



Participatory Mapping of Environment Sanitation Conditions in Settlement of Floating House in Ternate City

Firdawaty Marasabessy^{1*}, Vrita Tri Aryuni²

¹Department of Architecture, Universitas Khairun, Ternate, Indonesia;

²Department of Geography Education, Universitas Khairun, Ternate, Indonesia;

*Corresponding author email: mfirdawaty@gmail.com

Received : January 31, 2020

Accepted : November 1, 2020

Online : December 30, 2020

Abstract – The water settlement has unique and distinctive characteristics, but it can become an environmental problem if the sanitary conditions are poor. The poor sanitary occurred in the water settlement, namely in Makassar Timur and Mangga Dua Utara, which were initially iconic settlements, but now, both of these settlements have environmental degradation. In line with the Sustainable Development Goals, strengthening community participation was carried out to realize clean water and proper sanitation. The research aimed to map the environmental sanitary conditions by involving community participation. This mapping describes sanitary water settlement characteristics to become a planning database to handle both areas' sustainable hygienic. The results showed that the sanitary achievement index in the two regions, above 50% of the conditions were carried out or sufficient. The findings showed the mapping of settlement on the water in the two areas, revealed environment condition with the same characteristics in which the environmental conditions had experienced environmental degradation due to contamination of water bodies because of solid and liquid waste originating from residential houses deliverables from upland settlements. In the future, the settlement environment in Makassar Timur District will be planned to be completely stockpiled. As a result, this environmental area will lose its identity as a settlement on the water. Meanwhile, land conflicts occurred in Mangga Dua Utara District's settlement, resulting in the lack of government programs in this environment to structure slum environmental conditions.

Keywords: Participatory Mapping, Settlement On The Water, Sanitation.

Introduction

Sustainable Development Goals (SDGs) are sustainable development agendas that are synergistic, inclusive, and prioritizes human and earth sustainability and common welfare. SDGs are global action plans agreed by world leaders, including Indonesia, to end poverty, reduce inequality, and protect the environment. SDGs contain 17 Goals and 169 Targets expected to be achieved by 2030, one of which is having access to clean water and sanitation (Goal 6). The Sixth Goal is to ensure sustainable clean water management and sanitation for all (www.sdg2030indonesia.org).

Up to 2014, the achievement of access to sanitation in Indonesia had reached 59.71%, and it was optimistic that in 2015 the target of 62.41% would be achieved (www.sanitasi.or.id). Meanwhile, Maluku Utara Province ranked 18th with a percentage of sanitation access, reaching 57.3% in 2014 (BAPPEDA of Maluku Utara, 2015). Sanitation in Indonesia is defined as an effort to dispose of domestic liquid waste and rubbish to ensure cleanliness and a healthy living environment, both in household and housing environments. It is divided into 3 (three) subsectors: wastewater, waste, and tertiary waste management (ITPS, 2009).

The sanitary conditions in the settlements on the water in Ternate City were quite alarming. This could be observed in the residential houses where drainage and toilet were improper with faces disposal facilities directly disposed to the coast/sea. Ternate City has the characteristics of a dominant settlement place surrounding the coastal area. From BPS (Badan Pusat Statistik, 2018) data on Ternate City people's welfare level in 2018, there were still 2.46% of the final disposal sites in the beach, river, lake, pond, land, and others. Settlement on the water has unique and distinctive characteristics, but it has serious environmental problems when its residents do not care about environmental sanitation issues. As a result, environmental conditions will be damaged and can create slum areas. Inadequate sanitation is associated with adverse health effects and significant economic losses (Cameron et al., 2019).

Messy city development will cause health, traffic, pollution, scarcity of resources, poor waste management, and infrastructure (Borja 2007; Marceau 2008; Toppeta 2010; Washburn et al., 2010; Sujata et al., 2016). This happened in a settlement on the water in Makassar Timur and Mangga Dua Utara Districts. These residential areas used to be two of the iconic settlements since they built houses on the water. However, nowadays, both settlements have experienced environmental degradation. The environment has been polluted due to solid waste and liquid waste from households and community awareness of the environment. Local people are still disposing of waste and sewage under their houses. The poor sanitation system in the two settlement areas has worsened the local environmental conditions. The settlements' location is right on the shoreline and is a downstream part that causes the spoil tip originating from the upstream part to accumulate in this area. Waste accumulation becomes a significant factor in shaping the slums.

Referring to SDGs, it is indispensable to strengthen community participation in handling environmental sanitation problems. Supporting and strengthening local communities' involvement in improving water and sanitation management targets Goal 6 Access to clean water and sanitation. It is essential to have community participation-based mapping for an inventory of environmental sanitary conditions since the community is the main stakeholder who knows and understands the characteristics of the physical conditions of the environment in which they live. Participatory mapping allows stakeholders to reveal where they benefit from ecosystem services, which can be used to understand stakeholder values in the area and possible conflicts (Brown, 2003; Klain and Chan, 2012; Brown and Raymond, 2014; Reilly et al., 2018). The concept of the role of community participation in maintaining NTD (neglected tropical diseases) -WASH (water, sanitation, and hygiene) intervention program is to increase institutional sensitivity and policy reform. The concept can use participatory rural assessment (PRA) techniques, including mapping of sources and incomes together with an in-depth interview (IDI) and focus group discussions (FGD), the perspective of committee members derived from the adequacy of existing NTD and WASH delivery mechanisms and about new social processes being implemented through EDG model (Enhanced Development Governance model) (Madon et al., 2018).

Materials and Method

This research was quantitative research by means of collecting primary data in the field, and the residents identified the coverage of sanitation services for each residential house together. In determining the sanitation index, there were variables studied: ownership of toilets, availability of clean water, drainage channel, availability of sewerage, provision of waste management (TPS), and communal septic tank availability. The sanitation performance index was obtained from the determination of criteria representing the variable.

Table 1. Sanitation Index Criteria.

Sanitation Index	Criteria
0 – 25%	Poor
26 – 50%	Adequate
51 – 75%	Good
76 – 100%	Excellent

The number of respondents was 21 households in both Makassar Timur and Mangga Dua Utara. From the determination of the sanitation achievement index, a mapping was made together with the community to map the existing conditions of the coverage of sanitation services in the settlements on the water.

Results

Sanitation Achievement Index

The sanitation achievement index in the settlement on the water areas was analyzed based on six variables used as parameters for review in each research location, namely in Makassar Timur and Mangga Dua Utara, presented in Table 2.

Table 2. Percentage of Sanitation Index in Makassar Timur District

No	Component	Empirical Score	Ideal Score	Index %
1	Toilet	82	86	96
2	Clean Water	79	84	80
3	Drainage Channel	52	80	45
4	Sewerage	30	78	24
5	TPS	35	78	25
6	Communal Septic Tank	34	76	26

Access to environmental sanitation for residents living in the settlement on the water in Makassar Timur District.

Ownership of toilet and Access to Clean Water

Each residential house sampled in the research was equipped with toilet facilities in each house, both family residential houses and rented houses. However, there were still toilet facilities not suitable for use and seemed dirty.

Water is a basic human need. Water suitable for consumption must meet physical, chemical, and biological criteria. The source of clean water for the settlement in Lelong, Makassar Timur, came from PDAM (Regional Drinking Water Company) and community-owned wells donated to the surrounding community. There were 58% of residential houses that accessed water from PDAMs (Regional Drinking Water Company), and 42% of others used water sources from community wells.

Drainage channel and sewerage

The settlement's environmental conditions in Makassar Timur District were the water settlements, so the drainage channel with an open system was directly related to the water bodies.



Figure 1. The Toilet conditions the citizens in Makassar Timur District.

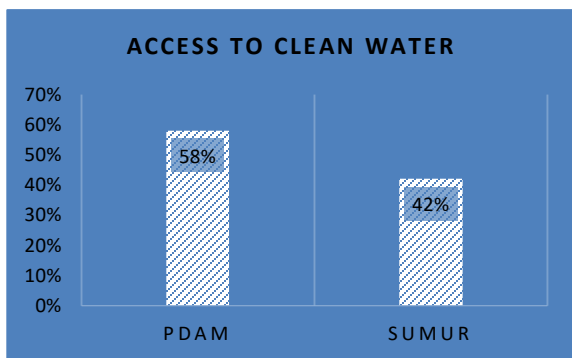


Figure 2. Diagram of clean water sources.



Figure 3. A source of clean water from community wells.



Figure 4. Conditions of the drainage channel.

Wastewater from residential houses was immediately disposed into water bodies. This was possible because the access was facilitated by being under the house.

Waste management and Communal septic tank

There was one landfill to collect waste in Lelong settlement, Makassar Timur. It was certainly not enough from the existing capacity, so the water bodies became a landfill for the residents.

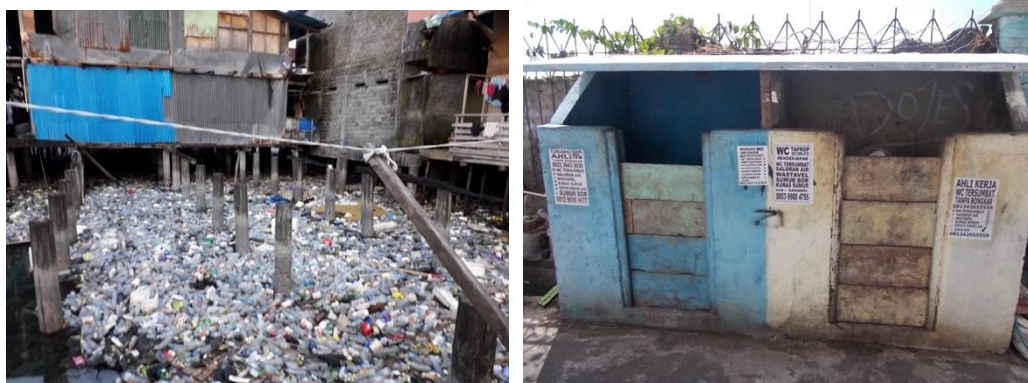


Figure 5. conditions of waste existing in the water bodies.

There were six communal septic tanks provided by the government. Nevertheless, most of the residents who used the septic tank were those whose houses were the closest to the septic tank location. The main obstacle was that many residents did not dispose of solid waste directly in the pipeline due to procuring pipelines.



Figure 6. Communal septic tank.

Table 2. Percentage of sanitation component index in Mangga Dua Utara District.

No	Component	Empirical Score	Ideal Score	Index %
1	Toilet	78	84	88
2	Clean Water	76	80	78
3	Drainage Channel	52	80	45
4	Sewerage	30	78	28
5	TPS (Waste Management)	52	76	32
6	Communal Septic Tank	34	76	25

Access to environmental sanitation for residents living in the settlement on the water in Mangga Dua Utara District.

Ownership of toilet

Of the 21 house samples studied, all of them had their toilet outside the house.



Figure 7. Conditions of the toilet in Mangga Dua Utara District.

Access to clean water

The source of clean water for Mangga Dua Utara's settlement mostly came from the Regional Drinking Water Company (PDAM). It was noted that 84% of the residential houses that accessed water from Regional Drinking Water Company) and 16% still used water sources from wells.

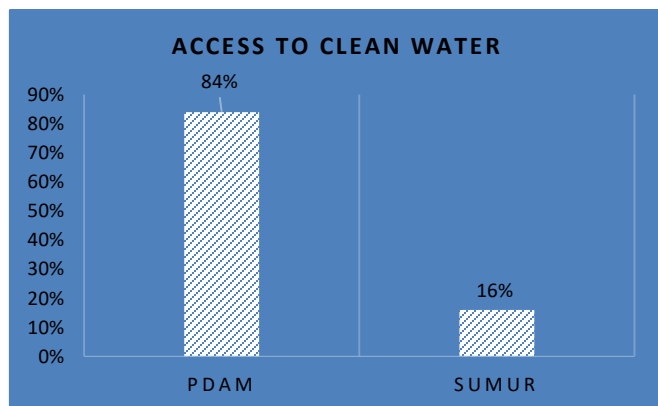


Figure 8. Diagram of Access to Clean Water



Figure 9. Water Source in The Wells

Drainage channel and sewerage

Like the settlement in Lelong, Makassar Timur, the water settlement in Mangga Dua Utara District had an open drainage system directly to the water bodies.

Wastewater from residential houses was immediately disposed into water bodies. This was possible because the access was facilitated by being under the house.

Waste management

There were two landfills in this location, but the waste management was not optimal, where there was still waste scattered in the water bodies. The source of waste was not only from the settlement itself but also from the upper areas.



Figure 10. Environment conditions in Mangga Dua Utara District.



Figure 11. Conditions were existing of sewerage.



Figure 12. Waste conditions in Mangga Dua Utara District.

Mapping of Sanitary Conditions

The sanitary conditions in the settlements on the water in Ternate City were quite alarming. This could be observed in the residential houses where drainage and toilet were improper, with feces disposal facilities directly disposed to the coast/sea. Ternate City has the characteristics of a dominant settlement place surrounding the coastal area. From BPS (Central Bureau of Statistics) data on Ternate City people's welfare level in 2018, there were still 2.46% of the final disposal sites in the beach, river, lake, pond, land, and others. Settlement on the water has unique and distinctive characteristics, but it has serious environmental problems when its residents do not care about environmental sanitation issues. As a result, environmental conditions will be damaged and can create slum areas.

The research on the sanitary conditions in the water settlement was carried out in two residential areas, namely in Makassar Timur District and Mangga Dua Utara District directly over the water. The initial phase of the research was performed with a preliminary survey of the settlements' environmental conditions with the initial identification of the house samples and the conditions of environmental sanitation facilities and infrastructure. The next stage was coordination with the District Government and data from the Central Bureau of Statistics of Ternate City to collect secondary data on population, occupation, education level, health level, etc.

The survey observed sanitary conditions, including toilets, septic tank, sewage, clean water sources, and waste. The area plotting of house samples that had toilet integrated with a communal septic tank. In Makassar Timur District, there were six communal septic tank points, and the residents used only four septic- tank. Usually, they resided only two to three houses around the septic tank locations. Most of the sewerage systems were immediately disposed of in the water bodies under their houses. This condition was due to constraints in the procurement of pipelines for each resident, so not many houses used communal septic tanks. Such conditions also occurred in the settlement on the water in Mangga Dua Utara District.



Figure 13. Map of Sanitary Mapping in Makassar Timur District

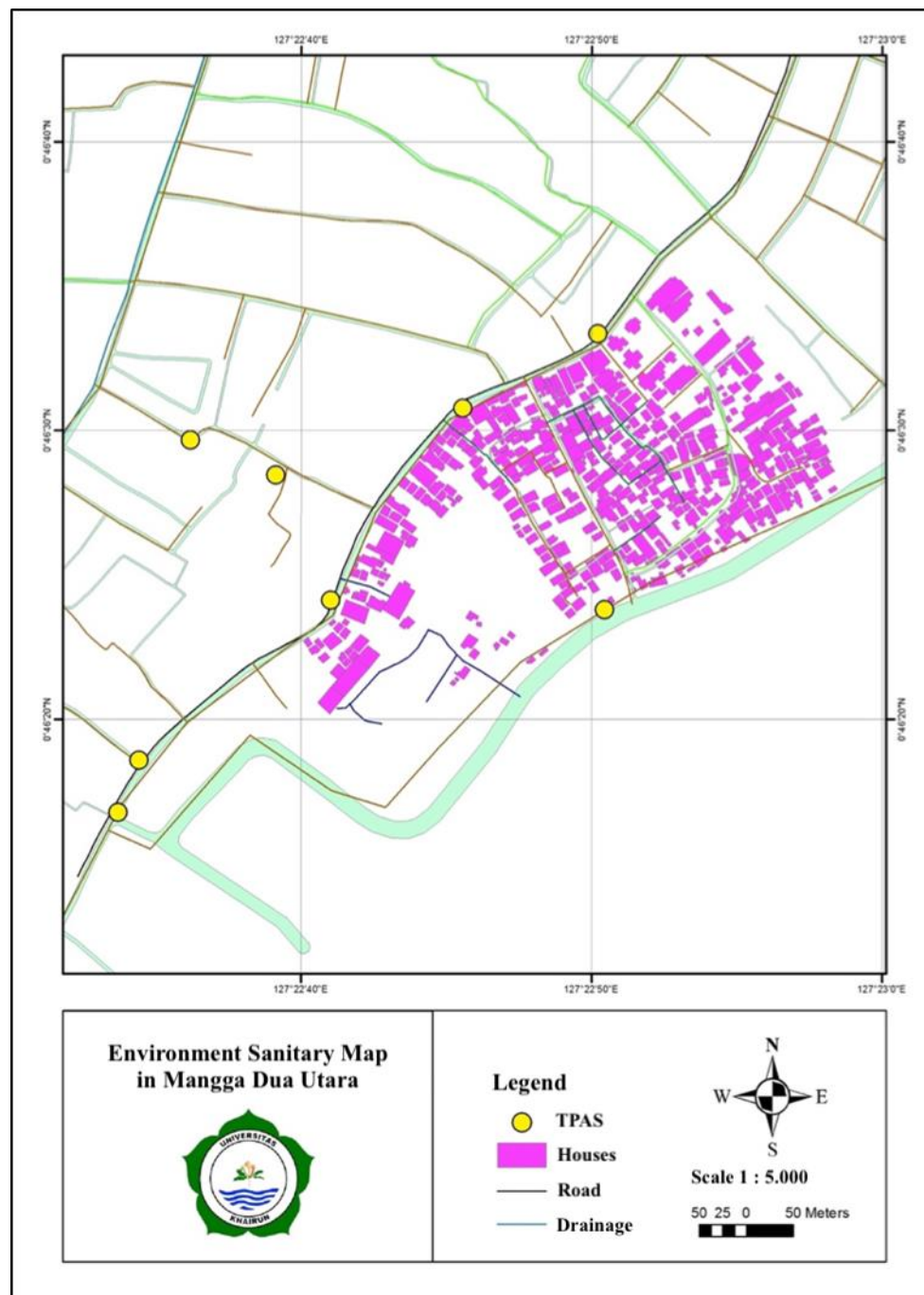


Figure 13. Sanitary Mapping in Mangga Dua Utara District

The sanitary conditions in Makassar Timur District became specific since they were directly adjacent to the city's economic center. This location was very strategic for the residents to live, especially those whose work was close to the settlement. Unfortunately, the environmental quality had declined with the increase of residents who lived there. Almost all residents who lived here were migrants, so the house owner was mostly rented/boarding houses. The availability of a communal toilet was for rented/boarding houses, while for the ownership of private homes, each house had its own toilet. Many government programs had been carried out to overcome slum areas in this place, communal septic tanks. There were seven communal septic tanks, but only 3 of them could be

utilized by the residents, so the toilet's solid waste was directly channeled to the water bodies. The condition of waste was also getting worse; not only the availability of landfills but also many settlement environments had been stockpiled, so the water did not easily escape to the sea. Consequently, a lot of waste was held under the residential houses. It is better to inform the plans that have been agreed upon by the residents and government that these settlements will be completely stockpiled, so it will indirectly eliminate the identity of the settlement on the water.

The sanitation mapping results, presenting the availability of drainage channels, TPS, communal septic tanks, and houses served by clean water and private and communal toilet facilities, have indicated the existing problem exists. In Mangga Dua Utara District, every house had a private toilet usually located outside the house. In contrast, a communal toilet was typically used in a rented/boarding house. The sources of clean water for the residents were obtained from Regional Drinking Water Company and communal wells. Here there were three communal wells used by surrounding residents. There were eight landfills in Mangga Dua Utara district, and specifically, in RT.14, there was one landfill located in front of the main road. The settlement's characteristic of the water was that it still left the waste problem, where there was still waste under each house, and when the water receded, it produced a pungent odor. Both dirty water drainage and liquid waste disposal channel were directly disposed into water. In contrast, only a few houses utilized communal septic tank for solid waste, while other residential homes dumped solid waste directly into the water bodies. Such conditions further aggravated the environmental quality in RT.14 of Mangga Dua Utara District.

Conclusion

The sanitation achievement index in the settlement on the water areas unveiled that the sanitary conditions in Makassar Timur District were that the toilet ownership was 96%, meaning that almost every house/rented house had a toilet even though there were some improper toilet conditions. The clean water source with an index of 80% was obtained from community wells and PDAM (Regional Drinking Water Company). The sanitation indices for drainage channel and wastewater variables were 45% and 24%, respectively. This demonstrated that the infrastructure was low, so the household wastewater was directly channeled to the residential house's water bodies. Waste management (TPS), with an index of 25%, contributed to worsening the environmental conditions. Since the availability of landfills was limited, so the residents threw waste into the water bodies.

On the other hand, an index of 26% for communal septic tank facilities depicted that the houses located close to the location of the communal septic tanks were using them. In the future, this settlement environment will be planned to be completely stockpiled. As a result, this environmental area will lose its identity as a settlement on the water.

The settlement on the water in Mangga Dua Utara District also showed environmental conditions not much different from the Makassar Timur district's environmental conditions. The environmental conditions in this settlement area also experienced ecological degradation. The water bodies' condition was also polluted with solid and liquid waste sourced from the residential houses. The sanitation indices for each component were 88% for the ownership toilet, 84% for the source of clean water, 45% for the drainage channel, 28% for the sewerage, 32% for the waste management (TPS), and 25% for the communal septic tank. In this settlement, only a few of the waste was transported to TPS.

In contrast, others were disposed directly to the water bodies, and the wastewater also flowed directly to the water bodies. This was the primary cause of environmental degradation. The lack of government programs reaching this environment was caused by the land ownership that still became a conflict with the residents.

Acknowledgment

The author thanked the LPPM of Khairun University in 2019, Faculty of Engineering Research Grant, for research funding assistance to be carried out correctly.

References

- Badan Pusat Statistik [BPS] Kota Ternate, 2018, Statistik Kesejahteraan Rakyat Kota Ternate.
- Badan Perencanaan Pembangunan Daerah [BAPPEDA] Maluku Utara, 2015, Buku Putih Sanitasi Maluku Utara.
- Cameron, L., Olivia, S. and Shah, M. 2019. Scaling Up sanitation: evidence an RCT in Indonesia. *Journal of Development Economics*, 138: 1-16.

- Hikmansyah. 2008. Proses perubahan rumah sasadu akibat urbanisasi, studi kasus masyarakat Sahu Halmahera-Maluku Utara, [tesis], Fakultas Sipil dan Perencanaan, Institut Teknologi Sepuluh November, Surabaya.
- Madon, Shirin., Malecela, Ntuli, M., Mashoto, Kijakazi., Donohue, Rose., Mubyazi, Godfrey., Michael, Edwin. 2018. The role of community participation for sustainable integrated neglected tropical diseases and water, sanitation and hygiene intervention programs: a pilot project in Tanzania. *Journal of Social Science and Medicine*, 202: 28-37.
- Oyinloye, M.A., and Fasabin, J.O. 2013. Application of geographical system (GIS) for siting and management of solid waste disposal in Akure, Nigeria. *IOSR Journal of Environmental Science, Toxiology dan Food Technology (IOSR-JESTFT)*, 4(2): 6-17.
- Prasad, B.A. 2013. Urban sanitation: health challenges of the urban poor. *Research Journal of Family, Community and Consumer Sciences*, 1(3): 1-6.
- Reilly, K., Adamowski, J., and John, K. 2018. participatory mapping of ecosystem services to understand stakeholders' perceptions of the future of the Mactaquac Dam, Canada. *Journal of Ecosystem Services*, 30: 107-123.
- Sujata, J., Saksham, S., Tanvi, G., and Shreya. 2016. Developing smart cities: an integrated framework. *Procedia Computer Science*, 93: 902-909.
- Sumathi, V.R., Natesan, U., and Sarkar. C. 2008. GIS base approach for optimized sitting of municipal solid waste landfill. *Waste Management*, 28: 2146-2160.
- Tim Teknis Pembangunan Sanitasi [TTPS]. 2009. *Buku Referensi-Opsi Sistem dan Teknologi Sanitasi*.