia are also facing this problem. One of the cities with a high population density is Bandung. Almost the entire area of the city is residential area, with little green open space, and prone to flooding when it rains. The rapid growth of urban areas puts a strain on existing water and sanitation infrastructure, making it difficult to meet the increasing demand for services. This can lead to inadequate mapping and planning for future needs (Tsole, 2022).

Mapping can be a powerful tool for improving access to clean water and sanitation in

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developing countries. By identifying areas in need of improvement (Local Burden of Disease WaSH Collaborators, 2020), monitoring progress (The Guardian.com, 2015), prioritizing interventions and allocate resources to areas with the greatest need (Healthdata.org, 2020 and sdg.iisd.org, 2021) For example, identify areas at high risk of water scarcity or contamination, allowing interventions to be targeted to these areas (esri.com, 2022).

As stated in the National Medium-Term Development Plan 2015-2019, Indonesian government launched the 100-0-100 program (developmentevidence.3ieimpact.org, 2022). The goal of the program is to provide 100% access to drinking water, reduce to 0% slums and provide 100% access to proper sanitation by the end of 2019. The demand to achieve an average of 6% to 7% per year in water supply and sanitation will be quite heavy (RPJMN 2015-2029). To help achieve the target will be impossible without the active participation of the community, including urban communities, especially the fulfillment of basic sanitation. Basic sanitation is a minimum environmental health requirement that must be owned by every family to fulfill their daily needs.

The purpose of this study is mapping water and sanitation condition and calculate the sanitation index in RW 06 Pasirluyu, a community neighbourhood in Bandung City. This location was chosen because it can represent the condition of the city. It is hoped that this study can identify steps and strategies for water and sanitation management that can ultimately solve environmental problems in the area.

Research Methodology

The methods conducted in this study were field observations, survey, and interview. Data collection was carried out to identify existing water and sanitation conditions in RW 06 Pasirluyu. Number of respondents of study locations was 225 houses, but only 101 houses were willing to participate in the study.

Determination of the sanitation index was calculated based on the sanitation index criteria table. RW 06 Pasirluyu consists of 5 neighborhoods. The sanitation index was calculated for each block of the neighborhood. There are several sanitation components used as review parameters in determining the sanitation index namely access to clean water, drainage, wastewater, and solid waste.

The index was obtained based on predetermined criteria on each component, divided into several questions in the questionnaire. The number of respondents was designed to be equal for each neighborhood in the research location. To calculate the sanitation index, the data collected was processed by scoring and analyzing qualitatively. The answers in the questionnaire only contained "Yes" or "No", so a "Yes" answer scored 1 and a "No" answer scored 0.

The total score of sanitation index is determined from each aspect of sanitation index. The index is based on the sanitation index criteria. The total score of sanitation index was then calculated using equation (1).

Table 1. Sanitation Index Criteria

Sanitation Index	Criteria
0-25%	Bad
26-50%	Simply
51-75%	Good

Total Score = (3×bad criteria)
+ (2×medium criteria)
+ (3×good criteria) (1)

The calculated total score from sanitation index will result in a sanitary risk assessment category. The categories is divided into three criteria, namely good, medium, bad.

Table 2. Sanitation Risk Assessment Categories

Category	Value
Good	1 – 1.59
Medium	1.6 – 2.39
Bad	2.4 – 3

Result and Discussion

Respondent Characteristics

The characteristics of the respondents consisted of gender, age, and occupation. Based on gender, there were 39% male respondents and 62% female respondents. Most respondents (66%) were over 46 years old, the remaining respondents aged between 17 and 25. Based on household status, housewives have the largest portion at 53%,

Access to Clean Water

89% of the respondents access to clean water is sourced from deepwell groundwater for cooking and washing, whereas main source for drinking water is from bottled water. Only 19% of the respondents use water from the water utility company as the main water source. This is due to the unreliable water flow from the city pipeline network which often does not flow. In general, all houses in RW 06 Pasirluyu have access to drinking water that can meet their needs, both during the dry and rainy seasons.

Map of access to clean water in RW 06 Pasirluyu shows that most respondents use private deep wells. It's important for well owners to be aware of their well's potential for contamination and the possible health effects of those contaminants (Freeman, 2007). Private wells can be contaminated by both naturally occurring sources and by human activities (Freeman, 2007). Deeper wells may be less susceptible to surface contamination, but they can still be affected by underground sources of contamination (polk.com, 2010). Excessive pumping of groundwater can cause depletion, which is when the rate of water withdrawal exceeds the rate of recharge (polk.com, 2010). This can lead to a lowering of the water table, which can cause wells to no longer be able to reach groundwater (Scherer 2020).

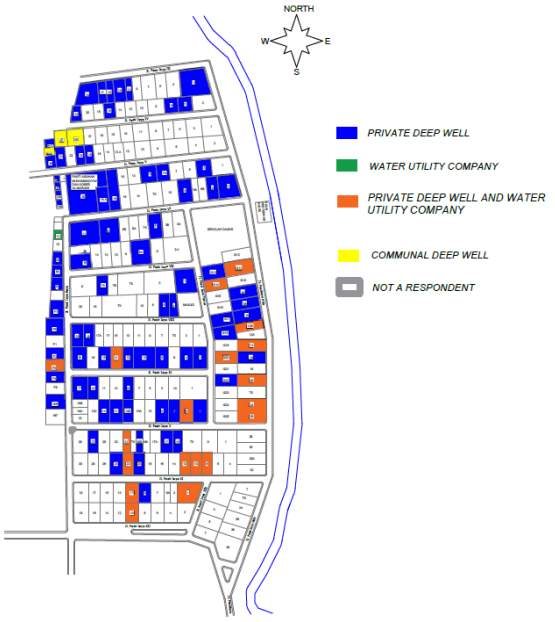

Figure 1. Sources of drinking water

Domestic Wastewater Access

100% of the respondents surveyed have private toilets/bathrooms and most of their domestic wastewater is channeled to septic tanks(89%).

Figure 2. Domestic wastewater access

However, 11% of respondents dispose their wastewater into open channels or conduct open defecation. The placement of septic tanks was 42% infront of the house, 35% behind the house, while 7% of respondents stated that they did not know. The distance between the septic tank and the water source (borehole/dug well) 52% met the requirement of more than 10 meters and the remaining 29% less than 10 meters. 48% of the respondents have desludged the septic tank using a septic truck, while 6% have desludged the septic tank using decomposing bacteria.

Drainage Access

All respondents stated that they had never experienced major flooding while living in RW 06 Kelurahan Pasirluyu. However, 19% of respondents stated that there had been inundation during heavy rainfall with a puddle height of less than 40 cm and the puddle receded within a few hours. The puddles did not enter the terrace of the house, but only inundated the road and the garden in front of it. The drainage channels are all located in front of the house with open rectangular channels (85%). In addition to channeling rainwater, 3% of the respondents also used it as a graywater drain.

There is one respondent who has four biopore infiltration holes in the yard of the house. Although flooding has never occurred in the research location, flood prevention measures such as making biopore infiltration holes will be very beneficial. Biopore infiltration holes are a type of drainage system that can help prevent flooding and improve soil quality. The hole is designed to allow water to infiltrate into the soil more easily. Biopore infiltration holes can help reduce surface runoff, produce compost, fertilize soil, reduce waste piles, and conserve groundwater.

Figure 3. Drainage access

Domestic Solid Waste Access

All houses have containers to collect their waste. The types of containers used are baskets, barrels, buckets, and garbage bins. Waste that will be put into the container is first packed in plastic bags.

Figure 3. Domestic solid waste access

As many as 91% of respondents who use waste baskets place their baskets inside the house. Respondents who use garbage cans (26%) keep

them in the yard. Respondents who use garbage bins (7%) keep them in the yard and some (7%) keep them in the outer yard of the house to make it easier for the cleaning staff to transport them.

Before disposal, 61% of respondents stated that they had sorted their waste first by separating dry waste and wet waste. Some respondents have also done composting although it is still not consistent. All waste from households in RW 06 Pasirluyu neighborhood is collected by the cleaning staff. Each neighborhood is served by one waste collecting officer using a garbage cart with a predetermined transportation schedule to be disposed of at the waste disposal site.

Sanitation Risk Assessment

Data processing is carried out by looking at the results of the questionnaire. Sanitation risk assessment is calculated and divided into three criteria, namely good, medium, bad using the sanitation risk assessment calculation formula. The results of the sanitation risk assessment of RW06 Kelurahan Pasirluyu can be seen in Table 3.

Table 3. Sanitation Risk Assessment of RW 06 Kelurahan Pasirluyu

No	Facilities	NH 01		NH 02		NH 03		NH 04		NH 05	
		NR	Category	NR	Category	NR	Category	NR	Category	NR	Category
1	Drinking Water	1.40	Good	1.33	Good	1.22	Good	1.22	Good	1.10	Good
2	Domestic Wastewater	1.31	Good	1.46	Good	1.11	Good	1.21	Good	1.06	Good
3	Drainage	1.18	Good	1.34	Good	1.12	Good	1.11	Good	1.18	Good
4	Waste	1.02	Good	1.01	Good	1.02	Good	1.02	Good	1.02	Good

Description: NH = Neighborhood NR = Average Value

Conclusions

Based on mapping results it can be concluded tha 89% of respondents clean water source comes from deepwell groundwater for cooking and washing, whereas main source for drinking water is from bottled water. 89% of respondents use septic tank for their wastewater, whereas 11% of respondents dispose their wastewater into open channels or conduct open defecation, 89% of the drainage is open drainage system, and 61% of the respondents conducted solid waste separation.

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