BUILDING HEALTHY CITIES

Community-Based Waste and Water Management Study: Makassar, Indonesia

September 2022

CONTENTS

ACRONYMS

3Rs	reduce, reuse, recycle
BHC	Building Healthy Cities
CWB	Community Waste Bank
FGD	focus group discussion
JSI	JSI Research & Training Institute, Inc.
LSKP	Lembaga Studi Kebijakan Publik (Institute for Public Policy Studies)
RT	rukun tetangga (neighborhood unit)
RW	rukun warga (community unit)
USAID	United States Agency for International Development

Building Healthy Cities

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Cover Photo

Lembaga Studi Kebijakan Publik (Institute for Public Policy Studies

Introduction

The United States Agency for International Development (USAID)-funded Building Healthy Cities (BHC) project aims to refocus city policies, planning, and services with a health equity lens while improving data-driven decision making for Smart Cities in India, Indonesia, Vietnam, and Nepal.

In Makassar, Indonesia, BHC is implemented by JSI Research & Training Institute, Inc. (JSI) and the International Organization for Migration, in partnership with the Mayor's office. BHC engages with various sectors that contribute, directly or indirectly, to community members' (particularly women's and children's) health and quality of life. In Makassar, these sectors within the government and across universities, the private sector, nongovernmental organizations, civil society organizations, and other UN agencies include:

- health
- urban planning and development
- information and communications
- public safety and security
- education
- water and sanitation
- waste management
- environment and natural resources
- social inclusion
- women's empowerment and child protection
- civil registration.

The first core value of BHC, multisector engagement, aims to provide all municipal sectors with a common understanding of how they contribute to health. The second BHC core value is to strengthen community engagement in municipal decision-making. Specifically, BHC is dedicated to building community awareness and capacity to engage decision makers to improve the quality of, and access to, services and information. Our third core value is to support the use of data for planning and decision-making, including use of citizen data for planning and budgeting decisions.

Informed by these three core values, BHC is partnering with Makassar Smart City, Bappeda, and the Mayor's office to improve healthy urban planning. This particular study, completed in partnership with Lembaga Studi Kebijakan Publik (Institute for Public Policy Studies, LSKP), has empowered the community to report their needs related to waste and water management, and create data for decision-making related to these issues.

Background

Makassar City, the capital city of South Sulawesi Province, is steadily growing. With rapid urbanization and population growth, urban waste has increased and has the potential to overwhelm city management services (Visvanathan 2006).

Makassar City has a population density of 8,122 people per square kilometer. As a coastal metropolitan area, waste and wastewater management is complicated by rising sea levels, frequent flooding, lack of space for landfills, and the interaction between solid waste and water sources. On average, the current Makassar resident produces 246 kilograms of waste annually, totaling 373,654 tons of total annual waste in Makassar City (National Waste Management Information System (SIPSN) 2022; Makassar Statistic Bureau 2022). However, as of 2021, the Makassar Municipal Government only had the capacity to reduce already-full landfills by approximately six percent per year, which is the equivalent of 21,097 tons. Similarly, current Makassar City recycling capacity is only five percent (19,232 tons) per year of total recyclable waste production (National Waste Management Information System (SIPSN) 2022).

Solid waste interacts with human health and wellbeing in two ways. According to the Health Needs Assessment conducted by BHC in 2018, drains were clogged with solid waste at several locations in Makassar City, which caused the overflow of wastewater into roads, houses, and other buildings (Biradavolu et al. 2018). Further work in the Maccini Sombala village through the BHC journey map titled "It's All Connected" found that there were two floods in 2017 and 2019 (Building Healthy Cities project 2020). Local public health centers reported that there were 9 cases of dengue fever and 84 cases of diarrhea during the 2019 flood while other residents reported skin diseases that they believed were caused by their exposure to polluted water.

Maccini Sombala village is part of Tamalate Sub-District. In 2021, its population was 23,420 across 4,934 households (Makassar Statistic Bureau 2022). Maccini Sombala village consists of 9 community units (*rukun warga or RW*) and 72 neighborhood units (*rukun tetangga or RT*). This village is one of the informal settlement areas in Makassar with a population density of 11,480 persons per square kilometer (Makassar Statistic Bureau 2022). Like the rest of the city, Maccini Sombala village experiences a rainy season, during which flooding is more likely.

Maccini Sombala village was chosen by BHC as a sentinel site for tracking this issue because it is located in one of 21 flood-prone areas in Makassar City that are experiencing rising sea levels, high volumes of stagnant water, and congested canals and other waterways (Asian Development Bank 2021). As such, it can provide representative data of the larger area.

Figure 1. Map of Maccini Sombala Village

Source: Google Maps, 2022

The Makassar Municipal Government is working to address urban waste and flooding issues by changing the previous waste management paradigm (collect - transport - dispose) to reduce – reuse - recycle (3Rs) principles. Several programs, including the Makassar Green and Clean campaign, which started in 2012 and was re-launched in 2019, provides widespread public awareness messaging and support for all of Makassar City to improve the environmental quality using the 3Rs principles (Towolioe 2018). The Waste Bank Program, a community-based waste management system that works at the RT and RW levels, works to change people's waste handling behavior to include more of the 3Rs concepts, uses financial incentives to encourage greater recycling, reduce loose plastics in the environment, and in some cases reuse of waste via individual waste bank initiatives.

In 2014, the Mayor of Makassar's office established the Community Waste Bank (CWB) system (Elshinta, 2019). In 2018, there were 544 CWB groups in Makassar with a total of 21,000 members (Kubota, Horita, and Tasaki 2020).

Several studies have documented the function of these CWBs in Makassar (Saleh 2015; Ismawati 2013; Ashariani 2022). Makassar's CWB program is unique among Indonesian cities as its city government has established and funded a Central Waste Bank as its Regional Technical Implementation Unit to facilitate the waste trade between CWBs and recyclers (Kubota, Horita, and Tasaki 2020). The Central Waste Bank essentially acts as a middleman, helping to negotiate prices with recyclers, clean recyclables, and provide a central location for waste to be stored in between transactions.

At the community level, there are two parts to the CWB program. First, there is a savings and loan program whereby participants can secure a loan of up to 500,000 rupiah (currently US$ 34) which can be repaid by disposing of their waste at the CWB. Second, garbage bins can be used for the "waste exchange for daily needs" program, which addresses food insecurity. People who are enrolled in CWBs can exchange their waste for up to 10 liters (15 pounds) of rice or other commodities each time they bring their

garbage to the CWB. Because CWB leadership resides with each RT and RW, there is variation in the management, quality, and reach of each CWB. Future efforts to increase the use and effectiveness of waste management through CWBs is considered critical for meeting the city's goals on waste management.

Despite these promising efforts, poor garbage disposal practices in Makassar and Maccini Sombala village, especially on the side of the roads and in waterways, still exist (Pomeroy-Stevens et al. 2020). Evidence from other BHC work sheds light on why waste problems persist. In some cases, low community awareness of the environmental impact of dumping and burning waste exist, but in other cases residents face barriers to better waste management including cost, transport, availability of services, and other issues (Building Healthy Cities project 2019). Without strong utilization and community support, these services are not prioritized for government funding and coverage is reduced or not expanded as the population grows. This, in turn, undermines government efforts to innovate and foster improvements to health and quality of life. The Makassar City government will need to increase participatory and responsive policies and services to optimize solid waste services for populations still struggling to overcome these barriers (Hasrul and Malik 2021).

This study is one example of a participatory approach to map waste management and adds to a small body of evidence on participatory community waste management across Indonesia. Some studies have focused on identifying household behaviors and factors that could improve 3Rs waste management (Santoso and Farizal 2019; Amin et al. 2021) while others have focused on the acceptance of demand-driven sanitation methods (Roma and Jeffrey 2010; Whittington et al. 2000). Our work aims to understand household behaviors and gaps in the community waste management service system, place these issues within the larger community ecosystem to better understand how these behaviors influence wastewater and human (including maternal and child) health, and then document acceptable solutions. It is our hope that results of this study will create a more waste-resilient community in Maccini Sombala village and inform other similar flood-prone communities in Makassar.

For the community itself, the application of study results may help reduce the total amount of waste generated, prevent environmental pollution, increase community ownership of, and participation in, waste management, and provide economic value from goods that can be recycled, thereby reducing the risk of related diseases and improving quality of life. For the Makassar City government, it is hoped that study results will be used to review the community-based waste management system and create strong waste management policies.

Methods

This study sought to answer the following questions:

1. What is the current situation regarding waste in Maccini Sombala village?
2. What is the current situation regarding water in Maccini Sombala village?
3. How is poor waste and water management affecting human health?
4. What do residents identify as possible solutions to these issues? What elements of a waste-resilient or more circular waste system would be acceptable and sustainable for the Maccini Sombala village?

To answer these questions, we used a mixed methods, participatory research approach that included four streams of data described in detail below. To conduct the work in a participatory way, the team involved residents in defining problem statements; identifying a thematic framework; finalizing study methods; contextualizing via the social mapping; collecting survey data; interpreting data; and identifying potential solutions. This study was reviewed and approved by the JSI Institutional Review Board.

Social Mapping Methods

Social mapping data collection was completed during several community meetings at the RW or village levels in January 2022. The three types of social mapping activities used by this study are described below.

- *Community maps* are a participatory rural appraisal tool used to explore problems related to village development and the natural and artificial resources available to overcome these challenges. The end product is a collaboratively created portrait that presents a general description of the community's physical resources. Community mapping was facilitated by a trained facilitator and assistant and carried out by community leaders, heads of RTs, and women leaders in each RW. In creating a map, participants were encouraged to identify, map, and draw the following elements:

    - community border
    - natural resources
    - land use
    - artificial resources (infrastructure and facilities).

    This group discussed mapping potential opportunities and problems by describing them in the form of community maps (see Annex 1). The facilitator provided participants with a large sheet of paper and colored markers to draw

community areas and identify locations or issues related to waste management and health. The number of participants engaged in mapping varied by RW, based on the number of RT representatives willing to attend. The highest number of participants was 16 in RW 2, while only 9 residents attended in RW 9. Most participants were women.

- A *seasonal calendar* was used to visualize and explore important periods or events which affect residents' living environment. This method aims to identify problems related to residents' basic welfare needs, diagnose health issues that impact community members, especially women and children, and pinpoint natural, economic, and cultural seasons such as rainy season, dry season, famine, transition, harvest season, planting season, fruit season, community events, and celebration seasons. This method was used at the RW level by representatives of community leaders, women leaders, and RW leaders. See Annex 2 for the calendar.

- *Waste circulation mapping* was used to document the flow of waste produced by households to better understand current household waste management. This activity was completed by representatives from each RW and some RTs who had a strong understanding of the conditions of the surrounding environment. Participants were primarily housewives who were active in women's community organizations. Women's involvement in this activity was very important because they are the main actors in producing household waste, primarily from cooking, and some are active in CWBs. This work was completed during a separate meeting of 20 people (including 12 women) and some attendees overlapped with those who also attended the seasonal calendar discussion.

To analyze the social mapping data, the team used an analysis framework with a grounded theory approach to extract key themes and patterns. The data analysis was completed using Excel and Word.

Focus Group Discussion Methods

In January 2022, a focus group discussion (FGD) was conducted with 20 people including 8 women, all of whom were the managers and administrators of three existing CWBs in Maccini Sombala village. They were asked to discuss their perceptions, attitudes, beliefs, opinions, and ideas related to community-based waste management, particularly CWB management. These data were analyzed in Excel and Word using the same techniques used for the social mapping data analysis.

Household Survey Methods

The household survey collected data related to solid and liquid waste management habits and systems in each household as well as the health of women and children. Data were collected from 72 RTs and 9 RWs in Maccini Sombala village in January 2022. BHC selected 27 local enumerators (8 men and 19 women) based on their involvement in Shelter Warga (the village community women's organization) who also had experience in community-based data collection. Enumerators were trained to understand research ethics, the purpose of the study, and the survey instrument itself.

Survey sample size was calculated to provide a confidence level of 95 percent and a sampling error of +/- 0.05, resulting in a minimum required sample of 460 households. Enumerators collected data from 504 respondents. Interviews were conducted in participants' homes and participants had to be at least 18 years old and provide consent to be interviewed. Data were cleaned and analyzed using Excel and Stata. Household demographics are included in Annex 3, along with the survey instrument.

Waste Audit Methods

The waste audit, carried out in January 2022 at the household level, collected data on the amount and type of waste generated by households in Maccini Sombala village. Participants were selected from among those who had completed the household survey and consented to further engage in the waste audit. Informants interested in participating in the waste audit were informed that there would be sorting and weighing of each type of waste either in the morning, or in the morning, afternoon, and evening of one day. The audit succeeded in collecting data from 144 households. A total of 128 participants from RWs 1-8 had their waste sorted and weighed by the project team three times in the day while 16 households from RW 9 had their waste sorted and weighed in the morning only. The waste audit was analyzed using Excel to understand the characteristics, amount, and type of waste generated from households.

Final Data Validation and Synthesis

After initial analysis of all data was completed, the team conducted Data Walks in each RW with RT representatives in June 2022 (see Annex 4 for list of attendees). The study team shared the village maps that had been created during the social mapping session as an entry point to get feedback about the data and elicit additional discussion among community members. Posters of the preliminary data were also shared (see Annex 5). Several participants expressed their appreciation for the Data Walk activity and stated that this was the first research study in which they had been highly engaged and where study results were reported directly to the community. Unlike in previous studies where they were observed as study subjects, the data walks

provided residents a way be involved as co-investigators, digesting the data, sharing their interpretations, and brainstorming recommended solutions. Feedback gathered from these Data Walks are incorporated into the results below.

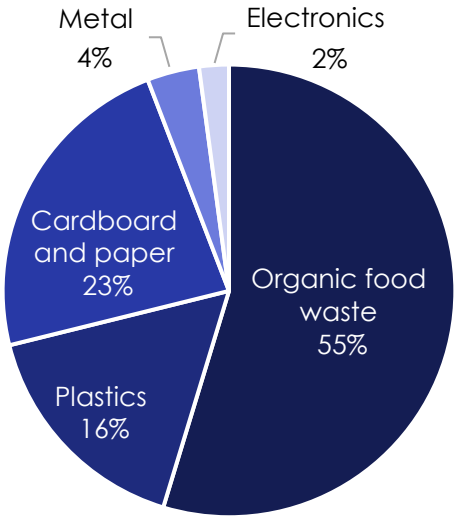
Results

This section is organized by study question. All relevant data were synthesized for each question to triangulate responses.

What is the current situation regarding waste in Maccini Sombala village?

Based on a household waste audit, this study identified various categories of waste generated by households (see Figure 2). The graph shows that food (organic) waste made up 55 percent of waste, followed by recyclables such as cardboard and paper at 23 percent, and plastics at 16 percent. Metal made up 4 percent and e-waste was 2 percent of the total.

Figure 2. Types of Waste in Maccini Sombala Village

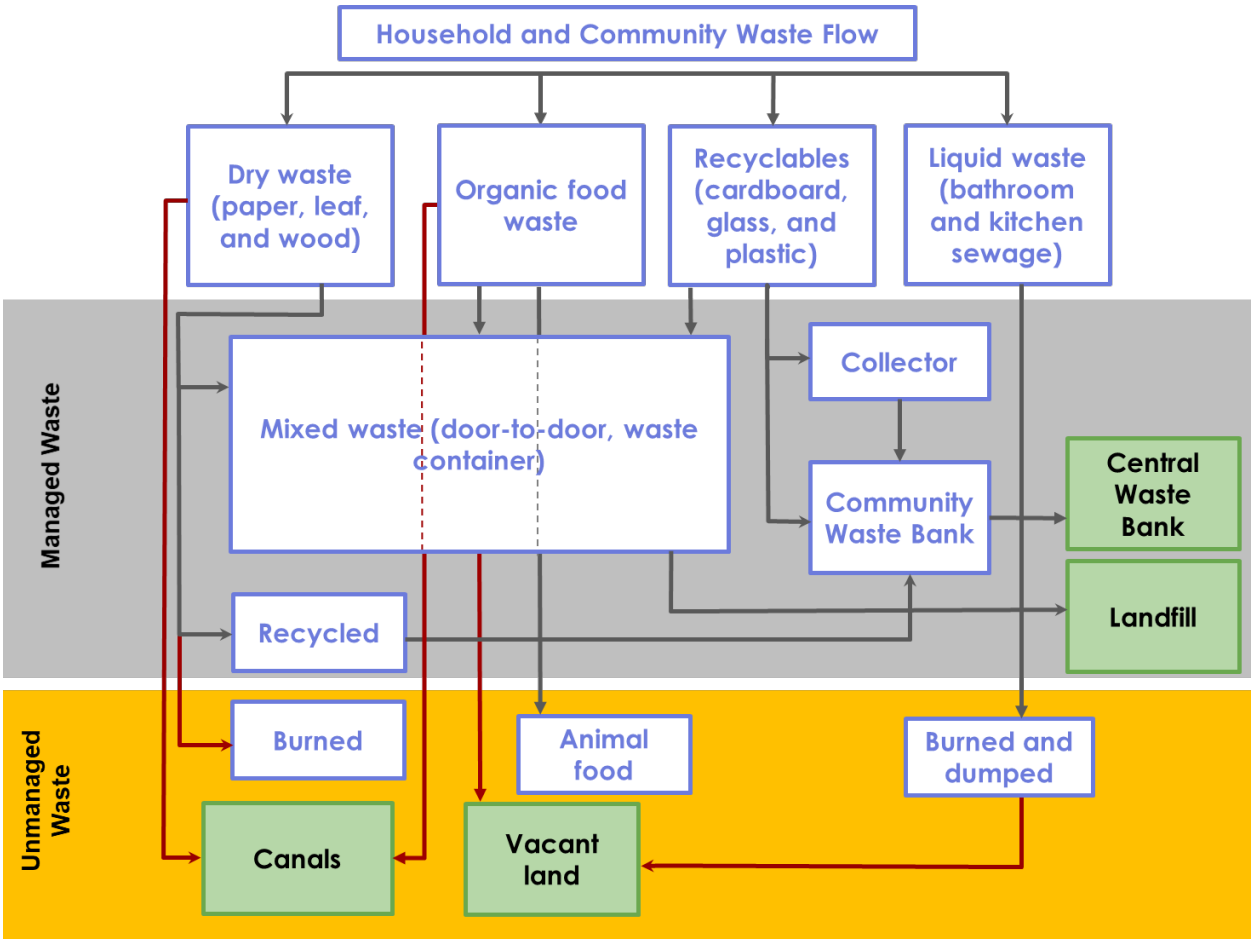


During the Data Walks, some residents said they were surprised food scraps were the largest category of waste. Some residents suggested that this food waste could be processed into compost instead.

Disposal of household waste was managed by various methods depending on the location of the home area. Door-to-door garbage collection and disposal in waste containers were the most common. From the survey, approximately 88 percent of households said they had some form of garbage collection service available in their

area and 79 percent said they used that service. Of those, 89 percent said they were satisfied with the services, and of those not satisfied, punctuality was the primary concern. Remaining waste was considered unmanaged (see Figure 3).

Figure 3. Flow of Waste Produced by Maccini Sombala Village Households



Door to Door Collection

Garbage is picked up from residents' homes, primarily by the municipality and village government, in one of three ways:

1. Pickup by a City Sanitation Department garbage truck three times a week. Households that use this service are generally those located near the main road. Because collection is not daily, residents store their waste in their own garbage bins; but with a wide variety of bins, some cannot keep out wild animals such as cats, dogs, or rats.

2. Pickup by the government and coordinated by the RW using a tricycle motorbike. This garbage pickup also occurs three times a week and serves residents whose homes are in narrow alleyways. These residents typically store

their waste in used plastic shopping bags, which are more likely to be spoiled by animals. Residents pay a waste management fee to the RT of between Rp 15,000 – Rp 20,000 (currently US$ 1–1.30) monthly.

3. Bicycle pickup by individuals, also for homes located in narrow alleys. This method is not managed by the government or RW. The cost varies and is sometimes paid in-kind rather than with cash.

Waste Container Collection

The government provides large waste containers in many locations and those close to the waste containers often find it easier to dispose of their waste directly into the container. Survey results indicated that approximately 22 percent of households had a container near their home. The containers are made of iron and are left half open so garbage often ends up outside the container. Because these containers are generally only picked up twice a month, biodegradable waste starts to smell and attracts disease-carrying pests and animals, impacting those living nearby. Residents who use these containers generally do not have to pay a fee.

Unmanaged Waste

Remaining waste is not picked up. Based on the results of social mapping, this condition occurred in several RWs. From the waste audit, approximately 77 percent of the total waste by weight was managed. Residents expressed enthusiasm for establishing more waste bins during the Data Walks.

This dynamic of unmanaged waste was not present in locations where CWBs were still active, especially in RW 6. The Head of RW 6, who is also the Director of the CWB, explained during the FGD that:

> *"I'm used to picking up plastic waste that is thrown away on the road and taking it home. This then makes my residents follow to collect garbage or throw it in the garbage bins."*

Residents' habit of littering changed after we came to discuss the results of the social mapping. During Data Walks, when residents were shown a map of the RW with unmanaged dumping points, several participants said that those waste disposal locations no longer existed because residents had cleaned them up due to greater awareness of the hazards. Further investigation is needed to see if this improvement continued without further support from the city to provide more waste bins. From the survey, 70 percent of households had participated in some sort of community or volunteer cleaning within the last year, though this also included street sweeping and green space improvements.

Recycling and Community Waste Banks

Only four percent of households had a recycling bin. Approximately 80 percent of households said they did not have a bin because there was no place to recycle items, while 10 percent said they did not like to recycle and 5 percent said they did not know how to recycle. From the qualitative data, it appeared that when recycling happened, it was via the CWBs.

All but RW9 established CWBs after the Waste Bank Decree was issued in February 2016, but only three were operational in RW3 and RW7. The COVID-19 pandemic significantly affected them due to difficulty recruiting staff and keeping customers and of the three CWBs that were operational, only one was still fully active as of January 2022. From the survey, 13 percent said someone from their household had joined a waste management agency in their area such as a CWB, which are meant to support 20-30 households and share profits. In one case, the head of the CWB bought groceries to be distributed to its members.

The CWB must weigh, clean, and store the waste until the Central Waste Bank comes to pick it up, which can take a long time. This is a threat to CWB sustainability for two reasons. First, CWB managers must store all the garbage on private land while they wait, which in one case led to a manager reporting that he got sick from living with all the waste. Second, customers do not get paid until waste is picked up and several managers complained that customers wanted their money right away and did not want to wait months for payment. One manager found that selling to independent waste buyers was more profitable than selling to the Central Waste Bank.

> *"The [CWB] in our RW is no longer active. For that, we hope that this Waste Bank can be rebuilt. Because I see in other RWs that still have active Waste Banks, they are able to manage waste well and I believe it can and is easy to do together."* – KR, resident of RW 1 and Data Walk participant

Two CWB managers said that having a plastic chopping/shredding machine would help them increase profits and reduce storage space needs. One CWB was also building a composting business from household waste to cultivate worms to sell, as they believed this was more lucrative than selling recyclables.

> *"I manage a [CWB], especially kitchen waste that can be composted. With compost I can develop a worm business and it is also very useful for farming. If all residents could use compost, they would be able to save their living costs by using land for farming, even on a narrow area."* – Director of the RW 3 Community Waste Bank

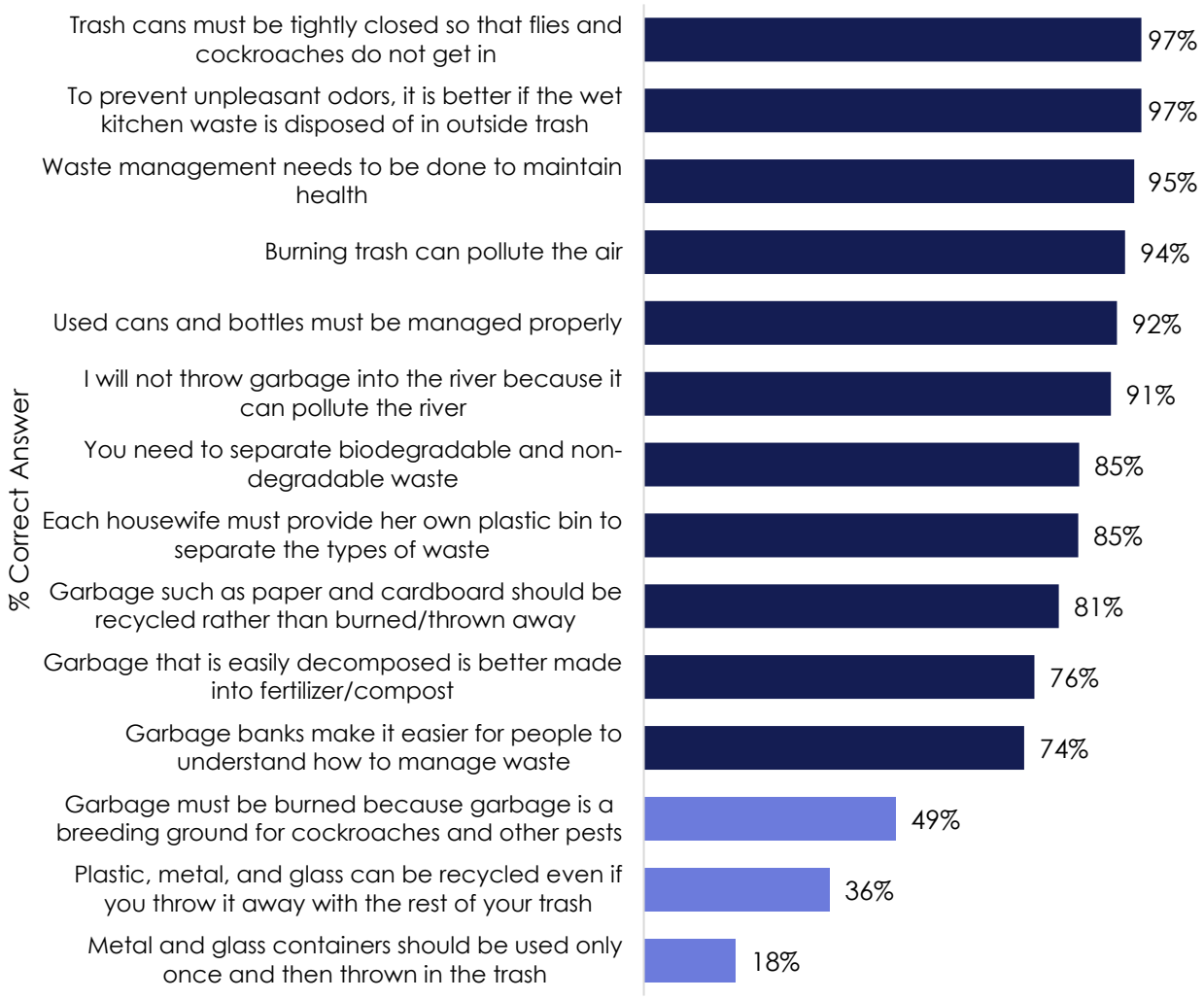
Since the pandemic began, this CWB mentioned in the quote was no longer active. When asked about what needed to be done to re-start the CWB, one manager

indicated that the problem was that "we don't pay attention to the needs of the people living in the area." This indicates the importance of designing a payment system that better suits the financial and waste management needs of each community.

Knowledge on Waste Management

In the survey, households were asked general knowledge questions about waste. Figure 4 shows the results. Respondents had high levels of understanding of general waste hygiene topics but lower levels of understanding of concepts related to recycling and reuse.

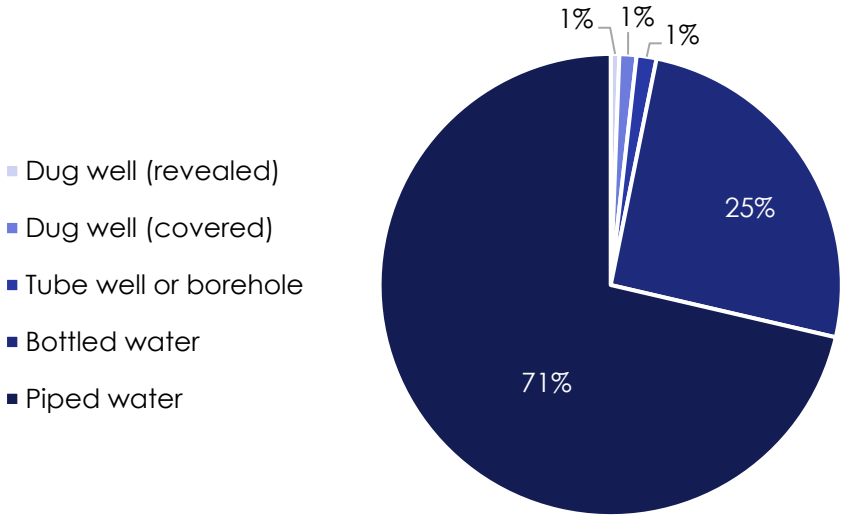
Figure 4. Knowledge of Good Waste Management Practices (n=504)



What is the current situation regarding water in Maccini Sombala village?

The survey provided details about the state of water in Maccini Sombala village. Piped water was the primary source of water on a daily basis but 25 percent of people reported also relying on bottled water (see Figure 5). This generates a considerable volume of plastic waste.

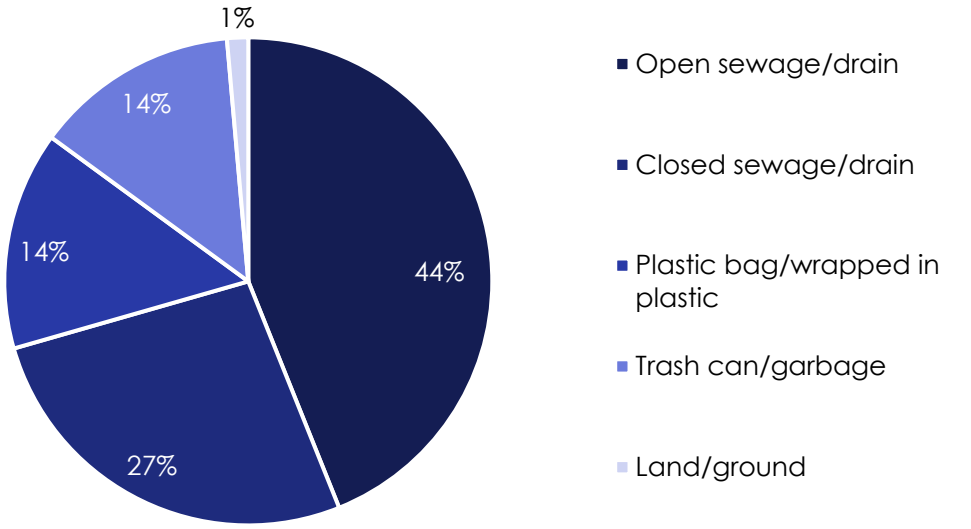
Figure 5. Primary Daily Water Sources (n=504)



While 97 percent of respondents said they had drinkable water in the last month, 62 percent said they had treated their water before drinking. Boiling was the most common form of treatment (77 percent), followed by use of some type of filter (9 percent). One quarter of respondents reported that they were not fully satisfied with their current water services, mentioning poor taste and smell, limited access hours, high costs, and sickness from drinking the water as common problems.

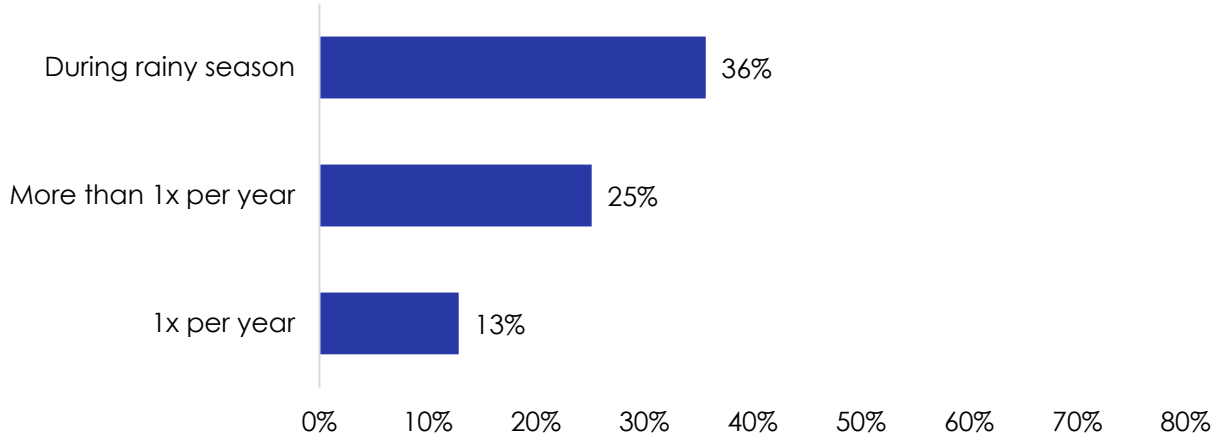
In terms of wastewater, 98 percent of households surveyed had a toilet of some sort. The most common sewage management system was open drains (Figure 6, 44 percent), followed by closed drains (27 percent) then plastic bag disposal and garbage disposal, both at 14 percent. This could explain the liquid waste described in the waste flow diagram in Figure 3.

Figure 6. Sewage Management Systems in Maccini Sombala Village (n=429)



One third of respondents reported that their drains have clogged. The range of answers on frequency were not mutually exclusive, but the most common answers are shown in Figure 7. Approximately 36 percent of those with blocked drains reported that it happened during the rainy season, while one quarter reported that it happens more than once a year.

Figure 7. Frequency of Drain Blockage (n=171)



Some areas of Maccini Sombala village experienced regular flooding every year, especially in the rainy season. As indicated on the seasonal calendar, floods occurred in all RWs except RW 9. Flooding was partly due to poor drainage and sewer management and residents reported that ditches near their homes were often narrow and clogged.

This issue was exacerbated by delayed or incomplete cleaning of sewage systems. Over half of survey respondents said they were responsible for cleaning the drains while

33 percent reported a combination of cleaning the drains and working with community groups to clean them. Only 15 percent reported that the municipality cleaned drains. During Data Walks, several residents explained that it was hard to clean most of the permanently closed drains as they were difficult to access. **Half of respondents (49 percent) also reported that there were visible blockages or buildup of solid waste in the drains nearest their homes.** While 60 percent reported that this was a nuisance, 37 percent reported that their primary concern with the poorly functioning drains was the risk of their home flooding.

How is poor waste and water management affecting human health?

Survey results showed that 32 percent of respondents reported suffering from digestive tract diseases, 16 percent from respiratory issues, 22 percent from skin diseases, and 3 percent from dengue fever (see Table 1).

Table 1. Recent Health Conditions in Maccini Sombala Village

Of those who had:	Percent reporting experienced in the last 3 months (%):	Percent reporting experiencing during a flood (%):
Digestive tract disease (n=161)	81	20
Respiratory issues (n=81)	85	17
Skin diseases (n=110)	91	41
Dengue fever (n=14)	7	23

Of those who said they had experienced any of these conditions, it appeared that skin diseases were most likely to occur during floods (41 percent) and with the exception of most cases of dengue fever, reported health issues had occurred in the previous three months. Households with children had no statistically increased risk of a family member having any of the four health conditions, but incidence of diarrheal disease during a flood was higher for households with young children (25 percent) versus those without (17 percent).

Table 2 sheds light on respondent knowledge of the interaction between health conditions, waste, and wastewater. Green indicates the correct answer.

Table 2. Knowledge of Interactions between Waste, Wastewater, and Health (n=504)

Knowledge questions	True	False
Diarrhea is one of the digestive tract diseases.	94%	6%
The location of a garbage bin can affect the bacterial contamination of food.	91%	9%
Floods cannot affect the incidence of diarrhea.	37%	63%
Burning garbage can pose a risk of respiratory problems.	94%	6%
Garbage that accumulates can be harmful to respiratory health.	94%	6%
Floods have an impact on skin diseases.	94%	6%
Dengue fever can be transmitted by mosquitoes.	98%	2%
Bathtubs are a breeding ground for mosquitoes.	98%	2%
Flood events have no effect on increasing the mosquito population.	43%	57%
3M sanitation activities (draining, closing, burying) are not methods of dengue fever prevention.	40%	60%

Most people answered correctly where the correct answer was "true," which may mean either they knew the answers to the questions or they were more likely to answer "true" than "false." Only 63 percent correctly answered that floods can influence diarrhea, while 57 percent knew that flooding can increase the mosquito population. A similar number of respondents knew that 3M sanitation activities (draining, closing, burying) help prevent dengue fever.

During Data Walks, residents assumed that most in their communities were used to interacting with sewage (liquid waste), especially during floods. Some residents said that skin diseases were one of the most common impacts from sewage during rains and floods, but that they were not considered serious illnesses.

> *"Some RTs in my RW are always flooded when it rains heavily or when the sea water overflows. So far, no residents have reported being seriously ill due to flooding. Generally, they experience skin diseases due to unclean water, especially body parts that are always submerged in water."* – JH, resident of RW 4 and Data Walk participant

Most respondents (79–83 percent across all health conditions) reported they could afford to go to a health care facility for any of these four health conditions. Nearly all (95 percent) said they felt they had easy access to a health facility, 79 percent said

they had a health facility in their own RW, and 90 percent were either satisfied or very satisfied with their health facilities.

Despite high reported levels of affordability and accessibility, 12 percent had no health insurance. Of those with health insurance, 45 percent used Indonesia's universal health insurance (BJPS), 51 percent used the health insurance provided for the poor, and the remaining had a combination of these two or some other form of insurance.

What do residents identify as possible solutions to these issues? What elements of a waste-resilient or more circular waste system would be acceptable and sustainable for the Maccini Sombala village?

Several themes point to how waste and wastewater management can be improved in Maccini Sombala village.

Improving Regular Waste Collection

Punctuality was the biggest concern for residents regarding the current waste management system. The quality of garbage collection needs to be improved by having a consistent pickup schedule. In addition, the issue of pest infestation and animal intrusion was a common concern. Residents suggested that the government or the private sector could help by providing low-cost animal and pest-proof garbage bins that can store household waste outside of homes. In the social mapping discussions, the study team heard that garbage bins without lids, which allowed garbage to both get wet and blow into the streets and drains, were a problem during the rainy season.

Reviving Waste Banks

For CWBs to work, community members stressed that the CWBs need to not only invite residents to become customers and help collect and sort waste, but also tailor returns on investment to customer needs. For example, providing immediate payment when waste is deposited is important, especially for lower- and middle-income households. Residents reported not always being able to wait for payments for a month or longer, especially when the schedule for waste purchase and pickup by the Central Waste Bank is so erratic. During the FGD and Data Walks, the study team heard that some residents and CWB managers hoped that the CWBs could partner with grocery stores to provide in-kind payments for daily needs at the time of waste deposit, and then be reimbursed by the Central Waste Bank later. Community members also suggested that the government could connect the food stamp system to the waste exchange system to meet household food needs for lower- and middle-income households.

During the FGD, CWB managers reported that customers also saw discrepancies in waste weight at the CWB and the Central Waste Bank and felt cheated since the reported weight was often lower at the Central Waste Bank. This created delays in paying community members and was demoralizing for staff at CWBs, where staffing shortages were already common. Other recommendations included paying residents to run the CWBs and/or providing machines to process recyclables with fewer staff.

Another obstacle for the CWBs in Maccini Sombala village is the lack of land. To address this and increase the profit margin from plastic, managers have requested plastic shredders. Managers have also requested support to increase management, resource, and supporting equipment capacity as well as financial capital to ensure CWBs are sustainable.

> *"I believe this Waste Bank can still develop. We need a lot of help and mentoring to help us keep going. If possible, we are taught with training in flower arrangement from plastic waste. We also need plastic waste shredder or other trainings that can help us manage or recycle waste to be more valuable."* – KDM, Director of the RW 3 CBW and FGD participant

This support could come from the government or private companies could buy plastic from CWBs to turn into concrete to sell to customers.

Changing Sewer Drain Design

Residents found it very difficult to clean sewers because they are either narrow or covered in concrete. Makassar City is working to cover more open drains with concrete but this will make it harder for residents to clean the sewers. Respondents suggested that if sewers are to be covered, the covers should be removable so cleaning is successful. They also noted that dredging of sewers in flood-prone locations should be done regularly, especially during the rainy season. This dredging can be completed by RW residents with equipment support from the Makassar Municipality government.

Residents also suggested the city should support public awareness about problems associated with the disposal of solid waste in sewers. In conjunction with awareness raising, community members also suggested that the government provide garbage bins in certain locations to minimize residents throwing garbage into sewers. The bins should have a closed design so that they cannot be easily dismantled by wild animals and should be resistant to heat and rain. Village garbage workers should pick up and dispose of garbage regularly.

Greater Posyandu Support

While not directly related to waste and wastewater, when the study team discussed some of the health and food waste findings during the Data Walks, residents had

several suggestions relating to posyandus (integrated health service posts), which are operated by the district and provide community health services. The posyandus offer maternal health services including pregnancy and postpartum check-ups, nutrition services, and tetanus immunizations as well as routine services for infants and the elderly. During Data Walks, women reported that there was not enough support from the government for certain RW posyandus or their related awareness activities to increase growth monitoring, pregnancy check-ups, and other maternal and child health services. They also indicated that posyandus needed more support for items such as baby formula and ready-to-use therapeutic food to address stunting, and suggested they could address concepts relating to the interaction of waste and health during monthly events.

Reusing Food Waste for Urban Farming

During Data Walks, women saw opportunity in the fact that the majority of household waste was food waste. They indicated that they could make compost with this waste, which would increase urban farming and therefore improve food supply and nutrition, and that there could be opportunities to test the urban farming concept in conjunction with posyandus.

> *"We just realized that the waste we produce from households is mostly food waste. In my opinion, this is an opportunity for it to be developed into compost and help fertilize plants in gardens managed by several residents."* – R, an officer of Health Community Center and Data Walk participant

Depending on how it is set up, urban farming could also reduce household food costs and/or create a source of income for women.

Improving Access to Drinking Water

Survey results indicated that there was relatively low satisfaction with water services, with one quarter of residents relying on bottled water for their daily water needs because of poor water quality. Residents indicated that they had registered complaints with the government water company and asked the government for both water tanks and drinking water facilities to be installed to increase accessibility and reduce the use of plastic bottles, but had received no response. Residents need help to advocate for these issues to be addressed.

> *"I suggest that the government should provide water tanks in strategic places where the water provided is drinkable. This of course can reduce the purchase of bottles or glasses of mineral water which will become a source of waste."* – I, resident of RW 5 and Data Walk participant

> *"The government should provide water taps at public space locations, such as at Losar Beach or Karebosi Field."* – MA, resident of RW 9 and Data Walk participant

Some residents mentioned that creating handwashing stations near drinking fountains could also help change people's hygiene behaviors.

3Rs Education Campaigns

Community members who participated in Data Walks discussed the need to change the culture of throwing away garbage. Some suggestions included:

- Placing garbage bins in front of households so children will see them and put waste there instead of on the street or in drains.
- Holding a workshop two times a year with the CWB to train household members about the 3Rs as well as about composting and recycling wastewater for livestock and gardens.
- Providing 3Rs training to encourage households to break down and clean 3Rs household waste, especially garbage from the kitchen, to prepare it for recycling or reuse.

> *"We know the city has many "smart" programs, but the culture of the community hasn't caught up to those "smart" solutions when it comes to the environment."* – Housewife in RW 1 and Data Walks participant

Discussion

This participatory study focused on identifying waste management issues and local solutions in Maccini Sombala village, where current household waste management is largely reliant on disposal of mixed waste at the landfill. While most household waste collection was managed by the City of Makassar government, CWBs were managed independently and some collection was completed by private collectors. Residents of Maccini Sombala village generally did not use a sorting system to separate organic and inorganic waste, which reduced the efficiency of the system and drew pests and animals to household garbage bins.

Up to 90 percent of all waste that was audited was potentially recyclable, reusable, or compostable. As noted in previous research (Fatmawati et al. 2022), re-establishing CWBs with community needs in mind will encourage recycling. However, if CWBs are successful in expanding, the capacity of the Central Waste Bank and private recycling companies will also need to expand to take in this waste.

Nearly half of surveyed households said they had seen solid waste blocking or clogging their sewer drains. They reported that the rainy season exacerbated this issue and that the city's efforts to cover drains may have created even more blockages and made drain cleaning more difficult, as covers are not removable. These issues have led to greater household flooding, which has coincided with a reported increase in skin diseases and cases of diarrhea. Dissatisfaction with water services was driven by unpleasant taste and smell, limited access, cost, and the perceived risk of sickness. This dissatisfaction drove greater use of plastic bottles of water, which in turn increased solid waste. CWBs will need equipment such as plastic shredders to better deal with this waste stream.

The participatory aspects of this study provided community members the opportunity to engage in study design, data collection, and data analysis. Residents, especially women, participated throughout the study process and provided insights about how to work with local customs and elicit information on challenges faced at the household level.

Residents expressed appreciation for this study approach, including how results were shared. One resident said:

> *"This study made us aware of the various weaknesses of waste management in our area. For that, we really hope that the results of this study can be followed up with programs that can help us solve the problem of waste management in our village."* – MU, resident of RW 8 and Data Walk participant

Another resident expressed that:

> *"LSKP has become part of our family in this area. We really hope that this study activity does not end here. We will always be willing to help and cooperate for programs that help us solve waste problems and also the economic problems of our residents who are partly large is from the lower middle economy."* – R, resident of RW 2 and Data Walk participant

In 2021, garbage bins with different colors were created to help people sort their waste appropriately. Further expansion of city initiatives is needed, and we hope that suggested solutions identified by Maccini Sombala village residents will be considered in the design of new initiatives. In particular, support for revival and expansion of CWBs appears vital to improve waste management in Makassar.

Limitations

While the study was carried out with a high level of adherence to the protocol, we did face some limitations and had to adjust the work to fit the local context. While we had strong participation from most RWs, it was difficult to secure participation from RW 9. This

residential area was built by a property company in the Maccini Sombala village and has a separate town management structure. Most RW 9 residents are upper-middle class and work for private companies or are entrepreneurs. Residents in RW 9 found it difficult to find time to attend community meetings and engage in this study.

We addressed this limitation by inviting household staff to attend meetings. Staff are often responsible for cooking and managing the cleanliness of the house and yard, so have an important role in waste production and management. To triangulate data collected from household staff, enumerators also conducted interviews with RW 9 residents at their house of worship after they finished their worship activities.

Community members were enthusiastic about sharing their health concerns related to waste and environmental management. While this discussion was outside of the original scope of the study, it generated important insights to improve the health status of women and children, including increasing the government's support for Posyandus and having health workers carry out awareness activities. We have included this information as it relates to the study goals of a healthier Makassar.

For some Makassar residents who are ethnically Bugis (the majority in Maccini Sombala village), information sharing related to the kitchen, including their household habits, is sensitive. As such, our study team had to build trust with them and using local enumerators was very helpful. By using local enumerators who understood the context and local language, this helped to assure the residents it was safe to share this information. Effective trust building resulted in 30 percent of all surveyed households participating in the waste audit.

Conclusions

Based on the results of this study, Smart City Makassar, the Mayor's office, and other key city organizations now have useful citizen-led feedback about ways to reduce waste and flooding and create sustainable, circular economies for waste in Maccini Sombala village and similar neighborhoods across the city. It is our hope that all parties work together to integrate these suggested solutions into future work.

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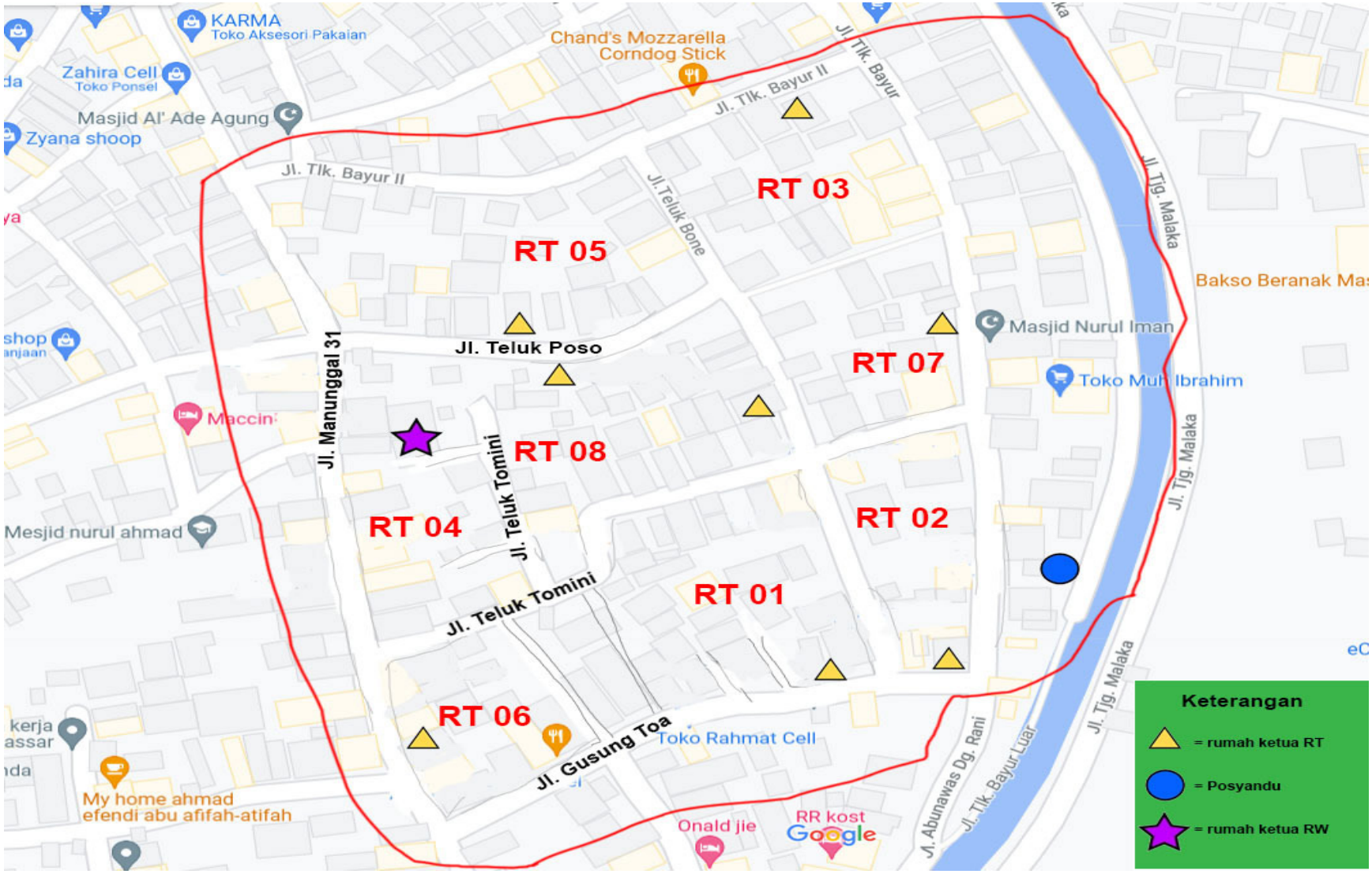
Annex 1: Community Maps

Map of RW 1

Map of RW 2


KARMA
Toko Aksesori Pakaian
Zahira Cell
Toko Ponsel
Masjid Al' Ade Agung
Zyana shoop
Chand's Mozzarella
Corndog Stick
Jl. Tlk. Bayur II
Jl. Tlk. Bayur
Jl. Tlk. Bayur II
Jl.Teluk Bone
RT 03
RT 05
Jl. Tjg. Malaka
Bakso Beranak Mas
Masjid Nurul Iman
Jl. Teluk Poso
RT 07
Toko Mul Ibrahim
Maccin
Jl. Manunggal 31
Jl. Teluk Tomini
RT 08
RT 04
RT 02
Mesjid nurul ahmad
Jl. Teluk Tomini
RT 01
Jl. Tjg. Malaka
RT 06
Jl. Gusung Toa
Toko Rahmat Cell
My home ahmad
efendi abu afifah-atifah
Onald jie
RR kost
Google
Jl. Abunawas Dg. Rani
Jl. Tlk. Bayur Luar
Keterangan
= rumah ketua RT
= Posyandu
= rumah ketua RW

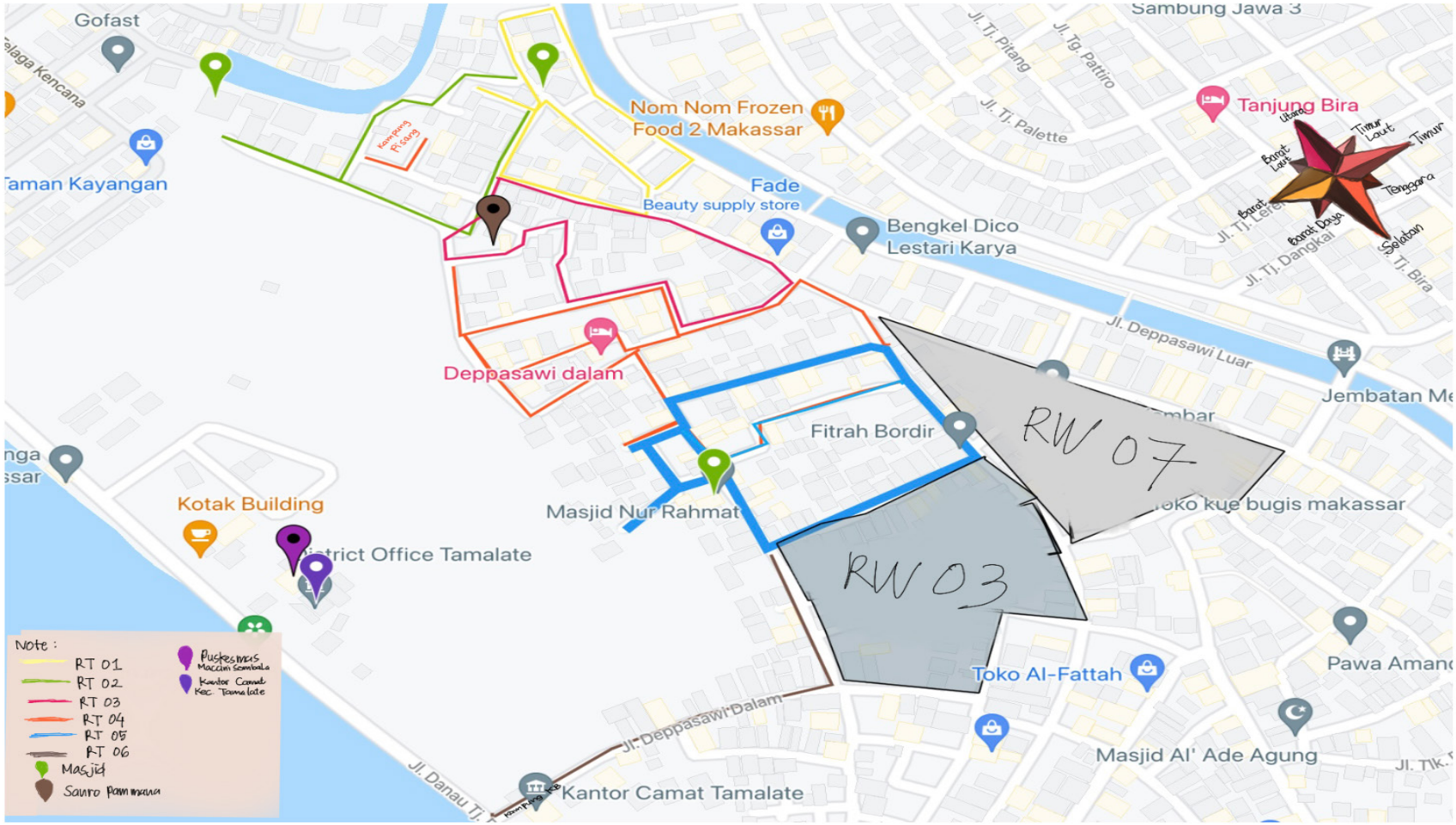
Map of RW 3


Jl. Danau Tanjung Bunga
Kampung KB
RW 05
RT 10
Jl. Deppasawi Dalam
Jl. Deppasawi Dalam
RT 12
RT 11
Lr. 7
RT 09
RT 01
RT 12
RT 01
RT 11
RT 08
RT 07
RT 05
RW 07
Lorong KB
Lr. 6
RT 02
RT 03
RT 07
RT 06
Lr. 1
RT 09
RT 08
RT 05
Lr. 5
Lr. 4
Lr. 3
Lr. 2
RT 06
Jl. Manunggal 31
RW 08
RT 04
RW 07
B
U
S
T

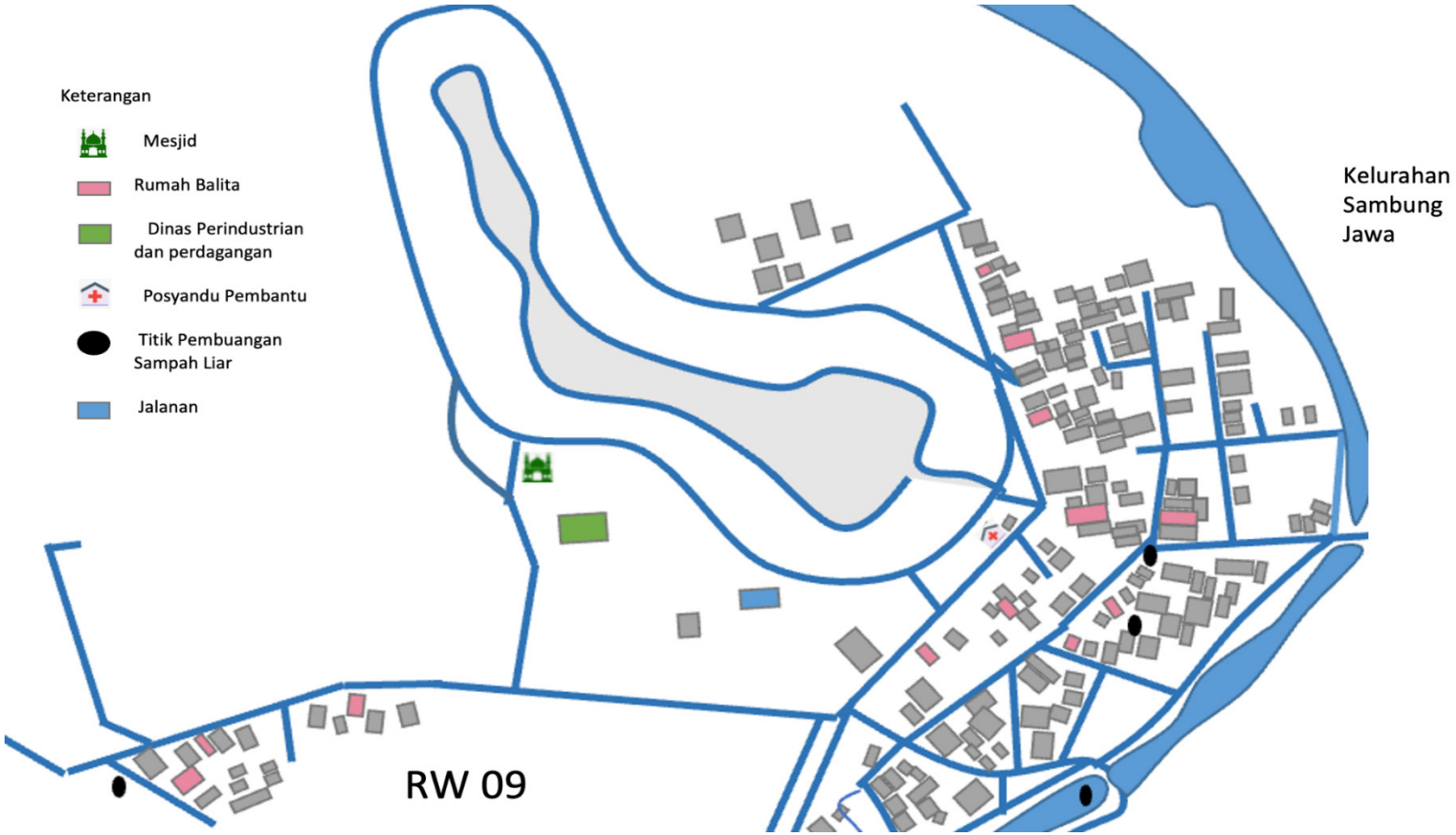
Map of RW 4


Jl. Tlk. Bayur
Jl. Tlk. Bayur II
Jl. Tlk. Bayur Dalam
Teluk bayur
RT 08
RT 09
RT 07
RT 02
RT 06
RT 03
RT 01
RT 05
RT 04
RW 003
RW 008
RW 002
Masjid Al' Ade Agung
Rumat RT
Posyandu
Klinik
Masjid

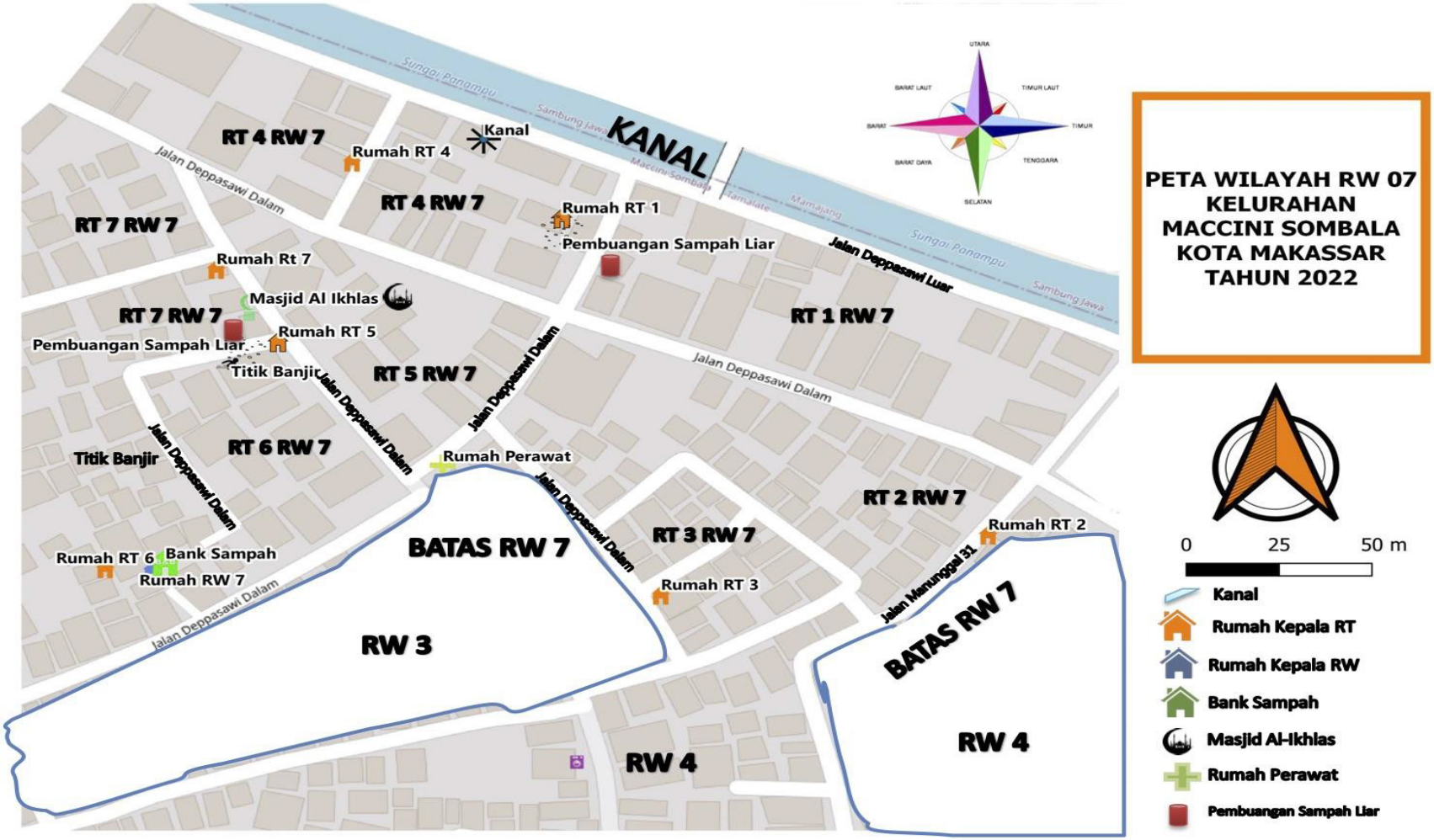
Map of RW 5


Gofast
Taman Kayangan
Nom Nom Frozen Food 2 Makassar
Fade
Beauty supply store
Bengkel Dico Lestari Karya
Tanjung Bira
Deppasawi dalam
Fitrah Bordir
Masjid Nur Rahmat
Kotak Building
District Office Tamalate
Jl. Deppasawi Luar
Jembatan Me
RW 07
RW 03
Toko kue bugis makassar
Toko Al-Fattah
Pawa Amano
Masjid Al' Ade Agung
Jl. Deppasawi Dalam
Jl. Danau Ti
Kantor Camat Tamalate
Sambung Jawa 3
Jl. Ti. Pitang
Jl. Tg. Pattiro
Jl. Ti. Palette
Jl. Ti. Dangkai
Jl. Ti. Bira
Note :
RT 01
RT 02
RT 03
RT 04
RT 05
RT 06
Masjid
Sauro Pammanu
Puskesmas Maccini Sombala
Kantor Camat Kec. Tamalate

Map of RW 6


Keterangan
Mesjid
Rumah Balita
Dinas Perindustrian dan perdagangan
Posyandu Pembantu
Titik Pembuangan Sampah Liar
Jalanan
RW 09
Kelurahan Sambung Jawa

Map of RW 7

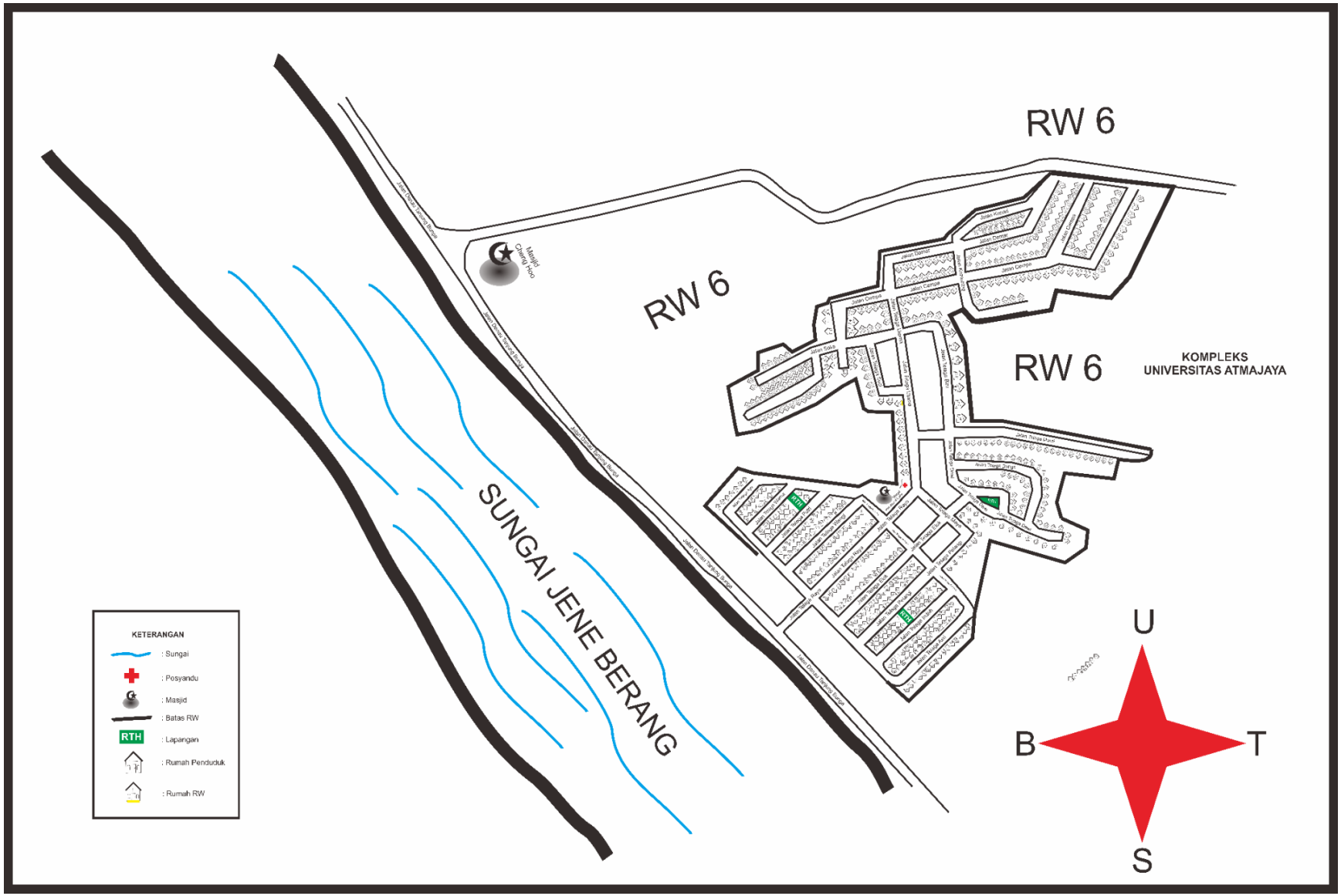

PETA WILAYAH RW 07
KELURAHAN
MACCINI SOMBALA
KOTA MAKASSAR
TAHUN 2022
KANAL
Kanal
Rumah RT 4
RT 4 RW 7
RT 7 RW 7
Rumah RT 1
Pembuangan Sampah Liar
Rumah Rt 7
Masjid Al Ikhlas
Rumah RT 5
Titik Banjir
RT 5 RW 7
RT 1 RW 7
RT 6 RW 7
Rumah Perawat
RT 2 RW 7
RT 3 RW 7
Rumah RT 2
Rumah RT 6
Bank Sampah
Rumah RW 7
BATAS RW 7
Rumah RT 3
RW 3
RW 4
Jalan Deppasawi Dalam
Jalan Deppasawi Luar
Jalan Manunggal 31
Sungai Panampu
Sambung Jawa
0
25
50 m
Kanal
Rumah Kepala RT
Rumah Kepala RW
Bank Sampah
Masjid Al-Ikhlas
Rumah Perawat
Pembuangan Sampah Liar

Map of RW 8


Rumah Rt 5
Rumah Rw 8
Tk
Rumah Rt 6
Rumah Rt 3
Rumah Rt 2
Pembuangan Sampah Liar
Masjid Nurul Haqqi
Masjid Al Ikhlas
Pembuangan Liar 2
Rumah Rt 4
Rumah Rt 1
Jalan Gusung Taa
Jalan Tanjung Merdeka
Jalan Manunggal 31


PETA WILAYAH RW 08
KELURAHAN MACCINI SOMBALA
KOTA MAKASSAR
TAHUN 2022
Keterangan
Masjid
Pembuangan Sampah Liar
Rumah Kepala Rt
Taman Kanak-kanak

Map of RW 9


RW 6
RW 6
RW 6
KOMPLEKS
UNIVERSITAS ATMAJAYA
SUNGAI JENE BERANG
KETERANGAN
: Sungai
: Posyandu
: Masjid
: Batas RW
RTH
: Lapangan
: Rumah Penduduk
: Rumah RW
U
B
T
S

Annex 2: Seasonal Calendar

No	Seasons	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	Rainy season	***	**	*							*	**	***
2	Transition		*	**	***					***	**	*	
3	Dry season					**	***	***	**				
4	Fruit season (mango, durian, langsat, rambutan)	***	**	*									
5	West season (related to fishing)	**	**	*								***	***
6	East season			*	**	***	***	**	*				
7	Party season (wedding, Aqiqah event, Thanksgiving)		*	**	***		***	**	*		*		
8	Islamic religious events (Ramadan, Eid Al-Fitr, Eid Al-Adha, Maulid)				***	***		**			***		
9	Christmas and New Year	**											***

* means low risk; ** means considerable risk; *** means severe risk

No	Season	Disadvantages	Advantages
1	Rainy season	- Puddles are found in the streets, hallways, alleys, squares, and courtyards of the house. In the event of heavy rainwater people's homes are flooded. - Worms will be more common in rivers and canals. - Vomiting, fever, hives, ulcers, flu, and cough are common. There are also people who have dengue fever and cholera. - Children take rain baths and play in puddles. Children also swim in the canal in the rainy season and at high tide. - The volume of waste in the canal increases.	- Integrated health centers - Public health centers - Clinics - Waste banks - Citizen organizations - Canal scavengers - Waste trucks - Janitors
2	Transition	- Flu and cough are common.	- Integrated health centers - Public health centers - Clinics
3	Dry season	- Flu and cough are common. - Communities experience drought, foul smelling water, and dying plants.	- Integrated health centers - Public health centers - Clinics - PDAM service (tank water)
4	Fruits season (mango, durian, langsat, rambutan)	- Vomiting and cholera are common among children. - The volume of fruit waste increases and scatters.	- Integrated health centers - Public health centers - Clinics - Waste trucks - Janitors
5	West season (related to fishing)	- Unemployment increases due to fishermen not going to sea and bricklayers and day laborers not working. - The price of fish is expensive.	- BRI People's Business Credit (PBC) - District Revolving Fund - District Cooperative
6	East season (related to fishing)	- It is difficult to secure a loan as capital to go to sea. - Families are left in debt. - The selling price of fish decreases.	- BRI People's Business Credit (PBC) - District Revolving Fund - District Cooperative - Marine processing crafts
7	Party season (wedding, Aqiqah event, Thanksgiving)	- Savings and community food production are used up for party expenses. People with inadequate savings tend to look for loans with	- BRI People's Business Credit (PBC) - District Revolving Fund - District Cooperative

		loan sharks who charge high interest rates. - The volume of waste increases, so it costs more to transport party waste. - The volume of waste in the canal increases.	- Waste banks - Waste trucks - Janitors
8	Religious events and New Year (Ramadhan, Eid Al-Fitr, Eid Al-Adha, Maulid, Christmas, New Year)	- The volume of waste increases so it costs more to transport. - A lot of waste is strewn because of the large number of seasonal food vendors. - The volume of waste in the canal increases.	- Waste banks - Waste trucks - Janitors - Traveling scavengers

Annex 3: Survey Household Characteristics and Survey Tools

Demographic information of households sampled for survey:

Head of Household Education	
Less than elementary	7%
Elementary school graduate	18%
Junior high school graduate	26%
Senior high school graduate	37%
More than high school	12%

Household Members	Mean	*Min*	*Max*
Number of household members	*5*	*1*	*15*
Number under 5 years old	1	*0*	*7*

Monthly Expenses	
Less than Rp 500,000	2%
Rp 500,000 - 1,000,000	14%
Rp 1,000,000 - 3,000,000	66%
More than Rp 3,000,000	17%
Don't know	2%

Individuals Who Responded for Each Household	
Married	81%
Average age	44 years old
Female	86%
Laborer was head of household's occupation	44%

HEALTH IMPACT URBAN WASTE MANAGEMENT STUDY IN MAKASSAR

CASE STUDY: MACCINI SOMBALA VILLAGE

Enumerator Name	
Date of Interview	

The interview will take a few minutes and the answers will be completely confidential for academic purposes only, namely to research health impacts. This interview aims to find out what factors influence health in Maccini Sombala village. Your feedback can assist policymakers in formulating policies that are following the existing health conditions in Maccini Sombala village.

Therefore, please answer questions honestly. Your participation is voluntary, you will not lose any privileges, benefits, or services if you choose not to participate. You can also choose to not answer certain questions if you are uncomfortable with them, or end the survey at any point. ***Can you verbally confirm your willingness to participate in this survey (Enumerator waits for response – if no, survey ends)?***

This study is conducted by Lembaga Studi Kebijakan Publik (LSKP) in collaboration with the City Government of Makassar and JSI Research & Training Institute, Inc., which is supported by USAID.

If you need more information about the study, you can contact us at +62 821-9156-6770 or send email to office.lskp@gmail.com.

INDIVIDUAL QUESTIONS

Sub - district :
Urban Village :
Neighborhood/Hamlet (RT/RW) :
Household number (use code) :

RESPONDENT CHARACTERISTICS

Respondent Initial Name :
Phone/No. WA Respondent :

1. Age : __ __ Years (If Less Than 18, Interview Ends)
2. Gender : Male (=0) Female (=1)
3. Marital status : Married/long-term cohabitation (=0)
   Single (=1)
   Widowed/Divorced (=2)

Education Level :

4. Of Respondent:
   0. No Schooling
   1. Unfinished Primary School
   2. Finished Primary School
   3. Finished Junior High School
   4. Finished Senior High School
   5. Finished University at Bachelor Degree
   6. Finished University at Master Degree
   7. Finished University at Doctoral Degree
   8. Others……..

5. Of Highest educated Household member:
   0. No Schooling
   1. Unfinished Primary School
   2. Finished Primary School
   3. Finished Junior High School
   4. Finished Senior High School
   5. Finished University at Bachelor Degree
   6. Finished University at Master Degree
   7. Finished University at Doctoral Degree
   8. Others……..

6. What is the Job of the Head of Household:
   0. Jobless
   1. Farmer
   2. Fisherman
   3. Laborer (other than farmer or fisherman)
   4. Housewife
   5. Professional/ Entrepreneur (Private Sector)
   6. Government Employee
   7. Student
   8. Other: _____

HOUSEHOLD CHARACTERISTICS

Total number of household members : ___ ___ people (adults and children)

How many household members are under 5 years old? : ___ ___ children

7. What are your average Household Expenses per month?
    0. Less than Rp. 500,000
    1. Rp. 500,000 – Rp. 1,000,000
    2. Rp. 1,000,000 – Rp. 2,000,000
    3. Rp. 2,000,000 – Rp. 3,000,000
    4. More than Rp. 3,000,000
    5. I don't know (code: 99)

Please can you describe your household's access to the following:

Question Number	Attribute	Yes (=1)	No (=0)	I don't know (=99)
8	Computer with Internet			
9	Smart Phone			
10	SMS Phone or Landline Phone			
11	Radio			
12	Television			
13	Newspaper			
14	Refrigerator			
15	Bicycle			
16	Motorbike			
17	Car			
18	Air conditioner			

19. What kind of mass media do you feel is used most often by you and your family?
    1. Radio
    2. Television
    3. Newspaper
    4. Social media
    5. others…….
    6.
20. Have you heard any messages on any mass media relating to water, sanitation and waste management in the last week?
    0. No
    1. Yes
21. What was that message about? _____

LATRINES AND WATER ACCESS			
22	What type of water source do you needs to use in your daily drinking?	Improved 1. Piped Water (Into Dwelling, Yard/Plot, or Via Neighbor) 2. Public Tap/ StandPipe 3. Tube Well or Borehole 4. Dug Well (covered) 5. Dug Well (Uncovered) Unimproved 6. Rainwater 7. Tanker Truck 8. Cart With Small Tank 9. Surface Water (River/ Dam/ Lake/ Pond/ Stream/ Canal/ Irrigation Channel) 10. Bottled Water 11. Other_____	
23	If purchasing water, how much do you spend on this per month?	(list in Rp.)	
24	In the last month, has there been any time when your household did not have sufficient quantities of drinking water when needed?	0. No 1. Yes	
25	Do you have a water reservoir for storage?	0. No (continue to Q27) 1. Yes (Continue to Q26)	
26	If yes, does the water reservoir in your house use a cover?	0. No 1. Yes	
27	Do you do anything to the water to make it safer to drink?	0. No 1. Yes	
28	In your opinion, why is the water not safe to drink without treatment?	(Write in Response)	
29	What do you usually do to make the water safer to drink?	1. Boil 2. Add bleach/ Chlorine Strain Through a Cloth 3. Use water filter (ceramic, sand, composite, etc.) 4. Solar Disinfection 5. Let it stand and settle 6. Other_____ 7. I don't Know (=99)	

30	Overall, how satisfied are you with your access to clean water supply?	1. I am fully satisfied with my water supply 2. Not satisfied, because it makes you sick 3. Not satisfied, Taste and smell 4. Not satisfied, Cost too high 5. Not satisfied, Limited access hours 6. Not satisfied, Others (Please specify)_____	
31	Do you have a latrine at home?	0. No (continue to Q33) 1. Yes (Continue to Q32)	
32	If yes, what type of latrine do you use?	1. Flush to piped sewer system 2. Flush to septic tank 3. Flush to pit latrine 4. Flush to somewhere else 5. Pit latrine/ventilated improved pit latrine 6. Pit latrine with slab/open pit 7. Pit latrine without slab/open pit (bucket/other) 8. Composting toilet	
33	Is there a sewage/sewer system available in your area?	0. No 1. Yes	
34	If yes, what kind of sewage system is it?	1. Open Sewage/Drain 2. Closed Sewage/Drain 3. Land/ground 4. Semi-permanent Sewage 5. Other, please specify	
35	Are the water supply lines passing through the sewage?	0. No 1. Yes	
36	Does your sewage ever back up into your home?	0. No 1. Yes	
37	How often does this happen per month?	___ ___ times per month	
38	If yes, do you know why this happens?	1. Sewer/drains blocked with garbage/other material 2. Pipes old/broken/poor quality 3. Other, please specify 4. I don't Know (=99)	
39	Who maintains drainage or sewage system?	1. Municipal Committee 2. Myself 3. Community group 4. Other, please specify	

40	Is there a buildup or accumulation of garbage in the drainage/sewage system near your house?	0. No (continue to Q42) 1. Yes (continue to Q41)	
41	What is the impact of this on your household? Select all that apply	1. It is a nuisance 2. It makes the house flood 3. It makes us sick 4. It has caused car accidents 5. It blocks the road 6. Other- specify	
VENTILATION			
42	Is there ventilation in your home?	0. No (continue to Q44) 1. Yes (continue to Q43)	
43	If yes, what type of ventilation do you use?	1. Window 2. Air hole 3. Others:	
44	What type of flooring do you use at home?	1. Land/dirt 2. Covered floor (planks/plastic/over dirt, etc.) 3. finished floor (wood/tile/cement/carpet/vinyl) 4. Plaster	

HEALTH SECTION (H)			
A. GASTROINTESTINAL TRACT INFECTION			
HA 01	Have you ever experienced digestive tract disease (seen from the symptoms)?	0. No (continue to HA09) 1. Yes (continue to HA02)	
HA 02	When did you experience the disease?	1. Last 2 weeks 2. Last 1 months 3. Last 3 months 4. Others:	
HA 03	Did you experience this disease during a flood?	0. No (continue to HA05) 1. Yes (continue to HA04)	
HA 04	If yes, what was the water and sanitation issue?	1. Flooding due to rain 2. Flooding due to backed up drain 3. Outage of clean and/or toilet services 4. Contamination of water services 5. Others:	
HA 05	If it's not during the flood, when did the disease appear?	1. Before the flood 2. After the flood	

HA 06	How many times have you experienced these symptoms in the last 6 months?	1. 1 time 2. 2 times 3. 3 times 4. Others:	
HA 07	What symptoms are you experiencing?	1. Heartburn 2. Nausea and vomiting 3. Defecate more than 3 times a day 4. Others:	
HA 08	What are you doing when you feel the symptoms of this infection?	1. Visiting the health care facilities 2. Buying medicine from the street stall 3. Didn't do a treatment because it will heal itself 4. Others:	
HA 09	Do you have any family members who have digestive track diseases?	0. No 1. Yes	
KNOWLEDGE			
HA 10	Diarrhea is one of the digestive tract diseases	1. True 2. False	
HA 11	The location of the garbage bin influence bacterial contamination of food	1. True 2. False	
HA 12	Flooding cannot affect the incidence of diarrhea	1. True 2. False	
PREVENTION			
HA 13	How do you prevent gastrointestinal tract infection?	1. Consuming nutritious food 2. Exercising regularly 3. Maintain a Clean and Healthy Living Behavior (CHLB) 4. Others:	
B. RESPIRATORY TRACT INFECTION			
HB 01	Have you ever experienced respiratory tract infection (seen from the symptoms)?	0. No (continue to HB09) 1. Yes (continue to HB02)	
HB 02	When did you experience/feel the infection?	1. Last 2 weeks 2. Last 1 months 3. Last 3 months 4. Others:	
HB 03	Did you experience/felt this infection during a flood?	0. No (continue to HB05) 1. Yes (continue to HB04)	

HB 04	If yes, what was the water and sanitation issue?	1. Flooding due to rain 2. Flooding due to backed up drain 3. Outage of clean and/or toilet services 4. Contamination of water services 5. Others:	
HB 05	If it's not during the flood, when did the infection appear?	1. Before the flood 2. After the flood	
HB 06	How many times have you experienced these symptoms in the last 6 months?	1. 1 time 2. 2 times 3. 3 times 4. Others:	
HB 07	What symptoms are you experiencing?	1. Shortness of breath 2. Sore throat 3. Pain in the chest 4. Others:	
HB 08	What are you doing when you feel the symptoms of this infection?	1. Visiting the health care facilities 2. Buying medicine from the street stall 3. Didn't do a treatment because it will heal itself 4. Others:	
HB 09	Do you have any family members who have respiratory tract infections?	0. No 1. Yes	
KNOWLEDGE			
HB 10	Burning garbage can pose a risk of respiratory problems	1. True 2. False	
HB 11	Stacked garbage can be harmful to respiratory health	1. True 2. False	
HB 12	Ventilation at home cannot help reduce the risk of developing respiratory infections	1. True 2. False	
HB 13	The type of floor in the house is not at risk for the incidence of respiratory infections	1. True 2. False	
PREVENTION			
HB 14	How do you prevent respiratory tract infections?	1. Consuming nutritious food 2. Exercising regularly 3. Maintain a Clean and Healthy Living Behavior (CHLB) 4. Others:	

C. SKIN DISEASE			
HC 01	Have you ever experienced/get/felt skin disease (seen from the symptoms)?	0. No (continue to HC09) 1. Yes (continue to HC02)	
HC 02	When did you experience/get/feel the disease?	1. Last 2 weeks 2. Last 1 months 3. Last 3 months 4. Others:	
HC 03	Did you experience/get/feel this disease during a flood?	0. No (continue to HC05) 1. Yes (continue to HC04)	
HC 04	If yes, what was the water and sanitation issue?	1. Flooding due to rain 2. Flooding due to backed up drain 3. Outage of clean and/or toilet services 4. Contamination of water services 5. Others:	
HC 05	If it's not during the flood, when did the disease appear?	1. Before the flood 2. After the flood	
HC 06	How many times have you experienced these symptoms in the last 6 months?	1. 1 time 2. 2 times 3. 3 times 4. Others:	
HC 07	What symptoms are you experiencing?	1. There is redness on the skin 2. There are spottings on the skin 3. Skin feels itchy and hot 4. Others:	
HC 08	What are you doing when you feel the symptoms of this disease?	1. Visiting the health care facilities 2. Buying medicine from the street stall 3. Didn't do a treatment because it will heal itself 4. Others:	
HC 09	Do you have any family members who have skin disease?	0. No 1. Yes	
KNOWLEDGE			
HC 10	Did you know that floods affect skin diseases?	1. True 2. False	
HC 11	Did you ever received information or counseling related to skin diseases?	0. No 1. Yes	

PREVENTION			
HC 12	How do you prevent respiratory tract infections?	1. Keep skin clean 2. Exercising regularly 3. Maintain a Clean and Healthy Living Behavior (CHLB) 4. Others:	
D. DENGUE FEVER			
HD 01	Have you ever experienced dengue fever (seen from the symptoms)?	0. No (continue to HD09) 1. Yes (continue to HD02)	
HD 02	When did you experience the disease?	1. Last 2 weeks 2. Last 1 months 3. Last 3 months 4. Others:	
HD 03	Did you experience this disease during a flood?	0. No (continue to HD05) 1. Yes (continue to HD04)	
HD 04	If yes, what was the water and sanitation issue?	1. Flooding due to rain 2. Flooding due to backed up drain 3. Outage of clean and/or toilet services 4. Contamination of water services 5. Others:	
HD 05	If it's not during the flood, when did the disease appear?	1. Before the flood 2. After the flood	
HD 06	How many times have you experienced/felt/gotten these symptoms in the last 6 months?	1. 1 time 2. 2 times 3. 3 times 4. Others:	
HD 07	What symptoms are you experiencing?	1. High fever 2. Rash on the skin 3. Pain on muscles and joints 4. Others:	
HD 08	What are you doing when you feel the symptoms of this disease?	1. Visiting the health care facilities 2. Buying medicine from the street stall 3. Didn't do a treatment because it will heal itself 4. Others:	
HD 09	Do you have any family members who have dengue fever?	0. No 1. Yes	

KNOWLEDGE			
HD 10	Dengue fever can be transmitted by mosquitoes.	1. True 2. False	
HD 11	The bathtub is one of the breeding places for mosquitoes.	1. True 2. False	
HD 12	Flood events have no effect on increasing the mosquito population.	1. True 2. False	
HD 13	3M's activities (draining, closing, burying) are not prevention of dengue fever.	1. True 2. False	
PREVENTION			
HD 14	How do you prevent dengue fever?	1. By doing 3M (draining, closing, burying) 2. Maintain a clean and healthy living behavior (CHLB) 3. Exercising regularly 4. Others:	
E. ECONOMIC FACTORS			
HE 01	Is your income enough to go to health facilities?		
	Gastrointestinal tract infections	0. No 1. Yes	
	Respiratory tract infections	0. No 1. Yes	
	Skin Disease	0. No 1. Yes	
	Dengue fever	0. No 1. Yes	
HE 02	Do you have health insurance?	0. No (continue to HF 01) 1. Yes (continue to HF 04)	
HE 03	What type of insurance do you have?	1. BPJS 2. Others:….	
F. HEALTH FACILITIES			
HF 01	Is there a health facility in your neighborhood?	0. No (Go to Waste Module) 1. Yes	

HF 02	What types of health facilities are available?	1. Auxiliary community health centers 2. Health center 3. Hospital 4. Medical Clinic	
HF 03	Is it the available health facilities easily accessible?	0. No 1. Yes	
HF 04	Please select the health workers who always serve you when you go to health facilities	1. Nurse 2. Physicians/doctor 3. Physician assistants 4. Dentists 5. Pharmacists 6. Other	

WASTE SECTION (W)			
A. KNOWLEDGE			
WA 01	Garbage that easily decomposes is better made into compost rather than thrown into the river or landfill.	0. No 1. Yes	
WA 02	I won't throw garbage into the river because it can pollute the river.	0. No 1. Yes	
WA 03	Managing waste needs to be done to maintain health.	0. No 1. Yes	
WA 04	To prevent unpleasant odors or bad smell, it's best if waste that is easily decomposed is disposed of in the garbage first.	0. No 1. Yes	
WA 05	Garbage must be burned because garbage is a breeding ground for cockroaches, flies and mice.	0. No 1. Yes	
WA 06	You need to separate the easy-to-decompose and non-perishable waste	0. No 1. Yes	
WA 07	Garbage such as paper and cardboard should be recycled rather than burned	0. No 1. Yes	
WA 08	Used cans must be managed properly so that not being a breeding ground for mosquitoes	0. No 1. Yes	
WA 09	Every housewife must provide her own plastic barrels to separate the rubbish	0. No 1. Yes	
WA 10	Burning garbage can pollute the air	0. No 1. Yes	
WA 11	Garbage cans must be tightly closed so that flies and cockroaches are not infested	0. No 1. Yes	
WA 12	Metal and glass containers should be used only once and then thrown in the garbage	0. No 1. Yes	
WA 13	Plastic, metal, and glass can be recycled even if you throw away with the rest of your garbage	0. No 1. Yes	

WA 14	Garbage banks make people easy to understand how to manage waste properly and correctly	0. No 1. Yes	
WA 15	I've joined the waste management agency in my town such as garbage banks	0. No 1. Yes	
B. WASTE MANAGEMENT PRACTICE			
WB 01	Do you use collection services or throw it by yourself?	1) I use collection services 2) I throw garbage directly	
WB 02	How many times you disposed your garbage in a week?	__ __ times per week	
WB 03	Is there a particular day of the week you dispose of it?	1. Monday 2. Tuesday 3. Wednesday 4. Thursday 5. Friday 6. Saturday 7. Sunday	
WB 04	What types of waste storage do you have at your house?		
WB 05	Where do you keep your waste bins?	1. In Home 2. Near Home 3. Open spaces 4. Nearby tip/waste container 5. Others—Specify ……..	
WB 06	Do you have a recycling bin?	0. No 1. Yes	
WB 07	If you do not have a recycling bin, what is the reason?	1. No place to recycle 2. I don't like to recycle 3. Too expensive to recycle 4. Other reason: _____	
WB 08	Is there any public storage of garbage near your home?	0. No 1. Yes	

WB 09	If yes, please specify the distance and the person in charge to handle the public storage.		Please specify: _____
C. GARBAGE COLLECTION SERVICES			
WC 01	Do you have regular garbage collection in your area?		0. No (continue to WC 07) 1. Yes (continue to WC 02)
WC 02	If yes, do you use it?		0. No (continue to WC 07) 1. Yes
WC 03	How often do you use the collection service?		1. Once a week 2. Twice a week 3. Every day 4. Other— specify.....
WC 04	How much do they charge per month?	Rp:	per month
WC 05	Are you satisfied with your current waste collection service?		0. No 1. Yes
WC 06	What is the main reason for your level of satisfaction/dissatisfaction?		1. Cost 2. Reliability 3. Improper Collection 4. Timeliness 5. Cooperative 6. Others., please specify……
WC 07	What is the distance between your house and closest area that has a problem with open dumping of waste?		……. Meters
D. WASTE MANAGEMENT KNOWLEDGE (HOUSEHOLD) – QUALITATIVE QUESTION			
WD 01	What kind of waste are in your house?		
WD 02	Related to Question No. 1, How do you differentiate the types of waste listed in your house?		
WD 03	What is the purpose of differentiating the type of waste?		
WD 04	How do you dispose of the garbage in your house? (*your habit*)		

WD 05	Solid waste is divided into two, namely wet solid waste and dry solid waste. Examples of dry solid waste are plastic, paper, food or beverage packaging containers, cans, wood, metal, and glass. Examples of wet solid waste are food scraps, vegetables, soft fruit skins, and leaves. Did you know that the solid waste can be recycled?		
WD 06	Related to question No. 5, do you do recycle for the solid waste? If yes, please explain?		
WD 07	Do you often burn garbage/waste in the yard?		
E. FINAL SCREENING			
WE 01	This year, did you or any member of the family participate in any community cleanup activities or other voluntary cleanups?	0. No (Continue to WE 03) 1. Yes (continue to WE 02)	
WE 02	How did you get involved?	(Fill the response)	
WE 03	In your opinion is waste management an environmental problem?	0. No 1. Yes	
WE 04	Are you concerned about the disposal methods of the service provider?	0. No 1. Yes	
WE 05	Do you think that leaving a better environment to future generations is something?	1.Important 2.Very Important 3.Not Important 4. I don't Know (=99)	

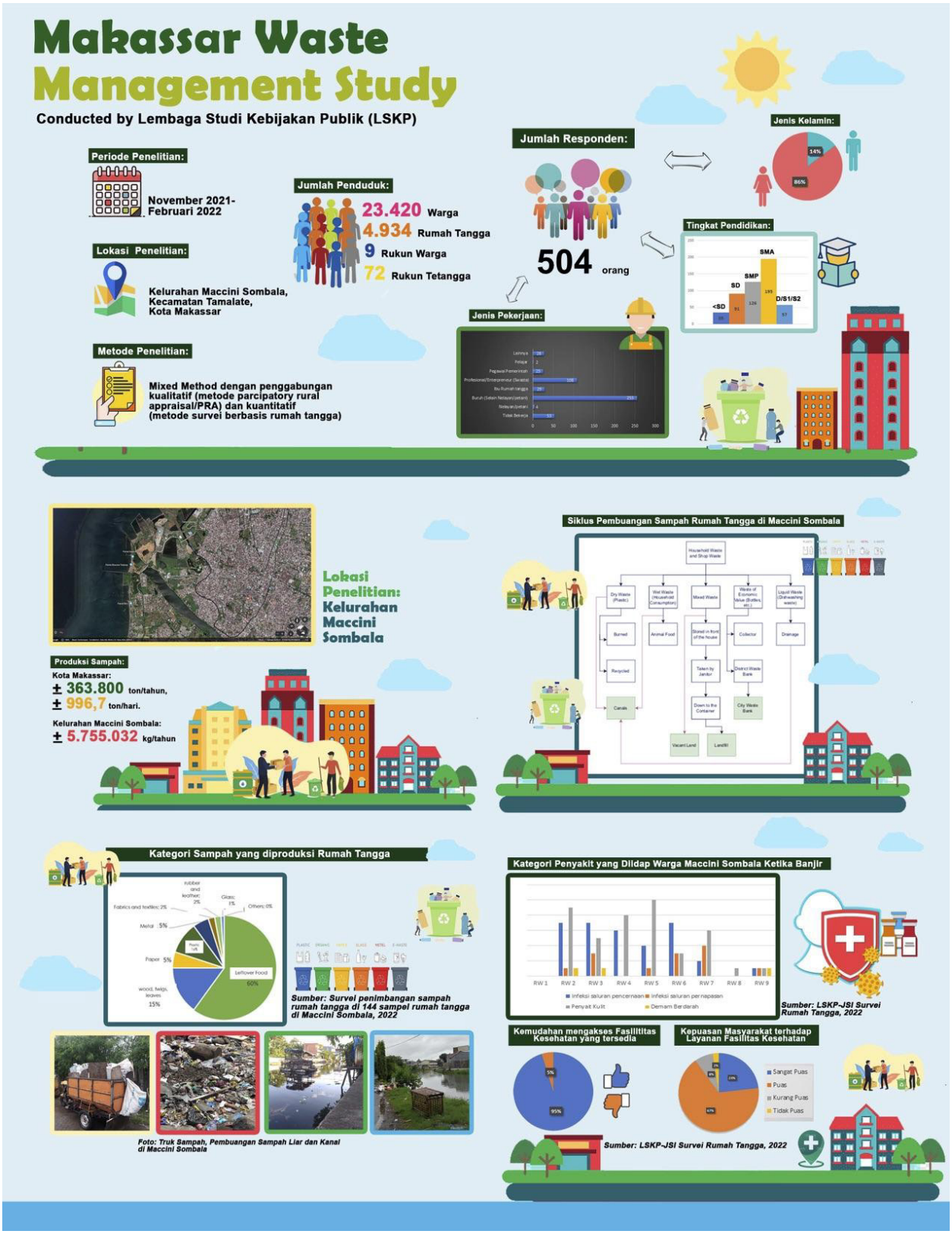
Annex 4: Data Walks Participant List

Data Walk Meetings at Village Level

	Participant Name	Role	Organization
1	Salma Daeng Kebo	Participant	Head of Garbage Bank KPRM Makmur
2	Ahmad Isa	Guest participant	IOM Makassar / BHC Team Project
3	Haji Hapiah	Participant	Field Assistant Coordinator
4	G Dg. Sanga	Participant	Head of RT 04 RW 02
5	Ratnawati	Participant	Head of RW 02
6	Firman HR	Participant	Head of Garbage Bank Parakaterong
7	Jumriati R	Participant	Resident of RW 02
8	Kiki Rizki	Participant	Resident of RW 01
9	Nisa	Participant	Resident of RW 01
10	Suriani	Participant	Resident of RW 08
11	Riska	Participant	Resident of RW 08
12	Sry Rahmi	Participant	Resident of RW 03
13	Sahari	Participant	Resident of RW 03
14	Syamsiah Daeng Caya	Participant	Head of RW 03
15	Jumriati Hasyim	Participant	Resident of RW 04
16	Juniarti Gatot	Participant	Resident of RW 04
17	Rosmiati	Participant	Head of RW 03
18	Nurhaedah	Participant	Field Assistant
19	Hasdiana	Participant	Inhabitant of RW 05
20	Ramlah	Participant	Field Assistant
21	Indrawati	Participant	Resident of RW 05
22	Rosmina Dewi	Participant	Field Assistant
23	Patta	Participant	Resident of RW 06
24	Meity Adnan	Participant	Resident of RW 09
25	Nurhikmah	Participant	Resident of RW 07
26	Salma	Participant	Resident of RW 07
27	Ramlawati	Participant	Public health center Maccini Sombala village

28	Ir Muh. Usman, MM	Participant	Head of RW 8
29	Nurhady	Participant	Head of RT 10 RW 06
30	Ardiand Arnold	Participant	Enumerator
31	M. Kafrawi Saenong	Participant	Enumerator
32	Muh. Pudail	Group Facilitator	LSKP
33	Andi Satria Pakkah	Participant	Enumerator/LSKP
34	Fathul Khan Tabir	Participant	Enumerator /LSKP
35	Fitriani	Participant	Enumerator /LSKP
36	Anugrah Sari	Participant	Enumerator /LSKP
37	Amaludin	Participant	Enumerator/LSKP
38	Musdalifah	Participant	Enumerator /LSKP
39	Andi Nurul Annisa	Participant	Enumerator /LSKP
40	Hasnawati	Program officer	LSKP
41	Basir	Group Facilitator	Hasanuddin University/LSKP Expert
42	Nurlia Sila	Participant	Hasanuddin University/LSKP Expert
43	Amril Hans	Group Facilitator	LSKP
44	Andi Yudha Yunus	Facilitator	LSKP
45	Andi Ahmad Yani	Facilitator	LSKP
46	Evi Aprianti S	Group Facilitator	Hasanuddin University/LSKP Expert

Annex 5: Data Walks Posters



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