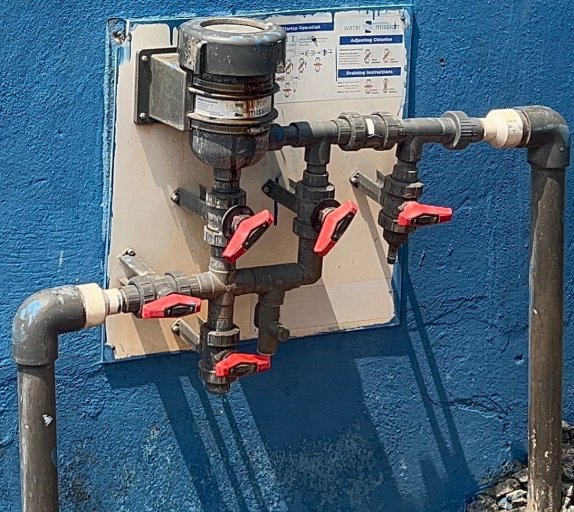


WaterTRACS

Testing, Research, and Capacity
Strengthening Initiative

With funding from the Conrad N. Hilton Foundation, the Aquaya Institute has been coordinating longitudinal water quality monitoring in two target districts in Uganda since 2022. In February 2025, Aquaya conducted a sixth round of surveys and water quality testing at households, water points, schools, and healthcare facilities in Kabarole District.



WATER QUALITY IN KABAROLE DISTRICT, UGANDA

A FOCUS ON PIPED WATER SYSTEMS

February 2025

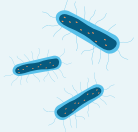
SUMMARY



Piped water systems are the most common drinking water source in Kabarole, used by 38% of households in February 2025, with higher use in Fort Portal City than the District.



Across all study visits, two-thirds of piped system taps had water available, with availability fluctuating seasonally and over time due to closures, breakdowns, water shortages, and intermittent supply.



In early 2025, *E. coli* was found in 63% of piped system tap samples, which is consistent with earlier sampling times.



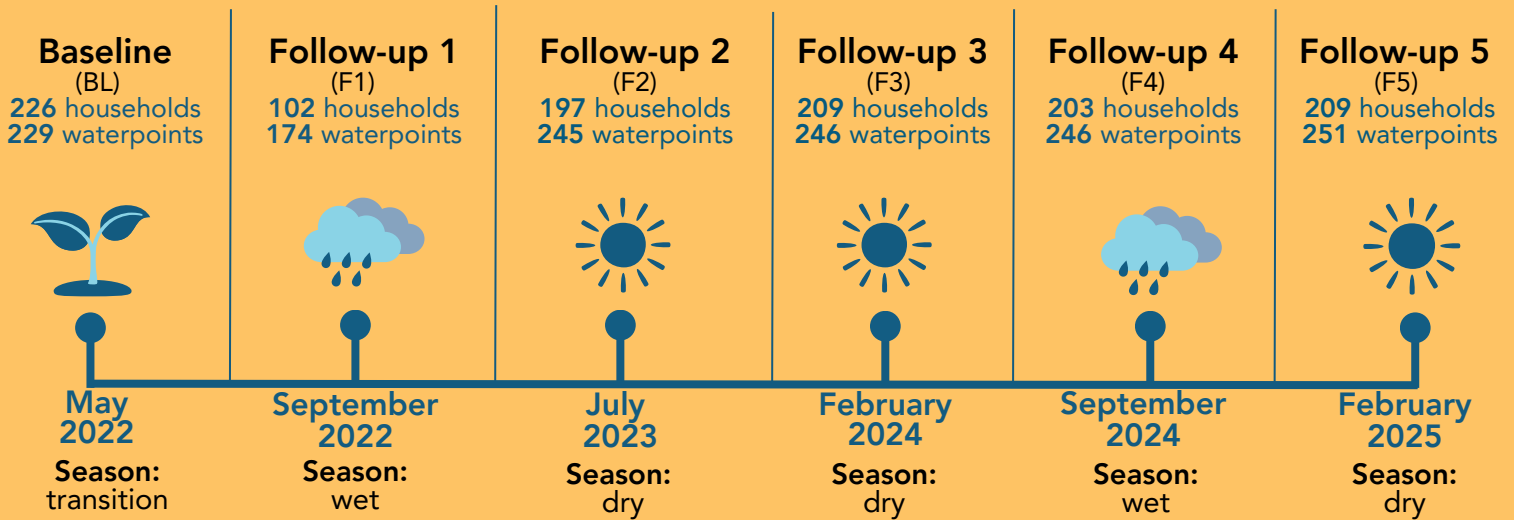
While 54% of tap samples had detectable total chlorine in February 2025, only 17% met the minimum recommended free chlorine residual (FCR).



One-third of stored household piped water samples had sufficient FCR to protect against recontamination.



DRINKING WATER SAMPLES TESTED IN KABAROLE



Across all sampling events, we tested *E. coli* presence in a total of 984 piped water samples. This included 328 from public standpipes, 249 from private (on-plot) taps, and 407 from stored household drinking water. Our sample was split between urban areas in Fort Portal City (40% of samples) and peri-urban and rural areas in Kabarole District (60%).

BACKGROUND

This research brief focuses on **pipied water systems**, which is the most common source of drinking water in Kabarole, used by 38% of households in February 2025 (F5). The use of piped water for drinking has remained fairly constant since 2022 (34%-45% of households) (Figure 1); however, use of piped water systems was greater in the Fort Portal City than Kabarole district (61% vs. 14% in February 2025).

Additionally, **pipied water has been consistently used by nearly half of schools in Kabarole district** (38%-57%, n=53) and **two-thirds of healthcare facilities** since 2022 (55%-75%, n=20)

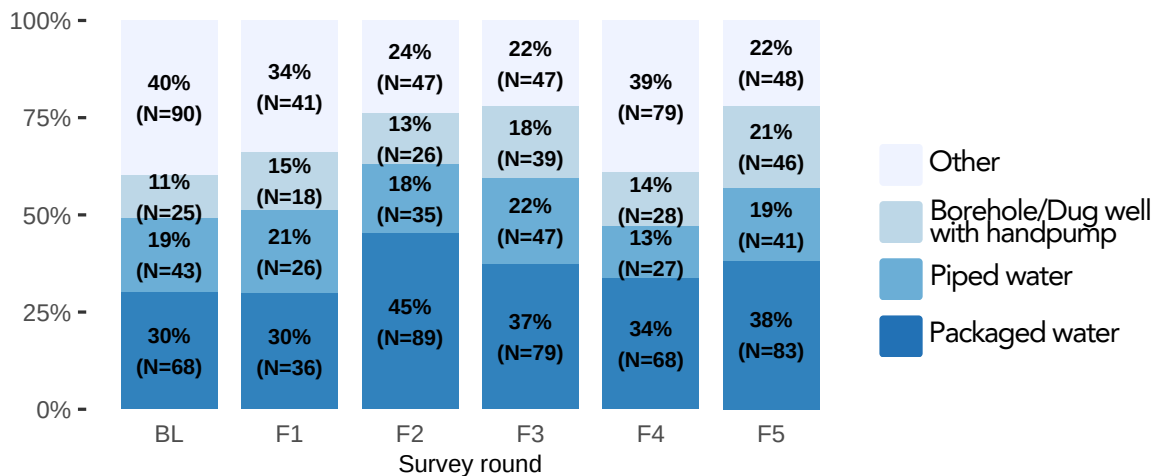


Figure 1: Current drinking water sources of surveyed households at each sampling time in Kabarole (including both Fort Portal City and Kabarole District), including piped water, boreholes and dug wells with handpumps, protected springs, and other source types.



RESULTS

PIPED WATER SERVICE RELIABILITY

Across all study visits, **two-thirds of piped system taps had water available** (n=486). Availability was highest in early 2022 (BL), when 81% of taps had water available (n=63), and lowest in early 2025 (F5) when 54% had water available (n=100). About half of the time, water was not available because the waterpoint was closed or shut off, meaning either the caretaker was not present or the respondent was unaware of a specific reason. Breakdowns were responsible for 15% of tap closures and insufficient water for 14%, the latter being more pronounced (26%) at two dry season visits (F2 and F5). Other reasons for waterpoint closure included the system undergoing maintenance or construction, water meters being removed by the utility, and users not paying tariffs. Overall, **half of piped system taps were reported to experience dry season water shortages** and half had intermittent supply (water being available some hours each day or some days each week).

In contrast, **87% of boreholes and protected wells with handpumps had water available** across all visits (n=300). Handpump functionality declined slightly over time; in 2022, 91% of the sampled handpumps had water available, versus 83% in early 2025. Across all visits, breakdowns were the most common reason for water not being available from handpumps. Further, a quarter of handpumps experienced seasonal dryness.

MICROBIAL WATER QUALITY

In Kabarole, *E. coli* contamination has been present in about three-quarters of piped water supplies across all study visits since 2022 (Figure 1). When comparing to other source types, boreholes with handpumps (although not widely available) and protected springs have consistently had less *E. coli* present than piped water. In early 2025 (F5), **63% of piped samples collected directly from taps had *E. coli*** (n=54).

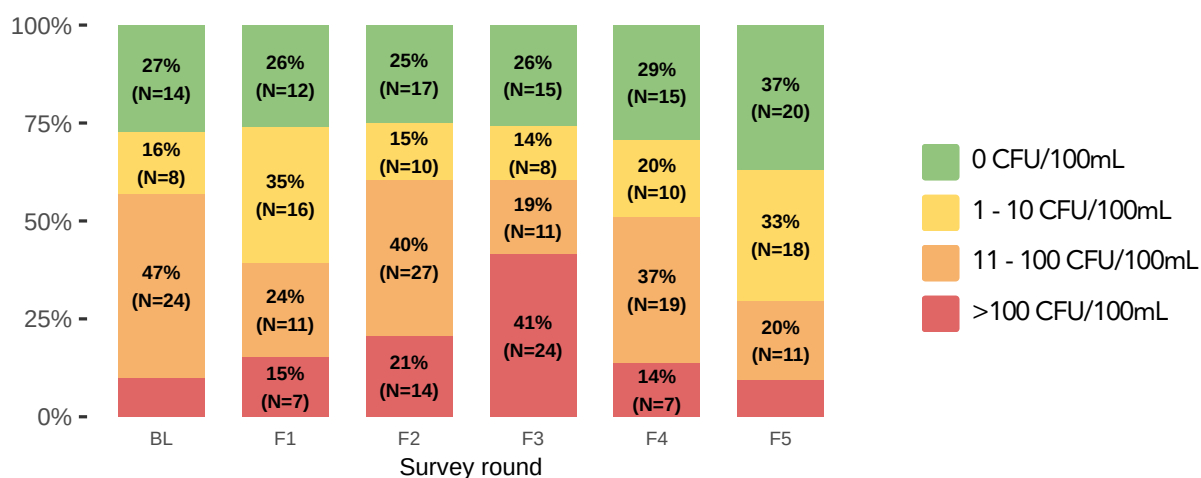


Figure 2: *E. coli* risk levels in drinking water samples collected at public piped system taps in Kabarole (including both Fort Portal City and Kabarole District, n=328 across all visits).



CHLORINATION

The presence of total chlorine residual (TCR) indicates that water was treated with a sufficient dose of chlorine to overcome the water's initial chlorine demand, while free chlorine residual (FCR) is the part that remains available to prevent further contamination. **Across all sampling times, free chlorine residuals were moderately low – with 17% to 39% of sampled taps having the minimum recommended value of 0.2 mg/L set by the Uganda national drinking water standard (Figure 3).**

DEFINITION

Chlorine demand is the amount of chlorine required to disinfect a water supply to the desired level. Organic matter and other dissolved substances increase the chlorine demand: they react with chlorine, leaving less available to inactivate pathogens, which means that a larger chlorine dose is required to achieve the same amount of disinfection.

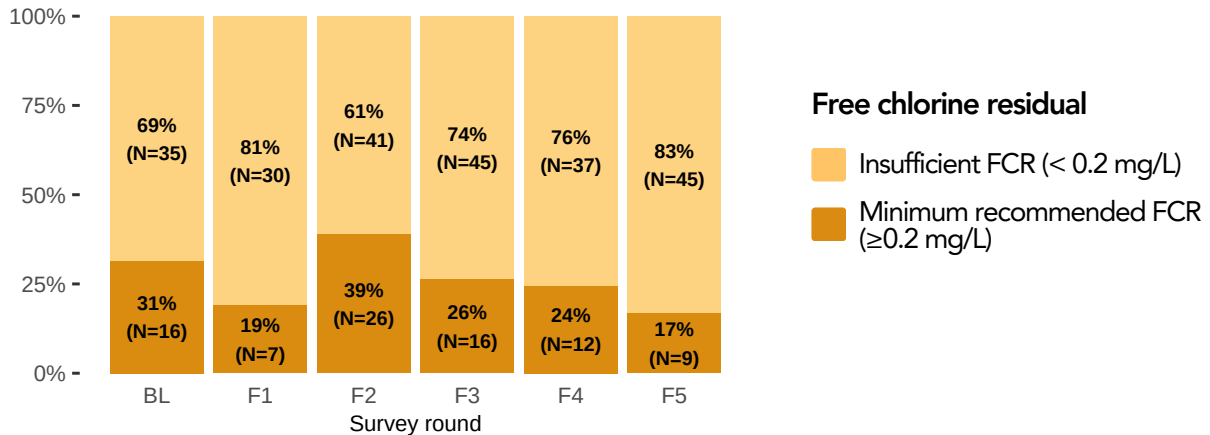


Figure 3: Free chlorine residual (FCR) of public piped water taps at each sampling time in Kabarole (including both Fort Portal City and Kabarole District, n=328 across all visits).

In February 2025 (F5), about half of piped water samples had detectable total chlorine (TCR ≥ 0.1 mg/L), indicating those piped supplies were being treated with sufficient chlorine for some disinfection to occur. However, **only 17% had the minimum recommended FCR (≥ 0.2 mg/L), indicating that most had insufficient chlorine for continued protection (n=54).** At households with stored piped water, **32% of stored household samples had FCR ≥ 0.2 mg/L (n=80)** (Figure 4). This indicates **most households' stored water was no longer protected against recontamination.**

The World Health Organization's Guidelines for drinking-water quality for small water supplies recommends a free chlorine residual of 0.5 mg/L at the tap for public water supplies that will be transported and stored. Only 5% of taps in Kabarole met that recommended level in February 2025.

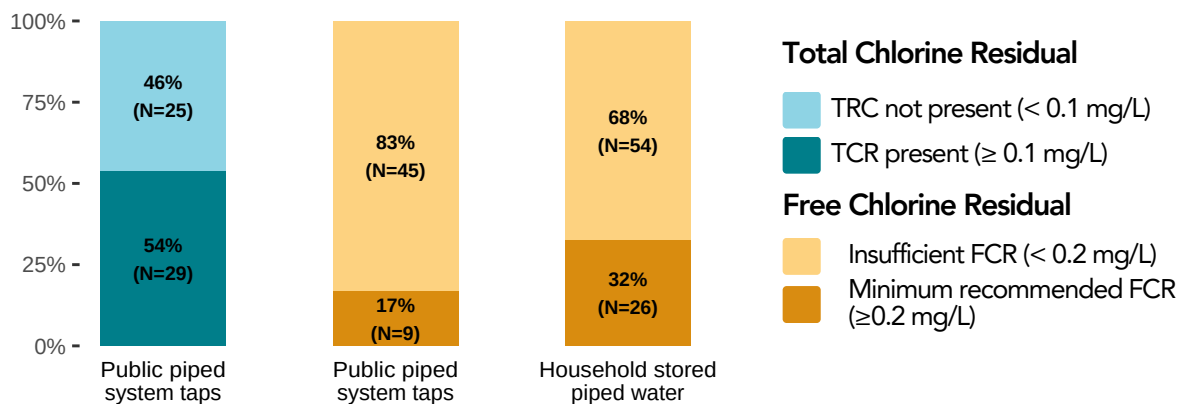


Figure 4: Public piped system tap samples with detectable total chlorine (TCR ≥ 0.1 mg/L, left) and minimum recommended free chlorine residual (FCR ≥ 0.2 mg/L, center), along with minimum levels of free chlorine residual (FCR ≥ 0.2 mg/L) in stored household piped water (right). Samples were tested in Kabarole in February 2025.

ON-PLOT PIPED WATER AND HOUSEHOLD STORAGE

Across all sampling times, nearly a quarter of households (22%) had an on-plot piped water connection and reported that as their current drinking water source (n=1,348). In contrast, only 7% of households reported drinking water from an off-plot piped source.

Nearly all households drinking on-plot tap water (97%, n=327) still stored their drinking water in the home. This may be because piped systems don't provide water at all times (49% of taps were reported to have intermittent supply and 13% were observed to not have water available across all study visits) or that households find having water inside the home more convenient (whereas taps are typically located in the yard).

Storing piped water had a negative effect on microbial quality, but deterioration was less pronounced for on-plot taps. For those using off-plot public taps, presence of *E. coli* increased from 75% at public taps to 89% in household stored drinking water (n=44 across all visits). For those using on-plot private taps, presence of *E. coli* only increased from 79% at on-plot taps to 82% in household stored drinking water (n=205, Figure 5).

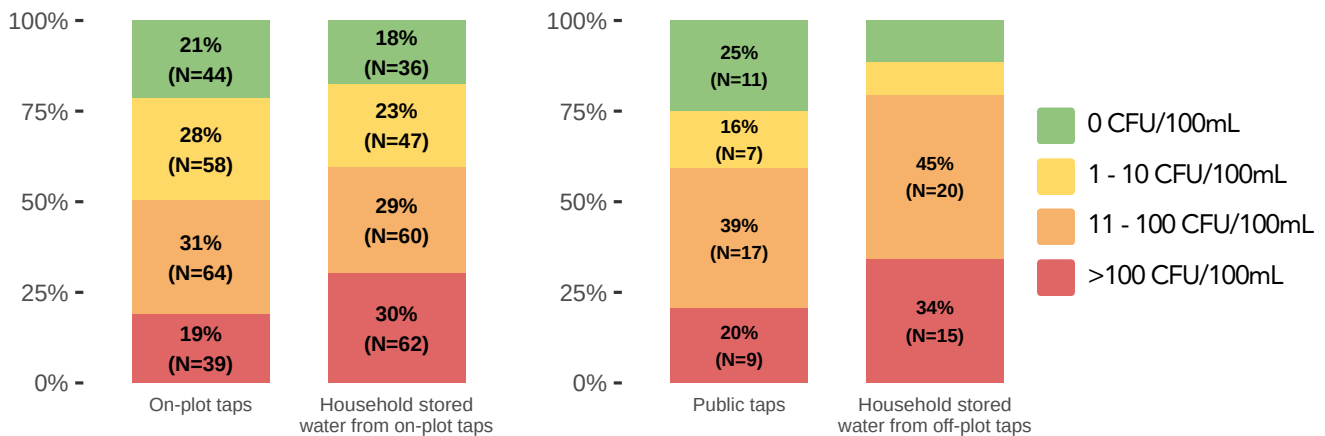


Figure 5: *E. coli* risk levels in drinking water samples collected from on-plot taps and household stored water from on-plot taps (left), and samples from public piped system taps and household stored water from public taps (right). Samples were aggregated for all study visits and reported only if household samples were matched to a specific waterpoint sample.

RECOMMENDATIONS



Piped water service reliability and climate resilience should be improved such that water service be provided more regularly throughout dry periods.



All piped water supplies should be chlorinated.



Chlorination should be done more consistently and at higher levels to ensure free chlorine residual stays above 0.2 mg/L throughout piped networks.