

4/7/2020: Purifying Water – *D.F.G.T.C.*

Key learning points:

1. Settlement
2. Treatment
3. Activated Carbon Filtration (and other filters)
4. Boiling water
5. Distillation
6. Testing for quality
7. Other ideas

Disclaimer:

This is not a complete course on water purification or recommended as your only source of study. PLEASE DO YOUR OWN RESEARCH. Educate yourself as much as possible – what is provided here is simplified, and therefore many topics are not covered.

1. Settlement

Settlement is the process by which dirty water is left, undisturbed, in a container, for a period of time which allows the heavier sediments and materials to collect at the bottom of the tank. The size of the tank can vary – but larger is better. Should be placed on level STABLE surface. Shaking is bad. Ideally, with a lid over the top of the tank.

1. Settlement (continued)

For the simple case: assume a 55 gallon barrel (make sure it's food safe) with a lid. The lid is necessary for both adding water, removing water, and cleaning the settlement tank periodically. Place the drum someplace where it is: dark, level, stable (no shaking or noise).

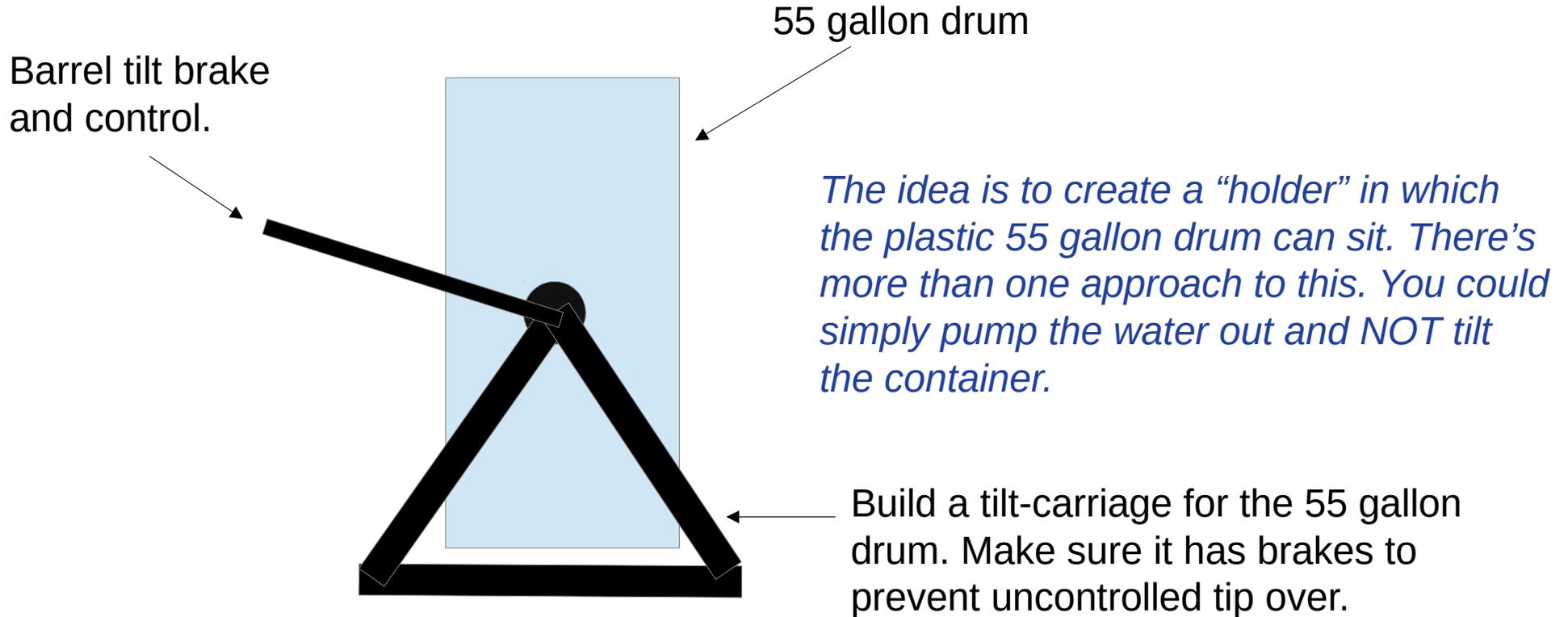
Source: <https://theprovidentprepper.org/tips-for-storing-water-in-a-55-gallon-plastic-barrel/>

1. Settlement (continued)

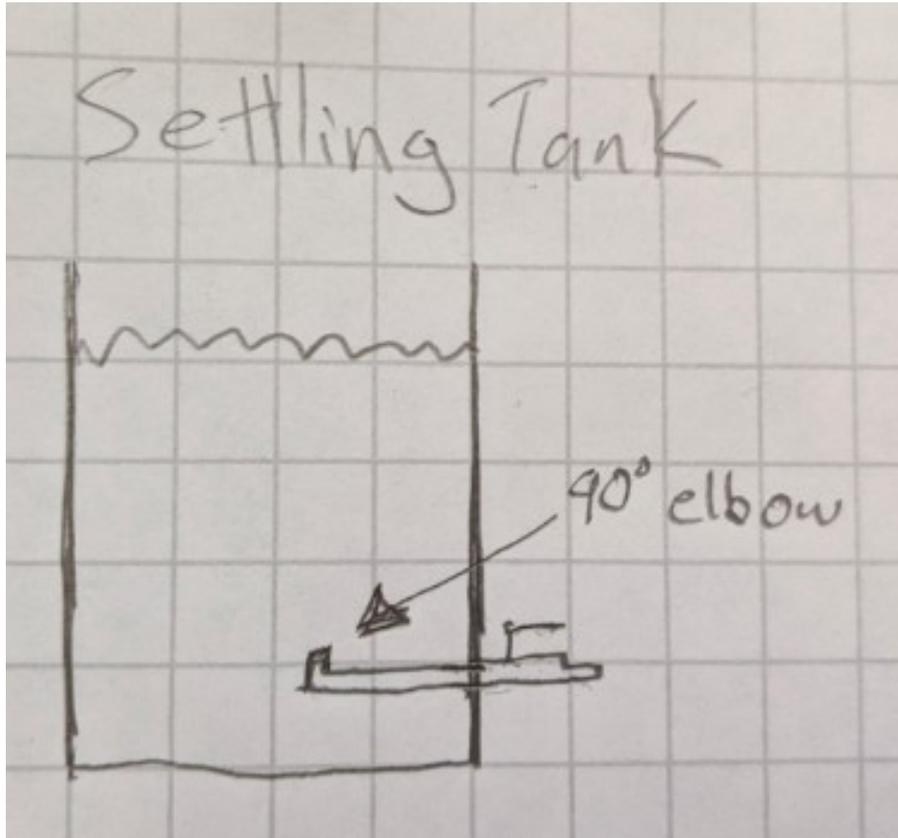
Simple system:

2 x 55 gallon drums: one is “settling” all the time, the other can be removed, have settled water transported to treatment, and then cleaned (basic non-potable water for cleaning). Some soap will help – but leave to air dry before adding water again.

1. Settlement (continued)



1. Settlement (continued)



This is another proposal to the settling tank design, similar to what A.J. was talking about. This comes from a listener on twitter: <https://twitter.com/OhmanRand>

A modification to this idea would be a nozzle that adjusted itself with the water level, keeping above the debris layer – as shown in diagram. But this idea works fine. Perhaps a nozzle that can always stay a few inches below the top level will be better. But this is a great idea, in the diagram.

2. Treatment

The step following settlement for water is “treatment” - this involves transferring water from settlement, to the treatment tank, and then adding bleach (other bleach sources can be used and tested):

Important: one gallon of settled water requires 40 drops of bleach. Allow the treatment step one day.

1 quart/liter water	1 gallon water	5 gallons water
If you have a dropper: Add 10 drops of bleach	If you have a dropper: Add 40 drops of bleach	If you have a dropper: Add 200 drops of bleach
If you have something that measures milliliters (ml): Add ½ ml of bleach	If you have something that measures milliliters (ml): Add 2½ ml of bleach	If you have something that measures milliliters (ml): Add 12½ ml of bleach
If you have a measuring spoon: Add ⅛ teaspoon of bleach	If you have a measuring spoon: Add ½ teaspoon of bleach	If you have a measuring spoon: Add 2½ teaspoons of bleach

Source:

<https://www.cdc.gov/healthywater/emergency/drinking/making-water-safe.html>

2. Treatment (continued)

1 quart/liter water	1 gallon water	5 gallons water
If you have a dropper: Add 10 drops of bleach	If you have a dropper: Add 40 drops of bleach	If you have a dropper: Add 200 drops of bleach
If you have something that measures milliliters (ml): Add ½ ml of bleach	If you have something that measures milliliters (ml): Add 2½ ml of bleach	If you have something that measures milliliters (ml): Add 12½ ml of bleach
If you have a measuring spoon: Add ⅓ teaspoon of bleach	If you have a measuring spoon: Add ½ teaspoon of bleach	If you have a measuring spoon: Add 2½ teaspoons of bleach

Source:

<https://www.cdc.gov/healthywater/emergency/drinking/making-water-safe.html>

2. Treatment (continued)

Simple case:

1. transfer water from settlement to treatment.
2. One 55 gallon treatment water barrel.
3. Once it is filled, add requisite amount of bleach given previous slide.
4. Wait one hour.
5. Transfer water to final filtration.

Source:

<https://www.cdc.gov/healthywater/emergency/drinking/making-water-safe.html>

3. Final Filtration

There are many ways to tackle this. The simplest would be to stockpile the filters you'll need and simply use a camping filter, or home purity filter (britta, berkey, etc). So you can go from treatment, to the preferred method of filtration.

However – what if you don't have any filters?

3. Final Filtration (continued)

What is an activated charcoal filter?

An activated charcoal filter uses the charcoal (activated) to filter out poisons, toxins, and other materials that will not be eliminated by treatment or settlement. You should **ALWAYS** settle water before filtering **UNLESS** you are getting it from a “clear source” - river, stream, some lakes.

3. Final Filtration (continued)

What is activated charcoal?

Activated charcoal is charcoal that has been treated with oxygen to open up millions of tiny pores between the carbon atoms.

The carbon atoms will combine with other elements and chemicals, and therefore remove many toxins from water.

3. Final Filtration (continued)

How do you make activated charcoal?

The method described is NOT laboratory, but functional. There are better ways to get activated granular charcoal.

1. gather wood.
2. start a fire.
3. once the wood glows, and you have coals, remove the coals from the fire and move them aside – be careful, use a shovel.
4. once the coals have cooled off, mash them with a hammer or use mortal/pestle to create powder.

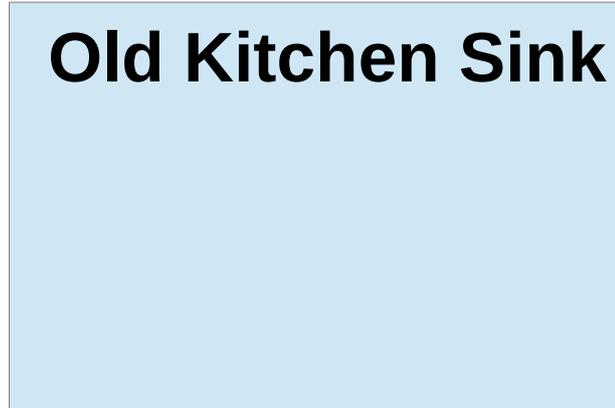
3. Final Filtration (continued)

What you will need:

1. cotton cloth (untreated)
2. an old kitchen sink – bigger the better. Should be clean.
3. granular charcoal from previous step.
4. Food/water safe rubber tubing.

3. Final Filtration (continued)

Using a kitchen sink simplifies the process. You can continuously feed the sink from treatment step.

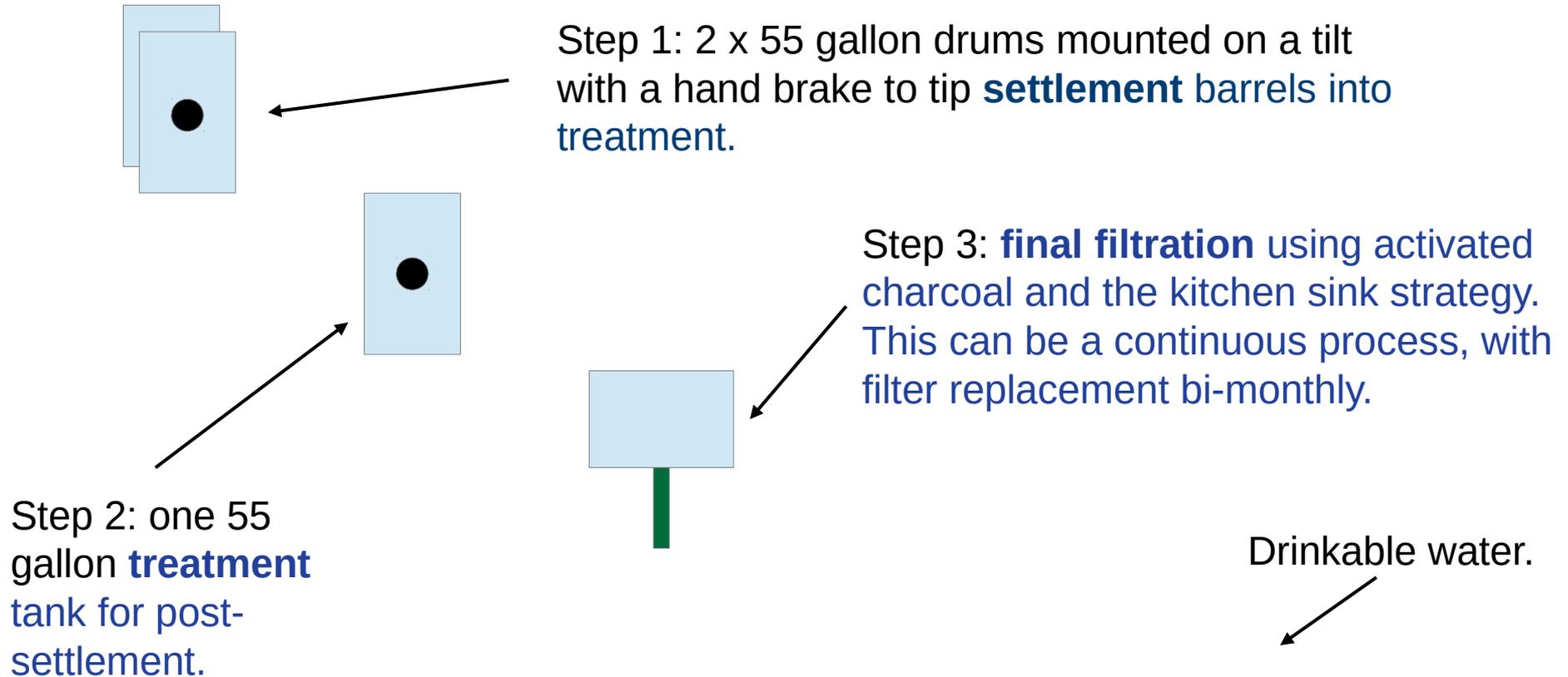


The filter is mounted (and this will take some work) to the bottom of the sink. You will need to have tools for this.

Whatever design you use for your filtration process
REMEMBER: you will have to be able to remove the filter, periodically (assume every 30 days).

Narrow pipe or tube mounted to the bottom of the filter. Make sure the diameter is narrow enough to create appropriate back pressure.

3 step water purification process



4. Boiling Water

1. Bring the water to a rolling boil.
2. The water must be boiling for at least 5 minutes.
3. Do this step **AFTER** settlement – settlement is always the best first step.
4. Boiling does **NOT** remove toxins or poisons – you will still need something like carbon filtration to remove these.

5. Distillation

1. This method is basically “one step”.
2. Can provide the highest level of purity.
3. You have to capture water vapor from the water, and then distill that vapor into a container.
4. You can boil the water, in a still, and use copper tubing for cooling/distillation from vapor.
5. You can use direct solar energy for this.

5. Distillation (continued)

1. Simple Idea (if you live in a warm climate):

2. Find an old BLACK IRON kettle – must be iron/black, and you might need to paint the outside to maintain the black color. Bigger the better – something that can hold a few gallons is great.
3. Find a bunch of old mirrors, at least 6.
4. Make sure the iron kettle has a lid.
5. Weld a copper tubing (wound into spirals) to the lid of the kettle, you will need to drill a hole first.
6. Have a clean glass collector for the distilled water.

5. Distillation (continued)

Copper tubing condenser



Water Collector

Dark colored bodies (painted black) absorb the most light, effectively.

Set up 6 large mirrors (or more) and angle them to maximize the focus of solar energy throughout the day. You may need to, once an hour, re-orient the mirrors. So, wardrobe style mirrors that can be tilted and aimed are best. But just have a simple way to adjust, and stabilize, the mirrors. **YOU WANT TO FOCUS A LOT OF EXTRA LIGHT ON THE IRON KETTLE.**

6. Testing and Quality

1. Get a microscope and learn to use it. Learn basic statistics for tracking microbe counts. This is about sampling.
2. Litmus paper can be useful for testing the water for pH level, which can indicate the presence of toxicity. I'll leave this for you to research.
3. Whatever method you use for periodically testing the water, make sure you take good notes – that you log your tests AND track the “batch” of water produced by your process.

7. Other ideas ...

- Using permanent magnets to remove metals.
- Using old aquariums (fish tanks), post settlement, to provide a dose of UV light. This method is similar to the solar distillation using mirrors, except the mirrors are intended to amplify the light that the water is exposed to.
- Creating a hydrogen fueled kiln for flash boiling water post settlement.
- Using hydrogen powered kiln to run continuous distillation. This would be hydrogen liberated from water using electrolysis.