

# **Dissemination of Ceramic Pot Filters by Pure Home Water in Northern Ghana**

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DLab III Lecture  
April 26,2007**



# Ghana Water/Sanitation Background



# GHANA – Water & Sanitation Access and Millennium Development Goal (MDG) Targets

		2000			MDG - 2015		
		Pop (m)	Access (m)	Access (%)	Pop (m)	Access (m)	Access (%)
<b>Water (MDG 2015)</b>	Rural	11.8	5.2	44%	17.1	12.5	73%
	Urban	8.4	5.1	61%	13	11.4	88%
	<b>Total</b>	<b>20.2</b>	<b>10.3</b>	<b>51%</b>	<b>30.1</b>	<b>23.9</b>	<b>79%</b>
<b>Sanitation (MDG 2020)</b>	Rural	11.8	1.3	11%	19.3	10.8	56%
	Urban	8.4	3.4	40%	15.1	12.1	80%
	<b>Total</b>	<b>20.2</b>	<b>4.7</b>	<b>23%</b>	<b>34.4</b>	<b>22.9</b>	<b>67%</b>

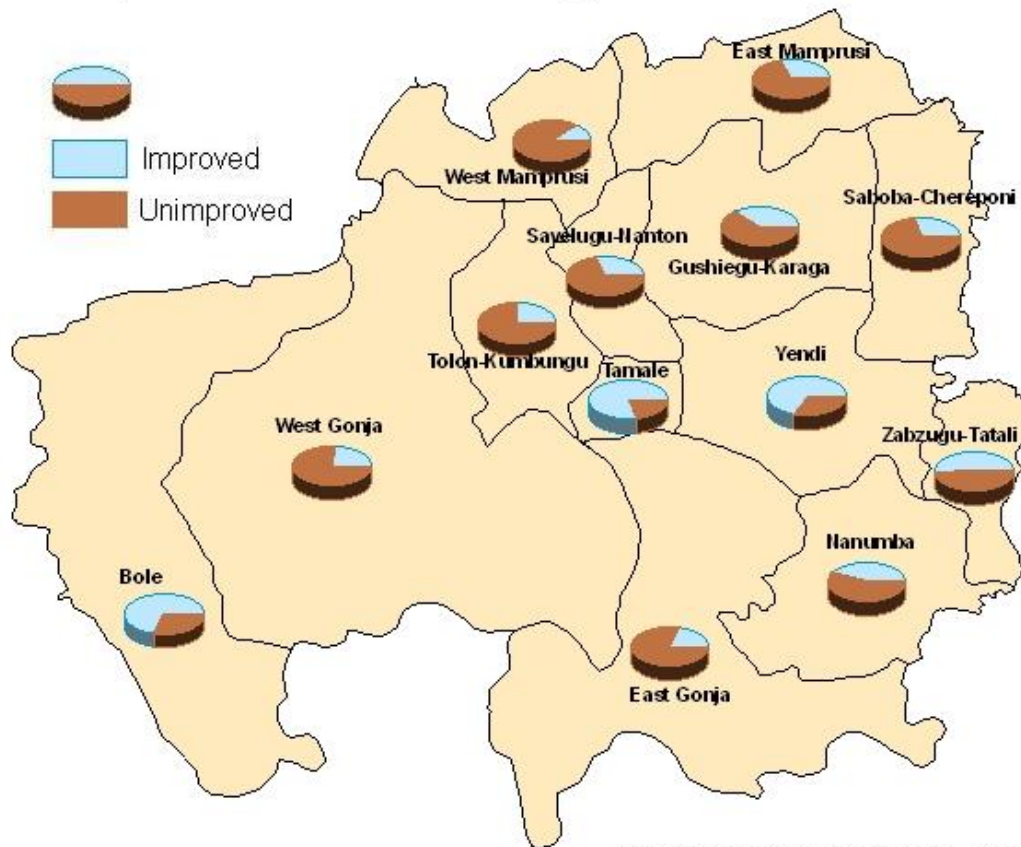
# PROGRESS TOWARDS MDGs (2002) (Ampomah, B., 2004)

Country	Goal 1 Eradicate extreme poverty and hunger	Goal 4 Reduce child mortality	Goal 7 Ensure environmental sustainability	
	Target Halve the proportion of people suffering from hunger	Target Reduce under five and infant mortality rates by two-thirds	Target Halve the proportion of people without sustainable access to improved water and basic sanitation	
	Undernourished people (as % of total pop)	Under-five mortality rate (Per 1,000 live births)	Population with improved access to water sources (%)	Population with improved access to basic sanitation (%)
<b>Ghana</b>	<b>On track</b>	<b>Off track</b>	<b>Off track</b>	<b>Off track</b>
<b>Mali</b>	<b>Off track</b>	<b>Off track</b>	<b>On track</b>	<b>Off track</b>
<b>Niger</b>	<b>Off track</b>	<b>Off track</b>	<b>Off track</b>	<b>Off track</b>



# 50% (0.9 million out of 1.8 million people) in Northern Region, Ghana currently use an unimproved source

## Percentage Use of Improved and Unimproved Drinking Water Sources



### Improved Sources

- Boreholes
- Household connection
- Public standpipe
- Rainwater harvesting
- Protected springs and dug wells

### Unimproved Sources

- All surface water sources
- Unprotected springs and dug wells
- Tanker trucks
- Vendor water

Courtesy Jenny VanCalcar. Used with permission.

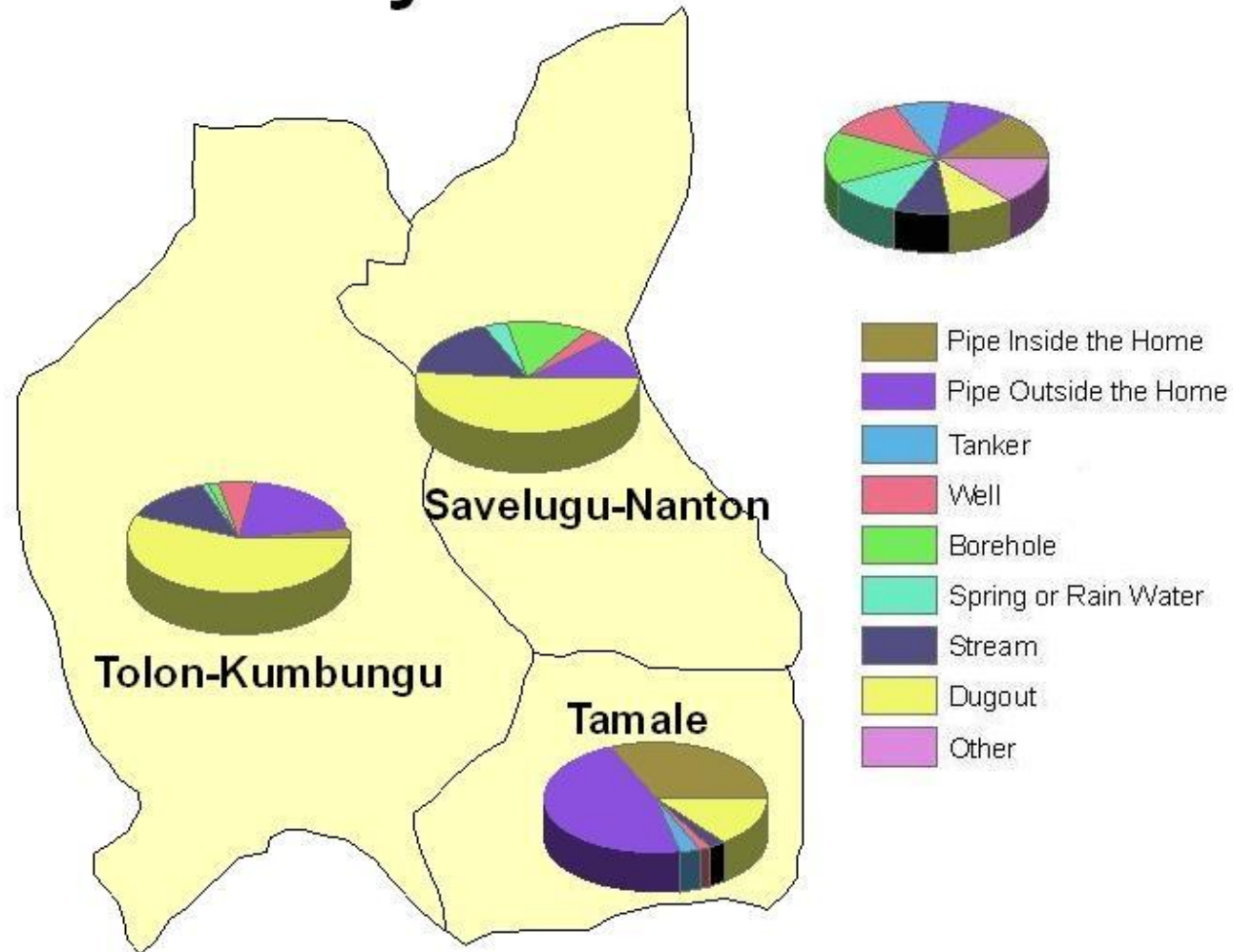
Data: Ghana Statistical Service, 2003  
Map: J. VanCalcar, 2006

Close-up 3 districts  
in Northern Region,  
Ghana -  
by type of supply.

Note: District capital  
Tamale, has a  
municipal water  
treatment plant and  
major piped supply.

Note: Neighboring  
districts, Tolon and  
Savelugu, have  
dugouts as major  
sources.

# Types of Water Sources Used by Households



These are typical unimproved sources, called “dugouts” or dams.

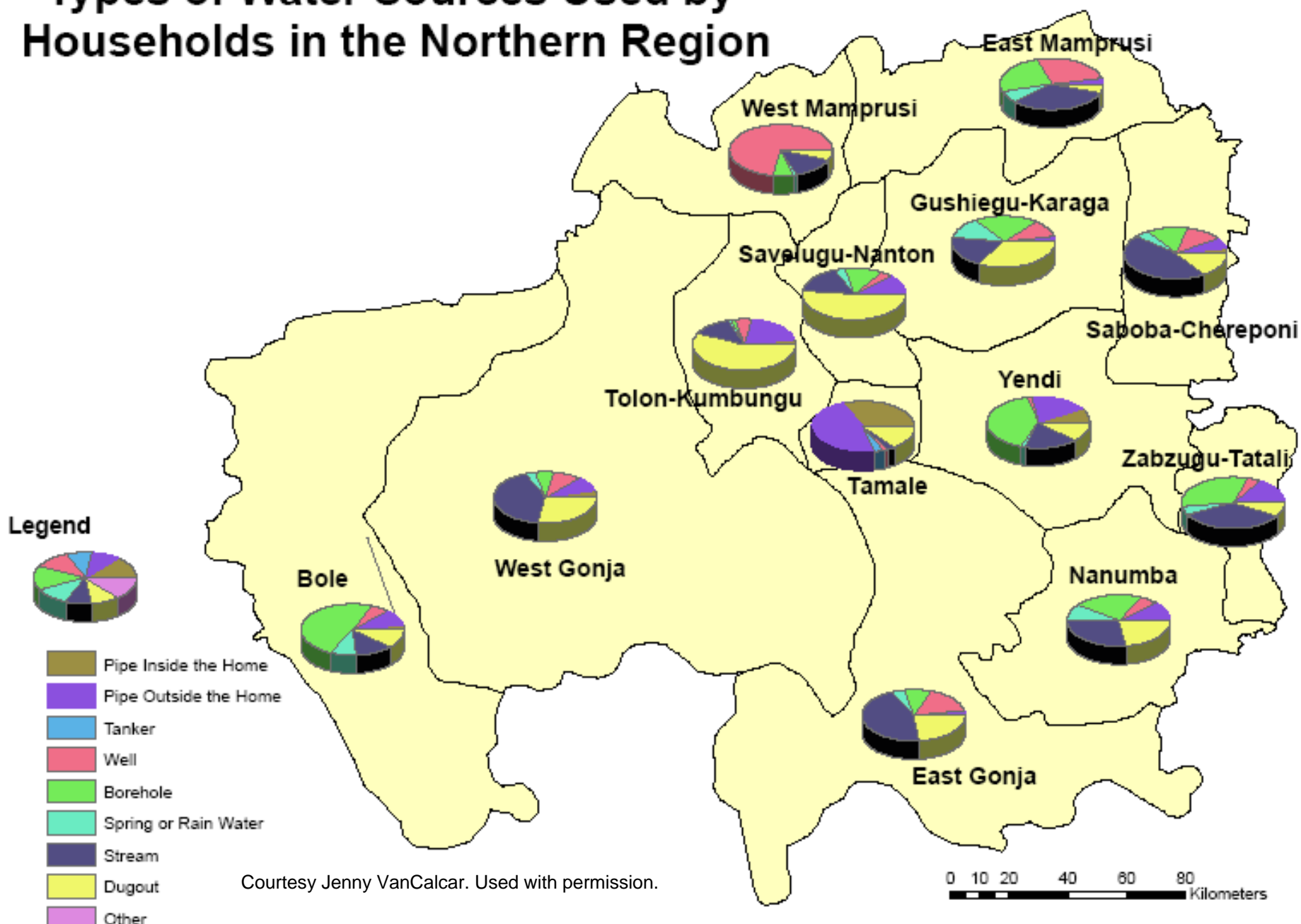


Ghanasco Muali Dam



Kaleriga Dam

# Types of Water Sources Used by Households in the Northern Region





# Pure Home Water

- Pure Home Water (PHW) is a social enterprise founded in 2005 which aims to provide safe drinking water via household water treatment and safe storage (HWTS) in Northern Ghana
- Our HWTS products reduce diarrhea, guinea worm and other water-related diseases.
- MIT engineering & business student teams support PHW with R&D, monitoring & evaluation and other studies



Since 2005, Pure Home Water has provided safe drinking water to low income communities in Ghana.



# Pure Home Water's Target Region is the Northern Sector:

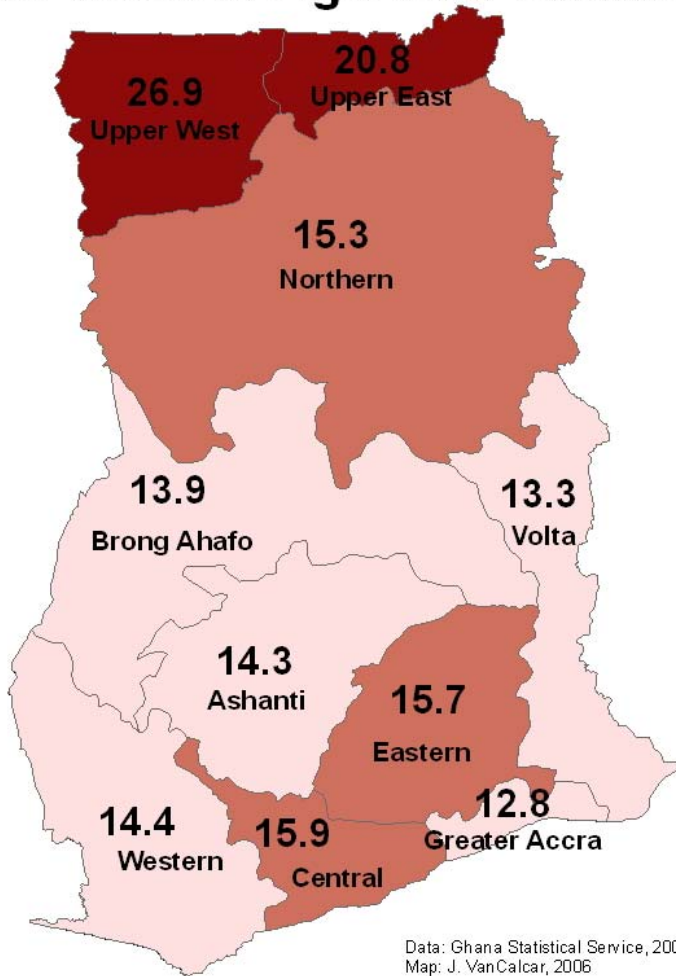
- Upper West (0.57 M)
- Upper East (0.92 M)
- Northern Region (1.8M)
- Total Target Region (3.4 M)

## Regions and Major Cities of Ghana

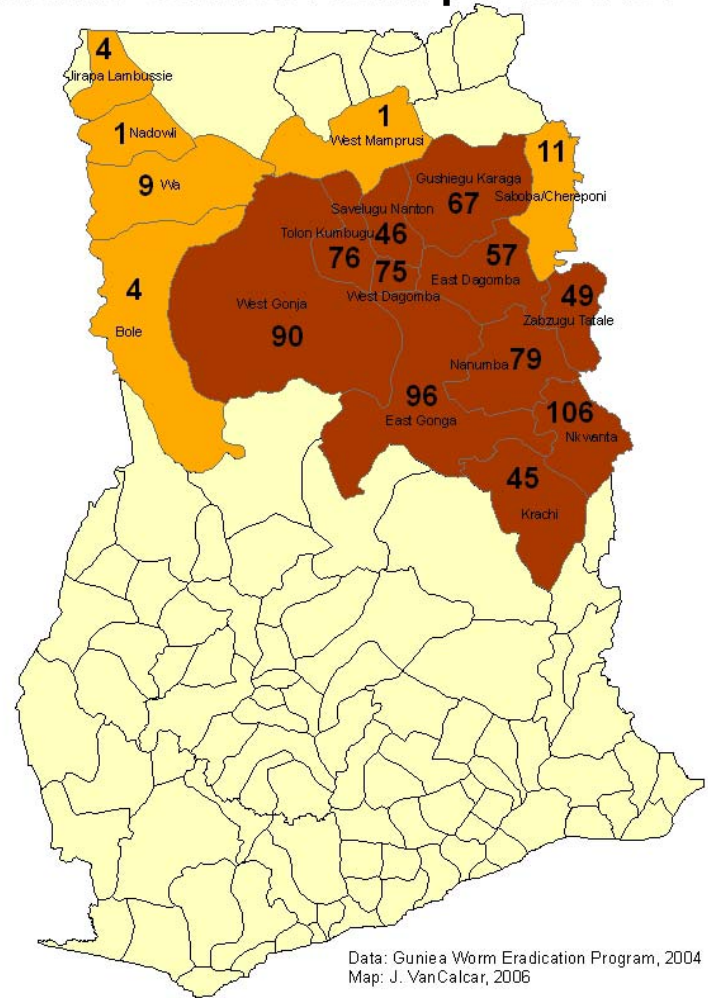




## Percentage of Children Under Five Years of Age With Diarrhea



## Number of Communities with Endemic Guinea Worm per District





# Ghana is one of the sole remaining guinea worm endemic countries



Woman from Yesapi, Central Gonja, with bandage covering guinea worm



Close-up of emergence of guinea worm and method of extraction

Image from Wikimedia Commons, <http://commons.wikimedia.org>

# Year 1

## Pure Home Water Products in Ghana

### 1 Safe Drinking Water Storage

- Modified “safe storage” clay pots
- Plastic “safe storage” containers

### 2 Filters

- Ceramic filters
  - (i). Ceramic Pot Filters (“*Kosim*”)
  - (ii) Michael Commeh’s ceramic candle filter
  - (iii) Indian imported candle filter
- Biosand Filters

### 3 Disinfection

- Household Chlorination (“Safe Water System”)
- Solar Disinfection (SODIS)

# Year 2 - Ceramic Pot Filter & Safe Storage

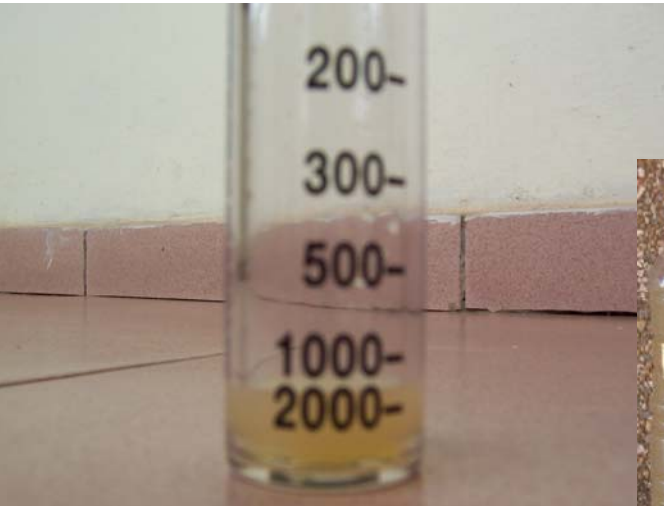


Since 2006, we have focused on disseminating the ceramic *Kosim* filter.



# Why did we choose a ceramic pot filter?

- Extremely high turbidity, even in dry season, in the widely used surface water supplies



**Turbidity Test (NTU)**





# Why did we choose a ceramic pot filter?

- Culturally compatible – rural water in Ghana is universally stored in large clay vessels



# AFTER

*Kosim treated water*

# BEFORE

*Kosim Filter filled with dugout water*



# Kosim Filter Water Quality Results

## Rural (traditional) Households

Table 1. Traditional Communities				
Water Quality Test		Source Water	Filtered Water	Percent Removal (paired samples)
Membrane Filtration	Average <i>E. Coli</i> CFU/100mL	690	2.5	99.7%
	Average Total Coliform CFU/100mL	23,000	170	99.4%
3M Petrifilm samples) (25	Average <i>E. Coli</i> CFU/100mL	330	0	100%
	Average Total Coliform CFU/100mL	5700	180	94%
Hydrogen Sulfide Bacteria Presence/Absence	Positive for H2S Bacteria	97% (30/31)	13% (2/16)	87% (13/15)*
	Negative for H2S Bacteria	3.2% (1/31)	88% (14/16)	
Turbidity	Average NTUs	190 (33 samples)	11 (19 samples)	92%

\*Percentage of samples that tested positive in the source water and negative in the filtered water.

# Kosim Filter Water Quality Results

## Urban Households

Table 2. Modern Communities				
Water Quality Test		Source Water	Filtered Water	Percent Removal (paired samples)
Membrane Filtration	Average <i>E. Coli</i> CFU/100mL	1.4	0.21	85%
	Average Total Coliform CFU/100mL	1500	150	90%
3M Petrifilm samples) (7	Average <i>E. Coli</i> CFU/100mL	0	0	n/a
	Average Total Coliform CFU/100mL	440	57	78%
Hydrogen Sulfide Bacteria Presence/Absence	Positive for H2S Bacteria	29% (2/7)	0% (0/7)	100% (1/1)*
	Negative for H2S Bacteria	71% (5/7)	100% (7/7)	
Turbidity	Average NTUs	4.5 (7 samples)	1.4 (7 samples)	68%

\*Percentage of samples that tested positive in the source water and negative in the filtered water.



# Health Impact of *Kosim* Ceramic Filter

- Urban (modern) households with filters have **88% less risk** of having diarrheal illness compared to households without filters (Peletz 2006)
- Rural (traditional) households with filters have **69% less risk** of having diarrheal illness compared to households without filters (Johnson 2007)

# Pure Home Water New Strategy 2007

*Main Goal: Demand Generation based on lower price / segmented market*



- URBAN OUTREACH
- HOSPITALS AND  
SCHOOLS
- RURAL OUTREACH

# Urban Outreach

- Provide retailers with filters and educational /promotional materials at no cost upfront

PHW Cost (US\$)	Retailer Price (US\$)	Customer Price (US\$)
13.70	10	12 (Cash)
13.70	10	13 (Credit)

- Train retailers in filter use and maintenance
- 10 active retailers/salespeople out of 17 trained
- Money is collected as filters are sold
- Future --- PHW-run retail outlet in 2007 (?)

# Hospital Outreach

- Meet with District Health Director and other officials
- Presentation for nurses and other caregivers at hospital
- Free filters for inpatient use



- **Nurse volunteer** responsible for
  - Maintaining PHW products in hospital
  - Answering patient questions about HWTS
  - Selling of filters
  - Collecting and transmitting user feedback



# School Outreach

- Meet with GES and GWP to determine target schools
- Presentation for teachers
- **Free filters for classroom use** (1/class or 1/40 students)
- **Teacher volunteer** responsible for
  - Overseeing maintenance of PHW products in school
  - Answering student and parent questions about HWTS and PHW educational materials placed in classrooms
  - Collecting and transmitting user feedback



# Rural Outreach

- Meet with partner NGOs to target communities
- **Free filters for opinion leaders**
- Presentation for community
- **Community liaison will**
  - Organize community product presentations
  - Answer in-field questions
  - Facilitate distribution
  - Monitor use and transmit user feedback
  - Attend bi-monthly liaison meeting with PHW



PHW Cost	Liaison	Customer
\$13.70	\$5	\$6 (Cash/Credit)

# Rural Outreach: Training

- Community liaison training
  - Held every 6 weeks
  - Conducted in local language; presenters evaluated by peers
  - Information traded and new goals assigned, materials distributed



# 2007 Summary

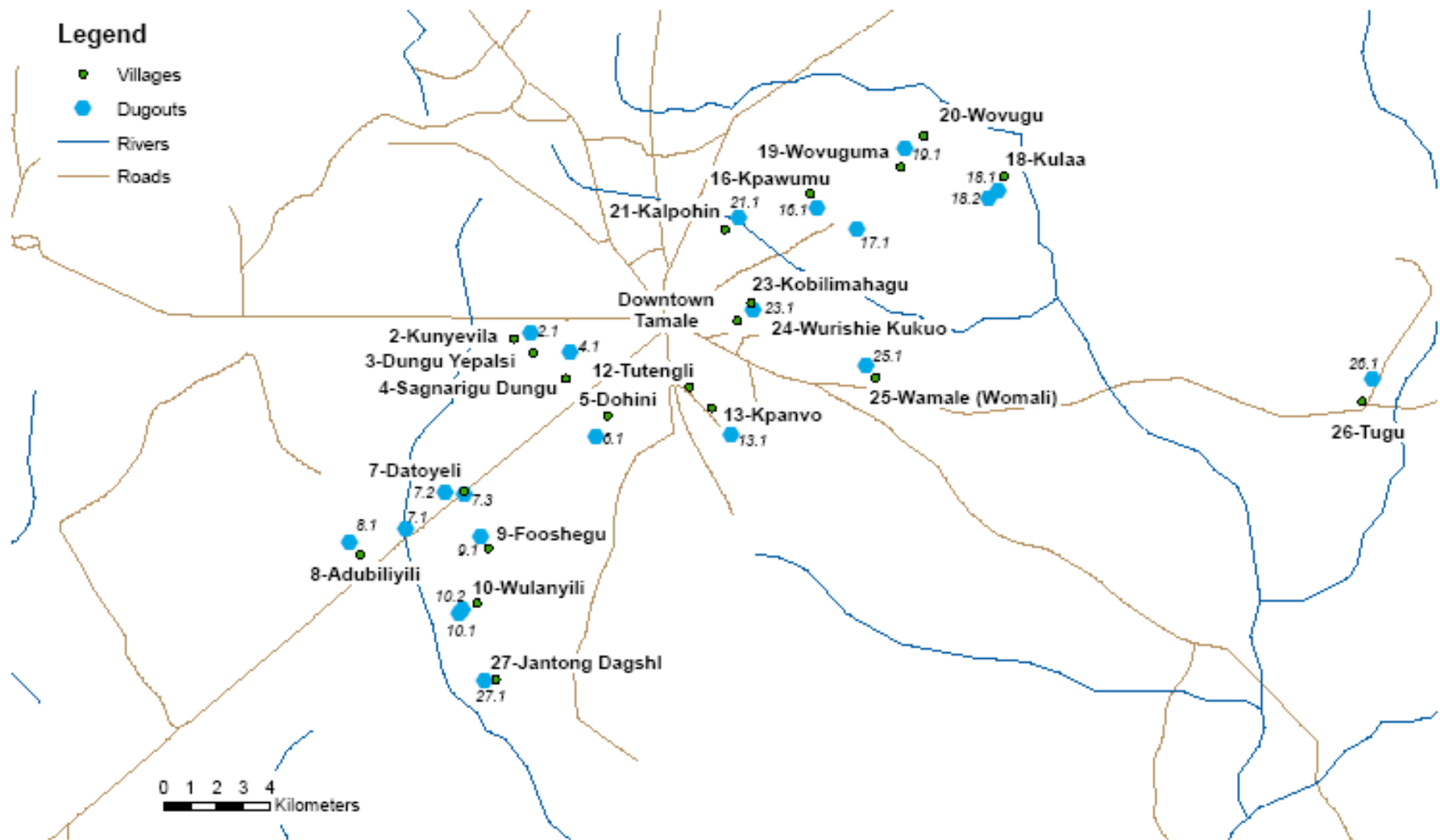
We aim to:

- Reach **hospitals, schools, religious centers** and **opinion leaders**
- Train **community liaisons, educators, nurses,** and **retailers** to educate communities and customers about HWTS
- Establish a **system of distribution** that responds quickly and cost-effectively to demand

Distribution Type	Distributor Cost	Customer Price
HOSPITAL	\$10	\$12
RURAL	\$5	\$6
URBAN	\$10	\$12



# Villages with unimproved water supplies (dugouts) which have household ceramic filters in Tamale District



# Estimated # People Reached Years 1 & 2 (June '05 to July'07)

	# People/HH	# People
Urban/Retail	6	5,797
Rural	12	8,508
Free – Schools & Clinics	40	4,600
International	9	1,080
<b>TOTAL</b>		<b>19,984</b>

# So... how do we scale up to reach millions of people?

Courtesy Matt Stevenson. Used with permission.





# PHW's 5-Year Expansion Program





# PHW's Expansion Program 2008 – 2013

(100,000 filters to 1 million people)

	%	Est. # HouseHolds	# People
Urban	20%	20,000	200,000
Rural	75%	75,000	750,000
Free hospitals, schools)	5%	5,000	50,000
Total		100,000	1,000,000

# Pure Home Water's Challenges



# Ceramic Breakage in Transport



# Breakage in Use





# Awareness and Training

Courtesy Matt Stevenson. Used with permission.



# Awareness of Educational Materials



**% of people aware of educational / promotional messages**

**A lesson in pictures:**

Water drunk straight from the dugout leads to guinea worm and the hospital.



Water drunk from the filter leads to school and happy family





# Local Capacity to Sell Filters



# Demand Generation – through awareness & training, social marketing & networking





# Transportation & Fuel Costs



# Behavior Change



# Proper Cleaning & Maintenance

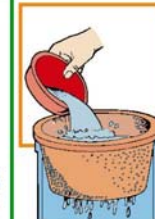
## HOW TO USE YOUR FILTER



- 1) Before using the new filter,
    - A) Fill the filter receptacle halfway with water and.
    - B) Add 10 drops of chlorine bleach or 16 drops of iodine to this water.
    - C) Let it sit for 30 minutes.
    - D) Use this water to rinse the receptacle, clay filter, lid and faucet and your hands. If chlorine or iodine is not available fill the receptacle halfway with boiled water and when it cools pour this water over the lid, faucet and filter. Discard all the water.
- Only chlorinated, boiled, or water treated with iodine will kill bacteria in the receptacle.



- 2) Place the clay filter in the plastic receptacle immediately.



- 3) Fill the filter several times and discard the filtered water. This will remove the taste of the clay.



- 4) If your river or well water is cloudy, use a piece of cloth over the filter element to prefilter the water each time. Tie a string around the cloth so that it does not fall into the filter.



- 5) Your filter will flow faster when it is full, so fill it often. Prefiltering will help your filter to flow faster.

## HOW TO CLEAN YOUR FILTER AND RECEPTACLE



- 1) **FILTER CLEANING**  
You do not need to clean your filter more than once a month unless it starts to filter too slowly. When this happens, carefully remove the filter. Leave the receptacle at least half full of filtered water. Place the filter on a cloth that has been washed in chlorinated or boiled water.



- 2) Using water from the receptacle, fill the filter half way and scrub it vigorously with a brush to unclog the pores. Discard the dirty water. You will have some small particles of clay come off if you are scrubbing hard enough.



- 3) **CLEANING THE RECEPTACLE**  
The filter receptacle should be cleaned each month. Follow the directions above beginning with "1-A" for cleaning your receptacle. The clay filter will usually last a year before it becomes too clogged to provide enough water. At this time it should be replaced. If cleaning still restores the flow, it does not need to be replaced. To replace your filter contact \_\_\_\_\_.



# Gender Roles





# Effect of Commercial Sales vs. Free Emergency Distribution in Neighboring Regions





# Limited Resources Capacity

- Currently PHW has 3 full time and 2 part time staff.



# Big Plans for 2007-2008

- Increase retail operations and extend our schools, hospitals and rural community outreach,
- Potentially establish a ceramic filter manufacturing facility in the Northern Region,
- Set up a laboratory capable of performing advanced microbiological and other water quality testing
- Continue capacity-building in a range of areas (management, accounting, operations, social marketing, and vehicle maintenance),
- Acquire a vehicle capable of transporting filters for outreach and sales,
- Open our own retail shop in Tamale (proposed),
- Engage key Ghanaian partner organizations to shape a national strategy for unified ceramic filter dissemination (common branding, shared promotional materials, unified pricing), and
- Continue to expand and share our GIS mapping of water sources in Northern Ghana with government agencies and fellow NGOs.

# We are weighing whether to build our own Factory. Reasons:

- Offer Kosim filter at much lower price so PHW can break-even
- Eliminate 12+ hour transport from South to North, with issues of breakage, fuel and vehicle costs
- Control quality of product
- Field laboratory to focus on research and development for product improvement
  - Breakage
  - Role of colloidal silver
  - Improved bacterial removal
  - Virus removal

# Filter Manufacturer - Peter Tamakloe of Ceramica Tamakloe





# Ceramica Tamakloe, Accra, Ghana



# References

- Johnson, Sophie. 2007. “Health and Water Quality Monitoring of Pure Home Water’s Ceramic Filter Dissemination in the Northern Region of Ghana.” Masters of Engineering Thesis. MIT Department of Civil and Environmental Engineering. Cambridge, Ma. June, 2007.  
[http://web.mit.edu/watsan/std\\_thesis\\_ghana.htm](http://web.mit.edu/watsan/std_thesis_ghana.htm)
- Peletz. Rachel. 2006. “Cross-Sectional Epidemiological Study on Water and Sanitation Practices in the Northern Region, Ghana.”. Master of Engineering Thesis. Massachusetts Institute of Technology, Civil and Environmental Engineering Department. Cambridge, Massachusetts. June. 2006.  
[http://web.mit.edu/watsan/std\\_thesis\\_ghana.htm](http://web.mit.edu/watsan/std_thesis_ghana.htm)

# For More Info:

- [http://web.mit.edu/watsan/meng\\_ghana.html](http://web.mit.edu/watsan/meng_ghana.html)

