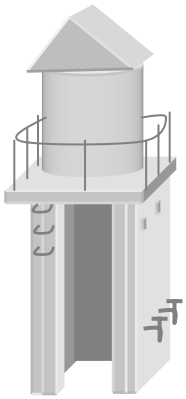
Community Safe Water Distribution System
Proposal – Samsam Village, Ghana

Overview

The Water for Life Community Safe Water Distribution System is designed to handle a wide variety of water situations, treating various water sources and conditions, and, because it is of modular configuration, can be expanded to serve 2000. UV treatment, killing the DNA of microorganisms, is the treatment of choice in the industry. In locations where electricity is not available, solar panels are utilized, with back-up battery power added to stabilize the UV. The System is not intended for desalinization.



Tower with filtration

The system configuration will depend upon site and water characteristics as follows.

System Filtration is capable of removing at least 99% sand and rust from water. Carbon filters remove the remaining iron and manganese from the water

The system offers four stages of protection . A laterite filter pre-system treatment including activated carbon will need to be built for removal of iron/manganese which will require a second pump. A system includes pre-filtration (to clarify water), purification (UV radiation to kill microorganisms – bacteria, cysts, amoebae, coliform, Typhus, Schistosomiasis, Cholera and many others), storage, and a final stage of purification (unique final dose of UV radiation to prevent re-contamination of the tank water/carbon filters).

The source is chemical and mineral free water taken from a borehole up to 150 feet deep, and serving approximately1000 people with 1000 gallons per day. The system is capable of operation sunup to sundown on sunny days and reduced operation on rainy/cloudy days

The system includes in addition to the laterite tank: solar panels, submersible pump, deep cycle batteries (2), ultraviolet sterilizers (2) pre-filter and interconnects. The system is designed with the following capabilities:

- Solar panel, (8) 65 watt – Capable of running up to 12 hours/day on solar energy
- Battery back-up power - (2) sealed, 100AH 12 volt batteries. Capable of providing 12-24 hours of pumping/sterilizing during cloudy periods.
- Submersible pump, 2.5-3.5 GPM – ETAPUMP 04-240 or equivalent). The pump is capable of pumping 150 feet vertical lift
- Purification system - (2) WFL 2 GPM sterilizers Model UV 200-5. The sterilizers are capable of removing at least 99.9% bacteria, cyst, amoebae from water
- Pre-filter Water for Life WFL-21 cartridge filter. The pre-filter cartridges are capable of being cleaned 100 times before replacing (if water is extremely contaminated or turbid, less times; if pre-system laterite filtration for arsenic/iron/manganese, more times)
- Spare UV lamps and filters to provide 3 years of operation before replacement is needed.

Other system capabilities are as follows:

- Capable of being installed by technical personnel in country
- Capable of being used on a well in conjunction with a hand pump
- Capable of being maintained by a trained person having a secondary school degree and mechanical aptitude
- Capable, if parts are reordered and on hand, of maintenance with less than 1 day down time.
- Replacement interval of UV lamps is 1 year minimum
- The typical replacement interval for the pre-filters is 1 year, and the carbon filters is 6 months.
- Design lifetime of non-consumables is 15 years.

The system includes100’ water pipe and electric cable to pump, 25’ electric cable to solar panels, all fittings and faucets, including brackets for mounting solar panel to a storage tank. A tank of 1000 gallon capacity is recommended.

The tower is not supplied, but layout drawings are furnished for a local contractor to build the tower. Up to 7 water spigots can be built into the tower or water stanchions can be put in to extend the water up to 100 feet away from the tower. 2 stanchions are recommended and can be located in a radius around the tower, each having 2 spigots.

The cartridge filter contains 21 individual filter cartridges. The filter cartridges are capable of being cleaned a minimum of 100 times before replacing. .

Installation

Preparing the Site

The site is chosen with the following considerations in mind:

1. The System requires a level ground area with dimensions of 4 meters by 5 meters (12 feet by 15 feet)
2. The basic system comes with 30 meters (100 feet) of pipe. Additional pipe will be needed if the source is further away.

Building the Foundation Structure

1. Follow the dimensions of the print (Figure A1). The system should rest on a cement pad. Use cement block and standard building techniques employing reinforcing bar to strengthen the structure.
2. We recommend to put in 3" electrical conduit sweep ells under the foundation in locations where plumbing and electrical lines will run to the laterite filter and plumbing stanchions (if used).

Building the Faucet Support

1. Faucet Stanchions permit faucet locations to be at a distance of 100 feet in three directions (use polyethylene pipe, not supplied). Three ¾ inch pipes are run from the purifier/control box underground from the system to the stanchion locations. Two spigots are placed on each stanchion. Up to 6 faucets can be connected to one system.
2. If the unit is put into a courtyard, the spigots may be put into a wall for security. Access is from the outside of the wall. In this instance, 4 faucets are recommended; two connected to each ¾ inch pipe coming from the sterilizer/control box.
3. If the secure tower system is built, then 7 faucets are connected to a common manifold supplied with the system, and spaced around the tower.
4. If a wall is built around the system for security, spigots can be built into the wall, instead of at stanchions.

Installing Pump in Well Location

The well needs to be capped at least 1 foot above the ground, to prevent contamination by runoff. Refer to the Dankoff pump manual supplied for detailed instructions, including installation in conjunction with a hand-pump.

Installing Pre-Filter on Location

The pre-filter is to be bolted to the foundation. Connect water pipes to pump and drain locations. Connections are labeled, but check with block diagram, at the end of this manual, to verify connections.

Placing Purifier Unit on Location

1. Bolt sterilizer/control box into place
2. Connect water lines to pre-filter.
3. Connect electrical lines. Wires are numbered on the terminal block inside the sterilizer/control box.
4. Place the (2) batteries inside the separate battery boxes inside the sterilizer/control box. The separate battery boxes ensure that there is no damage to other components in the event of battery leakage. A diagram will be provided with the batteries to show how to connect the terminals. **Be sure to attach the RED wire to the Positive (+) terminal of the battery and the BLACK wire to the Negative (-) terminal of the other battery. Reversing the connections will damage the control box.**

Placing Tank on Location

1. Bolt into place
2. Place float switch in tank according to instructions supplied.
3. Connect float switch electrical line to control box according to numbered wires.
4. Drill an air vent hole in the tank cap, and mount the air filter housing on the cap using the screws supplied. Install the 1 micron air filter supplied into the filter housing.

Placing Solar Panels on Location

1. Solar panels are pre-assembled and pre-wired at the factory. They will be attached to a mounting frame that is dimensioned for the specific overhead tank used, to be constructed. A specific drawing will be provided when the tank is selected.
2. Bolt in place.
3. Adjust for best solar angle
4. The solar panel poles come set-up for the correct latitude. There are 3 adjustment positions. The center position is correct in the spring and fall, and has about 10% reduction of power in summer and winter. If this is adequate, then the system can stay in this position. Otherwise, it will have to be adjusted for each season.
5. Connect electrically to sterilizer/control box. Wires are numbered at the terminal strip for easy identification.

Operation

Check for electrical operation. The switch to operate the sterilizers is located inside the sterilizer control box. Remove the cover and turn on the switch. Verify that the sterilizer lamps are on (handles glow) and that neither lamp failure warning horn sounds.

Switch on the pump inside the cover of the pump controller. Verify that water flows.

Check system for leaks. Tighten any hose-clamps that have small drips.

The pre-filter must be coated with cellulose. Switch off the pump (switch is located inside cover of pump control box). Close pre-filter valves. Fill the standpipe with cellulose and replace cap.

Note: A very small amount of chlorine bleach can be added to the system each time filters are cleaned to kill any bacteria that might build up in the storage tank. Put **no more than 1 capful** of bleach into the standpipe when filling with cellulose. Do not draw water from the tank until it is at least half full.

Maintenance

The pre-filter cartridges need to be periodically cleaned. There are 2 levels of cleaning possible. Each situation is different, and the time interval between these cleanings will be determined by experience.

- Purging – The bottom ¼ of the pre-filter housing is void, allowing sand and dirt to accumulate. Purging consists of opening the drain valve for 1 minute while the pump is in operation, allowing water to wash away these impurities. Close drain valve to resume normal operation.

- Cleaning – The pre-filters can be removed for cleaning. Using the pump connected to a spray hose, the dirt is power-washed off of the pleated pre-filter. Use the high-pressure nozzle setting of a garden hose. Start at the top and slowly work down, spraying well inside the pleats. It is important to clean all cartridges as well as possible without damaging any.

  Turn pump off.

  Valve positions: Close all valves.

  Remove top of filter. Remove pre-filter cartridges.

  When the filter cartridges are cleaned, they must be coated. Follow the procedure outlined in the OPERATION section.

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Replacement

We recommend replacement of the ultraviolet (UV) lamps once a year. The system is designed to maintain optimum UV lamp efficiency. Otherwise UV output declines by about 20% each year for the first few years, causing the unit to be less effective over time. 3 sets of lamps are provided with the system for operation for 3 years minimum.

Pre-filter replacement is needed when the filters become too plugged to be cleaned adequately by the 3 methods described in MAINTENANCE or develop a hole. Conditions vary greatly, but the filters should last at least 1 year. 3 sets of filters are provided with the system for operation for 3 years minimum.

Carbon filters (if used) should be replaced when water testing indicates they are no longer being effective at removing the contaminants they are used for. Conditions vary greatly, but the filters should last at least 6 months. They cannot be cleaned. 6 sets of filters supplied with the unit should last 3 years minimum. Carbon filters are not needed if the laterite filter also contains activated carbon.

For replacement filters and UV lamps contact the WHF/Ghana Country Program Representative in Accra, Ghana, Simon C. Tamakloe, at 021-512-655, or the WHF USA Chief Executive Officer, Mary K. Tauras, at Tel: (203) 270-7853 or at mktauras@worldhelpfound.org .

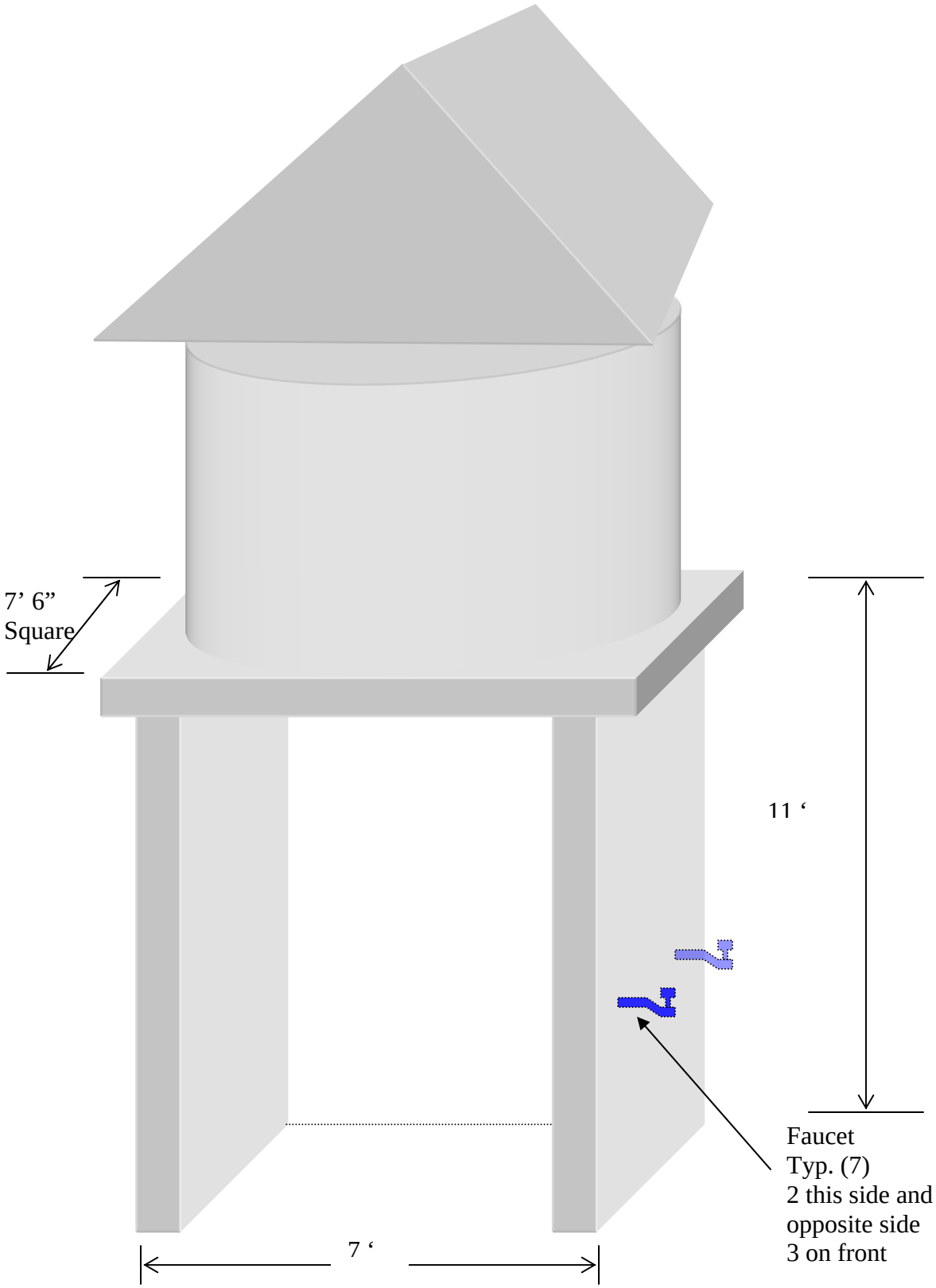
Equipment for the System described in this manual is provided by the following supplier:

Water for Life Corporation	Tel: (203) 270-1522
255 S. Main	Fax: (203) 426-1929
Netwown, CT 06470 USA	E-mail: sales@waterforlifecorp.com.

If there is any need, please do not hesitate to contact the WHF USA, P.O. Box 500, Newtown, CT 06470 Chief Executive Officer, Mary K. Tauras (Kathy), at (203) 270-2753 or at mktauras@worldhelpfound.org. World Help Foundation is working diligently to provide those served with the best service possible. We look forward to celebrating for years to come with safe, clear, sweet water.

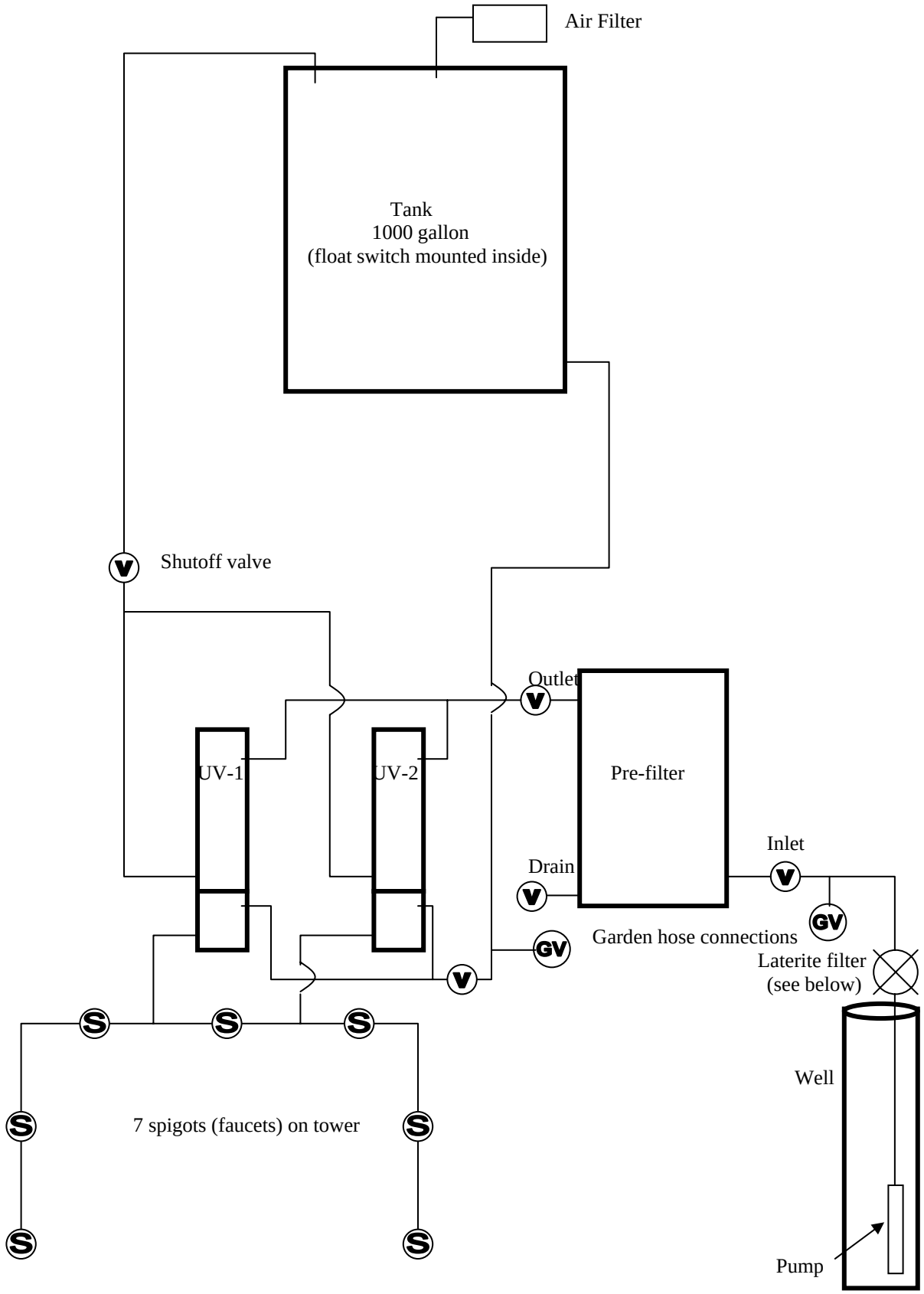
Appendix

A. Outline Drawing



Note: Closed back. Closed front with door for security recommended.

B. Plumbing diagram



Note: Connections from UV sterilizers to ¾" fittings are supplied. All connections and piping to be ¾"

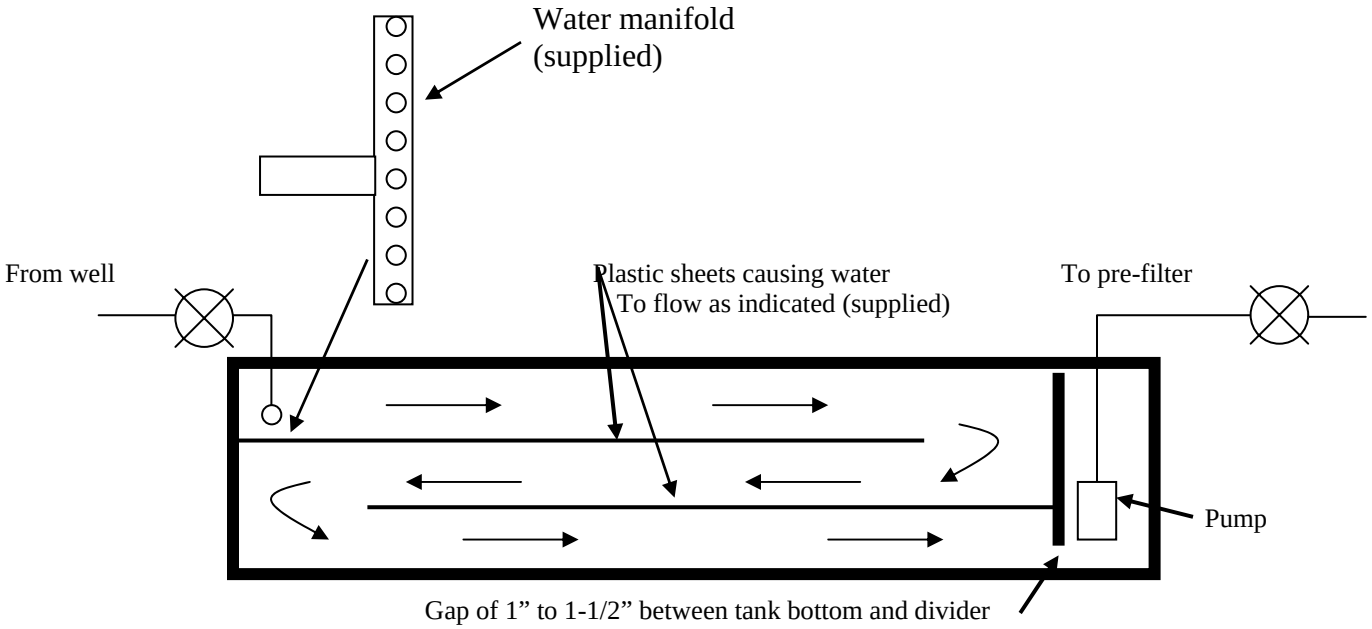
C. Laterite Filter
Coated Concrete Block Container Construction

A plant that removes iron, manganese, and arsenic from water has been built and tested by research scientists at New Mexico Tech University. This filter can be built with locally available materials and holds great promise based on their results in Ghana, and is still in development phase. Based on test results we believe this plant will be successful in Samsam village.

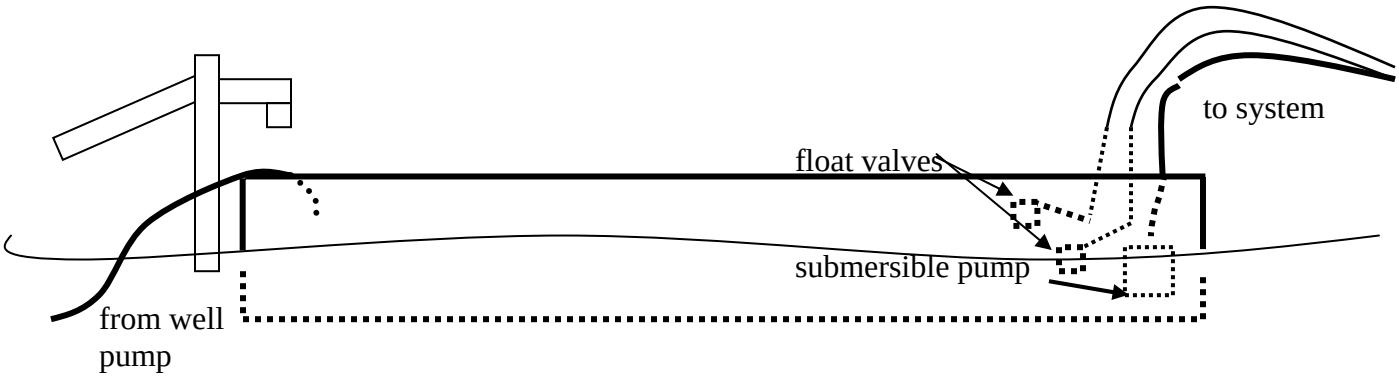
The filter is consists of graded laterite, a paving stone of iron oxide that is incorporated into a single chamber made of concrete bricks and mortar.

Construct the filter as follows:

- We recommend setting the base at a depth of 1-2 feet in the earth. The dimensions of the filter are 1m wide x 3 m length x 1 m height. Use standard construction techniques, ensuring that the tank is well sealed to prevent leakage.
- The inlet of the filter has an opening for a manifold (supplied). The inlet could be positioned underneath the spigot of a hand-operated pump if used with a submersible pump that allows a hand pump.
- The filter outlet is a divider located at the opposite end of the tank. The divider is made with a 2-3 cm gap at the bottom to let water into the outlet section.
- Use 1-cm laterite stones for the areas nearest the divider on the bottom layer. Fill to 1/3 meter high with the same stones or smaller ones, alternating with activated charcoal. These stones can be used throughout the tank.



Concrete tank 1 meter x 1 meter x 3 meters. Fill with a combination of laterite stones (1-10 millimeter screened) and activated carbon or charcoal.



We recommend three reinforced concrete covers for the filter. Each cover should be approx. 1 meter square, large enough to completely span the tank. All three covers should have handles made of reinforcing bar to enable lifting for maintenance.

A **submersible pump** will be located at the divider end of the tank. The pump sits on the bottom. The lower float valve shuts the pump off when water level is too low in the drum. Attach it to the pipe just above the pump. The upper float valve is attached just under the top of the drum. It shuts off the well pump when the water level in the tank reaches the maximum level.

Replacement of the laterite

The estimated lifetime of the laterite and activated carbon material is one to two years. The laterite can be shoveled out and used for other purposes such as roads, etc. When replacing the laterite, we recommend resurfacing the inside of the tank to ensure that it remains leakproof.

D. Pump Specifications

Well Pump

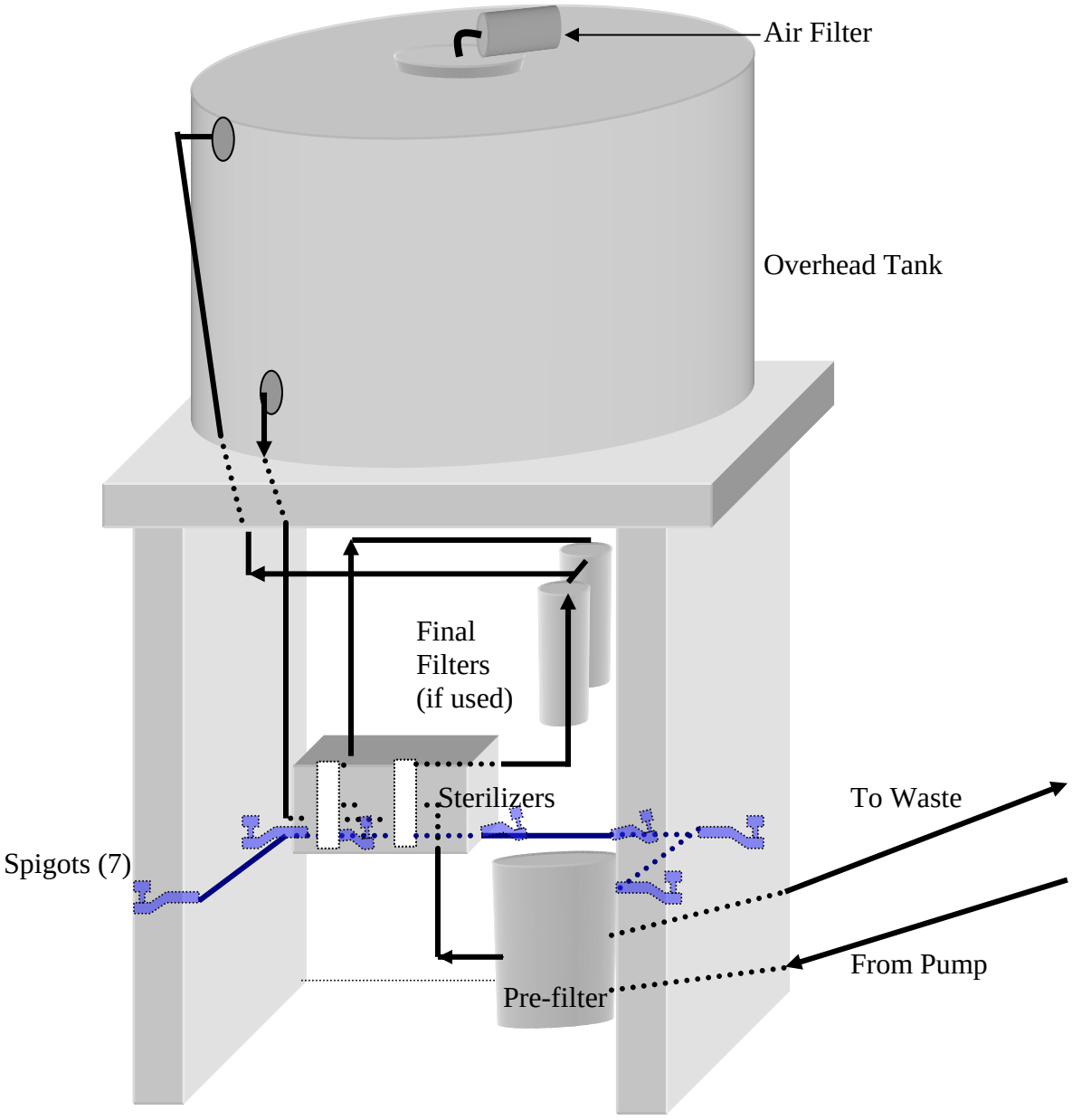
Standard pump		**ETA-14-24B**			
Ft	**m**	**GPM**	**LPM**	**Watts**	**Wire size**
25.0	8.0	5.0	18.9	50.0	12 AWG
50.0	15.0	4.6	17.4	78.0	
75.0	23.0	4.3	16.2	110.0	10 AWG
100.0	30.0	3.9	14.7	132.0	
125.0	38.0	3.4	12.8	157.0	8 AWG
150.0	46.0	3.2	12.1	180.0	

Deep well pump		**ETA-07-24B**			
Ft	**m**	**GPM**	**LPM**	**Watts**	**Wire size**
175.0	53.0	2.0	7.5	135.0	8 AWG
200.0	61.0	2.0	7.5	146.0	
250.0	76.0	1.8	6.8	168.0	

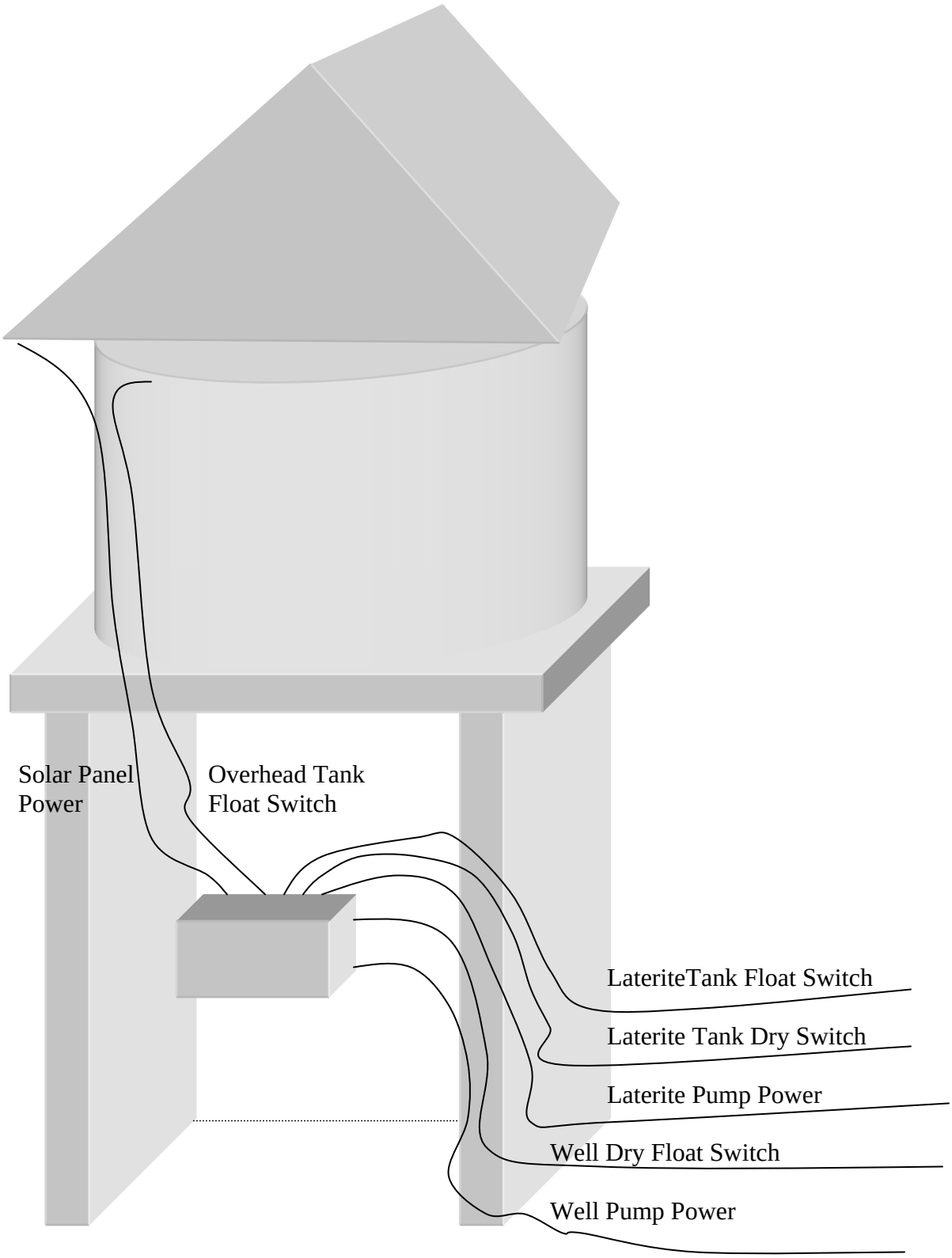
Laterite Pump

Diaphragm pump		**SD 12-30**			
Ft	**m**	**GPM**	**LPM**	**Watts**	**Wire size**
8.2	2.5	3.448	13.048	50.16	10 AWG
16.4	5	3.336	12.616	55.44	
24.6	7.5	3.224	12.208	61.2	
32.8	10	3.152	11.92	68.16	
41	12.5	3.056	11.56	73.44	
49.2	15	2.96	11.216	78.96	
57.4	17.5	2.888	10.92	84	
65.6	20	2.84	10.76	89.04	
73.8	22.5	2.792	10.56	93.84	
82	25	2.736	10.352	98.4	
90.2	27.5	2.68	10.136	102.72	
98.4	30	2.608	9.872	108	

E. Plumbing Schematic



F. Electrical Schematic



G. Solar Powered Distribution System
Equipment supplied
Samsam village

Components:

Well pump

Submersible pump, design lifetime 15-20 years, 1 moving part.

1 Pump, standard or deep well
1 200 ft pipe and hose and fittings
2 Float switches
2 100 ft cable for float switches
2 100 ft cable, pumps #10 direct burial wire

Solar power unit

Used where electric power is not available, or to drastically reduce operating cost

8 Solar panels, 65 watt
1 Frame Assembly and hardware ,
1 Wiring and cables - solar panel, and controller
1 Controller

Filter unit

1 Pre-filter
21 Filter cartridges
1 25 lb cellulose for coating pre-filter - 3 year supply

System control, Batteries, Ultraviolet Sterilizers

Kill bacteria, germs, parasites, amoebae
Batteries extend operation to cloudy/rainy days, allow UV to operate properly.

1 System control box and wiring
2 UV sterilizers and electronics
4 Holder assemblies for spare lamps
1 Junction box
1 Battery/UV Controller
2 Batteries
2 Battery cases

Laterite Tank

1 Laterite tank, laterite, activated carbon — Locally supplied
1 Pump for laterite filter
1 100 ft pipe and hose and fittings
2 Float switches
1 100 ft cable for float switches
1 100 ft cable, pumps #10 direct burial wire
1 100 ft roll of plastic sheet

Tower/tank

1 1000 gallon tank — Locally supplied
1 Pipe and fittings to/from tank
1 Spigots and manifold assembly
1 Tank bulkhead fittings
1 1 micron air filter assembly

Tower structure

Supports 1000 gallon tank and solar array. Houses pre-filters and hub. Locally supplied

Spares for 3 years of operation

42	Pre-filter cartridges
4	Holder assemblies for spare lamps
4	UV lamps
2	Pump diaphragms, laterite filter pump