SWASH+ School-based Rainwater Harvesting Pilot Study- November 2008 Follow-Up

SWASH+: Sustaining and Scaling School Water, Sanitation, and Hygiene Plus Community Impact

Summary

Background: In September 2007, eight of the ten current rainwater harvesting schools were visited and the SWASH+ Facilities Survey was conducted in those schools. In October 2007, 10 schools in Rachuonyo District of Nyanza Province, Kenya were selected to implement and conduct a pilot study on rainwater harvesting systems (RWHS). Schools also received hardware and training on the Safe Water System and new latrines. In July and November 2008, two rounds of the SWASH+ Rainwater Harvesting Survey were conducted. Additionally, monthly ongoing visits beginning in July 2008 entailing collection of school recorded meter logs have been ongoing up to April 2009.This second report primarily focuses on identifying challenges schools face in maintaining their RWH systems, monitoring results of the schools' Safe Water System components, what we have learned thus far with recommendations, and next steps.

EMORY UNIVERSITY CENTER FOR GLOBAL SAFE WATER, WATERPARTNERS INTERNATIONAL-KENYA

Summary- continued

Findings: Key findings as of November 2008 included:

- 11% had one of the two SWASH+ constructed tanks observed as clean with no noticeable objects present inside the tanks;
- 44% had one or both tanks with plant debris present inside;
- 56% had one or both tanks with mold / fungus present inside; and
- 78% one or both tanks with insects present inside.

The lack of insect proof screens and first flush devices as of November 2008 likely increased the odds of debris, insects, and animals from entering the tanks. Pending constructions issues such as lack of insect proof screens as of November 2008 are highlighted in this report. As of February 2008, WPI has corrected the repair and construction issues noted in table 3 at the end of this report.

Based on school recorded meter logs and enumerator observed monthly meter readings, on average, students used less than 1 liter per day (0.82 l/day) per student. Use was higher for weeks with high water availability (1.09 l/day) and lower for weeks with lower stored water volume (0.61 l/day). It is unclear whether water from the RWHS was supplemented with additional water from other sources. It is also unclear how much water was used for students and how much for community members.

In regards to the Safe Water System:

- In September 2007, soap observation was not collected; in July 2008, 3 out 9 schools (33%) had soap near the hand washing containers; and in November 2008, 1 out of 8 schools (13%).
- In September 2007, none of the 8 schools had hand washing containers containing water; in July 2008, 7 out of 10 schools (70%) had at least one hand washing container containing water; and in November 2008, 8 out of 9 schools (89%).
- In September 2007, none of the 8 schools had drinking water containers containing water; in July 2008, 8 out of 10 schools (80%) had at least two drinking water containers containing water; and in November 2008, 8 out of 9 schools (89%).
- In September 2007, 2 of the 8 schools (25%) reported treating their drinking water; in July 2008, all ten schools (100%), and in November 2008, 8 out of 9 schools (89%). However, on the day of the visit, none of the 8 schools in September 2007, 6 out of 10 schools (60%) in July 2008, and 2 out of 8 schools (25%) in November 2008 provided drinking water with detectable chlorine residual.

It is encouraging to see water treatment levels have increased since baseline; however, it is important to note there was a 35% decline in treatment between July 2008 and the November 2008. The schools were provided the Safe Water System between the periods of January to May 2008 during the time of RWH construction. The final follow-up at the schools will include assessment of whether schools have repurchased WaterGuard or other treatment products since the initial supply of WaterGuard as well as other potential reasons for the decline in treatment.

Summary- continued

Recommendations: In the section "What we've learned to date" the following seven components are addressed: Design & Construction, Maintenance & Monitoring, Supply Chain, Finances, Rainfall Patterns, Water Treatment & Soap Provision, and Community. In the section "Framework & recommendations for sustained rainwater harvesting schools" a framework consisting of seven factors affecting sustainability of school WASH are presented including: financial capacity; accountability; technical feasibility; supply chain; community support; school leadership and management; and student engagement.

To date, this study has identified maintenance and repair issues schools face with their RWH systems within the first year of implementation and potential solutions to prevent some of the problems--highlighted in the full report. The study will next use the findings to explore the "why?" Why are schools having difficulty maintaining and repairing their RWH systems despite the schools' positive view of the systems that is also benefiting their surrounding communities? No matter how perfect rainwater harvesting systems or any other WASH intervention may be in design, the ultimate sustainability of the system depends on the active participation of the school and community.

About SWASH+

SWASH+ is a five-year applied research program to identify, develop and test innovative approaches to school-based water, sanitation and hygiene interventions in Nyanza Province, Kenya.

Implementing partners are CARE, Emory University, the Government of Kenya, the Kenya Water for Health Organisation (KWAHO), and Water Partners International.

SWASH+ is funded by the Bill & Melinda Gates Foundation.

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Background of Study

In October 2007, 10 schools in Rachuonyo District of Nyanza Province, Kenya were selected to implement and conduct a pilot study on rainwater harvesting systems (RWHS), see Table 1. In addition to receiving RWHS, the schools also received hardware and training on the Safe Water System (SWS)[1] as well as new latrines. The main objectives of this pilot study are to:

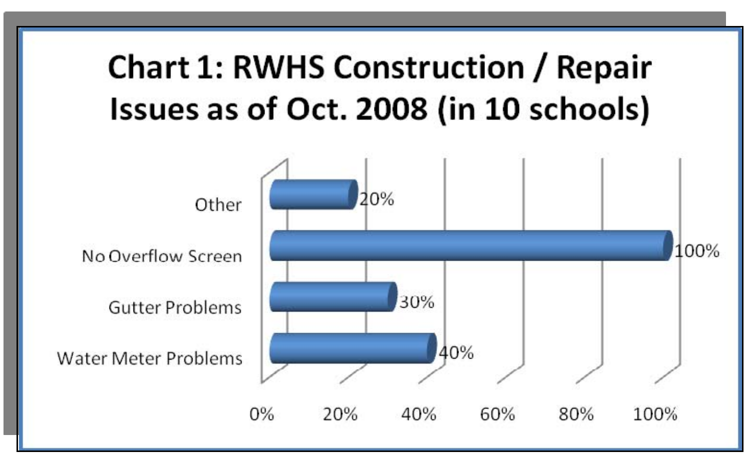
1. Identify challenges schools face in maintaining their RWHS
2. Monitor and evaluate the schools' water treatment and hand washing, and maintenance of latrines
3. Create and test potential systems for maintaining RWHS
4. Evaluate the cost and effectiveness of RWHS in relation to tank materials, tank size, catchment area, and rainfall patterns
5. Develop and share best practices for increasing efficiency and sustainability of RWHS to all relevant stakeholders

As of May 2008, SANA International, a former SWASH+ partner, had nearly finished construction of all 10 rainwater harvesting systems. As a result of SANA International formally leaving the SWASH+ partnership in July 2008, some components of the RWHS remained incomplete and were in need of further follow-up. Table 1 (located at end of document) highlights the status of each RWHS as of November 2008. For further background information on the specifics of the rainwater harvesting systems and types of latrines constructed, refer to the introduction report on this pilot study entitled *SWASH+ School-based Rainwater Harvesting Pilot Study- Intro May 2008*.

This report will primarily focus on objectives one and two while highlighting the current status of objectives three through five.

Objective 1: Identify challenges schools face in maintaining their RWHS

Although the original purpose of objective 1 was to identify maintenance issues encountered with RWHS in schools, it became clear through monthly monitoring that schools faced construction challenges as well. Table 3 (located at end of document) highlights both the various construction issues that still needed to be addressed as of November 2008 as well as repair and maintenance challenges faced.



[1] The Safe Water System consists of the provision of point-of-use drinking water treatment with sodium hypochlorite solution, safe water storage containers with narrow mouths, lids, and spigots to prevent contamination, and water and hygiene education including hand washing.

All 10 schools as of October 2007 lacked overflow screens. Insect proof screens or filters covering overflow openings on tanks are essential to ensuring that both insects and small animals do not enter the tank and contaminate the tank water. In one school, the monitoring field staff observed a dead rat inside one of the newly built tanks.

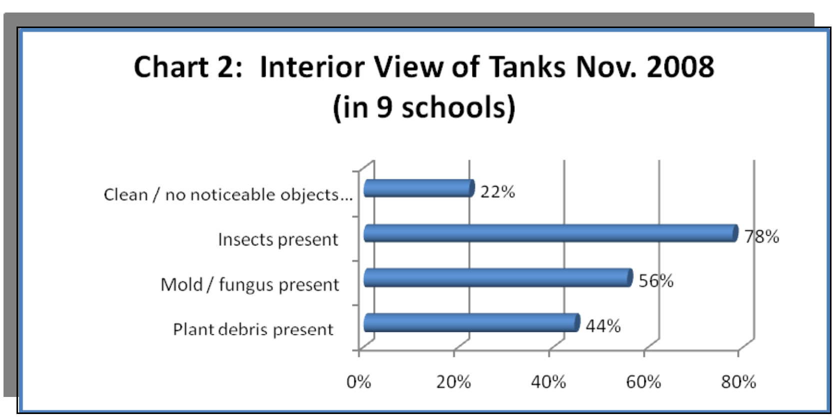
Additionally, all tanks lacked a first flush system. It is recommended that some sort of first flush device that prevents the first rush of water from entering the tank be installed. The first rush of rainwater typically carries along existing debris from the roof and gutters that either enter the tank or clog the pipe connecting the gutters to the tank. In lieu of a first flush device, WPI could consider installing a screen where the pipe connects with the gutters, thus preventing the debris from entering the tank. This latter method would require more maintenance by the school in ensuring the debris caught between the pipe and gutter connector is regularly disposed of to ensure maximum water enters the tank.

Thirty percent of schools had some sort of gutter problem (see Table 3 for more details) and 20% of schools had other problems, including a leaking pipe connecting gutters to a tank and a leaking tank.

Forty percent of schools had issues with the rainwater meters installed by the project in order to help schools track the amount of water being drawn from their RWHS over time as part of the RWHS pilot study. Most of these schools had loose meters and one school had a meter that had completely stopped working. In the typical school setting, water meters would not be a necessary component unless the school and /or interested stakeholder want to measure the amount of water being collected and drawn.

In terms of undertaking needed repairs, of the nine schools[2] visited in November 2008, two schools[3] reported one component of their RWH system in need of repair.

In addition to construction issues, maintenance challenges have been identified through a monitoring survey conducted in November 2008. Table 3 highlights maintenance challenges in detail per school.



[2] A follow-up survey was not conducted in Buru in November 2008 because the school had already closed for the year.
[3] This number reflects non-meter related repairs since typical implementation of rainwater harvesting tanks in the school setting is unlikely to include a metering system as a necessary component. Meters were installed in this study for the purpose of monitoring water use.

The schools' maintenance of the RWH systems is assessed on the overall observed cleanliness of the system, whether or not the school reports cleaning the system regularly, and whether schools take the initiative to undertake needed repairs of the system. In terms of overall observed cleanliness of the system, of the nine schools visited in November 2008 by a SWASH+ field enumerator, 11% had one of the two SWASH+ constructed tanks observed as clean with no noticeable objects present inside the tanks; 44% had one or both tanks with plant debris present inside; 56% had one or both tanks with mold / fungus present inside; and 78% one or both tanks with insects present inside.

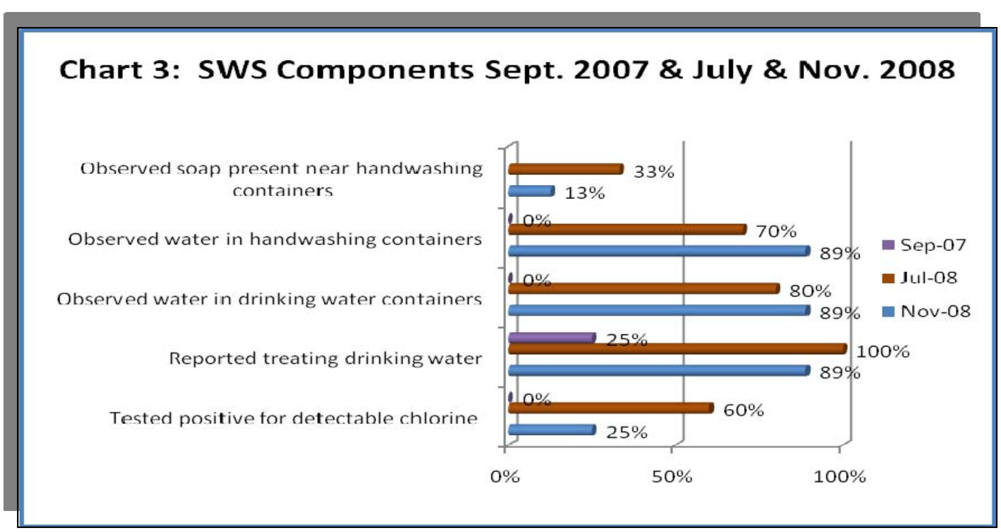
The observed plant debris, mold / fungus, and insects in the interior of the RWH tanks is not surprising given that only 22% reported ever cleaning their tanks or clearing their gutters of debris. Additionally, as mentioned previously, the lack of insect proof screens and first flush devices increases the odds of debris, insects, and animals from entering the tanks.

WPI has reported all 10 schools have received training on operation and maintenance (O&M) of their RWH systems by WPI staff. Specifically, the head teachers and two school management committee (SMC) members were trained from each school in October 2008.

As of November 2008 the majority of the schools reported not being actively involved in maintaining their RWH systems. This finding is troublesome and needs to be further understood. The remaining months of this study will potentially be used to conduct in-depth interviews with the head teachers and the SMC members who received training by WPI staff on RWH O&M in order to understand how much of the O&M training they have understood and what are the factors influencing the lack of maintenance. Additionally, in-depth interviews will be conducted with the head teachers to better assess how schools currently manage their RWH systems.

Objective 2: Monitor and evaluate the schools' water treatment, hand washing, and maintenance of latrines

In addition to monitoring the SWASH+ constructed RWH systems, key components of the SWS are also assessed in this study including: provision of drinking and hand washing water in child-friendly accessible containers; provision of soap for hand washing; chlorine treatment of drinking water through a locally available product like WaterGuard; and maintenance of latrines.



*Note: All 10 schools in the RWH sub-study were visited in July 2008; whereas, only 9 of the 10 schools were visited in November 2008. A follow-up survey was not conducted in Buru in November 2008 because the school had already closed for the year. Only 8 of the 10 sub-study schools were visited for the September 2007 baseline because 2 schools originally chosen had to be replaced due to conflict with ongoing SWASH+ year 1 school research.

Chart 3 illustrates changes in the SWS components since the September 2007 baseline visit. In September 2007, soap observation was not collected; in July 2008, 3 out 9 schools (33%) had soap near the hand washing containers; and in November 2008, 1 out of 8 schools (13%).

In September 2007, none of the 8 schools had hand washing containers containing water; in July 2008, 7 out of 10 schools (70%) had at least one hand washing container containing water; and in November 2008, 8 out of 9 schools (89%).

In terms of water provision, in September 2007, none of the 8 schools had drinking water containers containing water; in July 2008, 8 out of 10 schools (80%) had at least two drinking water containers containing water; and in November 2008, 8 out of 9 schools (89%).

With respect to water treatment, in September 2007, 2 of the 8 schools (25%) reported treating their drinking water; in July 2008, all ten schools (100%), and in November 2008, 8 out of 9 schools (89%). However, on the day of the visit, none of the 8 schools in September 2007, 6 out of 10 schools (60%) in July 2008, and 2 out of 8 schools (25%) in November 2008 provided drinking water with detectable chlorine residual.

It is encouraging to see water treatment levels have increased since baseline; however, it is important to note there was a 35% decline in treatment between July 2008 and the November 2008. The schools were provided the Safe Water System between the periods of January to May 2008 during the time of RWH construction. The final follow-up at the schools will assess whether schools have repurchased WaterGuard or other treatment products since the initial supply of WaterGuard as well as other potential reasons for the decline in treatment.

Latrine maintenance will be discussed in an appendix of the final assessment of the RWH study. There are currently a few schools that may not have received the originally planned latrine inputs and further follow-up will be needed. The latrine update in the final report will serve as a monitoring tool for SWASH+ partners to ensure schools have received the latrine inputs initially planned. The planned latrine inputs are listed in Table 1 (at the end of this report) in the “Status” column.

Objective 3: Create and test potential systems for maintaining RWHS

Given the unanticipated delays in the completion of the RWH systems as well as other SWASH+ project interventions, the degree of staff support available for this sub-study has considerably reduced while resources have been prioritized for more time sensitive implementation activities. Therefore, it is uncertain at this time whether or not Objective 3 can be fully realized. However, the initial goals set out to evaluate cost and effectiveness of RWHS in relation to tank materials, tank size, catchment area, and rainfall patterns as well as to characterize challenges schools face in terms of maintenance of systems are still being carried out for this study and may help inform a later initiative to create and test potential systems for maintaining RWH systems in schools.

Objective 4: Evaluate cost and effectiveness of RWHS in relation to tank materials, tank size, catchment area, and rainfall patterns

In terms of costing for rainwater harvesting tanks, SWASH+ partner, WaterPartners International (WPI) Kisumu, provided cost estimates in 2008 for the following three types of RWH tanks assuming 70 Kenyan Shillings (KSH) to 1 US Dollar (USD):

1. 168,630 KSH / 2,409 USD for a 25,000 liter ferrocement tank;
2. 180,000 KSH / 2,571 USD for a 25,000 liter cement tank; and
3. 267,000 KSH / 3,814 USD for a 24,000 liter plastic tank.

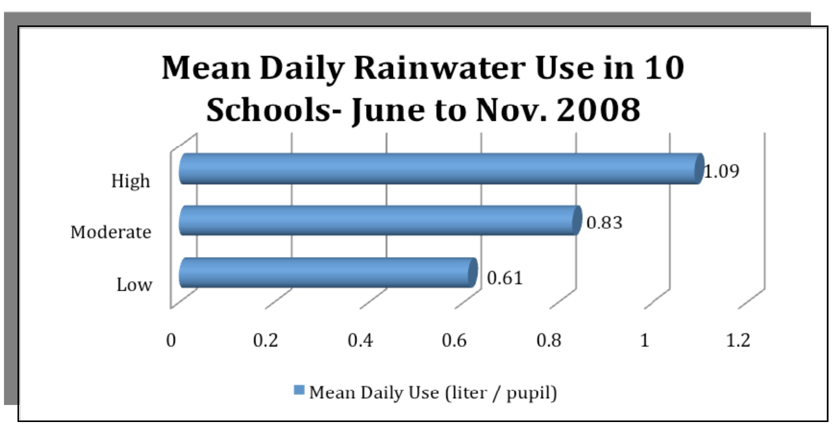
Additional information regarding costing of various tank sizes and gutters is provided in Table 2, courtesy of WPI Kisumu.

The true effectiveness versus cost cannot be accurately evaluated in this current report due to pending repair and construction issues as of November 2008. Table 3 highlights the various issues observed and documented by the monitoring field enumerator that are in need of repair.

School patrons as well as selected pupils were trained to collect and record daily water meter readings from the tanks. In practice readings were not always possible. For this assessment, weekly water use measurements were used for weeks when schools were in session and where full data were collected. A total of 91 school-weeks of data were analyzed. Total water use was combined with the average student attendance at each school to estimate the average daily intake (litres/pupil/day).

Information on the amount of stored water in the tanks was also included to adjust for rationing of water use during times of scarcity. Three categories of water availability were used, 'low' (approximately <10,000 litres), 'moderate' (approximately 10,000-25,000 litres), and 'high' (approximately >25,000 litres). Data was not used for weeks when no water was available. The analysis was adjusted for repeated measurements at the same schools.

Overall, students used less than 1 liter per day (0.82 l/day) per student. Use was higher for weeks with high water availability (1.09 l/day) and lower for weeks with lower stored water volume (0.61 l/day). It is unclear whether water from the RWHS was supplemented with additional water from other sources. It is also unclear how much water was used for students and how much for community members.



Water Availability	Mean Daily Use (liter / pupil)	Std. Error
Low (<10,000 liters stored)	0.61	0.14
Moderate (10,000 – 25,000 liters stored)	0.83	0.16
High (>25,000 liters stored)	1.09	0.08

In the final report, information on water use and rainfall will be incorporated into the Nyanza School Rainwater Model developed earlier.

In terms of rainwater use as the primary source of water in schools, when asked in November 2008 how many weeks in the past one month schools used rainwater as their primary source of drinking water, the average number of weeks was 3.1 (range 0 to 4) while in July 2008, the average was 3.8 (range 2 to 4). The change in the average number of weeks from July to November 2008 is likely due to the seasonal variability of rainwater.

Current challenges of this study:

In addition to the reduction of staff time available for this study outlined under Objective 3, to date, RWH water samples have not been collected and analyzed for microbiology as originally planned. The main reason for lack of collection stems from the distance of Rachuonyo schools to the Kisumu TICH University laboratory available for sample analysis. Resources have been made available to conduct the rainwater sampling over a period of two to three days in June 2009. Results of the rainwater quality analysis will be shared in the final report.

Additionally, 66% of schools reported members from the surrounding community accessing water from the RWH tanks at the school. The community users are not paying for the rainwater they are collecting in the schools. The current data available does not include the number of community members and the frequency of their use. The final assessment will collect this information as well as ask the school administration whether they believe that pupils are able to access sufficient water despite the current level of community users.

What we've learned to date:

- Design & Construction
    - Insect-proof screens / filters covering overflow openings on tanks are essential to ensuring that both insects and small animals do not enter the tank and contaminate the tank water
    - A locally made first flush device trapping the first rush of water that is typically debris ridden or a screen where the pipe connects with the gutters, thus preventing the debris from entering the tank
    - Gutters must be securely installed to capture and guide water to the RWH tank while the RWH tank should be installed at a significantly lower gradient from the existing roof line so that gutters and the pipe connector can capture and guide water towards the tank
    - Make maximum use of the roof availability in order to capture as much water as possible (gutters lined all along the roof where appropriate)

  - The final report will outline what improvements have been made or potentially will be made to the existing RWH systems since this report
- Maintenance & Monitoring
  - Clear roles and responsibilities must be outlined by the school administration and SMC members on required RWH maintenance activities, assigned persons for each activity, and a regular schedule in order to ensure maintenance is undertaken on a regular basis
  - The head teacher, an assigned teacher, or an assigned person from the SMC must monitor on an ongoing basis to ensure regular maintenance is conducted and report any repair issues to the head teacher and the SMC
  - Further follow-up needs to be undertaken to understand to what degree (if any) schools have set up maintenance / monitoring systems for their RWH systems
- Supply chain
  - In order to repair existing infrastructure, there must be the ability to access people / businesses that are able to provide support. The school must know of the support. The support must be located within a reasonable distance from the school or able to reach the school given enough notice.
  - Further follow-up needs to be undertaken to understand what sort of supply & service chain for RWH systems are available (if any) for the ten RWH system communities
- Finances
  - In order to carry out needed repairs for school infrastructure, the school must have adequate recurrent funds available
  - The current GoK rates of 5 KSH per child per year has been inadequate to address all the maintenance and repair needs for schools. Other funding sources must be available in the meantime.
  - Further follow-up needs to be undertaken to assess the amount of funds (if any) allocated for RWH system repair / maintenance per school.
- Rainfall Patterns
  - Rain gauge data continues to be collected in four out of ten schools. The final report will use this data to display the rainfall patterns in each school and infer whether the current RWH systems installed in each school is appropriate given the rainfall patterns recorded over the span of a year.
- Water Treatment & Soap Provision
  - Treatment of drinking water and provision of soap remain a challenge in most of the RWH schools. Lack of treatment may be due to the common misconception that rainwater is safe to drink. Lack of soap may be the schools' lack of funds and /or the consistent taking away of soap from school grounds observed at many other SWASH+ schools, dissuading the school administration from repurchasing soap.
  - These issues are being addressed through the follow-up from the Pilot Sustainability Assessment. Some of the RWH schools are also participating in the soapy-water assessment.
- Community
  - The involvement of the community, particularly SMC members, in helping to maintain and raise funds for infrastructure improvements is crucial given the current number of staff available in schools and the many other responsibilities head masters and teachers are currently engaged in.
  - Further follow-up is needed to understand the current role of SMC members (if any) in relation to the RWH systems.

Framework & recommendations for sustaining rainwater harvesting in schools:

The current assessment has important implications for sustaining effective RWHS in schools. In a recent assessment of the sustainability of pilot SWASH+ schools, a framework for an enabling environment for sustainability was proposed. The framework includes seven factors affecting sustainability of school WASH: financial capacity; accountability; technical feasibility; supply chain; community support; school leadership and management; and student engagement. Many of the findings of the current assessment fit within these domains as well.

The starting point for the framework is the vision of daily provision of sufficient safe water for drinking, hand washing and other essential uses. This requires schools to carry out specific activities on a regular basis, including: filling containers as needed, maintenance of containers, treatment of water, regular cleaning of tanks and gutters, regular inspection of proper functioning, identification of repairs that are needed, and arranging for maintenance of system as needed. Each of specific pre-conditions for sustainability is affected by a broader set of enabling conditions (some of which are outside the school itself). The effectiveness and long-term sustainability in RWHS may be increased by explicitly considering these factors in project planning, implementation, and monitoring.

Potential Steps to Increase School RWHS Sustainability		
Sustainability Domain	Planning and Implementation	Monitoring
Financial Capacity	• Determine the expected maintenance cost • Determine expected annual cost of repairs over 10 years • Define plan for how maintenance and repair costs will be financed	• Verify that funds for maintenance and repair have been allocated • Assess whether resource availability affected regular maintenance and repairs
Accountability	• Develop and sign MOU or contract that specifies school/SMC and implementer responsibilities for monitoring system, carrying out maintenance, initiating repairs and paying for repairs • Train school and SMC in all required steps including monitoring, maintaining, and inspecting • Consider incremental phases of implementation so schools demonstrate their ability to carry out required steps	• Verify that schools are carrying out their required tasks, including inspection and initiating repairs
Technical Feasibility	• Estimate monthly water yield given rainfall, roof catchment, and tank size • Ensure that it is sufficient to meet 1-2 liters per pupil per day • Ensure that trained and certified contractor performs work • Inspect all system components upon completion (including screens, gutter angle, etc)	• Assess whether system is producing the expected volume of water • Assess proper functioning of individual components

Supply Chain	• Determine what services and goods are needed to maintain and repair system • Identify where they are available and their cost • Purchase materials locally and use local contractors when feasible to promote availability of service and product supplies • Train SMC or community members in basic maintenance and repair	• Determine whether local supply chain is being used for repairs • Determine the quality of supplied goods and services for repair
Community Support	• Work with communities to clarify what rights (if any) community has to water, including payment, and what responsibilities (if any) the community has for maintaining system • Consider expanding the community financial contribution towards implementation as a pre-condition to project initiation • Community role with system clearly defined, including rights (if any) to water, payment and responsibilities (if any) in system maintenance	• Monitoring of community water use and payments • Monitoring community role in maintaining and repairing systems
School Leadership and Management	• Work with school leadership and management to plan their roles and responsibilities • Introduce monitoring and inspection reports that are regularly reviewed by SMC, community, implementers or government • Clear contract regarding school responsibilities • Incorporate maintenance and management activities into daily and weekly duty roster • Management plan for inspection, maintenance, and repair • Budget plan • Training of school management in operation and maintenance regimes to empower them to monitor ongoing construction of facilities	• Monitoring budget allocation and fund availability • Monitoring completion of regular inspection and maintenance responsibilities
Student Engagement	• Determine student responsibilities in system monitoring and maintenance	• Consider introducing student monitoring of water availability and conditions and posting for community or visitors.

Summary and next steps:

When schools were asked whether they would recommend rainwater harvesting systems for other schools, nine out of nine schools agreed they would. Additionally, on the day of the visit, eight out of nine schools were providing both drinking and hand washing water in SWS containers.
The September 2007 baseline survey assessed that seven of the eight schools (88%) had at least one rainwater harvesting tank with an average tank capacity of 2,514 liters--significantly less than the 50,000 to 60,000 liters in increased capacities since implementation. There is little doubt that the overall quantity of water accessible to each of the study schools has increased. WPI has reported conducting the needed repairs and construction issues outlined in Table 3 between November 2008 and February 2009. Therefore, there is an expectation that water quantity will increase even more in most schools unless rainfall patterns decrease significantly from January through May 2009.

The next and final RWH report will assess whether the improvements have increased the overall efficiency of the systems and if additional enhancements can be potentially made to increase effectiveness. However, water treatment of rainwater and provision of soap remain major challenges to safeguarding against microbial disease transmission.

Additionally, all schools have one or both tanks with undesirable materials inside such as insects; mold / fungus, and /or plant debris. It is recommended for the design of the RWH systems to include a first flush device in order to capture the initial rainfall water that is often accompanied by other materials washing off the roof. Insect proof screens should be installed over the overflow areas to ensure insects and animals do not enter and contaminate the rainwater. Since the findings of this report, all tanks have received filters to help trap debris. The follow up will document where the filters have been installed. WPI and KWAHO have also reported piloting first flush devices in four year two SWASH+ schools. They plan to conduct a follow-up to assess the effectiveness and sustainability of these devices. The results of the follow-up will be documented in the final report if made available.

To date, this study has identified the various maintenance and repair issues schools face with their RWH systems within the first year of implementation and potential solutions to prevent some of the problems. The study will now use the findings to explore the "why?" Why are schools having difficulty maintaining and repairing their RWH systems despite the schools' positive view of the systems that is also benefiting their surrounding communities? No matter how perfect rainwater harvesting systems or any other WASH intervention may be in design, the ultimate sustainability of the system depends on the active participation of the school and community. It is important to understand why the active participation is currently missing in order to work towards creating an enabling environment for schools to sustain their RWH systems.

TABLE 1: Status of RWH Schools as of November 2008

No.	School Name	Division	Status: April 2008: BP = "Base Package" aka SWS = Safe Water System	Tank capacity:	Tank material: RC = Reinforce Concrete; FC = Ferro Cement; PL= Plastic	Installations:
1	Nyarabi	Kabondo	(1)2 tanks completed and in use; meter installed; (2) BP; (3) 6 latrines (mobilets)- to be verified	Tank 1 = 25,000 Tank 2 = 25,000	Both RC	1 consumer water meter
2	Masogo	Kabondo	(1) 2 tanks completed and in use—however gutters for the 2nd tank need to be installed; meter and rain gauge installed ; (2) BP (3) 8 latrines (brick)- to be verified	Tank 1 = 25,000 Tank 2 = 20,000	Tank 1 = RC Tank 2 = FC	2 metering systems and 1 rain gauge
3	Nyandusi	East Karachuonyo	(1) 2 tanks completed and in use; meter installed; (2) BP; (3) 4 latrines (mobilets)- to be verified	Tank 1 = 30,000 Tank 2 = 25,000	Both RC	1 metering system
4	Buru	West Karachuonyo	(1) 2 tanks completed and in use; meter installed and one rain gauge will be installed ; (2) BP; (3) 6 latrines (mobilets)- 4 completed	Tank 1 = 20,000 Tank 2 = 10,000	Tank 1 = RC Tank 2 = PL	1 metering system and 1 rain gauge
5	Simbiri	Kasipul	(1) 2 tanks completed and in use; meter and rain gauge installed; (2) Original 2005 SWS pilot school; (3) 6 latrines (brick)- to be verfied	Tank 1 = 30,000 Tank 2 = 20,000	Tank 1 = RC Tank 2 = FC	1 metering system and 1 rain gauge
6	Ochunyno	Kasipul	(1) 2 tanks completed and in use along with a 3rd tank (3500 liters) all connected to a meter; (2) BP; (3) 6 latrines (brick)- to be verified	Tank 1 = 30,000 Tank 2 = 20,000	Tank 1 = RC Tank 2 = FC	2 metering systems
7	Opondo	Kasipul	(1) 2 tanks completed and in use but 2 meters of gutters not yet installed; (2) Original 2005 SWS pilot school; (3).5 latrines (brick)- 3 completed- to be verified	Tank 1 = 30,000 Tank 2 = 30,000	Both RC	2 metering systems
8	Kalando	Kasipul	(1) The 2 tanks have been completed and connected to a 3rd tank (25000 liters) and to one meter; (2) Original 2005 SWS pilot school; (3) 6 latrines (brick)- to be verified	Tank 1 = 30,000 Tank 2 = 25,000	Both RC	additional metering system
9	Buoye	Kasipul	(1) The 2 tanks have been completed and one meter and one rain gauge installed; (2) BP; (3) 7 latrines (brick)- to be verified	Tank 1 = 30,000 Tank 2 = 25,000	Both RC	1 metering system and 1 rain gauge

10	Ngulu	Kasipul	(1) The 2 tanks have been completed and connected to a 3rd tank (1000 liters) and to one meter; (2) BP; (3) 6 latrines (brick)-to be verified	Tank 1 = 30,000 Tank 2 = 30,000	Both RC	1 metering system

Table 2: Costing of Various Rainwater Harvesting Tanks / Gutters

ITEM	DESCRIPTION	UNIT	QNTY/Capacity	Unit cost-(kes)	Unit cost in ($)$=70kes
	GUTTERS				
1	GI Gutters gauge 28	m	1	450	$6.43
2	GI Gutters gauge 30	m	1	380	$5.43
3	GI Gutters gauge 32	m	1	220	$3.14
4	Plastic Gutters (Upvc)	m	1	850	$12.14
	TANKS				
1	Plastic Tank	m^3	6	32000	$457.14
2	Plastic Tank	m^3	8	47000	$671.43
3	Plastic Tank	m^3	10	89,000	$1,271.43
4	Plastic Tank	m^3	16	167,000	$2,385.71
5	Plastic Tank	m^3	24	267,000	$3,814.29
6	Concrete Tank	m^3	10	115,000	$1,642.86
7	Concrete Tank	m^3	20	140,000	$2,000.00
8	Concrete Tank	m^3	25	180,000	$2,571.43
9	Concrete Tank	m^3	30	220,000	$3,142.86
10	Ferrocement Tank	m^3	25	168,630	$2,409.00

Table 3: RWH Construction/Repair Issues and Maintenance Challenges-November 2008

RWH School:	Construction/Repair Issues as of November 2008:	Maintenance Challenges as of November 2008
(1) Buoye	* No repair needs reported.	Tank 1 interior: insects present Tank 2 interior: mold / fungus / insects present
(2) Buru	*The meter is loose.	**A dead rat was found in one of the tanks in an October 2008 monthly monitoring visit. No follow-up survey conducted because the school had already closed for the year in November 2008.
(3) Kalando	*Meter has stopped working resulting in inability to access water from all three tanks although tanks full of water.	Tank 1 interior: mold / fungus / insects present Tank 2 interior: insects present
(4) Masogo	*One of the newly built tanks has no gutters. **The meter is loose and leaking.	Tank 1 interior: insects present Tank 2 interior: clean, no noticeable objects present inside
(5) Ngulu	*One pipe that connects gutters to one of the tanks is leaking, causing significantly less water to enter the tank. **Meter is loose.	Tank 1 interior: unable to view interior Tank 2 interior: mold / fungus present
(6) Nyandusi	* One tank was built higher than gutters / roof preventing water from gutters from getting to the tank.	Tank 1 interior: plant debris present Tank 2 interior: insects present
(7) Nyarabi	* No repair needs reported	Tank 1 interior: mold / fungus present Tank 2 interior: plant debris present
(8) Ochunyno	*One tank is leaking and drains very quickly after a heavy rain (before the school can draw much water from it).	Tank 1 interior: plant debris / insects present Tank 2 interior: plant debris / insects present
(9) Opondo	*No repair needs reported	Tank 1 interior: mold / fungus / insects present Tank 2 interior: unable to view interior
(10) Simbiri	*Gutters were built in a way that causes more water to pour out than drain into actual tank.	Tank 1 interior: mold / fungus / insects present Tank 2 interior: plant debris / mold / fungus / insects present