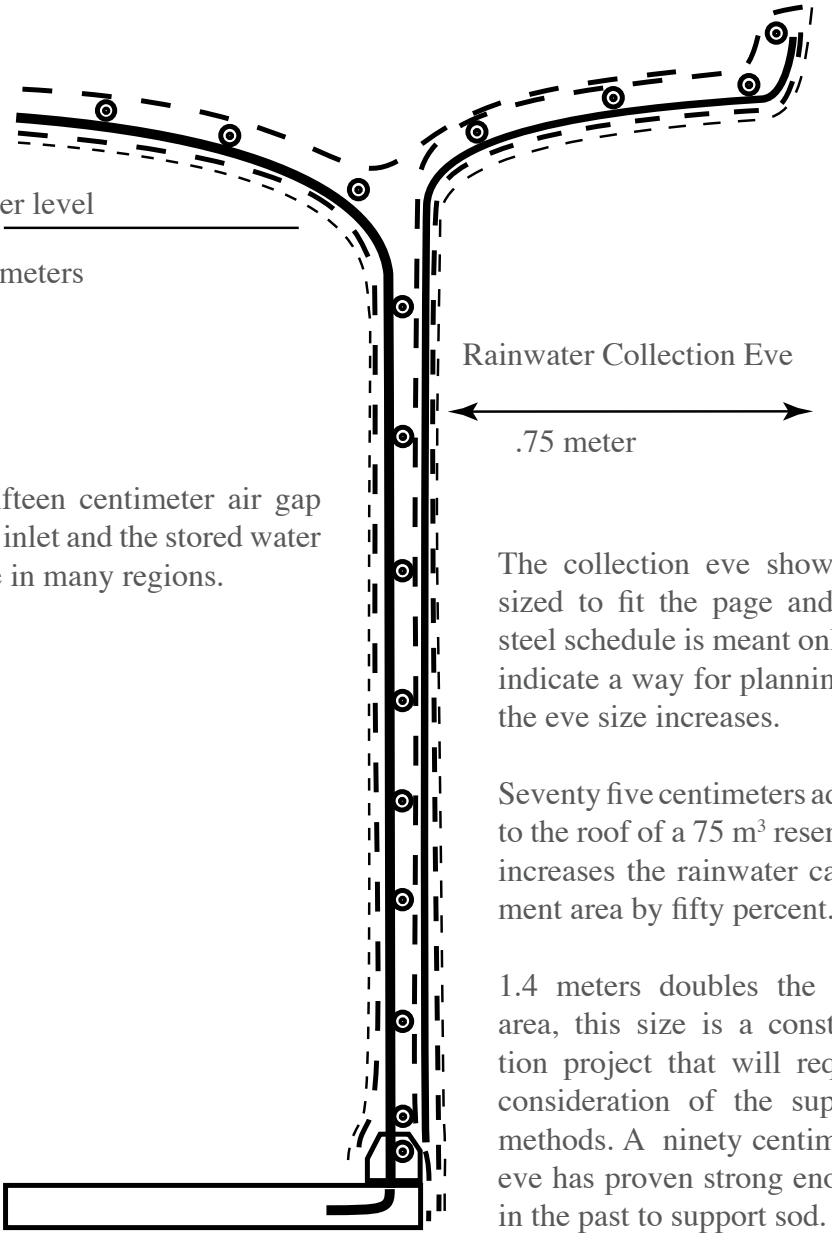
Chapter 13 : Rainwater storage



Sanitary note:

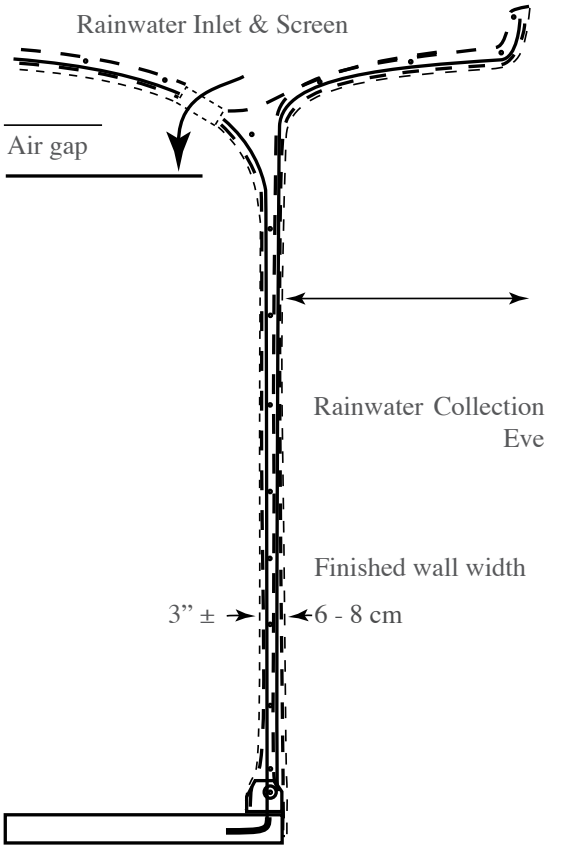
A minimum fifteen centimeter air gap between water inlet and the stored water surface is code in many regions.

The collection eve shown is sized to fit the page and the steel schedule is meant only to indicate a way for planning as the eve size increases.

Seventy five centimeters added to the roof of a 75 m^3 reservoir increases the rainwater catchment area by fifty percent.

1.4 meters doubles the roof area, this size is a construction project that will require consideration of the support methods. A ninety centimeter eve has proven strong enough in the past to support sod.

The next drawing has been altered slightly to better illustrate the wall thickness in proportion to the height. A more accurate thickness depiction is necessary to render the minimum fifteen centimeter air gap between the lowest point of the inlet and highest point of water surface when the tank is full. This distance was originally maintained to prohibit possible storage water contamination from flowing into a public water supply or water well. In this case the gap provides a separation which makes a barrier to contamination of the stored water through direct and prolonged contact with outside debris which may have collected on the roof.



The simple inlet shown requires further consideration for blocking sunlight which would allow mosses to grow in the reservoir. While the green plants are not harmful, they do set up a life cycle of growth and decay which might eventually provide a home for something undesirable. Simply placing the inlet on the north side with a small shade lip will eliminate most of the light. Such a shade will also help block hurricane force winds from blowing needed water away from the inlet before it enters the reservoir and is captured as storage.

Although sanitation is of primary focus here, one should not be afraid of water which falls as rain. Bacteria grows everywhere, even inside our healthy bodies. It is true that bacteria spore are astoundingly durable; space scientists, for example, work in clean rooms to keep from contaminating their experiments with earthly life forms that may hitch a ride with their experiments and perhaps contaminate other planets. Astrophysicists have determined that precursors of life are floating on interstellar

and galactic winds, and that they probably were scooped up by our wandering planet and deposited on the surface by rain and snow. Today there are millions of people using anti-bacterial soaps and living with worry that their bodies might be invaded. Relax. Most problems will be avoided by realizing that the roof which gathers the water deserves to be treated more like a clean dish than the kitchen floor. Those who are so terrified of germs they use antibacterial soaps should, in reality, be far more concerned about the environmental consequences of the soap passing through sewer systems and evolution of super-germs from the offspring of the surviving germs.

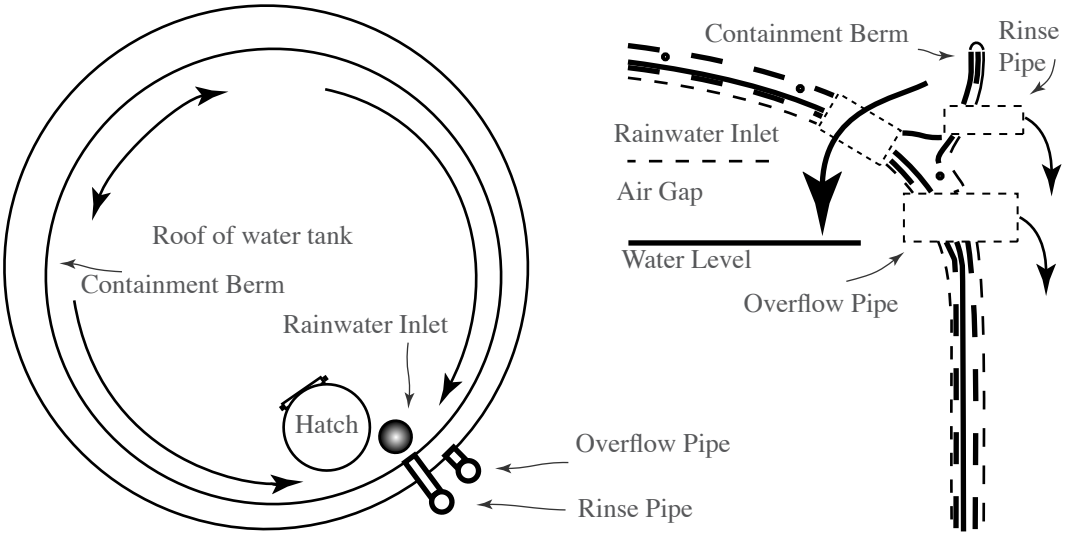
Wash your hands after using the bathroom. Wash your shoes before you are up and walking on the roof. Most of what we worry about doesn't like to live on a hot roof, still, a quick dunk of your shoes in soapy water will rinse off the dog poop you may not have noticed in the trail leading to clean the roof water catchment system. If hands and shoes are not clean, its better to stay off the roof.

I have friends who started out their new home in Hawaii by gathering rainwater from the roof and sending it to a very inexpensive plastic swimming pool under the house. What is shared here is food for thought and should not be taken as the ultimate or last words on rainwater storage. There are codes in some areas which direct one to locate the rainwater storage underground and quite close to the foundation. This is something I do not recommend and instead agree with the friend who replaced the plastic swimming pool under the house and opted for a free-standing, above-ground ferrocement tank. Why? Contaminates from any source do not seep into an above ground tank. The above ground storage reservoir is bathed in cleansing sunlight and all water borne contaminants drain downward and away.

The size of the rain water collection eve can be minimized to a small diversion berm running around the roof at the position which provides the minimum recommended air gap, illustrated next. The berm or wall need only be 10 - 15 centimeters high and may be fabricated from welded wire, without any reinforcing steel bars.

Position of the overflow pipe determines the minimum air gap, the lowest point of the overflow pipe is the maximum height of the stored water. Notice that the water containment berm is not centered on the tank. The far side from the inlet needs to be

slightly higher so water flows with the circular arrows, downward, to the inlet.



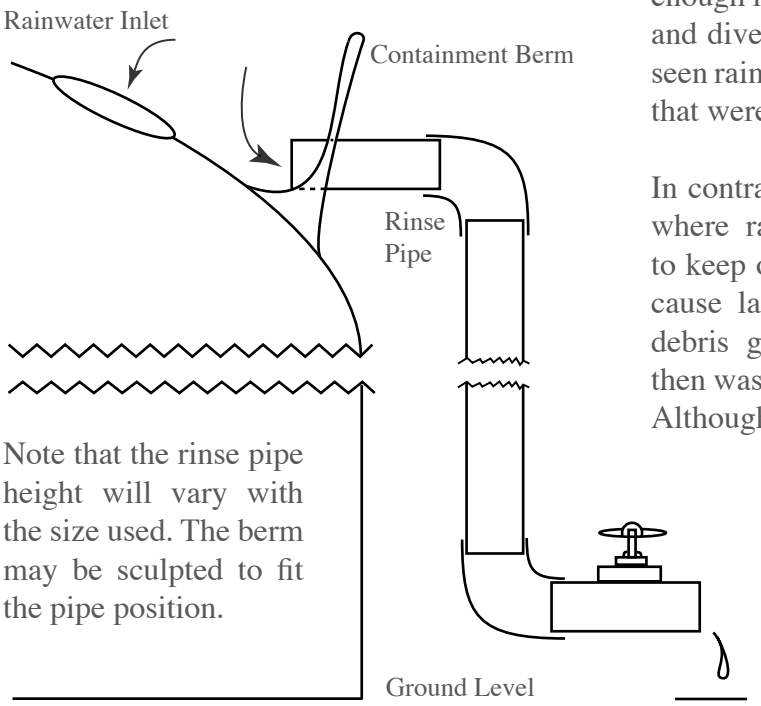
The simplest version of a reservoir roof water catchment system includes a rinse plumbing design which is a good idea but may present its own problems if it is not maintained and becomes filled with damp debris that acts as a growing medium.

The rinse pipe introduces a new topic, one that is covered in many discussions about roof rainwater water catchment systems. The basic idea is that a first portion of a rainfall is used to rinse the roof and then the remainder of the storm is contained in the reservoir itself. This is easily accomplished by connecting the horizontal rinse pipe to a vertical stand pipe with a 90º ell fitting or an even better clean out tee. A slightly open faucet at the bottom of the stand pipe continuously drips. The first bit of rain which falls will rinse the roof and run down the stand pipe, since that water merely drips out the faucet, the stand pipe fills and only the amount of water dripping out enters the stand pipe, at that point rainwater flows to collection and storage via the rainwater inlet. When the rain stops, the dripping faucet allows the stand pipe to empty and be ready to accept rinse water from the next rain.

Rainwater falls on roof and flows toward the inlet. The rinse pipe is lower than the inlet so the water enters rinse pipe rather than the reservoir inlet. Rainwater rinses dust and other contaminants into the vertical pipe until it fills. A valve at the bottom

restricts the outflow, the amount of rainfall for rinse is controlled by the size of the vertical pipe; large roofs will thus be better cleaned by larger pipe. This system works well for areas which have heavy downpours, those who live in arid climates will probably not use this design and simply use a broom once or twice a year. Some regions have abundant rain and little debris while others are semi-arid with much debris. The range of conditions varies greatly and the technique employed to gather and store rainwater will vary as well.

I recently helped repair a storage tank for a roof water gathering system that serves an orphanage in the Bahamas; the roof had never been cleaned and the children were bright eyed and healthy. The down spouts from rain gutters lead to intermediate open junctions which utilize window screen to catch any leaves or debris. The junctions are where rain gutter down pipe makes a transition to 10 cm water pipe, they are located where excessive deposits are quickly noticed and can be easily cleaned with a hanging clean tool located nearby for the rare occasions when the screen has caught enough leaves and twigs to block and divert the water. I have also seen rainwater systems in Hawaii that were never cleaned.



Note that the rinse pipe height will vary with the size used. The berm may be sculpted to fit the pipe position.

In contrast, Michigan, is a place where rain gutters are difficult to keep open, in some areas, because large quantities of forest debris gathers on roofs and is then washed into the rain gutters. Although Michigan is a beautiful place, it is also a prime example of how debris can disrupt a rainwater storage plan.

A forest environment drops a large amount of

leaf matter which can turn into soil and support vegetative growth in rain gutters within one year, if left unattended. Large size down pipes and more specialized debris separation equipment is required in forested areas where periodic rainfall may be brief and heavy. In such an environment, the simple tank roof rinse pipe previously illustrated will be 7 - 10 centimeters in diameter, the lower valve fitting will have a reducer bushing or perhaps a less expensive cap or plug with a small hole drilled through it. The fittings at the bottom of the rinse pipe should only be hand tightened for easy removal of collected material.

While it is usually possible to locate and purchase every part described in this chapter from retail or wholesale outlets which supply them factory made, and it is most often easiest to use standard parts manufactured for mass distribution channels, there will inevitably be projects and locations which require fabrication on site. This chapter is intended to give a brief introduction to an accomplished plumber's specialized parts inventory that may be of use to those interested in ferrocement reservoirs. To be fair, these parts are not completely confined to a single trade, carpenters, for example are the ones who most often install the rain gutters which bring the water to ground level. Carpenters or subcontractors specializing in rain gutters may also be the ones who install manufactured stand pipes which accept the first flush from a roof in the exact way described previously for the roof rinse pipe of a ferrocement reservoir. Rainwater flows to the storage reservoir via pipe lines after the rinse stand pipe, next to the actual down pipe, is filled with the first rinse and no longer intercepts flow.

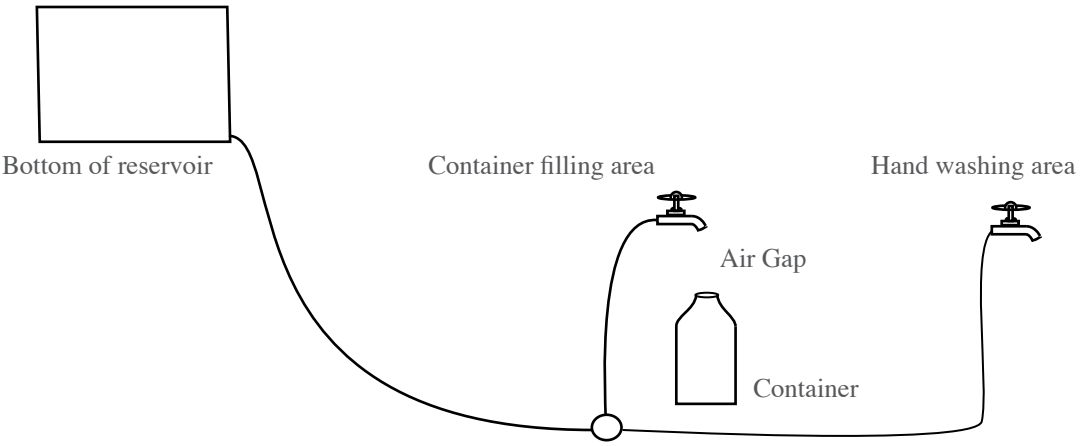
A companion subject is ultra violet light used to remove bacteria. Installation and maintenance of the UV light canister is similar to changing a neon light bulb. Size is determined by flow rate and volume, like selecting a pump from a pump size chart.

It is not uncommon for more than one roof to be used for collection of rainwater that is stored in a single tank. Nor is it uncommon that such an arrangement might be the only source of fresh water for an entire neighborhood in the aftermath of a large and disruptive storm. This situation directs attention to sanitation requirements not yet discussed and the reader is urged to acquire professional training where public health is involved. With that said, we can now proceed to the fundamentals of collection from several roofs into one tank. Keep in mind that if many people will be bringing

water containers to fill after a large storm, it will be necessary to assume that at least one of those persons has a dirty container, or dirty hands, or both. This is not to be viewed as negative judgement upon the quality of people in general, it is simply the way one must treat a central public water source so that it does not become a vector for sudden and rapid spread of epidemic disease.

There should be a place which is built to set the container in such a way that there is a standard air gap between the plumbing and the container, especially where those who come for water fill their own personal water containers. Do not use a hose which has been lying on the ground and handled by many people, if you must use such a hose, do not insert it in the container opening. This may sound elementary but after a large storm people are not necessarily thinking as clearly as they usually do. Someone should supervise the dispensing of clean and very valuable water after a storm.

The water dispensing area must have an additional separate but nearby faucet and soap for public hand washing. The entire container filling and washing facility must be located far enough away to be downhill from stored water; make sure that all the water is usable without power so people do not resort to lowering buckets into the reservoir to lift out remaining water. If water from the hand washing area simply spills on the ground, then place that faucet downhill from the container filling station separated by about three meters. Be sure that the faucet heights are lower than the floor bottom of the reservoir and disease will not become a problem.



Whether the rainwater collection serves an upscale surfing resort, a rural village, or a series of urban apartment buildings, consideration of the delivery of water from multiple roofs to a single reservoir is primarily a plumbing design task.

The final illustration contains several necessities for a sustainable economy; roofs to keep us warm and dry, clean water to drink, solar power to pressurize the water, and fun without pollution. Adequate diet, health, education, clean air and freedom to enjoy the earth round out the list, which is for discussion. Will you suggest others?

The smaller tank collects debris washed from the roofs. Storage water goes to the main tank when the debris tank is full. The debris tank leaks dry after the rain has passed, it should be emptied and cleaned regularly. A cross tee with larger drop pipe helps debris flow into the debris tank and allows easy cleaning. Place cleanout tees along delivery lines, never use corrugated thinwall pipe. Screen the inlet vent. Slope the floor inside the debris tank to a "V" shape, a tool can be used to clean the bottom, provide access from both sides and a smaller V channel to the drain/drip valve.