Peri-urban Water Study in Informal Settlement Communities of Montserrado County, Liberia

A Mixed Methods Report

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Table of Contents

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Acronyms

CI	Confidence interval
FGD	Focus group discussion
IDI	In-depth interview
KII	Key informant interview
LB	Liberia dollar
NGO	Nongovernmental organization
OR	Odds ratio
SBC	Social and behavior change
USAID	United States Agency for International Development
USD	United States dollar
WASH	Water, sanitation, and hygiene
WHO	World Health Organization

Executive Summary

Background

As of 2020, 36% of rural and 15% of urban Liberians lacked access to a basic water service.[1] Although access to a basic water service among urban Liberian households is fairly high (85%), there are disparities in access based on wealth. Joint Monitoring Programme data from 2020 show that almost a quarter (23.5%) of urban households within the lowest wealth quintile lacked access to basic water services, while only 6.6% of the richest households lacked basic water service access.[2] A continuing lack of access to sufficient quantities of convenient, affordable, and potable water poses great challenges for the urban poor living in informal settlements in Liberia. A 2016 study from Kumpel et al.[3] reported that 57% of water sources sampled in Monrovia contained fecal indicator bacteria. This evidence suggests that significant water access and use challenges still exist for the urban poor in Liberia.

Study Objectives

This study aimed to identify the access and quality challenges associated with household water resources in three peri-urban communities in Monrovia, Montserrado County. The study also explored personal, social, and environmental factors related to household water access and use.

The objectives of the peri-urban water study were to:

- Deepen understanding of the drivers and barriers to household water source selection in peri-urban communities of Montserrado county.
- Explore household preferences and practices related to water storage, treatment, and use in peri-urban communities of Montserrado county.

[1] World Health Organization and United Nations Children's Fund. (2021). Estimates on the use of water, sanitation and hygiene in Liberia. Joint Monitoring Programme.

[2] World Health Organization and United Nations Children's Fund. Summary of trends in use of drinking water by wealth quintile: Liberia. Joint Monitoring Programme. www.washdata.org. https://washdata.org/data/household#!/lbr

[3] Kumpel, E., Albert, J., Peletz, R., de Waal, D., Hirn, M., Danilenko, A., Uhl, V., Daw, A., & Khush, R. (2016). Urban water services in fragile states: An analysis of drinking water sources and quality in Port Harcourt, Nigeria, and Monrovia, Liberia. *American Journal of Tropical Medicine and Hygiene, 95*(1), 229–238. doi:10.4269/ajtmh.15-0766

Methodology

The peri-urban[4] water study took place in informal settlement communities of Montserrado county (Logan Town, New Kru, and Peace Island). Breakthrough ACTION Liberia used a mixed methods approach for this research study, a cross-sectional descriptive study using household quantitative surveys, household observational surveys, focus group discussions, in-depth interviews, and key informant interviews. The respondents for the peri-urban water study consisted of men and women (ages 18 or older) from informal settlement communities within informal settlements of Logan Town, New Kru, and Peace Island communities of Montserrado County. A total sample of 1,200 women and men was used.

Key Findings and Recommendations

While household access to improved water sources is relatively high, access to water sources vary based on season, convenience, perceived water quality, and distance. Despite close proximity to water sources, household water collection burdens are extremely high, and 63% of study participants reported challenges in collecting the minimum quantity of water for daily use set by the World Health Organization (20 liters/person/day). Household access to safe and sufficient water resources was hampered by cost, convenience, and reliability of water systems. Household water storage practices and sanitation practices created significant drinking water quality risks and affected household confidence in water quality. Gender disparities in household water responsibilities remained high among participating households. Based on these findings, our recommendations are to:

- Support the establishment and continuation of community-based water management committees, which was associated with reduced water collection travel times.
- Design and test accountability mechanisms that empower community members to report water system deficiencies and assist governments in holding service providers accountable for providing safe, reliable, and affordable water services.
- Increase community water access, to make 20 liters/person/day available in peri-urban settlements in Liberia and reduce long waiting time, by providing additional community water sources or service providers.
- Explore strategies to expand household financing for water, such as reduced or interest-free connection loans, pooling community resources to contribute to the extension of water infrastructure or to finance professionalized water services, or offering micro-loans to households or communities.
- Include community stakeholders in the development and implementation of water safety plans. Increase financial and capacity strengthening support to local and national governments to increase the frequency of water quality testing and implementation of mitigation actions.

[4] As the prefix “peri-“ (peripheral) and the word “urban” suggest, peri-urban areas occupy the region immediately outside and around urban areas. In practice, peri-urban areas are characteristic of developing countries because in these areas they exhibit some unique characteristics and serve some functions that are usually not found in developed countries.

- Design and test social interventions aimed at balancing the burden of water collection and management responsibilities more equally among men and women, while ensuring children's time is protected to pursue education and development activities.

Chapter 1: Introduction

Overview of the Breakthrough ACTION Liberia Program

Breakthrough ACTION is a global social and behavior change (SBC) project funded by the United States Agency for International Development (USAID) to lead SBC programs around the world. Breakthrough ACTION ignites collective action and encourages people to adopt healthier behaviors—from using modern contraceptive methods to sleeping under bed nets and beyond. The work harnesses the demonstrated power of communication and integrates innovative approaches from marketing science, behavioral economics, and human-centered design.

In Liberia, adopting healthy behaviors remains a critical barrier to improved health outcomes. While USAID Liberia has previously invested in community health, social mobilization, and community engagement including outreach activities and facility strengthening, the need for household-level change continues, along with strengthened engagement of traditional leadership structures. To address these needs and contribute to USAID/Liberia's Development Objective 3, Breakthrough ACTION will deliver effective quality SBC activities in Liberia that will result in behavior change across a variety of health sectors, including water, sanitation, and hygiene (WASH). Breakthrough ACTION will build on and complement existing knowledge, information, and partner efforts where possible, while building the capacity of Liberian institutions in SBC.

Background

As of 2020, 36% of rural and 15% of urban Liberians lacked access to a basic water service.[5] Although access to a basic water service among urban Liberian households is high (85%), there are disparities in access based on wealth. Joint Monitoring Programme data from 2020 show that almost a quarter (23.5%) of urban households within the lowest wealth quintile lacked access to basic water services, while only 6.6% of the richest households lacked basic water service access.[6] A continuing lack of access to sufficient quantities of convenient, affordable, and potable water poses great challenges for the urban poor living in informal settlements in Liberia. A 2016 study from Kumpel et al.[7] reported that 57% of water sources sampled in Monrovia contained fecal indicator bacteria. This evidence suggests that significant water access and use challenges still exist for the urban poor in Liberia.

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[5] World Health Organization and United Nations Children's Fund. (2021). Estimates on the use of water, sanitation and hygiene in Liberia. Joint Monitoring Programme.

[6] World Health Organization and United Nations Children's Fund. Summary of trends in use of drinking water by wealth quintile: Liberia. Joint Monitoring Programme. www.washdata.org

[7] Kumpel, E., Albert, J., Peletz, R., de Waal, D., Hirn, M., Danilenko, A., Uhl, V., Daw, A., & Khush, R. (2016). Urban water services in fragile states: An analysis of drinking water sources and quality in Port Harcourt, Nigeria, and Monrovia, Liberia. *American Journal of Tropical Medicine and Hygiene, 95*(1), 229–238. doi:10.4269/ajtmh.15-0766

The most common sources of drinking water in urban households are hand pumps, tube wells, or boreholes (48%); bottled water or mineral water in sachets (30%); and protected dug well (6%). Access to improved water sources is lower in rural communities (63%), with 31% of rural households obtaining their drinking water from an unimproved source versus 5% of urban households. Access to improved sources of drinking water varies per county, with Montserrado and Grand Gedeh counties having the highest coverage rate at 96% each. Additionally, access to safe drinking water is dependent on a household's wealth and ability to pay for safe drinking water—households in the lowest wealth quintiles in both urban and rural contexts are more likely to use an unimproved source of drinking water.[8] Despite the availability of water purification products (most commonly bleach or WaterGuard), water treatment practices in Liberia remain low. According to the Liberia Demographic and Health Survey 2019–2020, 25% of households treated their drinking water, with 19% using bleach or chlorine, and 4% using WaterGuard.[8]

Water Practices in Urban Study Locations

A 2012 study in the urban study locations of Sanniquellie city and Voinjama city found that a majority of residents in both cities (87% in Sanniquellie and 77% in Voinjama) reported convenience and water quality as their primary reason for selecting their most used water source.[9] Most respondents in both cities (79% in Sanniquellie and 64% in Voinjama) thought water quality from their primary water source was good or very good. In the same survey, 89% of the respondents reported owning water storage equipment.[10] Of the 89% who stored water, 75% reported storing water in jerrycans. Previous studies indicate that citizens of Sanniquellie and Voinjama would prefer to use more water if it were more consistently available and closer to home.[10] Their preferred water source type was a household piped connection, but households were often less willing to pay for shared or community stand-pipe connections because they were less convenient due to water access, distance, and/or queue times.[10]

Rapid urbanization has led to large parts of urban populations having limited access to clean water. This situation is exacerbated in the informal settlements in urban and peri-urban areas.[10] However, most urban studies tend to show an improved scenario as data are collected across the socio-economic spectrum and reported for the urban "whole." Unfortunately, urban data mask the poor water conditions of the informal settlements due to a lack of disaggregation between rich and poor areas, which is also true of the Demographic and Health Survey data. Studies that assess the real condition of informal settlements are necessary for ensuring better access to clean water for the poorest strata of society.

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[8] Liberia Institute of Statistics and Geo-Information Services. (2020). Liberia Demographic and Health Survey 2019–2020.

[9] Tetra Tech. (2012). Situational Analysis Report: Liberia Municipal Water Project. Liberia Municipal Water Project.

[10] Dos Santos, S., Adams, E. A., Neville, G., Wada, Y., de Sherbinin, A., Mullin Bernhardt, E., & Adamo, S. B. (2017). Urban growth and water access in sub-Saharan Africa: Progress, challenges, and emerging research directions. *Science of the Total Environment, 607–608*, 497–508. doi: 10.1016/j.scitotenv.2017.06.157

The objectives of the urban water study are to:

- Deepen understanding of the drivers and barriers to household water source selection in peri-urban communities of Montserrado county.
- Explore household preferences and practices related to storage, treatment and use in peri-urban communities of Montserrado county.

Research Questions

1. What are the current individual, household, and community practices related to water source selection, water treatment, and water use?
2. What are the social and behavioral determinants that influence household water source selection, storage, treatment, and water use?
3. What are the social, community, and service determinants that influence household water source selection and water storage, treatment, and use?
4. How do environmental determinants (water availability, variability, proximity) influence household water source selection and water use?
5. How do the local and political structures influence community (and household) action related to water source selection and water treatment and use?

Chapter 2: Methodology

Study Design

Breakthrough ACTION Liberia used a mixed methods approach for this research study, a cross-sectional descriptive study using household quantitative surveys, household observational surveys, focus group discussions (FGDs), in-depth interviews (IDIs), and key informant interviews (KIIs). Data collected from these methods were triangulated to develop a deeper understanding of household practices, preferences, and barriers.

Target Population and Geographical Focus

The neighborhoods of Logan Town, New Kru, and Peace Island were purposefully selected as study locations within Montserrado County due to their large urban poor populations and household homogeneity in water access (less than basic water service as per Joint Monitoring Programme definition).[11] Within these administrative boundaries, households were randomly selected to participate in the study (as described below). Breakthrough ACTION Liberia assessed water source selection behaviors and preferences and water use practices among households without access to basic water services. Households were stratified by informal settlement.

Sample Size

The sample size for the peri-urban water study was calculated on a maximum variance of 0.50 as we did not have data on sources of water distribution in the selected samples areas. With an alpha of 0.05 and a power of 80%, the sample to detect 0.50 was 407 households per site. Since the study was conducted in three towns, the total sample was 1,221 which was rounded to 1,200.

TABLE 2.1: SAMPLES SIZES BY DATA COLLECTION METHOD

Peri-Urban Water Study	Sample population (2014)	Household water storage and use observations	household Questionnaire	FGDs	IDIs & KIIs
Logan Town	6,749	400	400	2 (men) 2 (women)	10 men 10 women
New Kru	5,880	400	400	2 (men) 2 (women)	10 women 10 adults
Peace Island	4,658	400	400	2 (men) 2 (women)	10 women 10 adults

[11] World Health Organization and United Nations Children's Fund. (2021). Estimates on the use of water, sanitation and hygiene in Liberia. Joint Monitoring Programme.

TABLE 2.1: SAMPLES SIZES BY DATA COLLECTION METHOD					
Peri-Urban Water Study	**Sample population (2014)**	**Household water storage and use observations**	**household Questionnaire**	**FGDs**	**IDIs & KIIs**
Local government officials					6
Total sample size		**1,200**	**1,200**	**12**	**106**

Inclusion Criteria

Participants for the peri-urban water study consisted of women and men older than 18 years of age from informal settlement communities including Logan Town, New Kru, and Peace Island communities of Montserrado County. Participants were selected based on the following:

- Adults (women and men) ages 18 or older
- Full-time resident of the communities purposefully selected within Logan Town, New Kru, or Peace Island communities
- Households without access to a basic water service
- Only one participant from each household

Exclusion Criteria

- Children (<18 years old)
- Vulnerable populations (cognitive limitations, low education, illegal migration status, incarceration, poverty, or some combination of factors)
- Non-full-time residents of sampled communities

Data Analysis

For quantitative data collection, descriptive analyses and bivariate and multivariate analyses were conducted to determine trends in sanitation practices based on household settings and participant-reported behaviors and preferences. Survey CTO, a mobile data collection platform, was used for quantitative data collection and storage. Tablets were used to collect household surveys, and the data were uploaded to the Survey CTO platform once internet connectivity was available. Dedoose software was used to analyze qualitative data. Lawrence Green's PRECEDE-PROCEED model[12] was used to further analyze the qualitative findings.

[12] Green, L., Kreuter, M. (2005). *Health program planning: An educational and ecological approach*. 4th edition. New York, NY: McGraw-Hill

Chapter 3: Participant Profile

The study interviewed respondents from Logan Town, New Kru, and Peace Island. This chapter presents the socio-demographic profile of the overall sample of 1,200 respondents. Qualitative findings related to socio-demographic factors are also included.

Table 3.1 provides the socio-demographic profile of the total sample. Approximately 60.7% of respondents were women, while 39.3% were men. A large portion of respondents were between the ages of 18 and 35 (56.7%), while 9.9% of household heads were above 55 years old. Most respondents (81.4%) reported that they attended school in the past. Of the respondents who had attended school, the majority (63.4%) had completed secondary or higher education; however, education differed by respondent sex.

Almost 20% of the sample reported no source of income, while another 61.3% of respondents reported earning less than 100 USD per month. The remaining 20% of the sample reported earning over 100 USD per month, with no large differences observed by gender. Overwhelmingly, respondents were Christian (92.2%), with a small proportion reporting that they were Muslim (7.8%). The average household surveyed had 5.3 members. Of those surveyed, 53.9% reported that they currently rent their home, while 35.3% of the sample reported home ownership. The remaining 10.8% of respondents stated that they were currently living rent-free.

TABLE 3.1: SOCIO-DEMOGRAPHIC PROFILE

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Respondent sex	Male	39.3	0.0	39.3 (36.6, 42.1)
	Female	0.0	60.7	60.7 (57.9, 63.4)
Respondent age, years	18–35	46.4	56.7	52.7 (49.8, 55.5)
	36–55	41.5	34.8	37.4 (34.7, 40.2)
	55+	12.1	8.5	9.9 (8.3, 11.7)
Ever attended school	Yes	89.4	76.2	81.4 (79.1, 83.5)
	No	10.6	23.8	18.6 (16.5, 20.9)
Highest level of education	Elementary	8.3	16.0	12.7 (10.7, 14.9)
	Junior high	17.3	28.8	23.8 (21.3, 26.6)
	Senior high/secondary	49.5	42.9	45.7 (42.6, 48.9)

TABLE 3.1: SOCIO-DEMOGRAPHIC PROFILE				
Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
	Higher than senior high/secondary	24.9	12.3	17.7 (15.4, 20.2)
Household monthly income	Not working or no source of income	17.2	20.3	19.1 (17.0, 21.4)
	Less than 100 USD or 20,000 LD	57.6	63.6	61.3 (58.5, 64.0)
	Between 100 USD, or 20,000–40,000 LD	24.6	15.8	19.3 (17.1, 21.6)
	Other	0.6	0.3	0.4 (0.2, 1.0)
Religion	Christian	88.8	94.4	92.2 (90.5, 93.6)
	Muslim	11.2	5.6	7.8 (6.4, 9.5)
Average household size	Mean household size (not percentage)	5.0 (4.7, 5.3)	5.5 (5.3, 5.6)	5.3 (5.1, 5.4)
House ownership	Own	40.3	32.0	35.3 (32.6, 38.0)
	Rent	49.6	56.7	53.9 (51.1, 56.7)
	Live for free	10.2	11.3	10.8 (9.2, 12.7)

Chapter 4: Rainy Season Water Ownership and Access

This chapter examines water use patterns in the three peri-urban sites of Montserrado county during the rainy season. It assesses the primary drinking water source during the rainy season and how far the water source is from the house. It also measures how much time it takes to fetch water and the number of trips involved. In addition, the chapter explores whether drinking water is treated and the methods used for water purification.

The most common rainy season water source is a protected dug well or tap (34%), followed by an open dug well (21%). In addition, rainy season water sources include private taps in the yard (10%) or homes (4%). Water vendors (9%) are also a fairly common source of water in the rainy season. Other sources of water include water kiosks, public boreholes, and neighboring household pumps, among others (Table 4.1).

In terms of location of water source, 50% of respondents reported that their water source is located at a neighbor's house, indicating a shared use of individual water sources. About a third of respondents stated that their water source was located centrally within the community, while 8% of the respondents reported that their rainy season water source was situated outside their community (Table 4.1). No significant differences were observed between men and women regarding the water source and access situation during the rainy season.

TABLE 4.1: RAINY SEASON DRINKING WATER SOURCES AND ACCESS

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Water source	Lake, river, pond, stream (surface water)	4.0	1.7	2.6 (1.8, 3.6)
	Open or dug well/ spring (unprotected)	21.6	21.6	21.6 (19.3, 24.0)
	Protected dug well/tap	32.0	35.7	34.3 (31.6, 37.0)
	Private yard tap	9.1	10.4	9.9 (8.3, 11.7)
	Private Inside tap	5.3	3.3	4.1 (3.1, 5.4)
	Water kiosk	5.9	7.6	6.9 (5.6, 8.5)
	Water vendor	9.8	8.5	9.0 (7.5, 10.6)
	Public borehole/pump	6.6	5.2	5.6 (4.6, 7.2)

TABLE 4.1: RAINY SEASON DRINKING WATER SOURCES AND ACCESS				
Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
	Neighboring household well/pump	3.2	3.0	3.1 (2.2, 4.2)
	Rainwater harvesting system/tank	2.3	2.9	2.7 (1.9, 3.7)
	Public reservoir	0.0	0.1	0.08 (0.01, 0.6)
	Other	0.2	0.0	0.08 (0.01, 0.6)
Water location	On household plot/land	12.3	10.7	11.3 (9.7, 13.3)
	At neighbor's house	48.3	51.2	50.1 (47.3, 52.9)
	Centrally located within the community	30.1	29.0	29.4 (26.9, 32.1)
	Outside the community	9.1	7.8	8.3 (6.9, 10.0)
	Other	0.2	1.2	0.8 (0.5, 1.5)
Time per trip for water per person	Less than 30 minutes	78.6	73.2	75.3 (72.8, 77.7)
	More than 30 minutes	21.4	26.8	24.7 (22.3, 27.2)
Reason for using water source	Distance	18.0	18.8	18.5 (16.4, 20.8)
	Convenience	51.1	51.7	51.4 (48.6, 54.2)
	Water quality	27.1	26.9	27.0 (24.6, 29.6)
	Price	1.5	1.0	1.2 (0.7, 1.9)
	Other	2.3	1.7	1.9 (1.3, 2.9)
Point-of-use water treatment	Yes	26.5	24.7	25.4 (23.0, 28.0)
	No	73.5	75.3	74.6 (72.0, 77.0)
Point-of-use water treatment methods used	Boiling	3.2	1.1	2.0 (0.9, 4.3)
	Filtering	10.4	1.7	5.2 (3.2, 8.4)
	Chlorine water (WaterGuard)	85.6	97.2	92.5 (88.9, 94.9)
	Other	0.8	0.0	0.3 (0.05, 2.3)
	Yes	68.4	68.4	68.4 (65.7, 71.0)

TABLE 4.1: RAINY SEASON DRINKING WATER SOURCES AND ACCESS				
Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Is the same source for drinking water used for other household needs (bathing, laundry etc.)?	No	31.6	31.6	31.6 (29.0, 34.3)

As displayed in Table 4.1, 75.3% of the sample stated that one trip to collect water took less than 30 minutes. Convenience (51.4%) was the main factor for choosing a specific water source, followed by water quality (27%). Only 25.4% of the respondents stated they treated or purified their drinking water. The most common method for drinking water purification was chlorination (92.5%), followed by filtering (5.2%). A majority of respondents (68.4%) reported that they use the same water source for their drinking water and other household needs (Table 4.1).

As shown in Table 4.2, open or dug wells were the most commonly used water source for domestic use (52.8%), followed by the protected dug well/tap (31.7%), and rainwater harvesting (10%). The majority of respondents reported that their domestic water source was located on a neighbor's property (63.1%), while 19.5% of the respondents had their water source on their own household plot.

TABLE 4.2: WATER SOURCE USES FOR OTHER DOMESTIC USE DURING THE RAINY SEASON				
Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Water source for bathing and laundry	Open or dug well/spring (unprotected)	53.0	52.6	52.8 (47.7, 57.8)
	Protected dug well/tap	31.5	31.7	31.7 (27.2, 36.5)
	Private yard tap	1.3	0.9	1.1 (0.4, 2.8)
	Private inside tap	0.0	0.4	0.3 (0.04, 1.9)
	Water kiosk	2.7	0.9	1.6 (0.7, 3.5)
	Water vendor	1.3	0.4	0.8 (0.3, 2.4)
	Public borehole	2.0	0.4	1.1 (0.4, 2.8)
	Neighboring household	0.0	1.3	0.8 (0.3, 2.4)

TABLE 4.2: WATER SOURCE USES FOR OTHER DOMESTIC USE DURING THE RAINY SEASON				
Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
	Rain harvesting system/tank	8.1	11.3	10.0 (7.4, 13.5)
Location of water source	On the household plot/land	19.5	19.6	19.5 (15.8, 23.8)
	At neighbor's house	65.1	61.7	63.1 (58.1, 67.8)
	Centrally located within community	12.1	16.5	14.8 (11.5, 18.7)
	Outside the community	3.7	2.2	2.6 (1.4, 4.8)
Time per trip for water per person	Less than 30 minutes	84.6	80.4	82.1 (77.8, 85.6)
	More than 30 minutes	15.4	19.6	17.9 (14.4, 22.1)
Reason for using water source	Distance	26.2	23.9	24.8 (20.7, 29.4)
	Convenience	55.7	57.8	57.0 (51.9, 61.9)
	Water quality	8.1	8.3	8.2 (5.8, 11.4)
	Price	10.1	9.6	9.8 (7.1, 13.2)
	Other	0.0	0.4	0.3 (0.04, 1.9)
Number of five-gallon containers (jerrycans) used	Mean/Average (95% CI) quantity of water used in rainy season	6.8 (6.3, 7.4)	6.8 (6.4, 7.1)	—
Does water source change in dry season?	Yes	34.3	37.0	35.9 (33.2, 38.7)
	No	65.7	63.0	64.1 (61.3, 66.8)

Most respondents (82.1%) reported they took less than 30 minutes per trip to collect domestic water, with convenience (57%) being the main reason for choosing their water source. The other reasons for choosing water sources were distance (24.8%), water quality (8.2%), and price (9.8%). On average, both women and men used 6.8 jerrycans (five-gallon container) of water for household use during the rainy season. More than a third of the sample reported that their water source changed during the dry season (35.9%).

Chapter 5: Dry Season Water (Safe Drinking) Access and Ownership

Understanding the seasonality of safe drinking water access and ownership among households in peri-urban areas is important in determining the challenges faced by households in ensuring that water is available for drinking at the household level year-round. Water shortage and scarcity are often anticipated during the dry season due to a fall or drop in the ground water table/aquifer. This situation often leads households to either travel a long distance or queue in long lines to collect drinking water.

The study found that in the study communities, the most common source of safe drinking water during the dry season is a protected hand dug well/tap (26.9%). About 13.2% of the households' surveyed have a private yard tap that they access water from during the dry season; while 11.8% of households indicated that their drinking water source during the dry season is a public borehole/pump. Interestingly, results from Tables 4.1 and 5.1 show that household use of improved water sources increased from 76% in the wet season to 81% in the dry season. However, the proportion of households reporting use of surface water for drinking also increased slightly during the dry season (from 2.6% to 4.2%).

The location of the drinking water supply is an important factor to consider in household water ownership and access. The study findings show that 47.8% of respondents' source of drinking water during the dry season is at a neighbor's house, while 27.6% of respondents access drinking water that is located centrally in the community during the dry season. Only 3.5% of households have their source of drinking water on their house plot/yard.

The average distance traveled by households to collect drinking water is often an issue in water access. Households are considered to have basic access to drinking water if they can obtain water from an improved source, provided collection time is not more than 30 minutes for a roundtrip including waiting time at the water source.[13] Adequate access also considers the quantity of water available year-round. The United Nations Sustainable Development Goals also highlight the importance of water quality. According to the current study's findings, 53.6% of respondents' households travel less than 30 minutes during the dry season to fetch water from the nearest water source, while 46.4% of respondents' households travel more than 30 minutes to collect drinking water during the dry season (Table 5.1). The predominant reasons given for using the water sources include convenience (46.6%) and water quality (37.3%). Only 12.5% of respondents indicated that distance was a motivator in accessing a drinking water source during the dry season. However, it should be noted that this calculation of time taken to reach the water source is based on a single trip only. Most respondents fetch water for drinking and for

[13]World Health Organization & United Nations Children's Fund. (2021). Estimates on the use of water, sanitation & hygiene in Liberia. Joint Monitoring Programme.

domestic use; therefore, they make multiple trips to the water source to meet their household's basic water needs.

As for drinking water quality, only 21.3% of respondents mentioned treating their drinking water during the dry season, while 78.7% of the respondents indicated that they do not treat their drinking water. The most common method of treating drinking water among respondents who reported doing so during the dry season was chlorine-based treatment (92.4%), while 4.3% indicated filtration as their method of water treatment. No significant difference was observed between male and female respondents for these variables (:.1).

TABLE 5.1: OVERALL WATER (FOR DRINKING) OWNERSHIP/ACCESS DURING THE DRY SEASON

Variable	Value	Male	Female	Total Sample
		Household Head (N=162)	Household Head (N=269)	Household Head (N=431) (95% CI)
Water source	Lake, river, pond, stream (surface water)	4.3	4.1	4.2 (2.6, 6.5)
	Open or dug well/ spring (unprotected)	11.1	14.5	13.2 (10.3, 16.8)
	Protected dug well/tap	26.5	27.1	26.9 (22.9, 31.3)
	Private yard tap	12.4	13.7	13.2 (10.3, 16.8)
	Private Inside tap	7.4	6.7	7.0 (4.9, 9.8)
	Water kiosk	13.6	7.4	9.7 (7.3, 12.9)
	Water vendor	5.6	5.6	5.6 (3.8, 8.2)
	Public borehole/pump	10.5	12.6	11.8 (9.1, 15.2)
	Neighboring household well/pump	6.8	6.3	6.5 (4.5, 9.3)
	Rainwater harvesting system/tank	1.2	0.4	0.7 (0.2, 2.1)
	Public reservoir	0.0	1.5	0.9 (0.4, 2.4)
	Other	0.6	0.0	0.2 (0.03, 1.6)
Location of water source	On household plot/land	3.7	3.4	3.5 (2.1, 5.7)
	At neighbor's house	45.1	49.4	47.8 (43.1, 52.5)
	Centrally located within the community	29.0	26.8	27.6 (23.6, 32.0)
	Outside the community	22.2	19.7	20.6 (17.1, 24.7)
	Other	0.0	0.7	0.5 (0.1, 1.8)

TABLE 5.1: OVERALL WATER (FOR DRINKING) OWNERSHIP/ACCESS DURING THE DRY SEASON				
Variable	Value	Male	Female	Total Sample
		Household Head (N=162)	Household Head (N=269)	Household Head (N=431) (95% CI)
Time per trip for water per person	Less than 30 minutes	52.5	54.3	53.6 (48.9, 58.3)
	More than 30 minutes	47.5	45.7	46.4 (41.7, 51.1)
Reason for using water source	Distance	12.4	12.6	12.5 (9.7, 16.0)
	Convenience	44.4	48.0	46.6 (42.0, 51.4)
	Water quality	38.9	36.4	37.3 (32.9, 42.0)
	Price	0.0	0.7	0.5 (0.1, 1.8)
	Other	4.3	2.2	3.0 (1.8, 5.1)
Treat purify drinking water	Yes	21.6	21.2	21.3 (17.7, 25.5)
	No	78.4	78.8	78.7 (74.5, 82.3)
Water treatment method	Boiling	2.9	0.0	1.1 (0.2, 7.5)
	Filtering	5.7	3.5	4.3 (1.6, 11.2)
	Chlorine water	91.4	93.0	92.4 (84.8, 96.4)
	Other	0.0	3.5	2.2 (0.5, 8.4)
Is this the same water source your household most frequently uses for other household needs (bathing, laundry/washing, etc.) during the dry season?	Yes	69.7	69.5	69.6 (65.1, 73.8)
	No	30.3	30.5	30.4 (26.2, 34.9)

Dry Season Water (for Other Domestic Uses) Access and Ownership

Water availability for other domestic chores is often an access issue in most communities. The sources of water used for drinking sometimes differ from those used for other tasks such as laundry, cooking, cleaning, and bathing. The seasonal variations in communities with inadequate water infrastructure can have a significant impact on water access.

The study findings show that the most common source of water for bathing and laundry during the dry season is protected dug well/tap (46.6% of respondents), while protected open or dug well/spring (unprotected) is the second most common source (45% of respondents). Table 5.2 shows that the most

common location for the water source used for other chores is at a neighbor's house (66.4%) followed by water sources that are centrally located in the community (16.8%). Water sources on the households' plot/land constituted 13.7%, while the least common location for water sources used during the dry season for domestic work is outside the community (3.1%). Travel time for fetching water for other domestic chores was measured, and 65% of the respondents indicated a walking distance of less than 30 minutes to fetch water, while 35.0% of respondents indicated more than a 30-minute roundtrip to fetch water.

TABLE 5.2: OVERALL WATER (WATER FOR OTHER DOMESTIC USE) OWNERSHIP/ACCESS DURING THE DRY SEASON

Variable	Value	Male	Female	Total Sample
		Household Head (N=162)	Household Head (N=269)	Household Head (N=431) (95% CI)
Water source for bathing and laundry	Lake, river, pond, stream (surface water)	0.0	1.2	0.8 (0.1, 5.3)
	Open or dug well/spring (unprotected)	51.0	41.5	45.0 (36.7, 53.7)
	Protected dug well/tap	36.7	52.4	46.6 (38.1, 55.2)
	Private yard tap	4.1	1.2	2.3 (0.7, 6.9)
	Water kiosk	4.1	2.4	3.1 (1.1, 7.9)
	Public borehole	0.0	1.2	0.8 (0.1, 5.3)
	Neighboring household	4.1	0.0	1.5 (0.4, 6.0)
Location of water source	On the household plot/land	14.3	13.4	13.7 (8.8, 20.8)
	At neighbor's house	71.4	63.4	66.4 (57.8, 74.0)
	Centrally located within community	14.3	18.3	16.8 (11.3, 24.3)
	Outside the community	0.0	4.9	3.1 (1.1, 7.9)
Time per trip for water per person	Less than 30 minutes	84.6	80.4	65.0 (60.3, 69.3)
	More than 30 minutes	15.4	19.6	35.0 (30.7, 39.7)

Chapter 6: Household Water Collection and Water Storage

This chapter looks at household water collection and water storage patterns. The chapter discusses who has the primary responsibility for collecting household water, who else collects water, water collection frequency and time, travel partners for water collection, and the type of water container used for water collection.

Table 6.1 highlights information on household water collection, including who collects water, as well as the distance, frequency, and nature of water collection among respondents. Overwhelmingly, women and children are the primary water collectors in households (88.1%), and 70.2% of households stated that an additional person also collects water, with this person primarily being a woman or child.

The highest percentage of male and female participants (31.1% and 44.5%, respectively) reported that women in their household were responsible for collecting water, meaning 39.3% of all participants thought women were primarily responsible for collecting water. Men were the least likely to be identified as the primary household water collected by all participants (11.9%), although a much higher percentage of male respondents (24.6%) thought men were the primary household water collectors compared with female respondents (3.7%). Most participants (70.2%) reported having other water collectors for their household. Of these participants, most reported having either a girl (32.3%), a woman (28.4%), or a boy (24.5%) as secondary water collectors.

TABLE 6.1: HOUSEHOLD WATER COLLECTION

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Primary household water collector	Women	31.1	44.5	39.3 (36.5, 42.1)
	Men	24.6	3.7	11.9 (10.2, 13.9)
	Boy	28.8	25.7	26.9 (24.5, 29.5)
	Girl	15.5	26.1	21.9 (19.7, 24.3)
Other water collector	Yes	70.3	70.1	70.2 (67.5, 72.7)
	No	29.7	29.9	29.8 (27.3, 32.5)
Other water collector	Woman	25.3	30.4	28.4 (25.4, 31.5)
	Man	24.7	8.4	14.8 (12.6, 17.4)
	Boy	24.4	24.5	24.5 (21.7, 27.5)
	Girl	25.6	36.7	32.3 (29.2, 35.5)

TABLE 6.1: HOUSEHOLD WATER COLLECTION				
Variable	**Value**	**Male**	**Female**	**Total Sample**
		Household Head (N=472)	**Household Head (N=728)**	**Household Head (N=1,200) (95% CI)**
Water collection time of day	Early morning	68.4	66.4	67.2 (64.5, 69.8)
	Late morning	4.5	4.5	4.5 (3.5, 5.8)
	Mid-day	2.8	4.4	3.8 (2.8, 5.0)
	Early evening	23.5	23.9	23.7 (21.4, 26.2)
	At night	0.9	0.8	0.8 (0.5, 1.5)
Preference for water collection time	Convenience	41.1	41.5	41.3 (38.6, 44.1)
	Other daily priorities (school, etc.)	50.9	51.2	51.1 (48.3, 53.9)
	Safety	2.8	1.1	1.8 (1.1, 2.7)
	Operating hours of vendor	5.3	5.8	5.6 (4.4, 7.0)
	Other	0.0	0.4	0.3 (0.08, 0.8)
Travel alone or with others	Alone	58.3	57.8	58.0 (55.2, 60.8)
	With others	41.7	42.2	42.0 (39.2, 44.8)
Frequency of water collection	Every day	70.6	72.8	71.9 (69.3, 74.4)
	Alternate day	23.5	18.7	20.6 (18.4, 23.0)
	Once or twice per week	5.9	8.5	7.5 (6.1, 9.1)
Type of water collection container	Jerrycans (five-gallon containers)	71.4	61.7	65.5 (62.8, 68.1)
	Barrel	2.1	2.8	2.5 (1.8, 3.6)
	Open bucket	24.8	33.9	30.3 (27.8, 33.0)
	Other	1.7	1.7	1.7 (1.1, 2.6)

When asked if they travel alone or with others, those collecting water stated that 58% travel alone, while 42% travel with others. Given that only 1.8% of respondents reported safety as a preference for water collection time, the high percentage reporting that they travel with others likely indicates that water collection is considered a social activity.

The majority of respondents collect water every day (71.9%), while roughly a fifth of respondents report collecting water every other day. A small amount of the sample reported collecting water only one to two times per week (7.5%). The primary containers used for water collection were five-gallon jerrycans (65.5%) and open buckets (30.3%). Few respondents reported the use of barrels for water storage (2.5%). No significant differences were observed in water collection responses from men and women.

Household Water Storage

Household water storage is a method used by households to ensure water is available at the household level for drinking and other domestic uses in areas where reliable pipe-borne water is lacking. Storage is a cardinal aspect of ensuring drinking water quality at the household level in such situations. For drinking water storage at the household level (Table 6.2), the study findings show that 95.2% of all respondents store water at home. The most common containers used for storing water in respondents' households were jerrycans (62.2%) followed by barrels (20%) and water stored in sachet (11.3%).

Water storage for other domestic purposes was reported by 91.6% of respondents, while 8.4% of respondent households mentioned not storing water for other household uses. The most common storage containers used for storing non-drinking water by study participants were large containers/barrels (44.9%) followed by jerrycans (41.2%).

TABLE 6.1: HOUSEHOLD WATER COLLECTION

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Water storage in home	Yes	94.1	95.1	95.2 (93.8, 96.2)
	No	5.9	4.1	4.8 (3.8, 6.2)
Method of water storage	Jerrycans (five-gallon containers)	62.1	62.2	62.2 (59.4, 64.9)
	Large storage container (barrel)	18.4	21.0	20.0 (17.8, 22.4)
	Plastic rainwater catchment	1.1	0.8	0.9 (0.5, 1.7)
	Water stored in sachet (mineral water)	13.8	9.6	11.3 (9.6, 13.2)
	Water stored in tub/bucket (open bucket)	3.8	6.2	5.3 (4.1, 6.7)
	Other	0.9	0.1	0.4 (0.2, 1.0)
Water stored for other purposes	Yes	91.3	91.8	91.6 (89.9, 93.0)
	No	8.7	8.2	8.4 (7.0, 10.1)
Method of water storage for other purposes	Jerrycans (five-gallon containers)	45.8	38.2	41.2 (38.4, 44.0)
	Large storage container (barrel)	42.1	46.7	44.9 (42.1, 47.7)

TABLE 6.1: HOUSEHOLD WATER COLLECTION				
Variable	**Value**	**Male**	**Female**	**Total Sample**
		Household Head (N=472)	**Household Head (N=728)**	**Household Head (N=1,200) (95% CI)**
	Plastic rainwater catchment	1.3	1.7	1.5 (0.9, 2.4)
	Water stored in sachet (mineral water)	1.3	0.4	0.8 (0.4, 1.4)
	Water stored in tub/bucket (open bucket)	8.2	12.2	10.7 (9.0, 12.5)
	Other	1.3	0.8	1.0 (0.6, 1.6)

Chapter 7: Household Water Quality Perceptions

This chapter looks at perceptions of drinking water characteristics. The World Health Organization's (WHO's) Guidelines for Drinking Water Quality include the acceptability of the taste, color, and odor of drinking water.[14] Although water appearance or taste may not have negative health effects, consumers may consider water turbidity, taste, and/or odor as unsafe and may reject the water. Therefore, consumer perception of water is important because it is often a factor in decisions on where to access water for household consumption.

This study assessed respondents' perception of smell, turbidity, taste, and overall quality of the water from their primary water source. About 39% of respondents were not satisfied with the water quality, taste, smell, and turbidity of their primary water source. This study found that only 61% of respondents had a positive perception of the quality of water from their primary source and only 56% of respondents reported that their water has a good taste—27% of respondents stated that their water has a terrible taste. Interestingly, 65% did not perceive their water to have a bad smell/odor even though smell/odor can affect the perception of taste. However, 21% of respondents stated that the water is "extremely smelly." The perception of water turbidity was similar, with 59% of respondents reporting that their water is very clear and 23% of respondents reporting that the water from their primary water source is "extremely dirty." Around a quarter of respondents were not satisfied with the smell, turbidity, taste, and overall quality of their water.

TABLE 7.1:: HOUSEHOLD WATER PERCEPTIONS IN PERI-URBAN AREAS OF MONTSERRADO COUNTY

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Smell (scale from 1 to 10, with 1 being no smell and 10 being extremely smelly)	0–3	63.3	67.0	65.6 (62.8, 68.2)
	4–6	15.5	12.0	13.3 (11.5, 15.4)
	7–10	21.2	21.0	21.1 (18.9, 23.5)
Turbidity	0–3	58.5	59.1	58.8 (56.0, 61.6)
	4–6	18.4	18.4	18.4 (16.3, 20.7)

[14] World Health Organization. (2017). WHO: Guidelines for Drinking-Water Quality. World Health Organization. https://www.who.int/publications/i/item/9789241549950

TABLE 7.1:: HOUSEHOLD WATER PERCEPTIONS IN PERI-URBAN AREAS OF MONTSERRADO COUNTY				
Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
(scale from 1 to 10, with 1 being not clear and 10 being extremely clear)	7–10	23.1	22.5	22.8 (20.5, 25.2)
Taste (scale from 1 to 10, with 1 being terrible taste and 10 being great taste,)	0–3	29.5	23.9	26.1 (23.7, 28.6)
	4–6	19.5	17.5	18.2 (16.2, 20.5)
	7–10	51.0	58.6	55.7 (52.8, 58.5)
Overall quality (scale from 1 to 10, with 1 being terrible and 10 being great)	0–3	21.2	16.8	18.5 (16.4, 20.8)
	4–6	22.5	18.5	20.1 (17.9, 22.5)
	7–10	56.4	64.7	61.4 (58.6, 64.1)
Availability	Yes	54.7	52.1	53.1 (50.3, 55.9)
	No	45.3	47.9	46.9 (44.1, 49.8)

Chapter 8: Household Water Preferences

The preference households have for sources of water used for drinking and other domestic purposes is important in understanding what type of infrastructure or service to provide communities. The four most preferred water sources (in order of preference) among study participants were found to be protected well with cover (32.2%), private yard tap/pump (22.4%), open dug well/unprotected (12.7%), and water kiosk (10.7%). Private inside tap, although the best in the water ladder, was preferred by only 8.0% of the study participants (Table 8.1).

The reason for preference of the water sources was also assessed during the study (Table 8.1). The most common reason for water source preference was distance/convenience of the water source from the household (46.9%), followed by perceived water quality (36%).

TABLE 8.1: HOUSEHOLD WATER PREFERENCE

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Preferred water source	Lake, river, pond, stream (surface water)	4.5	3.4	3.8 (2.9, 5.1)
	Open or dug well (unprotected)	11.2	13.7	12.7 (11.0, 14.8)
	Protected well with cover	31.8	32.4	32.2 (29.6, 34.9)
	Private yard tap/pump	22.5	22.4	22.4 (20.1, 24.9)
	Private Inside tap	9.1	7.3	8.0 (6.6, 9.7)
	Rainwater	0.4	0.1	0.3 (0.08, 0.8)
	Public borehole	3.6	4.7	4.3 (3.2, 5.6)
	Water kiosk	12.3	9.7	10.7 (9.1, 12.6)
	Water vendor	3.2	4.8	4.2 (3.2, 5.5)
	Neighbor's tap	1.5	1.2	1.3 (0.8, 2.2)
	Other	0.0	0.1	0.08 (0.01, 0.6)
Reason for water source preference	Taste	12.9	12.6	12.7 (11.0, 14.8)
	Price	4.5	2.6	3.3 (2.5, 4.5)
	Perceived quality	37.1	35.3	36.0 (33.3, 38.8)
	Distance/convenience	44.3	48.6	46.9 (44.1, 49.7)
	Other	1.3	0.8	1.0 (0.6, 1.7)
	Yes	91.7	93.1	92.6 (91.0, 93.9)

TABLE 8.1: HOUSEHOLD WATER PREFERENCE				
Variable	**Value**	**Male**	**Female**	**Total Sample**
		Household Head (N=472)	**Household Head (N=728)**	**Household Head (N=1,200) (95% CI)**
If you could change your water source, would you choose a different water source?	No	8.3	6.9	7.4 (6.1, 9.0)

Chapter 9: Household Water Financing, Services, and Willingness-to-Pay

Household Water Financing

This chapter looks at payment for water services, along with water plan type, frequency, costs, and service management, which can all act as drivers of water source selection, and additional time spent traveling for water collection. Table 9.1 highlights the prevalence, types, and frequency of financing for water services.

The majority of individuals (72%) reported paying for their water, with the most common payment plans including pay per use (86%) with monthly billing frequency (73%). While the payment for services is high, the high proportion of billing that is monthly aids in normalizing expenditures for households and allowing adequate time for financial planning.

Generally, costs for filling a jerrycan are also quite low, with the majority of respondents reporting prices lower than 20 LD (86%). Further analysis shows that private providers and nongovernmental organizations (NGOs) have the highest prices among all providers, with 31% of respondents reporting that prices for a jerrycan at NGOs are more than 50 LD (0.29 USD). About 14% of respondents stated that jerrycans from private sellers cost more than 50 LD (0.29 USD). Individuals purchasing from local or national government sources and water user committees overwhelmingly reported prices lower than 20 LD (0.12 USD) per jerrycan.

The presence of water user committees was low or not known, with 13% of respondents reporting that their community has a water user committee and 35% stating that they do not know whether a water user committee exists or not. The majority of respondents reported an inability to pay for water services (53%). Of those respondents, 82% reported having difficulty paying for water at least monthly, if not more frequently.

TABLE 9.1: HOUSEHOLD WATER FINANCING

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Household pays for water	Yes	74.4	70.3	71.9 (69.3, 74.4)
	No	25.6	29.7	28.1 (25.6, 30.7)
Payment plan type	Pay per use	86.0	85.5	85.7 (83.2, 87.9)
	Periodic billing	14.0	14.5	14.3 (12.1, 16.8)
Billing frequency	Weekly	20.4	21.6	21.1 (14.8, 29.3)

TABLE 9.1: HOUSEHOLD WATER FINANCING				
Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
	Monthly	73.5	73.0	73.2 (64.6, 80.3)
	Other	6.1	5.4	5.7 (2.7, 11.5)
Jerrycan cost	<20.00 LD	84.3	86.7	85.8 (83.3, 87.9)
	20.00 LD	0.6	0.8	0.7 (0.3, 1.5)
	50.00 LD	10.3	6.8	8.2 (6.6, 10.3)
	>50.00 LD	4.8	5.7	5.3 (4.0, 7.0)
Water source manager	Private business	75.8	78.1	77.2 (74.3, 79.9)
	Local government	4.8	5.1	5.0 (3.7, 6.7)
	National government	6.6	5.5	5.9 (4.5, 7.7)
	NGO	6.3	4.5	5.2 (3.9, 6.9)
	Water user committee	5.4	6.5	6.0 (4.6, 7.8)
	Don't know	1.1	0.4	0.7 (0.3, 1.5)
Water users committee in community	Yes	12.3	14.0	13.3 (11.5, 15.4)
	No	50.6	51.7	51.3 (48.4, 54.1)
	Don't know	37.1	34.3	35.4 (32.8, 38.2)
Unable to pay for water	Yes	50.6	54.3	52.8 (50.0, 55.7)
	No	49.4	45.7	47.2 (44.4, 50.0)
Frequency of water payment difficulties	Daily	4.2	3.3	3.6 (2.4, 5.4)
	Once or twice per week	42.3	42.3	42.3 (38.5, 46.2)
	A few times a month	37.7	34.7	35.8 (32.2, 39.6)
	During certain seasons	7.1	7.6	7.4 (5.6, 9.7)
	Rarely	8.8	11.9	10.7 (8.5, 13.4)
	Other	0.0	0.3	0.2 (0.02, 1.1)

Water Services and Willingness-to-Pay

The cost, availability, convenience, and management of water sources and water services have a large bearing on a household's decisions on where to collect water and can further affect the burden of this activity on households. Essential to ensuring uptake of clean water services is an understanding of households' willingness-to-pay for water services, which can help guide the design of voucher and subsidy programs targeted at increasing the uptake of these services within communities. Table 9.2

highlights the current proportion of households that pay for water services and explores data on willingness of respondents to pay for shared and personal water connections.

Slightly more than half of households reported that they currently pay for maintenance of water services (57%), with the majority paying only when maintenance services are needed (68%); the average cost of maintenance services is usually less than 250 LD (1.45 USD) (80%). Similar proportions of households stated that they would pay for a shared (97%) or personal water connection (94%), with typical willingness-to-pay for both being less than 2,800 LD (16.22 USD) (93% for water point and 90% for water connection).

Respondents also stated that once they had a water connection, whether shared or personal, they would mostly be unwilling to pay more than 20 LD (0.12 USD) for a jerrycan (96% for shared connection and 97% for personal connection). Respondents further stated that they prefer private sector management of the water connections with oversight by national and local government entities (49%). However, 34% of respondents stated preference for national government management and 18% stated preference for local government management.

TABLE 9.2: HOUSEHOLD SUPPLEMENTARY WATER SERVICES AND WILLINGNESS-TO-PAY

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Contribution to water service maintenance	Yes	55.5	57.4	56.7 (53.8, 59.5)
	No	44.5	42.6	43.3 (40.6, 46.2)
Frequency of contribution	Monthly	27.9	27.0	27.4 (24.1, 30.8)
	Quarterly	6.1	4.1	4.8 (3.5, 6.7)
	Annually	0.0	0.2	0.2 (0.02, 1.0)
	As needed	66.0	68.7	67.6 (64.0, 71.1)
Average water maintenance fees	<250.00 LD	76.7	81.3	79.6 (76.4, 82.4)
	250.00–500.00 LD	6.9	4.6	5.4 (4.0, 7.4)
	≥500.00 LD	1.5	1.2	1.3 (0.7, 2.5)
	Varies as needed	14.9	12.9	13.7 (11.3, 16.5)
Respondent would be willing to pay for shared water connection	Yes	96.6	96.4	96.5 (95.3, 97.4)
	No	3.0	2.6	2.8 (2.0, 3.8)
	Don’t know	0.4	1.0	0.8 (0.4, 1.4)
	≤2,800 LD	92.3	92.6	92.5 (90.8, 93.9)

TABLE 9.2: HOUSEHOLD SUPPLEMENTARY WATER SERVICES AND WILLINGNESS-TO-PAY				
Variable	**Value**	**Male**	**Female**	**Total Sample**
		Household Head (N=472)	**Household Head (N=728)**	**Household Head (N=1,200) (95% CI)**
Willingness-to-pay for shared water connection registration	2,800–3,500 LD	5.5	6.4	6.0 (4.8, 7.6)
	>3,500 LD	2.2	1.0	1.5 (0.9, 2.4)
Willingness-to-pay for one jerrycan with shared connection	≤20 LD	96.6	96.6	96.2 (94.9, 97.2)
	20–50 LD	4.4	3.1	3.6 (2.7, 4.9)
	>50 LD	0.0	0.3	0.2 (0.04, 0.7)
Respondent would pay for own compound water connection	Yes	94.5	93.0	93.6 (92.1, 94.8)
	No	5.1	6.2	5.8 (4.6, 7.2)
	Don't know	0.4	0.8	0.7 (0.3, 1.3)
Willingness-to-pay for own compound water connection registration	≤2,800 LD	88.8	90.2	89.7 (87.7, 91.3)
	2,800–3,500 LD	8.3	7.6	7.9 (6.4, 9.6)
	More than 3,500 LD	2.9	2.2	2.5 (1.7, 3.6)
Willingness-to-pay for one jerrycan for direct connection	≤20 LD	95.5	97.4	96.6 (95.4, 97.5)
	20–50 LD	4.2	2.3	3.1 (2.2, 4.3)
	>50 LD	0.2	0.3	0.3 (0.08, 0.8)
Management preferences for water connection	Private sector with oversight by local/ national government	51.9	46.7	48.8 (45.9, 51.6)
	Government of Liberia with local staff	26.5	33.8	30.9 (28.4, 33.6)
	Local city or county government	19.5	18.3	18.8 (16.6, 21.1)
	Local community leadership	0.6	0.4	0.5 (0.2, 1.1)
	Other	1.5	0.8	1.1 (0.6, 1.9)

Chapter 10: Household Water Responsibilities

This chapter looks at the responsibility for water collection, payment, and use within the household. Views varied between male and female respondents when they were asked who in the household is responsible for making decisions regarding where water is collected. Fifty-two percent of the men reported that male household heads should make water collection decisions, while 67% of the women indicated that it should be the female household heads. Only around 13% of respondents said that spouses or partners should make the decision together. This trend continued for water payment decision with 59% of the men stating that the male head of household should make decisions on payment for water and 59% of the women stating that the female head of household should make decisions on payment. Greater consensus was found on who in the household is responsible for making decisions around water management and use, with 71% of female respondents stating that women are responsible for making decisions around water management and use; only 39% of males reported that men should make decisions on household water management and use.

TABLE 10.1: HOUSEHOLD WATER RESPONSIBILITIES

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Water collection decision	Head of household (man)	52.3	18.4	31.8 (29.2, 34.4)
	Head of household (woman)	29.0	67.0	52.1 (49.3, 54.9)
	Spouses or partners together	15.7	11.7	13.3 (11.4, 15.3)
	Any member of the household	3.0	2.9	2.9 (2.1, 4.0)
Water payment decision	Head of household (man)	59.3	24.0	37.9 (35.2, 40.7)
	Head of household (woman)	19.7	59.1	43.6 (40.8, 46.4)
	Spouses or partners together	18.6	14.7	16.3 (14.3, 18.5)
	Any member of the household	2.3	2.2	2.3 (1.6, 3.3)
Water management decision	Head of household (man)	39.2	11.1	22.2 (19.9, 24.6)
	Head of household (woman)	36.7	71.4	57.8 (54.9, 60.5)
	Spouses or partners together	19.1	14.3	16.2 (14.2, 18.4)

TABLE 10.1: HOUSEHOLD WATER RESPONSIBILITIES				
Variable	**Value**	**Male**	**Female**	**Total Sample**
		Household Head (N=472)	**Household Head (N=728)**	**Household Head (N=1,200) (95% CI)**
	Any member of the household	5.1	3.2	3.9 (2.9, 5.2)

Chapter 11: Household Sanitation and Hygiene Practices

Although this study focused primarily on household water access and use, basic sanitation and hygiene data were also collected. This chapter looks at household sanitation practices in the peri-urban areas of Logan Town and New Kru Town. As displayed in Table 11.1, toilet use in the area is 76.8% and bush use is low (23.2%). However, respondents reported that 75% of the toilets are shared and are not individually owned. About 65% of the toilets are within the household compound and another 17% reported using public toilet blocks.

TABLE 11.1: HOUSEHOLD SANITATION AND HYGIENE BEHAVIOR

Variable	Value	Male	Female	Total Sample
		Household Head (N=472)	Household Head (N=728)	Household Head (N=1,200) (95% CI)
Defecation location	Bush, lake, river, etc. (open defecation)	23.1	23.2	23.2 (20.9, 25.6)
	Latrine/toilet	76.9	76.8	76.8 (74.4, 79.1)
Is latrine shared with other households?	Yes	74.4	76.7	75.8 (72.9, 78.5)
	No	25.6	23.3	24.2 (21.5, 27.1)
Location of latrine facility	Within the household compound/yard	66.1	64.0	64.9 (61.7, 67.9)
	Outside the household compound, but within 30 m	9.1	11.8	10.7 (8.9, 12.9)
	Outside the household yard, but further than 30 m	5.0	4.1	4.4 (3.3, 6.0)
	In a neighboring household compound/yard	2.2	2.7	2.5 (1.7, 3.7)
	In a public facility (public toilet block, at a school, etc.)	17.6	17.4	17.5 (15.1, 20.1)

As displayed in Table 11.2, 83% of households provided permission to observe toilets. Among the observed toilets, 53% were pour flush toilets with concrete or zinc or mud walls, and with a commode (Table 11.2). This was followed by toilets with ventilated pit latrine with concrete, plastic, or ceramic flooring (18%). Another improved latrine was one with cement, plastic, or ceramic flooring (15%). A total

of 93% of households had improved toilets. The unimproved toilets included simple latrine with dirt or wood floor and ventilated pit latrine with dirt or wood floor.

TABLE 11.2: OBSERVATION OF HOUSEHOLD TOILETS				
Variable	**Value**	**Male**	**Female**	**Total Sample**
Permission to view household latrine facility	Yes	82.4	84.3	83.5 (81.0, 85.8)
	No	17.6	15.7	16.5 (14.2, 19.0)
Sanitation facility observed	No toilet facility (open defecation)	0.3	0.2	0.3 (0.06, 1.0)
	Simple latrine with dirt or wood floor (unimproved)	4.7	3.2	3.8 (2.6, 5.4)
	Ventilated pit latrine with dirt or wood flooring (unimproved)	2.0	3.6	3.0 (2.0, 4.5)
	Latrine with cement, plastic, or ceramic flooring (Improved)	11.7	17.6	15.3 (12.9, 18.0)
	Ventilated pit latrine with concrete slab, plastic or ceramic flooring, etc. (improved)	19.1	17.4	18.1 (15.5, 20.9)
	Pour flush toilet with concrete or zinc or mud walls, plastic or ceramic flooring and commode (improved)	55.5	51.4	53.0 (49.5, 56.5)
	Septic system (improved)	5.7	6.4	6.1 (4.6, 8.0)
	Municipal piped system (improved)	0.3	0.0	0.1 (0.02, 0.9)
	Other	0.7	0.2	0.4 (0.1, 1.2)
Distance from latrine to house	≤20 m	95.0	87.9	90.6 (88.3, 92.5)
	21–50 m	5.0	11.9	9.3 (7.4, 11.5)
	>50 m	0.0	0.2	0.1 (0.02, 0.9)
Foul odor inside latrine	No odor detected	28.5	32.1	30.7 (27.6, 34.1)
	Yes, a slight odor	56.4	51.7	53.5 (50.0, 57.0)
	Yes, a strong odor	15.1	16.2	15.8 (13.3, 18.5)
Cover for latrine hole	Yes	44.3	45.5	45.1 (41.6, 48.6)
	No	55.7	54.5	54.9 (51.4, 58.4)
	Yes	49.0	54.3	52.2 (48.7, 55.7)

TABLE 11.2: OBSERVATION OF HOUSEHOLD TOILETS				
Variable	**Value**	**Male**	**Female**	**Total Sample**
Availability of waste container inside sanitation facility	No	51.0	45.7	47.8 (44.3, 51.3)
Availability of artificial lighting	Yes	23.2	27.9	26.0 (23.1, 29.3)
	No	76.8	72.1	74.0 (70.7, 76.9)
Accessibility of facility to people with disability	Yes	59.4	59.6	59.5 (56.0, 62.9)
	No	40.6	40.4	40.5 (37.1, 44.0)
Walls of sanitation facility	No walls	0.7	0.6	0.7 (0.3, 1.6)
	Mud, dung, grass	2.0	1.5	1.7 (1.0, 2.9)
	Sun-baked bricks	1.7	2.8	2.3 (1.5, 3.7)
	Commercial bricks	31.2	24.3	26.9 (23.9, 30.2)
	Wood	0.0	0.6	0.4 (0.1, 1.2)
	Cement	59.7	64.5	62.6 (59.1, 66.0)
	Other	4.7	5.7	5.3 (3.9, 7.2)
Roof of sanitation facility	No roof	5.7	5.3	5.5 (4.1, 7.3)
	Plastic sheet, grass, thatch	0.0	0.4	1.7 (0.1, 1.2)
	Zinc roofing/metal sheets	92.6	92.1	92.3 (90.2, 94.0)
	Concrete slab (cement)	1.0	1.3	1.2 (0.6, 2.2)
	Wood	0.0	0.2	0.1 (0.02, 0.9)
	Other	0.7	0.4	0.5 (0.2, 1.4)
Availability of door or entrance covering for privacy	Yes	94.0	95.3	94.8 (93.0, 96.2)
	No	6.0	4.7	5.2 (3.8, 7.0)
Availability of lock on the inside of the door	Yes	70.1	71.5	71.0 (67.6, 74.1)
	No	29.9	28.5	29.0 (25.9, 32.4)
Availability of hand-washing station inside facility	Yes	16.4	19.4	18.2 (15.7, 21.1)
	No	83.6	80.6	81.8 (78.9, 84.3)
	Preference	3.7	5.9	5.0 (3.0, 8.3)

TABLE 11.2: OBSERVATION OF HOUSEHOLD TOILETS				
Variable	**Value**	**Male**	**Female**	**Total Sample**
Reason to choose bush over latrine	No space for a latrine/toilet	29.4	28.4	28.8 (23.7, 34.4)
	Too expensive to get a latrine/toilet	59.6	59.8	59.7 (53.8, 65.3)
	Other	7.3	5.9	6.5 (4.1, 10.1)

A large majority of the toilets (90%) were within 20 meters of the house. Over half (53%) of the toilets observed had a slight odor, and 15% had a strong odor. Observations indicated that 45% had latrine covers, and half the toilets had waste contained inside the sanitation facility. Most toilets did not have artificial lighting (74%).

About 60% of the toilets were accessible to persons with disabilities. Two-thirds of the toilets had cement walls (62%), followed by brick walls (27%). The majority of the toilets had zinc roofing or metal sheets (92%). Doors were observed for 95% of the toilets. About 70% had locks to the inside doors. Only 18% had handwashing stations within the toilet facility. The primary reason why people chose the bush over the toilet was the expense associated with procuring a toilet.

Chapter 12: Determinants of Water Treatment and Extended Trips for Water Collection (Multivariate Analysis)

This chapter presents the analysis of two models that demonstrate the main determining factors for water treatment and extended trips for collecting water. Data indicate that 75% of households do not use any form of water treatment such as filtration or chlorination at the household level. At the same time, 77% of households reported three or more trips a day to collect water. Of these, 37% of households made five or more trips a day.

Treatment of Household-Level Drinking Water

Table 12.1 describes the logistic regression model for assessing the determinants of water treatment at the household level. The dependent variable for this model is drinking water purification, assessed by responses to the question "Does your household do anything to treat /purify your drinking water from this source prior to consumption?" Options of water purification include boiling, filtering, chlorination, solar disinfection, and so forth.

TABLE 12.1: DETERMINANTS ON WATER TREATMENT AT THE HOUSEHOLD LEVEL IN PERI-URBAN AREAS IN MONTSERRADO, LIBERIA

Variable	OR (95% CI)
Religion	
Christian (reference group)	1.00
Muslim	0.36 (0.18–0.74)***
Time spent on one trip for water	
<30 minutes (reference group)	1.00
>30 minutes	0.84 (0.56–1.29)
Location of water source	
On household plot/land (reference group)	1.00
At neighbor's house	0.46 (0.31–0.71)***
Centrally located within the community	0.26 (0.15–0.42)***
Outside the community	0.45 (0.23–0.1.12)
Same water source for bathing, laundry, etc.	
No (reference group)	1.00
Yes	4.6 (2.9–7.1)***
Change primary water source in dry season	

TABLE 12.1: DETERMINANTS ON WATER TREATMENT AT THE HOUSEHOLD LEVEL IN PERI-URBAN AREAS IN MONTSERRADO, LIBERIA	
Variable	**OR (95% CI)**
No (reference group)	1.00
Yes	0.67 (0.48–0.93)**
Number of trips per day to collect water	
1	1.00
2	1.3 (0.49–3.5)
3	2.0 (0.79–5.4)
4	2.7 (1.03–7.2)*
≥5	2.2 (0.89–5.8)
Perception of water being very dirty	
Low (0–3) (reference group)	1.00
Medium (4–6)	1.54 (1.05–2.2)*
High (7–10)	1.73 (1.2–2.4)**
Availability of water in the past year	
No (reference category)	1.00
Yes	1.08
Pay for water source	
No (reference category)	1.00
Yes	0.62 (0.45–0.86)**
Number of respondents	1,190
Pseudo R^2	15.0
N=1,190 *P<0.05, **P<0.01, ***P<0.001 Note: The sample size for this model is 1,190 instead of 1,200 due to 10 missing cases for location of the water source. OR, odds ratio.	

Socio-demographic factors such as age, gender, education, and income were not significantly associated with water treatment. As a result, they are not included in the model. Religion was the only social factor that was significant for water treatment. Muslims were significantly less likely to purify their water than Christians (Table 12.1). About two-thirds of the respondents said they spend less than 30 minutes on a water collection trip. However, when time is multiplied by the three to five trips reported each day, it becomes clear that collecting water can be tedious and time-consuming task.

The location of the water source was most strongly associated with water treatment. Households with their water source on their plot of land or near their home were significantly more likely to treat their

drinking water. If the water source was located on a neighbor's plot, then respondents were 54% less likely to purify their water.

Using the same water source for drinking water and for other purposes such as bathing and laundry significantly increased the likelihood of water purification by 4.6 times. Respondents who reported changing their water source during the dry season were significantly less likely to purify their water compared with people who used the same water source during the wet and dry seasons (Table 12.1).

Data indicate that households reporting four trips to get water per day had a higher likelihood of using water treatment (OR 2.7, 95% CI 1.03-7.2). Respondents' perception about water "being dirty" drove their water treatment behavior. Medium and high perceptions of the water being filthy were significantly correlated with higher odds of treating drinking water (Table 12.1). Availability of water all through the year was not associated with water purification. However, those who have to pay for their water were far less likely to treat their drinking water (Table 12.1).

The pseudo R^2 of the model is 0.15 indicating that the predictors spanning social, behavioral, and water-related areas have implications for safe drinking water programs.

Water Source Distance

It is important to calculate the time needed to get water by the number of trips made each day. The data indicate that an average household makes 21 trips each week to fetch water (Table 12.2). For households with a large family size, the number of trips per week is more. The accurate calculation of time taken to get water per day is the number of trips multiplied by the amount of time taken per roundtrip. With the addition of number of trips to the time calculation, it is possible to accurately gauge the massive burden of water collection on women who have the primary responsibility for collecting water for the household.

Table 12.2 provides insight from survey data into the amount of time taken by households for water collection, as well as the median daily yield per person within each community. Households across all communities, on average, make approximately 21 trips to collect water each week. While most individuals reported that they take less than 30 minutes per trip, the high frequency of trips has severe implications for burden on an individual's time.

While the number of liters collected per trip seems quite large, these amounts are barely above the levels outlined by WHO to sustain basic needs in emergency situations (outlined as 7.5–15 liters per day per person), with individuals across all communities having a median amount of approximately 16 liters available per day. In some areas, namely King Peter Town, Blamo Town, Stockton Creek, and Lagoon East, the number of daily liters per person in a household was well below WHO recommendations.

These data highlight two challenges. First, households spend a significant amount of time collecting water, even though they technically meet the global standards for time collection per trip (<30 minutes).

Second, despite multiple trips, household are often unable to collect enough water to cover household water needs.

TABLE 12.2: WATER COLLECTION FREQUENCY AND YIELD PER PERSON, BY COMMUNITY

Community	Weekly Trips	Liters per Trip	Household Size	Daily Liters Per Person[a]
Crab Hole	18.19	45.42	4.61	18.93
Central New Kru Town	19.23	43.60	4.57	18.93
Lagoon East	19.83	37.66	4.36	14.19
Popo Beach B	20.21	45.33	4.91	18.93
Blamo Town	20.68	40.05	5.23	13.52
Stockton Creek	20.74	27.54	5.69	13.07
Gbandi Town	21.50	40.78	4.92	18.93
King Peter Town	23.01	27.63	5.00	11.36
Peace Island	23.93	39.32	5.42	16.40
Average	20.81	38.59	4.97	15.77[b]

[a]Daily liters per person calculated as follows: [(weekly trips/7) × liters per trip]/household size. Data presented here reflect the median value by community, as this value had significant positive skew.
[b]Reflects the median daily liters per person across the sample.

Table 12.3 highlights results from multivariate regression results (ORs) of socio-demographic and behavioral determinants on the number of trips individuals make when collecting water for the household. Households that source their water from protected and private taps, water kiosks, and public or neighboring water pumps are less likely to take more than three trips per day for collection of water, which may largely be determined by the proximity of these sources to their households.

The amount of time spent for water collection, surprisingly, had no significant bearing on the number of trips that individuals make on days that they go to collect water. School attendance (OR 1.83, 95% CI 1.24–2.73), respondent's gender being female (OR 1.63, 95% CI 1.16–2.30), and household size (OR 1.22, 95% CI 1.13–1.32) all increased the likelihood that households would make more than three trips for water on days that they go for collection. Household size is rather straightforward factor, given that the presence of more individuals necessitates a greater volume of water being needed. School attendance and female respondent ORs may be tied to greater awareness of needs and use of water within the household and may merely reflect knowledge and/or attention to these details rather than these being traits that directly influence water collection frequency.

Other household demographics such as income, religion, and whether more than one individual collects water had no significant bearing on water collection frequency. The largest demographic and gender-related drivers of reduced water collection frequency seem to be whether a male is the primary collector of water (OR 0.45, 95% CI 0.28–0.73), old age of the respondent (OR 0.50, 95% CI 0.30–0.85),

and whether individuals live in homes that are rented (OR 0.68, 95% CI 0.47–0.99) or provided for by individuals or entities outside their direct family (OR 0.45, 95% CI 0.27–0.74).

Decision-making for water services was not correlated with water collection frequency, and further, only a perceived strong odor of water from a household's current source was correlated with lower frequency of water collection (OR: 0.58, 95% CI 0.35–0.97). Preference for another water source also did not have a significant bearing on water collection frequency. Payment for water (OR: 0.61, 95% CI 0.40–0.94) and the presence of a water user committee in an individual's community (OR: 0.63, 95% CI 0.40–0.97) were significantly related to decreased frequency of water collection.

TABLE 12.3: RESULTS OF SOCIO-DEMOGRAPHIC AND BEHAVIORAL DETERMINANTS ON EXTENSIVE TRAVEL ON DAYS OF WATER COLLECTION (≥3 TRIPS)

Variable	OR (95% CI)
Primary water source	
Lake, river, pond, stream [surface water] (reference category)	1.00
Protected dug well/tap	0.07 (0.01, 0.58)*
Private yard tap	0.11 (0.01, 0.88)*
Water kiosk	0.08 (0.01, 0.70)*
Public borehole/pump	0.06 (0.01, 0.48)**
Neighboring household well/pump	0.08 (0.01, 0.67)*
Water collection time	
<30 minutes (reference category)	1.00
>30 minutes	1.08 (0.75, 1.57)
Respondent gender	
Male (reference category)	1.00
Female	1.63 (1.16, 2.30)**
Respondent age	
18–35 (reference category)	1.00
36–55	0.85 (0.59, 1.21)
≥56	0.50 (0.30, 0.85)**
Ever attended school	
No (reference category)	1.00
Yes	1.83 (1.24, 2.73)**
Household monthly income	
Not working or no income (reference category)	1.00
<100 USD	1.18 (0.80, 1.74)
100–200 USD	1.50 (0.89, 2.51)

TABLE 12.3: RESULTS OF SOCIO-DEMOGRAPHIC AND BEHAVIORAL DETERMINANTS ON EXTENSIVE TRAVEL ON DAYS OF WATER COLLECTION (≥3 TRIPS)	
Variable	**OR (95% CI)**
Respondent religion	
Christian (reference category)	1.00
Muslim	1.23 (0.69, 2.19)
Household size	1.22 (1.13, 1.32)***
Home ownership	
Own (reference category)	1.00
Rent	0.68 (0.47, 0.99)*
Live for free	0.45 (0.27, 0.74)**
Main water collector	
Woman (reference category)	1.00
Man	0.45 (0.28, 0.73)***
Boy	1.17 (0.78, 1.75)
Girl	1.27 (0.82, 1.97)
Other water collector in household	
No (reference category)	1.00
Yes	1.18 (0.84, 1.67)
Water collection decision maker	
Male household head (reference category)	1.00
Female household head	1.01 (0.70, 1.47)
Spouse or partner joint decision	1.62 (0.90, 2.91)
Anybody in household	1.44 (0.50, 4.14)
Water perceived to have foul odor	
No or minimal odor (reference category)	1.00
Moderate odor	0.71 (0.42, 1.20)
Strong odor	0.58 (0.35, 0.97)*
Prefer another water source	
No (reference category)	1.00
Yes	1.62 (0.95, 2.77)
Household pays for water	
No (reference category)	1.00
Yes	0.61 (0.40, 0.94)*
Water committee in community	
No (reference category)	1.00

TABLE 12.3: RESULTS OF SOCIO-DEMOGRAPHIC AND BEHAVIORAL DETERMINANTS ON EXTENSIVE TRAVEL ON DAYS OF WATER COLLECTION (≥3 TRIPS)	
Variable	**OR (95% CI)**
Yes	0.63 (0.40, 0.97)*
Water payment difficulty	
No (reference category)	1.00
Yes	1.16 (0.82, 1.65)
Community water fund contribution	
No (reference category)	1.00
Yes	0.92 (0.66, 1.26)
Number of respondents	1,200
Pseudo R^2	15.5

*P<0.05, **P<0.01, ***P<0.001

Note: Data were missing for dry season water sources, so this variable has been omitted from the dry season's regression. Odds ratios presented for the primary water source include only those that show statistical significance to retain table legibility. For similar reasons, only significant variables of perceived water quality have been included. Extensive travel for water collection in this analysis was defined as a household making three or more trips on days that they collect water.

Chapter 13: Qualitative Findings

This chapter focuses on the qualitative study findings. Lawrence Green's PRECEDE-PROCEED model was used to organize the data in a meaningful way and highlight the water-related realities and challenges faced by peri-urban Montserrado communities in Liberia.

Theoretical Framework

The PRECEDE-PROCEED model[15] was adopted to further understand the water needs in the three peri-urban study locations (Peace Island, Logan Town, and New Kru). The PRECEDE-PROCEED model was developed in the 1980s to provide a framework that takes a systematic approach to conducting needs assessment and planning programs for illness prevention and health promotion.

The model essentially consists of nine phases, from an initial needs assessment to an outcome evaluation of an intervention. These phases include social assessment, epidemiological assessment, behavioral and environmental assessment, education and ecological assessment, administrative policy assessment, implementation, impact evaluation, and outcome evaluation (Figure 13.1). The PRECEDE-PROCEED model has been applied to many different health areas, such as community health, water, diabetes, and maternal health, among others.[16,17,18,19]

The first four phases of the PRECEDE-PROCEED model were applied to the peri-urban water study: (i) social assessment, (ii) epidemiological assessment, (iii) behavioral and environmental assessment, and (iv) education and ecological assessment. The PRECEDE model was applied to the context of clean drinking water and household use of water in the peri-urban areas of Montserrado in Liberia.

The model begins with a social assessment that assesses quality of life as an outcome (Figure 13.1). Quality of life is closely tied to the availability of drinking water and water for household use. Communities that lack a regular supply of water are under constant distress, which makes daily life very

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[15] Green, L. W., Kreuter, M. W., Deeds, S., & Partridge, K. (1980). *Health education planning: A diagnostic approach.* Mayfield Publishing Company.

[16] Gielen, A. C., & Green, L. W. (2015). The impact of policy, environmental, and educational interventions: A synthesis of the evidence from two public health success stories. *Health Education and Behavior, 42*(1 Suppl), 20S–34S. doi: 10.1177/1090198115570049

[17] Jeihooni, A. K., Harsini, P. A., Kashfi, S. M., & Rakhshani, T. (2019). Effect of educational intervention based on the PRECEDE-PROCEED model on preventive behaviors of cutaneous leishmaniasis among housewives. *Cadernos de Saude Publica, 35*(7), Article e00158818. doi: 10.1590/0102-311X00158818

[18] De Kleijn, A. (2008). Health improvement through dietary management of type 2 diabetes. *British Journal of Community Nursing, 13*(8), 378, 380–383. doi: 10.12968/bjcn.2008.13.8.30731

[19] Furuta, M., & Mori, R. (2008). Factors affecting women's health-related behaviors and safe motherhood: a qualitative study from a refugee camp in eastern Sudan. *Health Care for Women International, 29*(8), 884–905. doi: 10.1080/07399330802269600

difficult. Data from the study have been analyzed from the quality of life perspective based on the lived experiences of the study participants.

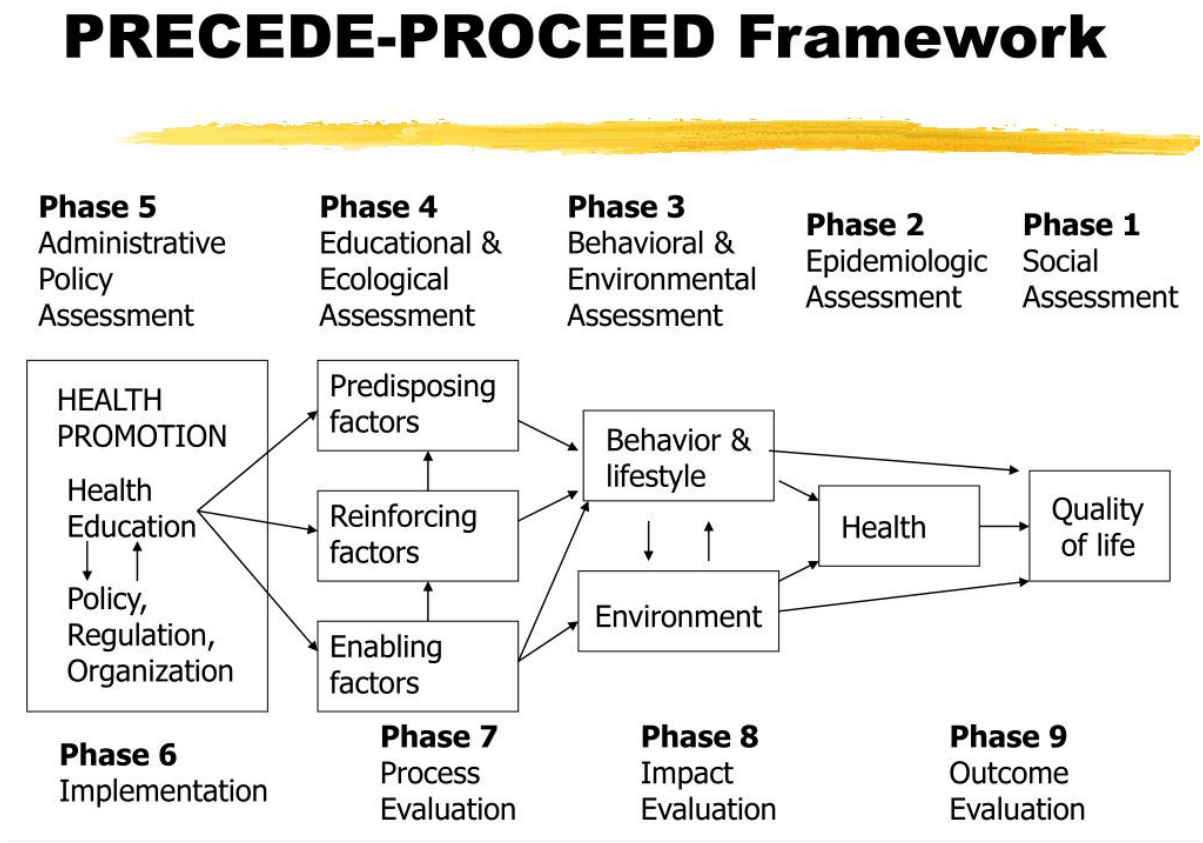

Figure 13.1 : The PRECEDE-PROCEED Framework

The second phase in the model is the epidemiological phase, and in the context of water, it examines infectious diseases such as diarrhea, dysentery, typhoid, and cholera. Lack of water can also lead to skin diseases.[11] The epidemiology assessment examines the health consequences of contaminated water and the ill effects of water scarcity on the health of women and children (Figure 13.1).

The third phase is the behavioral and environmental assessment in which specific water-related behaviors and environment-related issues are articulated. The two water-related behaviors examined in the study included drinking water treatment and time taken by household members to fetch water. An analysis of the determinants of the two water behaviors can provide guidance on how to plan interventions. Environmental factors related to water and its use include type of soil, availability of water sources near the residence, and number of households per water point, among others.

[1] World Health Organization and United Nations Children's Fund. (2021). Estimates on the use of water, sanitation and hygiene in Liberia. Joint Monitoring Programme

The fourth phase is the educational and ecological assessment. This phase examines the predisposing, reinforcing, and enabling factors of the two water behaviors, water treatment and time taken to fetch water. Predisposing factors are related to values, beliefs, attitudes, and knowledge. They determine a person's motivation to adopt a behavior or not. Green defines enabling factors as, "the skills and resources necessary to perform a health behavior"[20] (p. 75). Reinforcing factors are the factors that either support or limit the behavior that is being promoted. These usually include the social circle around an individual, which is composed of their peers, neighbors, family, and so forth. In the context of the water study, factors that motivate people to adopt water treatment were identified and the predisposing, enabling, and reinforcing factors were examined based on the data.

Results

Phase 1: Social Assessment Results

The first phase of the PRECEDE framework is the social assessment and it deals with quality of life. Quality of life has been defined by WHO as "individuals' perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns."[21]

Access to safe water and sanitation is a basic human right recognized by UN agencies.[22] WHO recommends at least 20 liters per person per day for meeting basic water and hygiene needs of an individual.[23] The analysis for this section has been drawn on the basis of the WHO standards set for an individual's water needs per day. These needs include drinking water and water for domestic use. WHO has worked out basic minimum level of standards, "Hierarchy of water requirements" for emergency situations where a minimum of 20 liters per person per day is required for minimum essential levels for health and hygiene.[23] They also have standards for daily water needs in non-emergency situations. According to WHO, the basic minimum requirement for a person per day is 20 liters with a distance of water access of 20 minutes.[24] The next level is intermediate access which includes 50 liters of water per day within a 5 minute distance. Optimal access is 100 liters per person per day where there is continuous access through different water taps.

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[20] Green, L. , Kreuter, M. W, Deeds, S. G, & Partridge, K. B. (1980). *Health education planning: A diagnostic approach*. Mayfield Publishing Company.

[21] International Encyclopedia of Public Health. (2008). https://www.sciencedirect.com/topics/nursing-and-health-professions/quality-of-life

[22] United Nations. (2010). The human right to water and sanitation. Media brief. https://www.un.org/waterforlifedecade/pdf/human_right_to_water_and_sanitation_media_brief.pdf

[23] World Health Organization. (n.d.). Water sanitation and health. https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/environmental-health-in-emergencies/humanitarian-emergencies

[24]Moral, C. (2013). *How much water is needed in emergencies* [Blog post]. https://blog.ferrovial.com/en/2020/03/how-many-litres-of-water-does-a-person-need-per-day/

Figure 13.2 shows a Maslow's hierarchy of water needs. The model indicates that for basic short-term survival, the minimum requirement is 10 liters for drinking and 20 liters for cooking. Medium-term survival needs include washing oneself, laundry, cleaning home, growing food, and sanitation; these tasks require an additional 50 liters of water a day. Long-term survival includes water for business purposes and for recreational needs.

Figure 9.1. Hierarchy of water requirements (after Maslow's hierarchy of needs)

Figure 13.2: Source: https://www.un.org/waterforlifedecade/pdf/human_right_to_water_and_sanitation_media_brief.pdf

Adequate water access and clean water are inextricably linked to people's quality of life. Communities with compromised water supply and access live on the margins of society in terms of poverty and lack of resources.

Data for the social assessment were primarily drawn from 12 FGDs with women and men from the three study sites. Such peri-urban communities are at the margins of society globally.

The data from Logan Town, New Kru Town, and Peace Island tell a similar story. The communities are not fully integrated into the formal urban set-up, and they are consequently at the mercy of private water providers who charge per bucket/gallon of water.

Problems with Water Quantity and Access

Community members in focus groups across the three study locations expressed a high level of distress related to the water situation in their towns. For example, the situation in Momo Town is very difficult according to some of the residents. Only one handpump caters to the drinking water needs of people from four blocks of Momo Town.

> *I am not satisfied at all because water doesn't come on time; most often we have shortages in the water line for which we are out of water for about two to three days. According to Water and Sewer the general pipe has burst and we will not receive water for a couple of weeks.*
>
> —Man (P6), FGD, Momo Town, Logan Town

> *The water situation in Momo Town is not fine because of the water shortage. The day the water is available it becomes slower. Sometimes it takes two to four days for us to get water. We have thousands of houses that don't have access to a (hand) pump …. We need about four or six pumps each of the four blocks in our community.*

—Man (P5), FGD, Momo Town, Logan Town

Two women from Grandi, another town in Logan Town, said in an FGD that their water woes run high. They spoke of issues with water safety, quantity, and access. In terms of water quantity, often there is insufficient water for cooking purposes, and to make matters worse, the water is dirty. The women described their plight as follows:

> *We suffer to get water here both drinking and cooking water. We can go distance for cooking water. Everyone goes to that one place, sometimes when we go we can't find water. The day the pump will open for you to get water, you will be there the whole day. It is not easy getting water in our community.*
>
> —Woman (P3), FGD, Grandi, Logan Town

> *We are not satisfied about the water. The pump water which we drink, when it go for two days it can be dirty when it comes back, the water can be dirty. The distance to the well is also far about 15 minutes' walk and when you reach there, the place can be packed and the owners can tell you to pay 100 LD [0.58 USD] monthly to be able to draw. If you don't pay the money, you wouldn't draw until you pay.*
>
> —Woman (P2), FGD, Grandi, Logan Town

The situation was similar in most of the peri-urban towns included in the study. Men in New Peter Town spoke about the lack of handpumps and the lack of safe drinking water in their community.

> *Because we don't have safe drinking water in our community. The population of our community is high and we suffer from safe drinking water. The population is about 5,000 plus.*
>
> —Man (P1), FGD, New Peter Town, Logan Town

> *We are not satisfied with the water situation in the community…because there is no pump and we use wells. The pump we have here was built by certain NGO and we are required to pay for the water.*
>
> —Man (P2), FGD, New Peter Town, Logan Town

> *The only challenge is that the distance that we cover for the water. Yes, we used more than one water source because of the crowds that can be at the well. It is very difficult to get water. The woman is responsible to retrieve water.*
>
> —Man, IDI, Logan Town, Blomo Town

Quality of Drinking Water

Women and men from three towns, Crabhole, Grandi, and Blamo, complained about the quality of water in their communities. Men in the FGD at Crabhole Town said that their water is contaminated and cannot be used for drinking purposes. Crabhole does not have a handpump, and people have no choice but to use well water for drinking purposes.

I am not satisfied because the water situation in this community is very bad. We don't have anything to treat the water for quality purposes. We don't even have hand pump in the community. People who have wells in the community face difficulty with overflow of water because the dirty water from the surface of the ground gets into the wells as such when we take bath with the water it creates rashes on our skin.

—Man (P5), FGD, Crabhole, New Kru Town

Meanwhile, women in Grandi talked about the problems with obtaining clean drinking water. They spoke about the rainy season when the surface water is dirty and how families are compelled to buy mineral water for their children.

It is very difficult to get water in this community. The well water and the drinking water can be very dirty when the rain falls. If you don't have money to buy cold water for your children to drink, they wouldn't drink water for that day.

—Woman (P1), FGD, Grandi, Logan Town

Similarly, the situation in Crabhole is such that the community is forced to drink unsafe and unclean water. The only option they have is to buy "plastic water," but most people cannot afford mineral water.

The water situation in this community is very bad as such some of us don't drink from it. We rather buy mineral water from the plastic to drink but two-thirds of the majority can't afford to buy the plastic water.

—Man (P6), FGD, Crabhole, New Kru Town

Yes…. The water situation in our community is not fair because we can cook, drink and take bath with the same water. Some of us don't have money to buy water.

—Man (P4), FGD, Crabhole, New Kru Town

The quality of drinking water needs to be assessed periodically to deem the water safe for drinking purposes. Community members across several FGDs mentioned that they had never seen water from their water sources being tested at the water source itself. Women in Blamo Town reported that their water has never been tested.

No, they don't do that.

—Woman (P2), FGD, Blamo Town, New Kru Town

Apart from you people nobody has ever come here to do that but at the clinic the nurses and doctor tell us how to use our water.

—Woman (P4), FGD, Blamo Town, New Kru Town

Fees for Water Use

An important dimension of quality of life is the daily out-of-pocket payment for water for basic needs. Among study participants, the privatization of a basic amenity such as water was linked to accountability

and risk challenges. The risks include falling ill and adults passing the day without adequate safe drinking water. The women of Grandi, Logan Town, expressed their despair in the following words:

> *We are begging the government and the health ministry of help us because the water business is giving us hard time. We are getting sick from the water. Sometimes when those who pump were built on their land have a bad time, they will tell people that only two buckets is allowed to be drawn by everyone. When you carry six gallons, you will come back with four empty.*
>
> —Woman (P5), FGD, Grandi, Logan Town

> *Some people can give their land for a pump to be built on it. When the pump is built and we use it for one month, the owners of the land will forcibly take the pump as their own and lock it.*
>
> —Woman (P4), FGD, Grandi, Logan Town

The amount paid for water varies from community to community and context to context. In Blamo Town, people pay 25.00 LD (0.14 USD) for one gallon of water and at New Kru Town they pay 10 LD (0.06 USD) for a gallon. Participants were asked whether members in their community pay for water, and how much it costs:

> *Yes, we pay for water, every week because my mother sell juice and sometimes, I get only one gallon and it is not enough for our house. ... It is pump water.*
>
> —Woman (P5), FGD, Blamo Town, New Kru Town

> *We (pay) 25 dollars for one gallon of water.*
>
> —Woman (P4), FGD, Blamo Town, New Kru Town

Water is a daily need and therefore has an impact on peoples' quality of life. Women in Blamo Town spoke about how the lack of adequate water points affects their access to water. Study participants were clear across FGDs that if they don't pay for the water, they don't get it. The term "suffer" or "suffering" appears many times in the dataset.

> *Mainly for us we really suffer for water here and the other people we'll we go to sometimes they tell us that if we are not from their environment, we won't draw water from their well or we should pay the amount of 50 LD (0.30 USD) ... Every day we pay that if you don't he tell you to empty the water back into the well.*
>
> —Woman (P3), FGD, Blamo Town, New Kru Town

Participants were also asked about the cost for a gallon of water:

> *It is 10 dollars even though the mineral sack is expensive but the time you will take to get water at the pump is not easy sometimes you don't even get water.*
>
> —Woman (P2), FGD, Blamo Town, New Kru Town

Some people drink mineral water but it is because of the closing and opening of the pump and the place is full with people, so we are forced to buy mineral water because we don't get water sometime.

—Woman (P4), FGD, Blamo Town, New Kru Town

The fee for water is a complex issue. People are willing to pay for water but only up to a tariff limit. Liberia is among the poorest countries in the world, with 64% of its population living below the poverty line and 1.3 million people living under the extreme international poverty line of 1.90 USD per day.[25,26]

The overall of quality of life of many study participants from peri-urban communities near Montserrado has been compromised owing to the daily problems with water access and quality. Community members shared their experiences with every aspect of water, and the issues, such as quality of drinking water, quantity of water availability, and time taken to fetch water, are compounded when there is a daily tussle to procure water. Almost every person in the IDIs stated that getting water is the responsibility of the woman of the household, adding a gender dimension to an already strained situation. This additional burden on women in terms of time and stress needs to be considered as water-related solutions are proposed.

Phase 2: Epidemiological Assessment

Data for the epidemiological assessment were drawn from all the IDIs, FGDs, and KIIs conducted with women and men from the three study sites. The data from Logan Town, New Kru Town, and Peace Island tell a similar story. All participants knew and wanted to reap the health benefits of consuming and using clean water. While a small number of participants thought the water in their community was clean, most participants felt their community water was unsafe. Participants described skin rashes, stomach issues, and other diseases that they or others have experienced from the unclean water in their or other communities. Participants also suggested potential solutions to improving water cleanliness and consequently decreasing negative health outcomes.

Health Benefits of Clean Water

Many respondents felt that sufficient quantity and quality of water was essential to achieving good health.

Water is good for our health.

—Man, IDI, Logan Town, Blamoh Town

[25]World Food Programme. (2018). Liberia country programme (2013–2018). https://www.wfp.org/operations/200395-liberia-country-programme-2013-2018

[26] World Bank. (2021). Poverty and equity brief: Liberia. https://databank.worldbank.org/data/download/poverty/987B9C90-CB9F-4D93-AE8C-750588BF00QA/AM2020/Global_POVEQ_LBR.pdf

I need quality and safe water for good health.

—Man, IDI, Logan Town, Gbandi

Respondents felt that clean and sufficient water would help them and their family members, including their children, be healthy and strong.

We want you people to help us. We are also appealing to the government so that God will touch their hearts to help us because we are going to so many problems with water in this community. We need safe drinking water for our children to grow healthy. You cannot life without water so we are appealing to the government of Liberia to help us and come to our aid.

—Woman (P1), FGD, Logan Town, Blamoh Town

One respondent specifically highlighted that having clean water will prevent gastrointestinal issues or water-borne diseases:

The importance is when you have safe water you will always be healthy and strong because noting bad will be going in your system.

—Woman, IDI, Peace Island Community

Overall, it seemed that many respondents knew that clean and sufficient water was essential to becoming and staying healthy.

Perceptions of Safe Drinking Water

A few respondents reported being content with the cleanliness/safety of their communities' water. One respondent highlighted that he knew his community had clean/safe drinking water because he had not experienced any illness like he had from other water sources.

When you use the water you don't experience any sickness from the water like other water does so it is safer.

—Man, IDI, Peace Island

Another respondent noted his uncertainty about the source of the water and therefore the safety of the water, but that once he started drinking the water, he knew it was safe.

Because the water is from underground and we don't know whether it is safe or not to other people but since we been practicing drinking the water we never notice anyone getting sick from it but other people drink it.

—Man, IDI, New Kru Town, Popo Beach Community

However, even though a couple of respondents seemed content with the cleanliness of their communities' water, many study participants were dissatisfied (refer to "quality of drinking water" in the social assessment section).

Perceptions of Community Members About Unclean/Unsafe Water

Many respondents thought the unclean water in their community used for drinking, bathing, cooking, and handwashing could cause illness in various ways.

> *Because the water for cooking and bathing is not safe for drinking… Because the wells are not properly covered, some bacteria may drop in the well and they (cause) sickness for us too.*
>
> —Man, IDI, New Kru Town, West Largon

Health Consequences of Unsafe Water

Respondents reported various skin and stomach issues that resulted from unsafe water in their communities. When it came to skin issues, respondents highlighted that unsafe water could cause serious rashes on people's bodies.

> *The water we use here is not safe at all; there is well here called "Bend-Down-Booty" [you need to bend down to fetch water]. When you see it you will feel sorry for us because the well is very dirty. At times, rashes grow on our skin from taking bath with it.*
>
> —Man (P3), FGD, New Kru Town, Logan West

> *People who have wells in the community face difficulty with overflow of water because the dirty water from the surface of the ground gets into the wells. As such, when we take bath with the water, it create rashes on our skins.*
>
> —Man (P5), FGD, New Kru Town, Crab Hole

Many study participants also reported various illnesses with stomach symptoms that resulted from use and consumption of unclean water in their communities.

> *We will only tell the NGO to continue giving us the same assistance that they are rendering us here, that is to purify the water correctly, because humans as a whole, we do want problems within our stomach. So let them continue the assistance.*
>
> —Man, IDI, Logan Town, King Peter's Town

One of the most cited symptoms that resulted from unclean drinking water was diarrhea.

> *Like for our little sisters and brothers, when there is not drinking water they usually go and drink the water, and after some time it causes diarrhea for them. So, we are really need of safe drinking water.*
>
> —Woman (P1), FGD, Peace Island

A couple of other study participants reported that unclean water could cause malaria.

> *When people are drawing water from the well, they can sometimes place some tires in these wells and they can most any breeds mosquitos that are giving people sicknesses (like malaria and diarrhea). We need a pump in this community because the well has some effects, but the pump might be well-protected for the community and you will never experience germ.*
>
> —Woman (P4), FGD, Logan Town, Blamoh Town

Another community member from New Kru Town reported that unclean water would cause typhoid.

> *We face difficulties with safe drinking water and access to good toilets in this community. Most people can free themselves in the bucket waste outside early morning… we might contract malaria, typhoid and other diseases from that.*
>
> —Man, IDI, New Kru Town, Central Comm

One study participant also associated unclean water as well as improper water and waste drainage with cholera.

> *There are many challenges. The ground is not too good for water because this is a swampy land as such, we can contract other diseases like cholera, etc. The water can overflow during the rainy season because there is no drainage system meanwhile people-built houses one alley which can cause overflow of water in the community.*
>
> —Man (P6), FGD, Logan Town, King Peter Town

Another study participant highlighted the serious health consequences of drinking unfiltered, salty water, sharing that some people have died due to unclean, salty water in his community.

> *But the water treatment does not make the wells safe because the water is salty. Some of our people have died from chloride because of the saltwater.*
>
> —Man (P6), FGD, New Kru Town, Crab Hole

Overall, many study participants felt that having unclean water in their community has caused and could cause many different diseases, especially diseases that lead to serious stomach problems.

Solutions to Improving Water Safety

Some study participants shared solutions they have used to address unclean water in their community or proposed solutions to cleaning the water in their community. The most common solution was water maintenance through chlorination of water, whether that was structural maintenance of water or individual maintenance of water.

> *Every month we paid hundred dollars towards the well maintenance…it is good… Because even if you don't boil the water before bathing with it, there can be no rashes on your skin.*
>
> —Woman, IDI, New Kru Town, Crab Hole Community

> *When I bring the water I put chlorine in it for few time before using it… for germs to die.*
>
> —Woman, IDI, New Kru Town, Lagoon West

The second most popular solution was separate water that is used for different purposes. This means that drinking, cooking, handwashing, and/or bathing water were separated. This implies that study participants felt water needed to be more protected and cleaner for some purposes as compared with others.

Yes, I separate them [the drinking water and bathing water] as for me I drink the pump water and I buy sack of water for my kids when they are around… I does that for my health, this is why in my bathroom I don't like my children to touch the bath bucket because I don't want them to mix the bucket with the cooking one.

—Woman, IDI, Peace Island Community, Estate Block A

One participant suggested a requirement for handwashing before fetching water from the hand pump to ensure the water source stays clean.

It will not be safe to keep well and pump water together… For the water to be free from sickness… I think they should have water to wash hands before getting water because people touch the pump and we are in a world full of sickness so that's it.

—Man, IDI, Logan Town, King Peter's Town

Another participant proposed more water kiosks in their community in order to reduce contamination of the water.

We need more water kiosks in our community. Most diseases are contracted through contaminated water.

—Man, KII, Logan Town, Momo Town

Finally, one participant highlighted the need to stop illegal distribution of water, which does not always contain clean water.

The important thing about water is the purity of the water. If the water is safe and purified the human consumption [of water] will be safe… [I] advise that those that illegal distributing the water to houses should stop it.

—Man (P5), FGD, Central Peace Island

Overall, study participants provided various solutions that they or their community has used to clean water, or proposed solutions that might improve the cleanliness of water sources. These included maintenance of water sources, separating water sources based on what it is being used for, handwashing before water collection, increasing water kiosks, and reducing illegal connections of household to water lines.

Phase 3: Behavioral and Environmental Assessment

The third phase of the PRECEDE-PROCEED model includes a behavioral and environmental assessment. This assessment enables a better understanding of key water access and use behaviors and the role of environmental factors in facilitating or obstructing access to safe drinking water sources.

Behavioral Assessment

The behavioral assessment focuses on two water behaviors: the treatment of drinking water at community and household levels and the time taken to fetch water.

Water Access and Time Taken to Fetch Water

Water access for households depends on two factors, the location of the water points and the number of water points available within a community. Peri-urban communities or towns in Liberia are often divided into blocks, and if the water source is not available in the block where the individuals reside, they experience the additional daily burden of distance to collect water for drinking and domestic chores.

A community chairperson in Central New Kru Town shared his experiences on the water situation in his community. Despite two new water kiosks having been built in one block in October 2020, many problems persist. He said that not everyone trusts the water kiosk to provide safe drinking water and people opt for mineral water (sachet water). He mentioned that only one of the three blocks has water kiosks, so the basic problem of the number of water points in the community continues.

> *It's important because it brought little relief to our people who have the water kiosks in their block. I don't know about the others, but my children don't drink from it because they are afraid of the instability of the water kiosk.*
>
> —Community Chairperson, KII, Central, New Kru Town

Similarly, the WASH officer of West Largon, New Kru Town highlighted the lack of community access to water and noted that many water points are not functional. He described the situation in his community as follows:

> *No, we had not but most of them are not functional more bedsides the quantity of water in this community is low.*

In response to the question, "Do you know of any project currently working to increase the supplies of water in your community?," he had a brief and emphatic answer: "No!"

These descriptions indicate the challenging water situation in peri-urban communities around Montserrado. Another water official from Peace Island echoed the same scenario of very low availability of water in his town. In response to the question, "Why are there such few water points?," he replied:

> *I said so because the water sources in the community are not many and it is not coming the way it supposed to come, and also the population in Peace Island is more and people really struggle to get water.*
>
> —Water Official, Male, KII, Peace Island

The behavioral assessment for the time taken to fetch water is intrinsically linked to the number of water points in the community and their location. Unfortunately, the communities studied do not have an equal or adequate number of water points per block. Some blocks have more water points than others. As a result, the time taken to fetch water is longer for the residents who have few water points in their blocks.

Water Treatment

Water treatment is the second behavior explored in the behavioral assessment. The qualitative findings indicate that the practice of treating water at the source or at the household level is inconsistent and that weak social norms exist around water purification.

As discussed earlier, water treatment products are not always available within the community. A WASH officer from West Largon, New Kru Town stated that there are no shops within the community that sell water treatment products. Community knowledge should be built around water treatment products.

> *We don't have any water treatment product in this community except you go to the market to buy it. For WaterGuard, we can buy it from the drug store.*
>
> —WASH Officer, Male, KII, West Largon, New Kru Town

The lack of attention to maintaining standards of water purity and safety are evident from the following observation that the government authorities are unable to sustain a good standard for water quality. The WASH officer stated that it can take people 45 minutes to go to a neighboring town/community to buy water treatment products.

> *I want the government to improve on the quality and frequency of the water access in our community. Sometimes we can go Momo Town for fetch drinking water. It takes us 45 minutes to go and come.*
>
> —Water Official, Male, KII, Peace Island

The responses of the WASH officer from Peace Island in the following exchange sums up the water treatment situation in these peri-urban communities around Montserrado. The key issue is that no one has been assigned the responsibility of prevention of water contamination at the household level by providing the community with water-related SBC inputs.

> *Interviewer (I): Can you give me some insight on water treatment?*
> *Respondent (R): I don't have any idea on it.*
> *I: What is it the community people don't treat the water; only Water and Sewer you people depend on to treat the water?*
> *R: It's because we don't have any machine or idea on treating water.*
> *I: Where do people assess the product for treating the water?*
> *R: In the market.*
> *I: Do you also find some product around the community to buy?*
> *R: No, very far away from the community.*
> *I: Who is responsible for the promotion of household water treatment and save storage?*
> *R:* Nobody is responsible for that.

The behavioral assessment indicates that efforts are required to provide more water points in informal settlements and to conduct an SBC campaign on water treatment at the household and community levels.

Environmental Assessment

Data on the environmental assessment were drawn from all the IDIs, FGDs, and KIIs conducted with women and men from the three study sites. The data from Logan Town, New Kru Town, and Peace Island were similar with regard to the water-related problems the residents encounter. When it comes to the

environment and its effects on water and use of water, most study participants thought the type of land as well as seasonality had strong effects on the quality and quantity of water available for use.

Effect of Land on Drinking Water Quality

Study participants made it clear that the type of land can adversely affect water quality. For example, a few study participants noted that water coming from the ground can come out red or brown. Logan Town and New Kru Town are situated in flood plains. Peace Island also has marshland.

> *The water is not alright because sometimes it is red in color.*
>
> —Man, IDI, Logan Town, Blomo Town

> *Red Cross dug a well in order to help the church, as we draw the water it was clean but suddenly the water turned red, completely red. Some places have good soil because the water there is clean and don't turn red at all and some other area like around that upstairs house the soil there is not good at all.*
>
> —Man, IDI, Logan Town, King Peter's Town

A couple of study participants shared that they dealt with this colored water by sifting the water with sand to clear the water.

> *Yes, there are so many challenges. We can sifter water before we wash our clothes. The well water is very red and dirty we have to sifter the water before using it.*
>
> —Man (P6), FGD, Logan Town, Momo Town

> *We are experience environment challenges. The challenges are the distance we can cover to get water, the color of the water is brown; sometimes we can't find water to bath our child until four pm. There is too much red mud in the well. We can draw the water and sifter with sand.*
>
> —Woman (P3), FGD, Logan Town, Blamoh Town

Study participants also noted that swampy land could cause the water to be unclean and thus unusable.

> *Some parts [of the land are] swampen—and because of these reasons, our well waters don't look like water people supposed to use or even drink, so we are forced to look for water elsewhere.*
>
> —Woman (P3), FGD, Logan Town, Blamo Town

Many study participants said the swamp lands in these communities cause unclean water that is turbid and/or salty.

> *Because the area we live is swampy and the wells water become very dirty at certain point in time.*
>
> —Water Official, KII, Logan Town, Momo

> *If you dig the well near the swamp, it will always be salty and muddy. It also depends on the location of the well.*
>
> —Woman (P3), FGD, Peace Island, Small Island

The water is salty and muddy because the land is swampy for this reason it gives us difficulties in getting water from the well.

—Man (P3), FGD, New Kru Town, Crab Hole

The water is very salty as such it becomes much harder for us to get water during rainy and dry seasons.

—Man (P2), FGD, New Kru Town, Crab Hole

A couple of study participants also noted that swampy lands can create unclean water that can lead to various diseases.

Like for me I don't live down the hole, but I have relatives that live there. During raining season, the water can really embarrass[27] them, and the well they have is contacting to the swamp, so the water from the swamp can enters the well and pollute the well because the water for the swamp is not conducive, it causes harm to the body.

—Woman, FGD, Peace Island

When you leave the swamp water like that and bath with it you can get skin sickness and also the water smells.

—Woman, IDI, Peace Island

Overall, many respondents felt that the land can produce clean water, but it can also make it dirty, salty, and contaminated. This was especially true of swampy land.

Effect of Land on Water Quantity

Some study participants noted that the type of land in their community affected the quantity of water they were able to extract and use. Communities with land that has hard or rocky ground had difficulties in hand-digging wells with pumps affixed to access water.

Block D of this community is struggling with water because they have solid ground. It is very difficult to get water from the soil.

—Man (P5), FGD, New Kru Town, Crab Hole

Yes, and one of the major challenges we faced from the environment is that it is difficult to have a well dug because of the surface of our ground; the ground is too hard.

—Woman (P3), FGD, Logan Town, Blamo Town

One of challenges is that the area is rocky and the process to dig a well will be difficult. We need help from NGOs because Water and Sewer doesn't come every day.

—Woman (P5), FGD, Peace Island, Small Island

[27] "Embarrass" in this context refers to seasonal flooding.

The ground is very much hard that we can't afford to easily get water from the soil. I am a living example; I dug a well that contain 15 culvert28 but I can't still get water from the ground because it's very hard.

—Man (P4), FGD, Logan Town, King Peter Town

Well construction in rocky areas is difficult especially when the well provided is hand dug. The required water column is often not met, which limits the quantity of water available, especially during the dry season. Study participants highlighted this issue as one of the factors responsible for water scarcity in their community.

Effect of Dry Season on Water Quality

Overall, only a couple of study participants noted ways in which the dry season could adversely affect the quality of water—changing the color of the water and creating an odor in the water—available to the community. One study participant mentioned that the dry season could change the color of the water they collect.

During the dry season, the water can change color but during the dry season the water can be fine.

—Man, IDI, King Peter's Town, Logan

Another study participant noted that while the rainy season had cleaner water, the dry season could cause the water to become pungent.

- *During the raining season you will notice that the well water will be clean and no smell, but the dry* season it gives bad smell.

—Community Chairman, KII, Peace Island

Effect of Dry Season on Water Quantity and Pricing

Some study participants noted that the dry season directly led to a limited water supply. As the weather gets warmer, water beds and sources (e.g., rivers) dry up and less water is available for community use.

Because the water we use in this community, it comes from St. Paul River, so whenever the river is full that's the time we get water to draw, but when it goes dry, we find it difficult in getting water to use.

—Woman, IDI, New Kru Town, Crab Hole

Yes, sometime during the dry season the well can go dry.

—Woman, IDI, New Kru Town, Crab Hole

[28] A culvert is a round cemented tube used in Liberia to protect the inner wall of a hand-dug well.

It is not sufficient, but for now it is raining, so water is there. But when sun shines for two to three days, the water dry down from the well.

—Community Chairman, KII, Peace Island

One study participant noted that the dry season and scarcity of water available for collection changes their water collection time. They felt they needed to leave for water collection very early in the morning to improve their chances of getting water before it ran out.

We have a well right back here, but sometimes the water can go dry, and we have to wake up by four in the morning to go and draw because of the water condition… because when the river goes dry the well can go dry too.

—Woman, IDI, New Kru Town, Crab Hole

Another study participant noted that the dry season and consequent scarcity of water could increase travel times because nearby wells could have dried up during the dry season, making it necessary for people to travel to further wells or water sources to collect water.

The water business is very tedious; the sun has dry-up some wells. Because of this, it is hard for people to get water so they can go distances like 30 minutes' walk to get water.

—Man, IDI, New Kru Town, Central

Study participants also noted that that the dry season could restrict water business because if there is less water supply available, there is less water that can be provided or sold to community members.

Yes, during the raining season the well get fill with water and during the dry season the well get dry and water business are restricted.

—Community Chairman, KII, Peace Island

This increase in water scarcity due to the dry season was also reported to increase water prices. While many respondents reported no change in water price in a comparison of the dry season with the rainy season, a few study participants reported that water prices increased during the dry season due to increased water scarcity.

We use the well most often but during dry season there can be restrictions because the well can get dry during dry season… during dry season when the water is going dry, the owner of the well can seek money and the house can sometime pay 150 or 200 hundred and sometime 500 hundred per month.

—Man, IDI, Peace Island, Black Estate J2

It is [usually] five dollars… it changes during the dry season and it became 20 dollars.

—Community Chairman, KII, Peace Island

One study participant even noted that people are more likely to purchase mineral (sachet) or bottled water during the dry season rather than search for water to collect due to the water scarcity.

> *The people can use pumps water but they can drink the plastic mineral water during the dry seasons when water become scarce… Because they feel it's safe to drink.*
>
> —Community Leader, KII, Logan Town, Momo Town

Overall, many respondents reported increased water scarcity during dry seasons, which would result in changing water collection schedules, increased travel time to collect water, restricted water business, increased prices of water, and increased consumption of bottled water.

Effect of Rainy Season on Water Quality

Many study participants reported that the rainy season negatively affected the quality of water available for use by making the water unclean with more dirt and germs. Many respondents (especially those in flood-prone areas) reported that the rain made their water sources and consequently the water collected take on a different color/appearance.

> *Yes, when the rain fall the well water looks different so during that time we put sand in the bag to help make the water clean.*
>
> —Man, IDI, New Kru Town, Popo Beach Community

> *During the rainy season the color of the water can change because of the rain.*
>
> —Man, IDI, New Kru Town, Central

Study participants also noted that the rain more specifically brought germs into their water source and thus the water they could collect and use.

> *The well water is only clean when the rain fall heavy and sometimes it bring germs in the water.*
>
> —Woman (P2), FGD, Logan Town, Blamo Town

> *As for me I will say for the raining season the well is not save for water because during the raining season the water flow and go down the hill and the wells are not protected so the water is not safe for human consumption.*
>
> —Woman, IDI, Peace Island, Estate Block A

> *The bacteria can be in the well during the raining season.*
>
> —Man, IDI, King Peter's Town, Logan

Overall, many study participants thought that the rainy season could negatively affect the quality of water they collected from water sources by changing the color/appearance of the water and causing more germs and bacteria to be present in it.

Effect of Rainy Season on Water Quantity

Most study participants reported that the rainy season increases the quantity of water available for use. This is because most respondents use water collected from rainfall through rainwater harvesting as an alternate water source.

> *During the rainy season many community members don't use the water and sewer instead they used the rainwater.*
>
> —Water Official, KII, Peace Island

> *No, we don't use river but we can use rainwater during the rainy seasons… Yes, during the rainy season, we actually focus on rainwater instead of going to the well to get water.*
>
> —Community Leader, KII, New Kru Town, Central

> *We can use rainwater during the rainy season… During the rainy season we can have access to the rain and the other sources can also be functional and faster.*
>
> —WASH Officer, KII, New Kru Town, West Largon

> *Yes, we get water from the rain during the rainy season… I use it for drinking, cooking, bathing, and washing cloths and the bathroom.*
>
> —Woman, IDI, Peace Island Community

Of note is the fact that increased water availability due to rainfall meant decreased time spent collecting water for many respondents.

> *During the rainy season, we can put our buckets under the rain to get water but during the dry season, we can get on motorbike from here to CCWC community to draw water.*
>
> —Woman, IDI, Peace Island, Central

> *Water is business is hard in Peace Island this year. We used to buy one bucket for 20 LD on this island here. So, we pray to God this year rain falling so water business is not much. And water and sewer was not coming for almost two months, it was this people dirty well that we can go draw one bucket for twenty dollars. So, I pray to God for rain to fall so we can get water.*
>
> —Woman, IDI, Peace Island

However, these study participants also stated that they do not use rainwater for drinking water and will still use water from wells, pumps, and other sources for drinking water.

> *Yes during the rainy season when I have enough water I won't go for water but it is only my drinking water I worry about.*
>
> —Woman, IDI, New Kru Town, Lagoon West

Like for the raining season I hardly go to the well because I catch water but I always go for water to drink.

—Woman, IDI, New Kru Town, Lagoon West

Like for the raining season I hardly go to the well because I catch water but I always go for water to drink.

—Woman, IDI, New Kru Town, Crab Hole

Overall, the rainy season increases water quantity for study participants because they can collect rainfall water in addition to the water they can collect from various other water sources. This convenient source of water also decreased travel times needed to collect water for many respondents. However, rainfall water is often not used for drinking water, so respondents reported still having to collect or purchase drinking water from various water sources.

Phase 4: Educational and Ecological Assessment

The educational assessment includes an understanding of individual, societal, and environmental factors that are related to water access, water quality and use. These factors provide a contextual understanding of the overall physical and cultural environment where the residents of the study communities live and work. According to Green, the education assessment is divided into three areas: predisposing, reinforcing, and enabling factors. Predisposing factors can facilitate or impede access to safe drinking water and adequate water for hygiene and domestic use.

Predisposing Factors

Lack of Knowledge of Water Treatment Techniques

The water survey conducted for this study indicated that only 21% of the respondents treat their drinking water to make it safe for drinking. Women from Peace Island discussed treatment related to purifying their drinking water. The discussion shows that while two women know how much chlorine to put into the water, another woman in the group had no idea about the quantity of chlorine to use to treat her drinking water.

You talk about putting chlorine into water, so what's the quantity of chlorine that you put into the water? ... I used half of the bottle tap to cut down the germs in the water.

—Woman (P6)

That's the same measurement I used to treat my water.

—Woman (P3)

For me I can't treat my water, so I am asking the NGO to please come a train us how to treat water because we don't know how to treat water.

—Woman (P2)

Knowledge about how to purify drinking water, what cleaning agent to use, and what quantity of cleaning product to use was uncommon among the study participants, as illustrated by a continued discussion among the same group of women from Peace Island. The women in the FGD answered the question, "Is there any awareness project that been in this community that talk about water purity and improvement of water safety?," as follows:

> *No awareness.—P2*
> *No awareness project has ever done that.—P2*

Access to Handpumps for Drinking Water

Another predisposing factor is access to handpumps for drinking water. Most of the study participants live in communities where very few blocks have access to handpump water. Households with limited access to handpump water are forced to use other water sources for drinking water such as wells. People who can afford bottled mineral water, opt for it, but even that option requires a daily level of spending among the poorest residents living in peri-urban areas.

> *The most important issue that I would like to express is drinking water, because water is life, so I am appealing to NGO to please come and build some pump for us and also educate us about how to treat our drinking water.—P6*
> *We are appealing to NGO to bring drinking water for us, because there is no safe drinking water in this community.—P5*
> *That's the same water business; we want NGO to bring water for us because we don't have safe drinking water.—P4*
> *I want NGO to bring clean drinking water for us, because we walk on far distances to go get water. So, we are appealing to people to please bring some drinking water in this community.—P3*
>
> —Women, FGD, Peace Island

Meanwhile, in King Peter's Town, a carpenter who rents a single room in a mud house, said that they must pay for their drinking water, which comes from the only handpump in his area. They pay 5 LD per gallon, and he brings two gallons of drinking water per day, which is inadequate for his family of three people. Similarly, a nonliterate single mother of five children from Lagoon West, talked about the challenges she faces related to water, especially drinking water. Her main problem is lack of access to a handpump; she feels that handpump water is safer to drink than well water. Her experience highlights the issue of lack of access to safe drinking water and the daily struggle it causes.

Reinforcing Factors

As with every influencing factor in the PRECEDE-PROCEED model, the effect can either be to facilitate behavior change or to obstruct it. Reinforcing factors are factors found within the social environment. Some of the reinforcing factors (positive and negative) include social inequities within communities; inadequate quantities of water, which leads to low water use for hygiene and domestic purposes; and croaking, a Liberian term for "being cheated."

Inequity Within Communities

One of the main reinforcing factors identifiable in the data was the social inequity in access to and use of water. Study participants articulated this unequal status between themselves and the owners of private water sources. A woman from Peace Island Central who participated in an FGD said, "Majority of us are going through the same water issue and some the people here have their own well, so they don't feel like us." It is as if those with the privilege of access to a good water source live a different life than the rest of the community.

The implication of this social inequity translates into unfair treatment at the water site, such as having to wait longer to collect water, not getting the desired amount of water, and so forth. In FGDs, women from Peace Island Central responded the question "Do they treat people fair or they limit access to some people for getting water?" as follows:

> *They don't treat us fair because sometimes they will waste our time at the pump and at the end of the day we won't have a drop of water, so it is not fair.—P4*
> *When the water company comes they hardly reach us who are really catching* hard time for water.—P2

Several study participants from Small Island felt that some people struggle to even get safe drinking water and that vulnerable groups such as the poor, unemployed, and elderly suffer the most. Two men from Small Island shared their views on the inequity of the water divide, where those at greatest need are unable to have their bare minimum water requirements met. The lack of adequate water points near their homes results in people having to fetch water from long distances.

> *It is not fair because water is life and you need water to live. Everybody is not working, if you buy water at that price it affects the community and yourself. You can't go to hustle for food money and you look for water money too. We need help.—P2*
> *I will say it is not fair because the distance is more expensive than even the water I pay for. I can buy the water for 5 dollars and transport; it can cost me almost 30 LD for one gallon. So, imagine if you have 10 gallons to draw that day.—P4*
>
> —Men, FGD, Peace Island (Small Island)

Inadequate Water Quantity

Another reinforcing factor that reduces even basic access to water is the daily water availability to marginalized families within the study communities. The median amount of water available in the peri-urban communities studied is 15 liters per person, which falls short of the WHO standard of 20 liters per person per day. Also, 50% of the families getting less than the median level of 15 liters per person fall below the survival level delineated by WHO for emergencies.

A woman who lives in a dirt house with her husband and five children in Momo Town stated that she can store only four gallons of water (15 liters) per day for her household of seven members. Study participants shared that they store five to 10 gallons of water a day and that it usually does not last

beyond a day. Several IDI participants were unemployed or had a partner who was unemployed adding to the strain of paying for drinking water.

Croaking (Cheating)

Croaking is a Liberian term for being cheated. Study participants spoke about how people

with private water sources such as hand pumps or wells first take water for themselves and then sell what is left to waiting residents after the water runs out. Croaking is a negative reinforcing factor in these communities, and it prevents people from getting adequate water.

We provide the example of croaking in Peace Island Central where women described their plight in a FGD. When asked how the community water point is managed, one woman said,

> *The person who is managing the water is draw water in lot of gallons and later sell it to people when water is gone.*

Another woman added,

> *As she said the water don't come most often so the lady who is managing the pump draw water and sell it to people after the water is gone.*

A third woman further stated,

> *The water is managed by the person who is selected to take care of the pump so that the pump will not damage soon they report the money to collected to the water company because the pump is in their yard.*

Further describing the process of croaking people, another woman added,

> *It will be good as we are crying for water that our people hear our cry and bring water. Those that will manage it should be fair to the water and to the community that they wouldn't croak them. There should also be a vigilant group to take care of the water ….*
> *Yes, it happened here when Rev. Yekeh brought his water during the Ebola crisis. He told the community to use the water and warned people not to generate cash from the water and sit on it and not go the Water and Sewer Corporation to pay the bills. If you are fair to Water and Sewer in paying this bill, water will continue to be running in this community. Those he put over the water to control it, they croak the community with the water money in the tune of 50,720 LD.*

The reinforcing factors related to water are primarily barriers to water access and use. The suboptimal water use for families without adequate access to water in the peri-urban communities of Montserrado county is rooted in systemic issues.

Enabling and Obstructing Factors

As part of the education diagnosis, enabling or obstructing factors related to daily water access and use were identified from the data. These included insufficient data points, location of water source, availability of water products, and certified/uncertified access to water.

Insufficient Water Points

One of the main reasons that the communities in the study (11 out of 12) had severe complaints related to their water needs was the lack of adequate water points in their own and other blocks. Peri-urban towns around Montserrado county are usually divided into four or five blocks. Sometimes a few blocks have only one water point that is not functional. As a result, people are forced to go to other blocks in the town to procure water for their daily needs. The population to water point ratio in these communities is very low and it disadvantages people who have to traverse long distances for water.

A woman from Peace Island spoke about the need to increase water resources in her community as the population of her area is very large. Similarly, women from Small Island stated in an FGD that more water points are needed to save time on water collection. They also requested water availability on a regular basis.

> *Yes, we need more water points to come near to us so that we will not be transporting our water from one point to another.—P5*
> *We need water not only from Water and Sewer Corporation but we need water that will be in our community that we will get every day.—P6*
>
> —Mont. County Peace Island (Small Island)_FGD_Adult Males_04-05-2021

The water issues related to Peace Island Central are slightly different, but equally distressing. Women in a focus group in Peace Island Central indicated that they only have one handpump in their community, which is grossly inadequate for meeting the needs of all the households. Sometimes, the handpump has no water for more than two weeks. With a single handpump, crowding becomes a problem and then there is a fee for buying water.

> *This community we live in water business is very difficult, because the pump we have we hardly see water almost two weeks now there is no water, we have one hand pump in this community and sometime the place is fill with people and the well also is ten dollars for one bucket so it is not easy here we are still facing problem when it comes to water.*
>
> - Peace Island Central, FGD, Adult Females.

The other problem in Peace Island Central is that the well water is not safe for drinking, but sometimes people have no choice but to drink it. The well is also at a great distance for many people, and it is very disappointing for community members to return from the well with little or no water.

> *The drinking water business is very hard and the well water is ten dollars and it is not good for drinking but still other people drink it. We buy sack of water sometimes but we that have many children, the sack of water is insufficient for us.—P6*
> *We are not satisfied with the water because the people who are taking care of the well we don't know how often they treat the well water. The distance of the well is very far and we go down the hill to get the water... the one that hurts is sometimes you don't get one bucket at all and the pump water too is not really safe because the pipe is always getting damaged.—P2*
>
> —Women, FGD, Peace Island Central

Location of Water Source

Since water points are inadequate in the communities covered in the study, location of the water source offers premium advantages. Households closer to a water source benefit from the proximity by saving time on fetching water and being able to collect enough water for their household needs. A man from Small Island described the situation of people who live far away from the handpump as follows:

> *Yes, they have certain people on the Island here who are really suffering for water business because they are not near the pump.*
>
> —Man (P4), FGD, Peace Island (Small Island)

Water Products Are Often Unavailable

By and large, based on the quantitative and qualitative data, drinking water is not treated at home. One of the reasons explored by the study was the availability of water purification agents such as chlorine and WaterGuard near these peri-urban communities where the study was conducted. The study found that cleaning agents are not readily available close to the community. In Small Island, men participating in an FGD stated that water products are not sold near or within the community. They have to go to another area to buy them.

> *We don't have area like that. No one is here selling chlorine or WaterGuard. We can go out to places like Red-light and Old Road to purchases these materials. For water and sewer, we don't have no way to chlorinate it.*
>
> —Man (P1), FGD, Peace Island (Small Island)

The experience of Blamo Town residents is similar. Water products such as chlorine are available at a 25-minute distance. For WaterGuard, the distance is 45 minutes on foot. Responses to the question, "Is there any shop or nearby market where water treatment material are sold?" included the following:

> *Yes at the market the people sell chlorine there It is about twenty to twenty-five minutes —P2*
> *For the water guard is not sold here so I go as far as Jamaica road to buy the water guard. Yes I walk, and the place is about 45 minutes —P5*

In New Kru Town, a nonliterate woman whose husband is unemployed described her water situation during an IDI. She lives in a zinc house (without a toilet) with her husband and children and sells donuts for a living. She gets drinking water for her family from either of the two wells in the community. She pays for the water but says she does not treat it further once she reaches home because she feels that the water should be cleaned at the source. The nonavailability of water cleaning products near the community is a factor that acts as a barrier to using cleaning agents to purify water.

Chapter 14: Conclusions and Recommendations

This mixed methods study on peri-urban water issues among households living in informal settlement communities of Montserrado County, Liberia contributes to the very limited existing research on water access, quality, and use challenges facing peri-urban poor households in Montserrado County, Liberia. Our findings suggest that water access remains a challenge due to water shortages resulting from an insufficient number of safe, convenient, and affordable water sources, along with recurring maintenance and water availability issues. Gender disparities related to water collection and management activities remain stark. The main findings of this study are the following:

A large proportion (63%) of the respondents from the three study sites have challenges securing the minimum quantity of water for daily use as outlined by WHO's 20 liter/person/day minimum. Households across the nine study communities received a median of 15 liters of water/person/day, which is less than the 20 liters recommended by WHO for emergency situations. This low access forces households to prioritize water needs and hampers improvements and maintenance of basic household hygiene and cleanliness standards.

Household access to improved water sources is relatively high, although water sources vary based on season, convenience, perceived water quality, and distance. Three-fourths (75%) of households reported use of improved water sources in the wet season, and 81% in the dry season. The increased use of improved water sources in the dry season was surprising, and it may be explained by the fact that unimproved systems and surface water are more sensitive to seasonal water table changes compared with improved systems such as boreholes and kiosks. Almost one-third of households (31%) reported using more than one water source to meet their household needs, and 30% reported that their primary water source changes in the dry season. As expected, convenience (51%), perceived water quality (27%), and distance (19%) were the most commonly reported factors for households when choosing their water sources.

Despite close proximity to water sources, household water collection burdens are extremely high. Although 82% of respondents reported that it took less than 30 minutes roundtrip to collect water, more than three-quarters of respondents reported making three or more trips a day to collect water. On average, households made over 20 trips per week to collect water, and only collected an average of <15 liters/person/day, which is below the WHO minimum of 20 liters/person/day. Limited water points result in people having to access water from greater distances resulting in more time spent collecting water and longer distances carrying five-gallon water containers. This large water collection burden falls heavily on women and girls, with 70% of respondents reporting that a woman or girl was considered the primary water collector for their household.

Household water storage practices and sanitation practices create significant drinking water quality risks and affect household confidence in water quality. Household water treatment was low, with only 21.3% of respondents mentioning treating their drinking water, primarily with chlorine-based treatment

(WaterGuard). Almost half of respondents have negative perceptions of the water quality, taste, and turbidity of their primary water source. Almost one-fourth of households (23%) reported practicing open defecation. In a large and densely populated environment where a significant proportion of the population is relying on hand-dug wells and surface water for drinking, the prevalence of human feces in the environment poses a significant risk to drinking water quality.

Gender disparities in household water responsibilities remain high. In 70% of households, the primary water collectors in the households were women and girls. While there was general consensus among men and women that women are responsible for making decisions on water management in the household, there were differences of opinion along gender lines when it came to who should make household decisions on water collection and payment decisions.

Household access to safe and sufficient water resources is hampered by cost, convenience, and reliability of water systems. More than half of respondents earn less than 100 USD per month (~1,716 LD). The majority of individuals report paying for their water (72%), with the most common payment plans including pay per use (86%) with monthly billing frequency (73%). The reported average cost of water was 20.00 LD (0.12 USD) per jerrycan. Private providers and NGOs have the highest prices among all providers compared with local or national government-managed sources. The presence of water user committees is low or not known. The majority of respondents reported an inability to pay for water services (53%). Of those respondents, 82% reported having difficulty paying for water at least monthly, if not more frequently. The most commonly preferred management agency for water connections was private sector with government oversight (49%), followed by national government (34%) and local government (18%). Almost all respondents (96.6%) were willing to contribute to the cost for household connections to water utility lines.

Program Recommendations

Based on the above conclusions, we offer the following program and policy recommendations:

- Support the establishment and continuation of community-based water management committees, which were associated with reduced water collection travel times.
- Design and test accountability mechanisms that empower community members to report water system deficiencies and assist governments in holding service providers accountable for providing safe, reliable, and affordable water services.
- Finance the strategic installment of additional improved water sources to decrease water collection times. Installation of new water sources should be informed by mapping data on population density and current water access gaps within each neighborhood (or even each block) to ensure that additional water infrastructure investments result in improved household access to basic water services. Consider having private service providers manage these systems in order to respond to household water source management preferences.

- Increase community water access, to make 20 liter/person/day available in peri-urban settlements in Liberia and reduce long waiting times, by providing additional community water sources or service providers. Test financing strategies to increase household access to sufficient quantities of safe drinking water for household use. Potential strategies include reduced or interest-free connection loans, pooling community resources to contribute to the extension of water infrastructure or to finance professionalized water services, or offering micro-loans to households or communities.
- Include community stakeholders in the development and implementation of water safety plans. Increase financial and capacity-strengthening support to local and national governments to increase the frequency of water quality testing and implementation of mitigation actions.
- Design and test social interventions aimed at balancing the burden of water collection and management responsibilities more equally among men and women, while ensuring children's time is protected to pursue education and development activities.