

EWB-Morocco Water Distribution Site Plan – Summer 2017

*****FOR EACH SECTION, READ THROUGH ALL INSTRUCTIONS BEFORE BEGINNING*****

Pre-Tank Work

Test how long it takes for the water to settle and how much sediment there is. Perform this test every time the pump is turned on.

1. Calibrate the TDS (Total Dissolved Solids) meter with clear water (for best calibration, have bottled water on hand)
2. Fill up a 5 gallon jug by piping water from the well to the jug. If possible, obtain a container with markings on the side.
 - a. This can be done during piping tests/trips at the well
3. Measure and record the initial TDS reading from the TDS meter
4. Every 30 minutes, measure and record a new TDS reading
 - a. Continue until the TDS reading remains relatively constant and the water appears clear
5. Repeat multiple trials and average the results. Keep track of both the approximate rate of settlement and of how long it takes for the sediment to be settled.
6. Once the sediment has settled, approximate the ratio of sediment to water in order to estimate the volume of sediment per unit volume of water.

Test methods for sealing the pipes attached to the tanks

- To do this, model the tanks with two large, empty, plastic containers (e.x. unused water drums) and small HDPE pipe lengths (but of the same diameter as what will be used in the actual tanks)
- Attach the HDPE pipe lengths to the containers and seal with different methods, fill the containers with water to check how effective the sealing method is
- Methods to try include:
 - Washers/O-ring setups
 - Different sealants that might be available in country already

Choose a location

- Two potential locations:
 1. (Preferred) Distribution site where the well pipeline ends currently. This is right by a ravine, so drainage from the distribution site can run off straight there. Additionally, there are bodies of water inside the ravine, which would function similarly to a soak pit.

2. (Alternative) Distribution site about 150m away but in the direction of higher elevation. Refer to Francesco's coordinates for general area. Drainage pipes point towards lower elevation.

In general, the local geography should be taken advantage of such that the drainage will run off to lower elevation.

Settling Tank (1500 L)

NOTE: All outlet dimensions will match the dimensions of the HDPE pipe being used, in this case 2"

1. (If a suction hose screen is unavailable. If a suction hose screen is available create the PVC pipe system as described below but instead of drilling holes and adding a cap simply use the suction hose screen). Take a PVC pipe about $\frac{3}{4}$ the height of the settling tank. Drill large holes (~1"+) along a lower section of the PVC pipe such that when placed into the tank, the holes along the length of the PVC pipe will be in the lower 1/3 of the settling tank. Be sure that both ends of the PVC pipe are open. Leave space at the top of the PVC pipe for an elbow joint.
 - a. If the holes are above the lower 1/3 of the settling tank, sediment rich water will be displaced in the upper 2/3 of the tank, which is being transferred to the storage tank.
 - b. A small hole (1/4 inch or so) should be drilled in the side of the pipe immediately above the end cap so that the pipe does not fill with sediment.
 - c. The area of the 2" pipe is 3.14 square inches. Four 1" diameter holes would give the same area. Drill eight 1" holes to double the area to lower velocity and account for orifice head loss.
2. Drill and cut out an inlet near the top of the tank, next to the access hatch. To make connections, you can reach through the access hatch.
 - a. The dimensions of the inlet should match the dimensions of the PVC pipe elbow joint.
 - b. Be sure that the tanks are arranged so that the access hatches are up hill to maximize storage volumes.
3. Insert and seal the PVC pipe into the inlet.
4. Insert and seal HDPE pipe into the connection to the PVC pipe. Female threaded coupling is on the inside of the tank and is connected to the PVC pipe. The male threaded coupling is connected to HDPE pipe with a gate valve leading away from the settling tank towards the well.
5. Add a transition coupling and tee connection at the current end of the pipeline. Cap one end of the tee and connect HDPE from the other end to the gate valve. If the GI pipeline is too leaky, HDPE piping will have to go directly from the well to the distribution site (in this case the location of the distribution site will likely be closer to Muhammed's

house). . When the gate valve is opened, water from the well should run into the settling tank.

6. On one side of the access hatch of the settling tank, drill and cut out an outlet. This will be the overflow outlet for the settling tank.
7. Cover one end of a short length of HDPE pipe with a screen. Insert and seal the other end of the short HDPE pipe into the overflow outlet.
8. On the other side of the access hatch, drill and cut out an outlet for the connection between the settling tank and the storage tank.
 - a. The pipe connecting the two will be added at the distribution site, leave the outlet alone for now.
 - b. The spacing of these two outlets is to prevent instability in the space in between the two outlets.
9. On one of the bottom corners of the back face of the settling tank, drill and cut out an outlet. This will be the drainage outlet for the settling tank.
 - a. When choosing what corner to use, keep in mind that the settling tank will be at two angles on the rock foundation, such that the corner where the drainage outlet is will be at the lower elevation relative to the rest of the settling tank. Remember that the same is being done with the storage tank.
10. Insert and seal a short HDPE pipe length into the drainage outlet. On the other end of the short HDPE pipe attach a ball valve.
11. Connect a 5m HDPE pipe into the other end of the drainage outlet ball valve.

Storage Tank (1000 L)

NOTE: All inlet and outlet dimensions will match the dimensions of the HDPE piping being used, in this case 2”.

1. Drill and cut out an inlet at the top of the tank near the access hatch. The access hatch can be reached through to make connections.
 - a. The dimensions of the inlet for the storage tank should match the dimensions of the connection outlet from the settling tank.
 - b. The pipe connecting the two tanks will be added at the distribution site, leave the inlet alone for now.
2. On one of the bottom corners of the back face of the storage tank, drill and cut out an outlet. This will be the drainage outlet for the storage tank.
 - a. When choosing what corner to use, keep in mind that the storage tank will be at two angles on the rock foundation, such that the corner where the drainage outlet is will be the lowest elevation relative to the rest of the storage tank. Remember that the same is being done with the settling tank.
3. Insert and seal a short HDPE pipe length into the drainage outlet for the storage tank. At the other end of the short HDPE pipe attach a ball valve.
4. Connect a 5m HDPE pipe to the other end of the drainage outlet ball valve.

5. On the center of the front face of the settling tank, drill and cut out an outlet 5 cm below the highest point. This will be the overflow outlet for the storage tank.
6. Cover one end of a short length of HDPE pipe with a screen. Insert and seal the other end of the short HDPE pipe into the overflow outlet.
7. Towards the bottom of the front face of the settling tank, drill and cut out an outlet. This will be where the tap stand is connected to.
 - a. Two options for location of tap stand outlet:
 - i. Wait until **after** the rock foundations have been built, then create the outlet such that it is above the rock.
 - ii. Make the outlet about 5cm from the bottom and in the center of the front face. In this situation, more water will be able to be provided, but space will have to be made in the rock foundation for the tap stand to stick out of.
 - b. From here, there are a number of different options for how the tap stand is set up. Current favored option is a ball valve with HDPE piping. The travel team will decide what is most suitable there.

Rock Foundations

NOTE: The CAD models in the appendix do not show the two angle construction (referenced later in this instructions), these are only sloped at one angle, however they do provide some visual.

NOTE: In general, be adaptable to the conditions of the field. This procedure does not have to be followed verbatim, follow what you and the residents feel is best. Assuming pipe connections are made around the top access hatch, set all the upper inlets, outlets, and overflows on either side of the top access hatch for ease of installation and orient the pipes to make that easy.

Notes on the relative positions of the settling tank and storage tank to each other:

- The settling tank should be at an equal or higher elevation than the storage tank.
- The drainage of one tank should not flow into the area of the tank
- If the ravine location is selected, drainage should go into the ravine.

Construction

- Each rock foundation will be at two angles (~10 degrees) such that when each tank is placed into their respective rock foundation, the corner drainage outlet is at the lowest relative location.
 - NOTE: The 10 degrees measurement is arbitrary, but there to demonstrate that the rock foundations should allow the tanks to sit at a slight slope. As long there is some slope, the sediment should be able to settle and drain.

- Each rock foundation will be built such that there is a groove for each respective tank to be placed into. The perimeter of the rock foundation will be extended such that the respective tank is securely supported on all sides.
 - Smooth out the groove with mortar such that when the tanks are placed on sharp rocks do not puncture the tanks.
- Leave space for the drainage outlets to exit out of and for the tap stand to exit out of (if applicable). One method of doing this would be to build the rock foundation up partially, placing the tanks on (with the pipes sticking out), and then continuing to build the rock foundation/supports.
 - The drainage outlets should pipe away from the tanks and down to lower elevation
 - Since the HDPE pipe is flexible, use rocks to support the pipe and its path away from the tank
 - If needed, use rocks to create a trough to guide the drainage after it exits the pipe
- Make sure the rock foundation of the storage tank is high enough for a 5 gallon water jug (~50 cm) to fit underneath the tap stand.
 - Likewise, make sure there is enough height in both the storage and settling tank rock foundations for the respective drainage pipes to have space to slope downwards.
- (Optional) Secure the rock construction with mortar as it is built.

NOTE: The residents are very good at rock construction, trust what methods they prefer.

Connection between Sedimentation Tank and Storage Tank

Assuming the sedimentation tank and storage tank have been securely placed into the rock foundations...

1. Insert and seal a short HDPE length into the connection outlet of the settling tank. At the other end of the short HDPE pipe add a tee with gate valves in both directions.
2. Connect an HDPE pipe from one of the gate valves to the inlet of the storage tank. Insert into the storage tank inlet and seal.
3. Connect a short length of HDPE to the other gate valve. This will serve as a sampling port for the sediment, allowing residents to check that the water being displaced from the sedimentation tank is sufficiently clear before releasing it into the storage tank.

Usage

Filling

1. Make sure all drainage outlets and the tap stand outlet are closed.
2. Open the gate valve to the settling tank. Turn on the pump until the settling tank is full (indicated by water exiting the settling tank overflow). This should take about 5 hours

when the sedimentation tank is empty (assuming 5L/s flow rate, to be adjusted after head loss calcs). When the sedimentation tank is full, turn off pump and let water sit for three hours (time to be adjusted after testing). Close the gate valve to the settling tank.

3. Let the settling tank settle for whatever time was determined as necessary for the water to fully settle.
4. Open the gate valve for the pipe connecting the settling tank to the storage tank.
5. Re-open the gate valve to the settling tank. Turn on the pump. By displacement, as new water enters the settling tank, the settled water will enter the storage tank. Continue until the storage tank is full (indicated by water exiting the storage tank overflow). This should take about 3 hours (to be adjusted for after flow rate tests). Close the gate valve to the settling tank and turn off the pump.
 - a. Now, there is water available from the storage tank for the residents to use and there is new water in the settling tank to let settle.
6. Repeat step 5 at the time interval determined by the sedimentation settling tests

Drainage

- Once a day, open the ball valve of drainage outlet for the settling tank and let the water run until clear, then turn off the ball valve.
- For the storage tank, only open the ball valve of the drainage outlet for the storage tank if sediment starts coming out of the tap stand. If this is the case, run until the water becomes clear, then close the ball valve.

Misc.

- Right now, the drained sediment is being dealt with simply by piping away down lower elevation or into a ravine. There is a chance that the sediment could have uses in the community or that, regardless of where it is drained, will dry up and be blown away like dust due to the dry climate. For a first step, the water will be drained away downhill from each tank with an ~5m pipe (as described in the procedures). A rock trough can be added to guide the drain-off further.

Appendix

NOTE: The rock foundations only show one angle, they should be built with two angles such that the drainage pipe is at a corner. There was not enough time to update the models fully.

Key:

Light gray = Settling tank

Dark gray = storage tank

Blue = Pipe from well to settling tank

Red = Connection between settling tank and storage tank

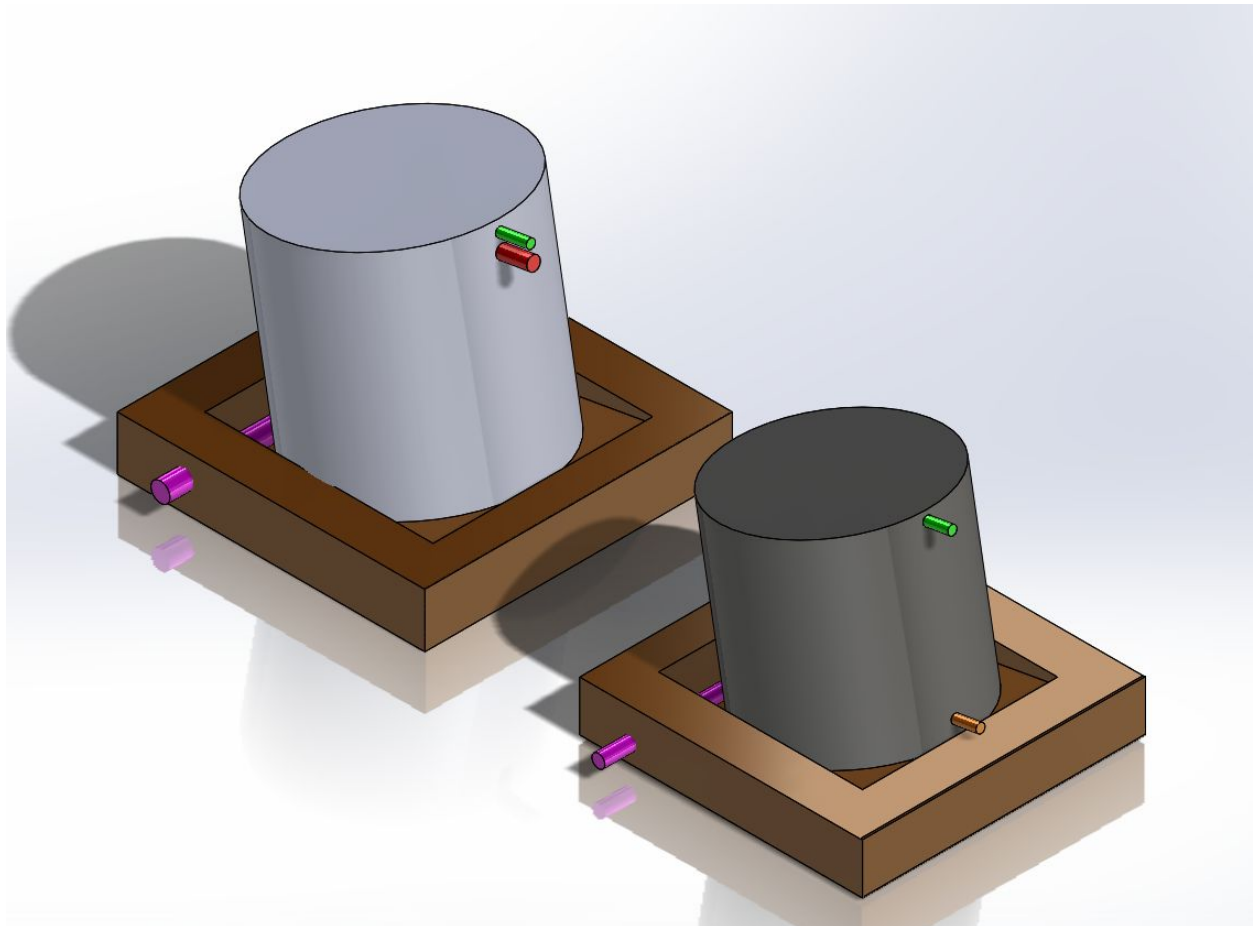
Purple = Drainage outlets

Green = Overflow outlets

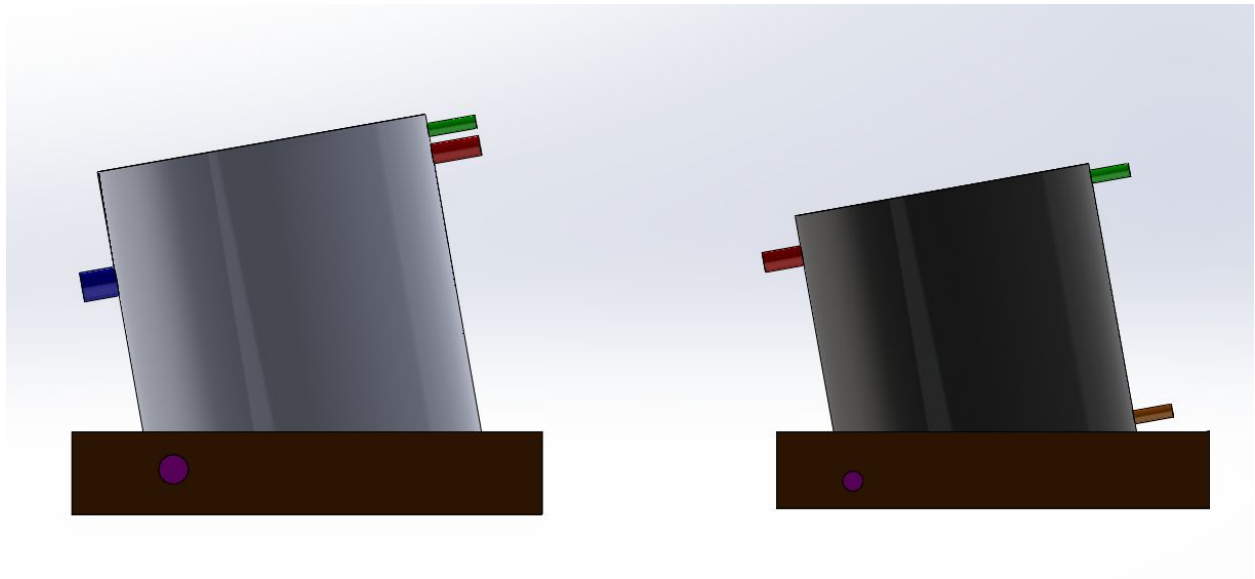
Orange = Tap stand

Brown = Rock Foundations

Isometric View



Side View



Top View

