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# WATER QUALITY TESTING ASSURANCE FUND: LESSONS LEARNED

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## MONITORING FOR SAFE WATER II

With funding from the Conrad N. Hilton Foundation (CNHF), The Aquaya Institute (Aquaya) supports government agencies in selected districts of Ghana and Uganda in their efforts to achieve 100% coverage of safe, sustainable, and equitable drinking water supplies. As part of this effort, Aquaya develops resources to promote water safety management.

## SUMMARY

- The Aquaya Institute (Aquaya) developed and evaluated a Water Quality Testing Assurance Fund to encourage Ghana Water Company Limited's (GWCL) laboratory in the city of Sunyani in western Ghana to provide water quality monitoring services to small water systems in the nearby rural district of Asutifi North. Under the terms of the Assurance Fund, water systems were responsible for paying GWCL for monthly testing services. If water systems defaulted on their payments, GWCL could file a claim against the Assurance Fund.

- Between March 2020 and January 2021, GWCL collected 134 water quality samples from nine water systems, revealing microbial contamination in over half of the samples. This information raised awareness among water system managers, several of whom are now taking steps to improve the effectiveness of chlorination procedures.

- In two-thirds of cases, water systems paid GWCL within one month of receiving testing services. Despite payments being delayed for the remaining one-third of testing services, GWCL only filed one claim against the Assurance Fund, finding it more convenient to negotiate with defaulting water systems and give them more time.

- Evaluating the Assurance Fund helped identify technical and design adjustments required for future iterations. These adjustments will address the challenges that we experienced with respect to i) adherence to high-quality laboratory protocols, ii) logistics and communication, iii) community engagement, and iv) response to water contamination.

- The approach of centralizing water quality testing at a professional laboratory proved more cost-effective than on-site testing by water systems. Including Aquaya's facilitation and oversight, the Assurance Fund approach cost an average of 388 GHS (67 USD) per test, which is approximately 60% of the cost of providing training and testing equipment to every water system.

# BACKGROUND AND OVERVIEW

**Monitoring water quality is crucial for ensuring that treatment processes are effective and that consumers receive safe water.** However, small water systems (handpumps, mechanized boreholes, and small piped systems) often struggle to collect adequate revenue to cover operations and maintenance, and water quality testing is often deprioritized. Aquaya's research has demonstrated that for many of these small water systems, investing in on-site laboratory equipment and capacity building can be cost-prohibitive. Instead, outsourcing water quality monitoring to a local laboratory is often more cost-effective [1].

**Aquaya designed a Water Quality Testing Assurance Fund (referred to as the "Assurance Fund") to encourage existing laboratories to provide water quality monitoring services to small water systems.** The Assurance Fund's primary role is to guarantee that laboratories will be paid for testing activities and, therefore, mitigate the risk of non-payment by the small water systems. Additionally, it provides a vehicle for subsidizing water quality testing when needed. In contrast to most water quality testing interventions, which focus on one-time capacity building and provision of equipment, we designed the Assurance Fund to improve ***ongoing*** support for water quality monitoring [2].

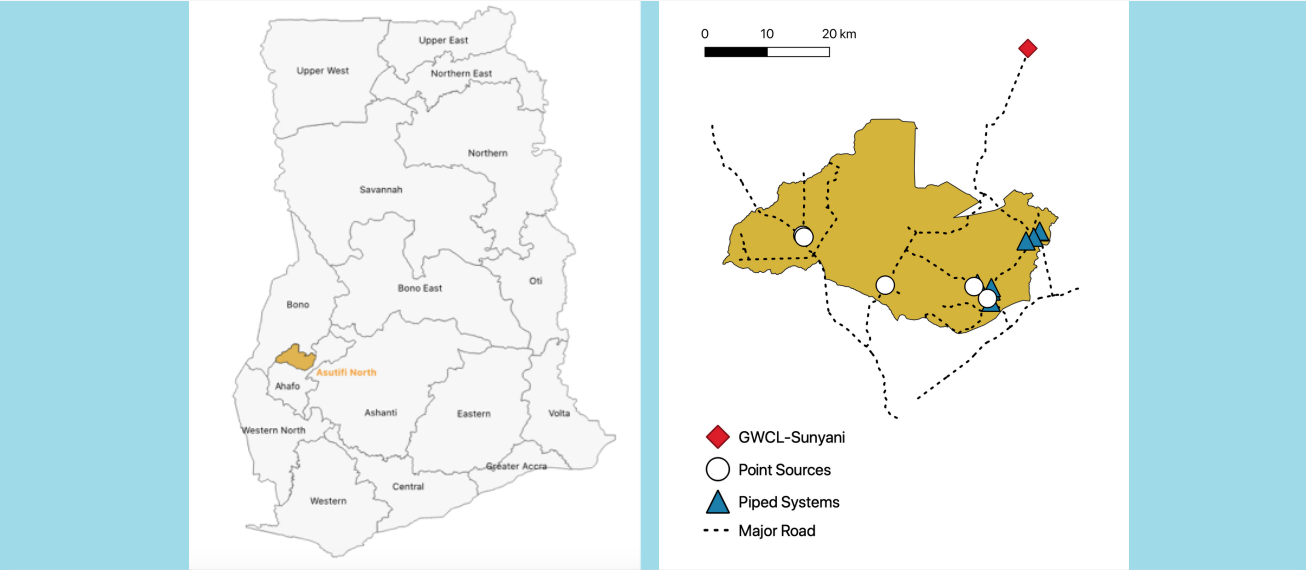


**Figure 1.** Map of Asutifi North, Ghana.

From March 2020 to January 2021, Aquaya evaluated the Assurance Fund with water systems in Asutifi North, a rural district in the Ahafo region of Ghana (Figure 1). **Aquaya signed an agreement with the Asutifi North District Assembly (ANDA) and the closest laboratory, Ghana Water Company Limited's Sunyani regional office (referred to as "GWCL").** Under this agreement, GWCL collected and tested samples from each enrolled water system on a monthly basis and received corresponding payments directly from water system managers. Water systems were tested on a pre-determined monthly schedule but retained the possibility of opting out of the agreement at any time. Unless they opted out, they received GWCL's services monthly without having to request them. Aquaya hosted monthly water quality discussions with water system managers to help them interpret results and discuss water quality issues.

**Our evaluation comprised nine water systems serving a population of approximately 30,000.** These included four piped systems, four handpumps, and one system with two mechanized boreholes (Table 1). Water systems were eligible for enrollment if their revenue was greater than four times the cost of water quality testing or if the ANDA agreed to pay for testing on their behalf (which was the case for two handpumps).

**Table 1.** Characteristics of water systems enrolled in the Assurance Fund evaluation.

| System type | Estimated Population Served[1] | Sampling plan[2] | Estimated monthly revenue | Approximate monthly testing costs |
|---|---|---|---|---|
| Piped System 1 | 20,000 | 4 standpipes/month<br>2 samples/intake borehole/year | ~24,700 GHS<br>(4,260 USD) | 770 GHS<br>(133 USD) |
| Piped System 2 | 15,000 | 3 standpipes/month<br>2 samples/intake borehole/year | ~9,500 GHS<br>(1,640 USD) | 620 GHS<br>(107) USD |
| Piped System 3 | 5,000 | 1 standpipe/month<br>2 samples/intake borehole/year | ~8,200 GHS<br>(1,410 USD) | 360 GHS<br>(62 USD) |
| Piped System 4 | 5,000 | 1 standpipe/month<br>2 samples/intake borehole/year | ~7,200 GHS<br>(1,240 USD) | 330 GHS<br>(57 USD) |
| Mechanized Boreholes[3] | 350 | 2 samples/month | ~250 GHS<br>(43 USD) | 70 GHS<br>(12 USD)[4] |
| Handpump 1 | 350 | 1 sample/month | ~125 GHS<br>(22 USD) | 90 GHS<br>(16 USD)[4] |
| Handpump 2 | 350 | 1 sample/month | ~170 GHS<br>(29 USD) | 40 GHS<br>(7 USD)[4] |
| Handpump 3 | 350 | 1 sample/month | ~60 GHS<br>(10 USD) | 40 GHS<br>(7 USD)[4] |
| Handpump 4 | 350 | 1 sample/month | ~135 GHS<br>(23 USD) | 40 GHS<br>(7 USD)[4] |

1. These numbers reflect population estimates at the start of the evaluation.
2. For piped systems, the sampling plan reflects the sampling frequency required by GSA: one sample per month for every 5000 people served. For handpumps and mechanized boreholes, the sampling plan corresponds to six times the sampling frequency required by GSA of two samples per month.
3. This water system included two mechanized boreholes overseen by the same managers. Each borehole was sampled once per month.
4. Cost reflects an 80% subsidy from Aquaya.

GWCL's tariffs for water quality testing are summarized in Table 2. If a water system failed to pay GWCL after three reminders, GWCL could file a claim for payment against the Assurance Fund, which Aquaya capitalized. Aquaya and GWCL would then inform ANDA to issue an enforcement notice to the defaulting water system, which included a 10% penalty in addition to the testing costs. Water systems would be withdrawn from the program if they defaulted three times. The agreement structure is summarized in Figure 2.

| ITEM | GWCL TARIFF |
|---|---|
| Transportation | • 200 – 350 GHS (34 – 60 USD) per trip |
| Sampling | • Piped systems: 150 – 200 GHS (26 – 34 USD) per sampling event<br>• Point sources (handpumps and mechanized boreholes): 40 GHS (7 USD) per sampling event |
| Analysis | • 60 GHS (10 USD) per microbial test (*E. coli* via membrane filtration or multiple tube fermentation)<br>• 20 GHS (3 USD) per conductivity test (via electrometric field meter)<br>• 20 GHS (3 USD) per pH test (via electrometric field meter)<br>• 20 GHS (3 USD) per turbidity test (via nephelometric field meter)<br>• Additional physical parameters (color, temperature) were tested at no additional cost. |

**Table 2.** GWCL's tariffs for transportation, sampling and testing.

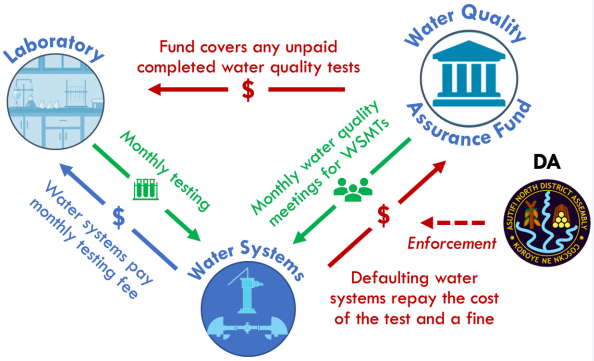


**Figure 2.** Assurance Fund overview.

**The agreement also included a provision for subsidizing water quality testing in cases where water systems needed financial support.** We implemented subsidies in two cases during our evaluation. First, we provided an 80% subsidy to point sources (handpumps and mechanized boreholes), because the monthly testing that was stipulated in our agreement exceeded the testing requirements established by the Ghana Standards Authority (GSA), which is a test every six months for point sources [3]. We calibrated our subsidy such that point sources would only pay for required testing levels. Second, piped systems received a similar 80% subsidy after April 2020, as their revenue declined dramatically during the COVID-19 pandemic due to the government's "free water" directive.

# EVALUATION SUMMARY

Our evaluation included nine rounds of water quality testing between March 2020 and January 2021 (Table 3). Testing was interrupted in May and June 2020 due to difficulties in procuring testing supplies during the COVID-19 pandemic-related lockdown.

| Round | Sampling Month | Water Systems Tested | Claims Filed | Water Systems with Outstanding Payments* |
|---|---|---|---|---|
| 1 | March 2020 | 9 | 0 | 0 |
| 2 | April 2020 | 9 | 1 | 0 |
| 3 | July 2020 | 9 | 0 | 0 |
| 4 | August 2020 | 9 | 0 | 0 |
| 5 | September 2020 | 9 | 0 | 1 |
| 6 | October 2020 | 8** | 0 | 0 |
| 7 | November 2020 | 9 | 0 | 0 |
| 8 | December 2020 | 9 | 0 | 4 |
| 9 | January 2021 | 9 | 0 | 4 |

**Table 3.** Summary of pilot implementation testing rounds.

* As of February 2021.
** One handpump was not functioning.

## WATER SYSTEM PAYMENTS

**As of February 2021, water systems had made 71 (89%) out of the 80 payments that were due for testing services.** Overall, water systems made 35 payments (44%) at the time of sampling, 20 (25%) within the following month, and 16 (20%) over one month after sampling. Three water systems reported that either the system manager or the Water Board Chairman paid for tests with their personal funds on multiple occasions when water system revenue was depleted. Of the nine outstanding payments (11%), two were owed by a piped system and seven by handpumps. ANDA managed two of the delinquent handpumps, and payments were delayed because it faced challenges in adding GWCL to its payment system.

**Despite the delayed payments, GWCL filed only one claim against the Assurance Fund**. GWCL staff told us that it was easier to negotiate delayed payments with the defaulting water system rather than filing a claim. This could have been due to the administrative hurdle of assembling claim paperwork or to the relationships that developed between GWCL and the water systems. A GWCL lab technician responsible for collecting payments explained that he was reluctant to file claims because water systems assured him that they would pay: "*We are not going very strictly by the contract by going ahead to file a claim because probably we are having faith in them and hoping that they will be able to honor their words*." In the case of the one claim that GWCL filed against the Assurance Fund, the defaulting water system never paid the reimbursement or penalty to replenish the Assurance Fund, and ANDA was not successful in enforcing this aspect of the agreement despite issuing three penalty notice letters.

## TEST RESULTS

**Test results indicated widespread *E. coli* contamination:** overall, 48% of samples had more than 1 CFU/100 mL and thus failed the GSA standard for water safety (Figure 3) [3]. Further, 16% of samples had more than 10 CFU/100 mL, falling in WHO's high risk category. Contamination levels were comparable across water system types (Figure 3).

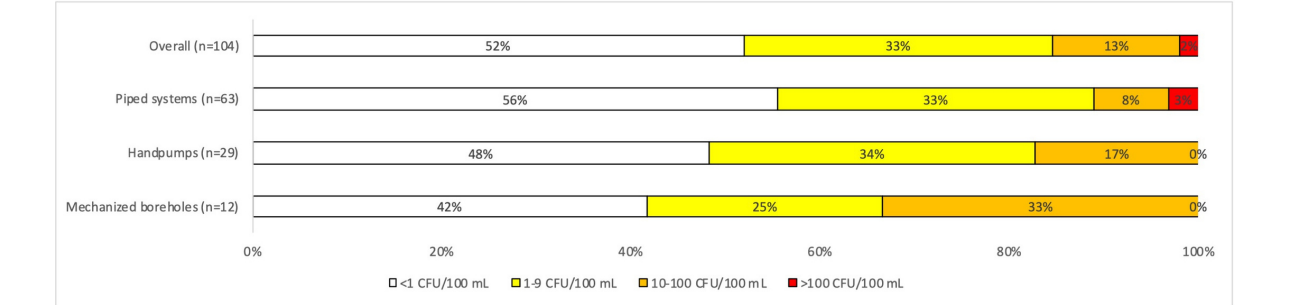


**Figure 3.** *E. coli* contamination levels over seven rounds of testing, presented by water system type. We do not present data from the first two rounds of testing because our quality control checks indicated that these early measurements were not reliable.

**Test results also revealed that water supplied by the systems was slightly acidic**, with a median pH of 6.4 (interquartile range: 6.0 – 6.8). In comparison, the GSA recommends a pH between 6.5 and 8.5, as pH below this range promotes pipe corrosion. In contrast, conductivity, turbidity, total dissolved solids, and color usually fell within GSA specifications (Figure 4).

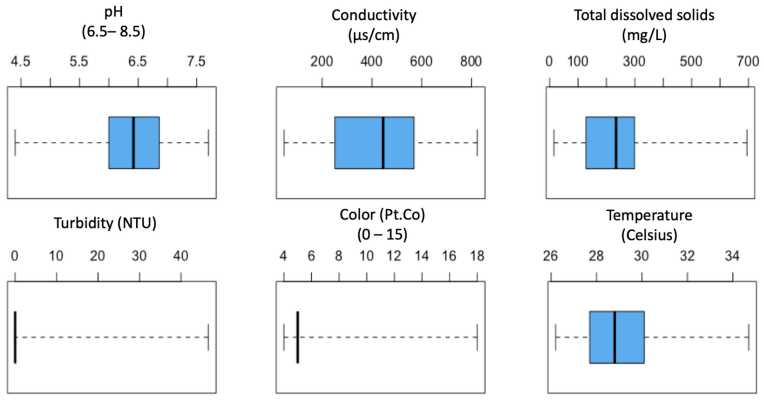


**Figure 4.** Aggregated test results. Parentheses indicate GSA specifications, where provided.

## MONTHLY MEETINGS

**Aquaya's monthly meetings with water system managers focused on interpreting test results.** These meetings had an average of 11 participants, usually representing all water systems. One session was dedicated to pH and its practical impacts, as water system managers had expressed concerns with the low pH measurements. For example, one manager feared that "*the plastic pipes would start bursting*". To address misconceptions, this session clarified that the observed pH levels did not present a health risk and only created a risk of corrosion in metal pipes. Two other sessions focused on water safety management practices, such as source protection and chlorination options for household level treatment. Additionally, meetings were an opportunity to discuss areas of improvement, such as i) engaging community members on water quality issues, and ii) involving Water Board chairmen in water quality meetings. Four water system managers shared test results with their Water Boards, while the remainder felt that board members did not prioritize water quality information.

**Water system managers reported that meetings helped them understand the importance of water quality testing as well as how to interpret different parameters.** The meetings also provided an opportunity for system managers to learn from each other about best practices. One piped system manager noted that the meetings were unique compared to previous testing efforts where there was no opportunity to learn about or discuss the test results.

## COMMUNICATION OF WATER QUALITY RESULTS

**Most water systems were reluctant to post-test results publicly or discuss them with community members.** One handpump manager stated, "*There is a possibility that such information can let people not trust the water systems because it has a possible health implication*." Only two piped systems posted test results on the wall of the office and near water points. However, they acknowledged that this was not an effective way to communicate water quality information as community members could not easily read or interpret the test results. Another piped system manager said explicitly, "*because we recorded E. coli, we are careful not to communicate it to the public, because of the possible outburst*."

**Initially, community members thought that water quality testing itself meant that the water was safe to drink**. Testing activities were noticeable as GWCL staff entered communities with distinctive vehicles and wore lab coats. Water system managers reported that testing activities had increased community confidence in water systems, irrespective of actual contamination levels. For example, one water system

manager, whose system recorded contamination in 7 out of 9 testing rounds, stated that the testing program "*gives us confidence and people are not afraid of drinking the water*". Misconceptions regarding the meaning of water quality testing activities thus existed not only among community members, but also among water system managers.

**One piped system, which recorded contamination in only 1 out of 9 testing rounds, leveraged water quality test results to initiate a new contract with a local nursing training college.** The college asked the system to supply water "*due to the water quality testing results we shared with them*," and became the system's biggest institutional client. However, this system did not share water quality results with the community at large.

In October 2020, ANDA held a Town Hall meeting with community leaders. One of the meeting objectives was to discuss water quality issues in the district. After the Town Hall meeting, Aquaya and ANDA agreed to **promote household water treatment as a short-term response** to the microbial water quality issues identified. This activity further raised awareness of water contamination among community members and initiated discussions regarding responsibilities for water treatment.

## WATER TREATMENT

**Water quality information increased awareness of microbial contamination and demand for water treatment among water system managers.** Three out of four piped systems adjusted their chlorination procedures (e.g., dosage, frequency) in an effort to improve treatment effectiveness (Table 4). Mechanized boreholes and some handpumps sought support from a NGO, local leaders, or GWCL to introduce chlorination (Table 4). These follow-up actions were partly a response to water quality information, but also likely resulted from the frequent interactions between water system managers and GWCL staff, who advised on chlorination activities and in most cases sold chlorine supplies. These changes in chlorination practices however did not result in higher microbial water quality during the pilot, which suggests that further adjustments of treatment procedures are required. Aquaya is now collaborating with piped systems to improve chlorination effectiveness.

| System | Water treatment before March 2020 | Water treatment after March 2020 |
|---|---|---|
| Piped System 1 | Irregular addition of chlorine into storage tanks (unknown frequency). | Since August 2020, bi-weekly addition of chlorine in the storage tanks and in the main input borehole. |
| Piped System 2 | Addition of chlorine into storage tank using a "sanikit," a container that holds chlorine tablets together near the top of the tank. | Water system managers investigated reasons for contamination. They found that water often did not come in contact with the chlorine in the tank. They changed their dosing method to add tablets directly to the tank (instead of using the "sanikit"). |
| Piped System 3 | Irregular addition of chlorine tablets to storage tanks. | They stopped treating their water in April 2020 because GWCL suggested that its high iron content was incompatible with chlorination. In August 2020, they treated the water with chlorine tablets once. |
| Piped System 4 | Weekly dosing of the storage tank with chlorine tablets. | GWCL offered advice on the chlorine tablet type and dosing precautions in July 2020. They switched to larger chlorine tablets and a bi-weekly dosing schedule. |
| Handpumps | No disinfection actions ever taken. | World Vision conducted shock chlorination of one handpump in August 2020. ANDA is arranging for World Vision to shock chlorinate other handpumps. |
| Mechanized boreholes | No disinfection actions ever taken. | They wash storage tanks and repair all cracks and leakages. A local official requested that GWCL supply them with chlorine tablets and advise them on dosing. |

**Table 4.** Water treatment actions before and during the Assurance Fund pilot.

## FINANCIAL SUMMARY

**The Assurance Fund evaluation cost 388 GHS (67 USD) per test, for a total of 52,055 GHS (8,975 USD).** In comparison, we estimated that equipping and training every water system to conduct its own monitoring would have cost at least 657 GHS (114 USD) per test (when considered over a five-year timeframe).

**Image 1.** A customer (right) and a water vendor (left) at a standpipe in Asutifi North.

The primary costs (Table 5) included:

- Direct testing costs: tariffs charged by GWCL for sampling, analysis, and transportation (Table 2). These amounted to 233 GHS (40 USD) per test.
- Monthly meeting facilitation costs: lunch and transport for participants. On average, this amounted to 37 GHS (6 USD) per person per meeting. Meetings had an average of 11 participants.
- Transport to GWCL: Aquaya visited GWCL in Sunyani approximately once every month to monitor laboratory procedures, discuss test results, and resolve miscommunications regarding terms of the agreement.
- General administration and oversight: time spent by an Aquaya field staff to conduct monthly meetings, visit GWCL, follow-up with water systems, and liaise with ANDA.
- Assurance Fund seed: Aquaya seeded the Fund with 2,300 GHS (397 USD) at the start of the pilot. Only 756 GHS (130 USD) had been disbursed by the end of the pilot, corresponding to one claim.

| Item | Total Cost | Cost per test |
|---|---|---|
| Water quality testing fee[1] | 31,245 GHS (5,387 USD) | 233 GHS (40 USD) |
| Hosting of monthly meetings[2] | 4,950 GHS (853 USD) | 37 GHS (6 USD) |
| Transport for monthly visits to GWCL[3] | 800 GHS (138 USD) | 6 GHS (1 USD) |
| General administration and oversight[4] | 12,760 GHS (2,200 USD) | 95 GHS (16 USD) |
| Assurance Fund seed[5] | 2,300 GHS (397 USD) | 17 GHS (3 USD) |
| **Total** | **52,055 GHS (8,975 USD)** | **388 GHS (67 USD)** |

**Table 5.** Summary of primary costs.

1. Total of fees invoiced by GWCL. Water systems paid 27% of this total, and Aquaya subsidized the remainder.
2. Includes participants transport and meals.
3. Visits required for quality assurance and troubleshooting. Includes rental car with driver and fuel.
4. Includes time of Aquaya staff overseeing the pilot: 3 days per month for four months, then 2 days per month for five months (22 days total).
5. This amount was disbursed at the start of the pilot. Only 756 GHS (130 USD) was paid out.

## CHALLENGES AND CORRESPONDING RESPONSES

This section summarizes the challenges that we identified through our evaluation of the Assurance Fund and our corresponding responses for further implementation (Table 6).

## ADHERENCE TO TECHNICAL PROCEDURES

**Test method:** Initially, GWCL used multiple tube fermentation but quality controls revealed that this method was prone to errors due to its complexity. GWCL thus transitioned to membrane filtration, though sourcing consumables was difficult during the pandemic and required Aquaya's assistance.

**Quality assurance:** GWCL did not ensure that laboratory technicians adhered to agreed-upon quality assurance protocols. For example, GWCL only reported on the use of positive and negative controls during testing ~50% of the time. In addition, after Round 3, GWCL stopped adding sodium thiosulfate to sample containers to quench residual chlorine water samples, despite this being a requirement in the agreement. Most piped systems were doing some level of chlorination, thus this oversight may have led to underestimates of microbial contamination levels.

**Rotation of sampling sites:** For piped systems, the agreement specified that GWCL should sample different standpipes across testing rounds. However, GWCL staff did not always follow the rotation plan, because water system managers directed them to specific sampling points. Further, GWCL staff did not always label results clearly, making it difficult to track the extent to which the rotation was taking place.

## LOGISTICS

**Transportation:** GWCL did not have dedicated vehicles for sample collection. Sampling events were often scheduled around vehicle availability or relied on the personal vehicle of a laboratory staff. Scaling up the Assurance Fund will require the laboratory to allocate dedicated vehicles for sampling.

**Service interruptions on sampling days:** During one round of testing, a piped system experienced a service outage. GWCL asked the water system managers to collect the samples on a later day and deliver them to GWCL themselves. As a result, samples were not collected in sterile containers nor maintained on ice during transport, which likely compromised the results.

## RESULTS REPORTING

**Delays in test results:** GWCL was often delayed in sending test results to Aquaya because the results needed to be officially signed by GWCL Sunyani leadership. Further, GWCL was not thorough in reporting all test results. Occasionally, data from a water system or from control samples were omitted from the results document.

**Communication with water systems:** GWCL staff reported that communicating results to water systems took a lot of time and effort. None of the managers of the point sources used the Whatsapp messaging application or read their text messages regularly, so GWCL was unable to successfully share their test results electronically. These water systems thus only received their test results at the monthly discussion meetings or on the following month, when GWCL visited them for the next sampling event and provided a hard copy.

**Interpretation of test results:** GWCL recommended corrective actions every time test results were outside of GSA's recommended range. While this can be useful in principle, GWCL did not specify the type of correction required. Further, GWCL did not comment on the degree of severity, treating small pH violations in the same way as microbial contamination (an immediate health risk). For example, the water quality report would state: "*the water sample did not meet the standards for pH and E. coli. pH correction and disinfection are recommended*". Water system managers thus needed help in interpreting the recommendations from GWCL.

## FINANCE AND RECORD KEEPING

**Invoice preparation:** Laboratory staff was not able to adjust invoices to reflect actual testing activities, or correct mistakes after invoices had been signed. Invoices usually contained small rounding errors (less than 0.5 GHS), and one invoice was off by 57 GHS (9.8 USD) due to a calculation mistake.

**Record keeping:** GWCL did not have a digital record keeping system for laboratory test results. Aquaya asked the staff to enter results into a shared Excel spreadsheet, as per the agreement. However, this proved to be a significant burden for GWCL staff and was not completed without multiple follow-ups from Aquaya. Additionally, GWCL staff made frequent data entry errors such that digital records did not match hardcopies of test results.

**Table 6.** Summary of challenges experienced during the pilot and corresponding recommendations.

| | Challenges experienced during pilot | Recommendations for future iterations |
|---|---|---|
| Adherence to technical procedures | • Unclear adherence to rotation of sampling sites.<br>• No use of sodium thiosulfate when sampling water from chlorinated water systems.<br>• Errors when performing testing method.<br>• Lack of adherence to quality assurance procedures (positive and negative controls). | • The agreement with GWCL should be more explicit with respect to these technical procedures and include a clear checklist for laboratory staff.<br>• Prior to signing, the agreement should be discussed in detail not only with GWCL management but also with field/laboratory staff.<br>• The template for reporting water quality results should be adjusted to include i) sampling sites, ii) positive and negative controls.<br>• Include the cost of quality assurance procedures in the testing fee. |
| Logistics | • Inconsistent availability of vehicles for sampling staff to go to the field.<br>• Water outages on sampling days. | • GWCL should allocate a dedicated vehicle for water quality sampling, particularly if the program is scaled up.<br>• GWCL should maintain close communication with water systems and adjust the sampling schedule around possible water outages. |
| Results reporting | • Delays in GWCL communicating results due to internal administrative procedures.<br>• Difficulty for GWCL to communicate results electronically to some water systems.<br>• Small pH violations highlighted as similarly critical to microbial water quality violations. | • When water system managers do not use Whatsapp or email, GWCL staff should call them to discuss microbial test results. These water systems will only receive results in hard copy during the next sampling event.<br>• The template for reporting water quality results should differentiate water quality violations by order of importance. |
| Finance and record keeping | • Absence of digital database storing water quality results.<br>• Due to internal administrative procedures, difficulty for GWCL to adjust invoices to reflect actual testing activities. | • GWCL is now introducing a digital database for the laboratory.<br>• Aquaya will communicate with GWCL more closely to indicate when changes to regular invoices are required. |

## ASSURANCE FUND SUCCESSES

Despite the required technical adjustments discussed above, our evaluation of the Assurance Fund identified three major benefits that justify expanding this model beyond the pilot stage.

1

**First, the design of the Assurance Fund program was successful at promoting regular water quality testing**. The first key ingredient of this design was enrollment by default: water system managers did not have to decide to conduct testing every month; rather, GWCL's monthly visit was the default option. Although water systems could opt out of the agreement at any moment, enrollment by default leveraged inertia to promote the desired outcome. The second key ingredient was the Assurance Fund itself, which encouraged GWCL to serve customers without a risk of non-payment. The third key ingredient was Aquaya's ongoing support to interpret test results and to subsidize testing when needed, particularly during the COVID-19 crisis. These elements concurred to ensure regular financial contributions from water systems: they paid most of their bills in full, and GWCL filed only one claim throughout the duration of the pilot.

2

**Second, by making water quality information available, the Assurance Fund program raised awareness of microbial contamination among water system managers and District Assembly officials.** Water quality monitoring revealed microbial contamination in over half of water samples, with a similar prevalence among piped systems, handpumps, and mechanized boreholes. Prior to this, water system managers had no information on the quality of the water they supplied. As this information became available, most managers of piped systems and mechanized boreholes took steps to improve or introduce water treatment procedures. They are now seeking technical support from Aquaya to make chlorination more reliable and effective. Additionally, the District Assembly disclosed water quality issues with community leaders during a Town Hall meeting and organized sensitization events in communities to emphasize the importance of household water treatment. These activities show that water quality information is an entry point that can catalyze change towards improved household water safety.

3

**Third, the approach of centralizing water quality testing at a professional laboratory proved more cost-effective than water systems conducting onsite testing.** Including Aquaya's facilitation and oversight, the Assurance Fund pilot cost an average of 388 GHS (67 USD) per test, which is 41% less than training and providing testing equipment to every water system. Further, ensuring adherence to good water quality testing protocols, which required sustained oversight during this pilot as discussed above, would be even more difficult and expensive in the case of onsite testing. Therefore, in settings with a sufficient density of water systems that are close to an existing laboratory (e.g., three to four water systems within a two-hour drive of the laboratory), our evaluation showed that centralizing water quality monitoring is a compelling approach.

## RECOMMENDATIONS FOR SCALE-UP

In addition to the technical adjustments listed in Table 6, we recommend the following adjustments to the program design when expanding the Assurance Fund beyond the evaluation phase:

### COMMUNITY ENGAGEMENT

We recommend that each water system enrolled in the agreement hosts a community meeting to introduce the testing program and describe treatment activities. This will help mitigate tensions if contamination is detected and ensure that community members are aware of the benefits and limitations of testing (e.g., that testing does not automatically mean good quality water). Community engagement may also promote the accountability of water system managers and encourage them to share test results.

### WATER BOARD ENGAGEMENT

We recommend inviting Water Board members to discussion meetings. Water Boards are the primary decision-makers regarding water system expenditures. Therefore, ensuring that they are aware of, and value, water quality testing activities is essential.

### FREQUENCY OF TESTING

We recommend lowering the frequency of testing for point sources such as handpumps and mechanized

boreholes. Although we initially wanted the Assurance Fund to provide similar testing frequencies to all enrolled water systems, we found that point sources were more likely to make late payments and were more difficult for GWCL to communicate with. Therefore, lowering their testing frequency to twice per year would ease implementation of the Assurance Fund while still meeting the GSA requirements.

## FREQUENCY OF DISCUSSION MEETINGS

Beyond the first six to 12 months, we recommend lowering the frequency of discussion meetings with water system managers to quarterly. Once water system managers and Water Board members have gained a basic understanding of water quality results and mitigation approaches, monthly meetings are no longer cost-effective.

## GUIDANCE ON TREATMENT

Although water quality information motivated several water system managers to improve their treatment procedures, the effectiveness of their actions was unclear. For example, the addition of chlorine tablets to large water storage tanks may not provide consistent treatment. Aquaya will, therefore, support water systems in evaluations of in-line passive chlorination solutions.


**Image 2.** A water vendor selling petty goods through a kiosk next to a water point in Asutifi North.

## REFERENCES

**[1]** Karon, AJ. Laboratory Landscaping and Economic Analysis of Testing Structures in Asutifi North, Ghana. December 2018. Unpublished presentation.

**[2]** Peletz, R. et al. Why Do Water Quality Monitoring Programs Succeed or Fail? A Qualitative Comparative Analysis of Regulated Testing Systems in Sub-Saharan Africa. International Journal of Hygiene and Environmental Health (2018), https://doi.org/10.1016/j.ijheh.2018.05.010.

**[3]** GSA Water Quality – Specification for Drinking Water FDGS 175-1:2013

**Image 3.** A GWCL technician collects a sample from a water point.