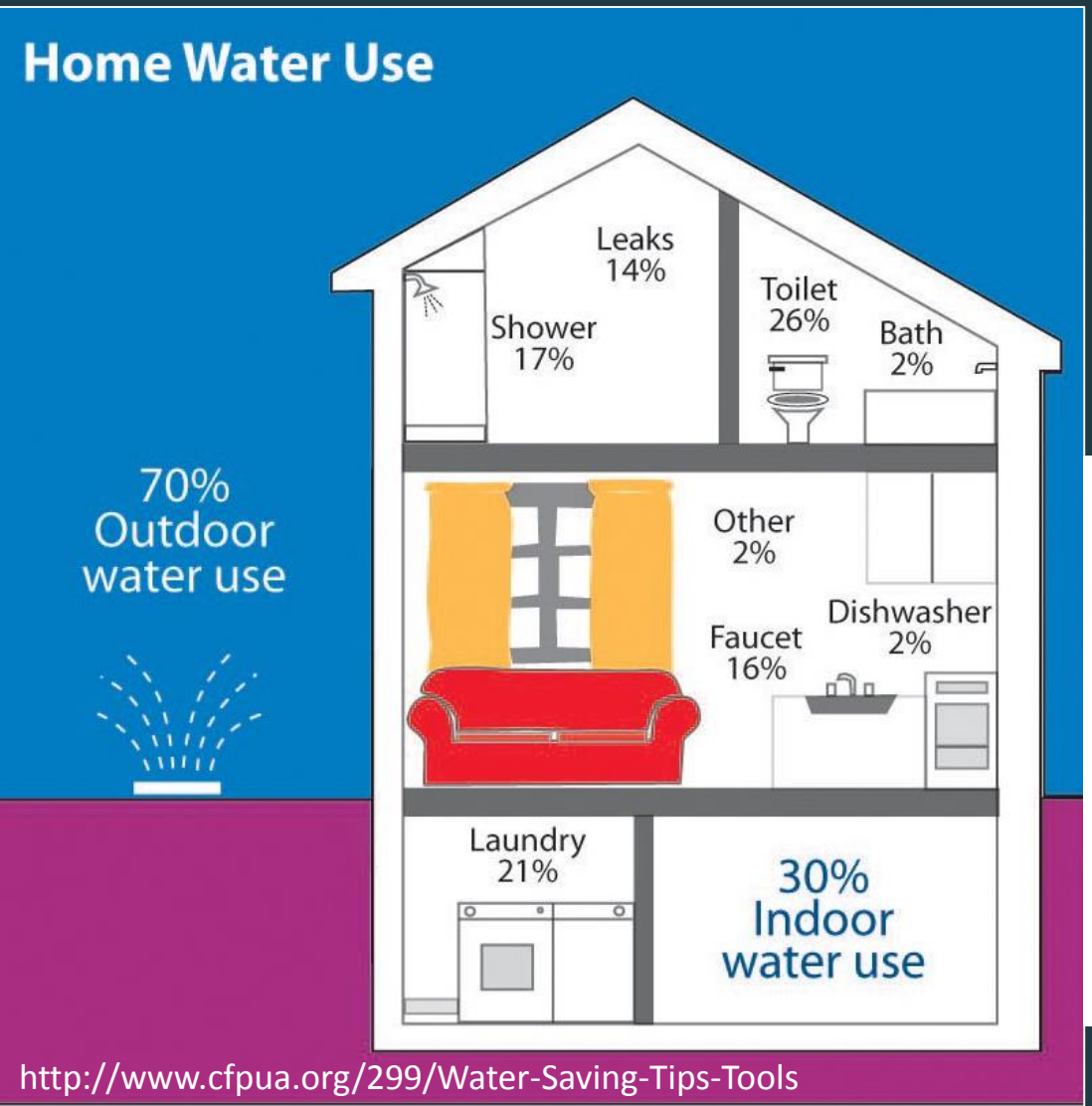
Session Outline

- Conservation
- Collection Capacity
- Components
- Aesthetics
- Precautions

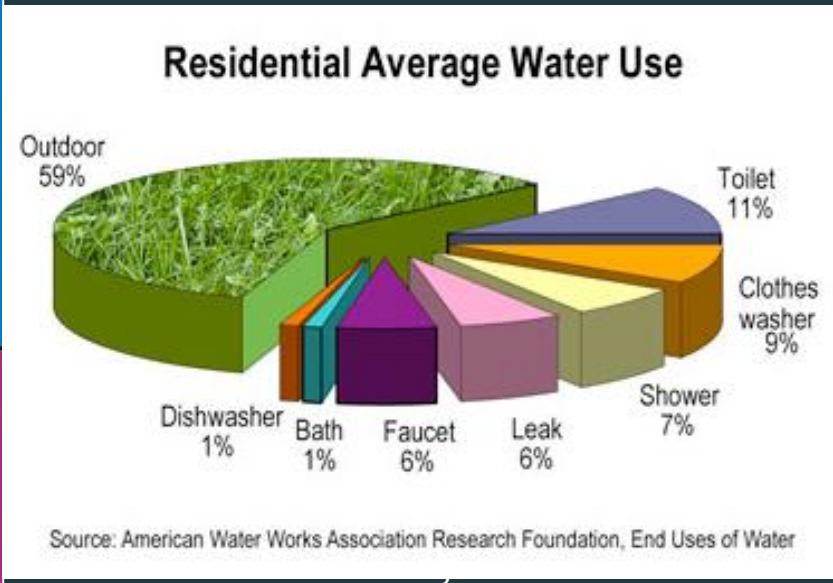
Conserving a Precious Resource

Rainwater harvesting is the capture, diversion, and storage of rainwater for use in landscaping, rangeland, and other purposes

How Do We Use Water?

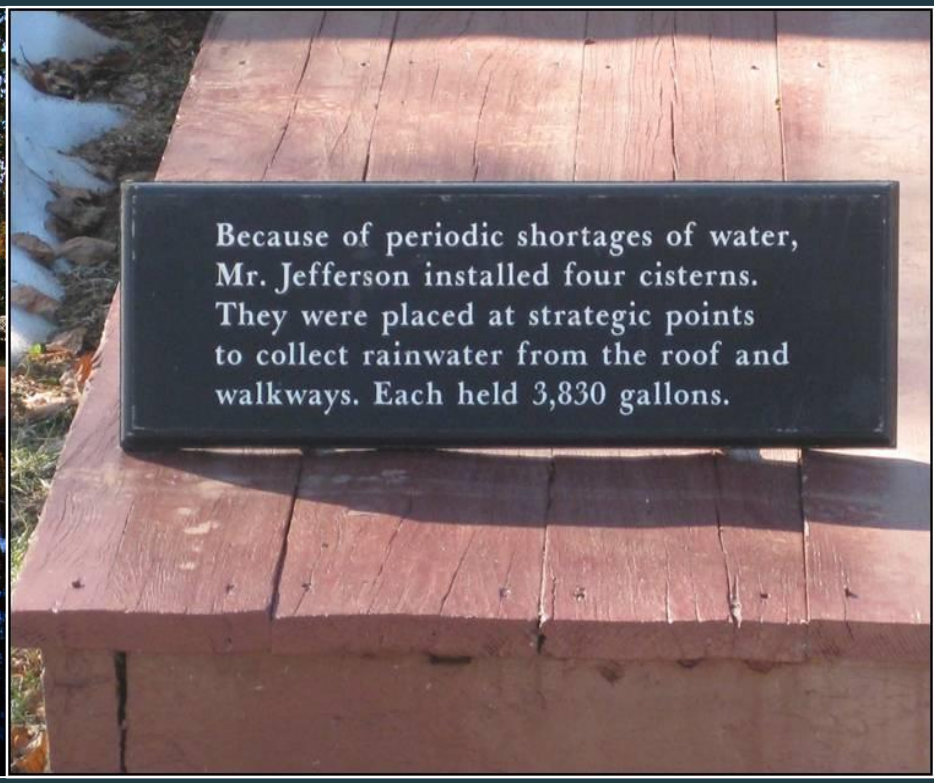


Outdoor use is about 60 – 70% (estimates vary slightly)!



http://www.cfpua.org/299/Water-Saving-Tips-Tools

Not a New Idea!



Source: www.monticello.org

Advantages of Rainwater Harvesting

- Is a conservation practice
- Can reduce storm water runoff, and so reduces pollutants entering water bodies
- Rainwater is of superior quality: zero hardness, sodium-free, and nearly neutral pH (neither acidic nor basic)
- When properly managed, rainwater harvesting eliminates the need for costly treatment and distribution systems
- Apart from costs to collect, store, treat, and convey the water into the facility, rainwater harvesting is free

Disadvantages of Rainwater Harvesting

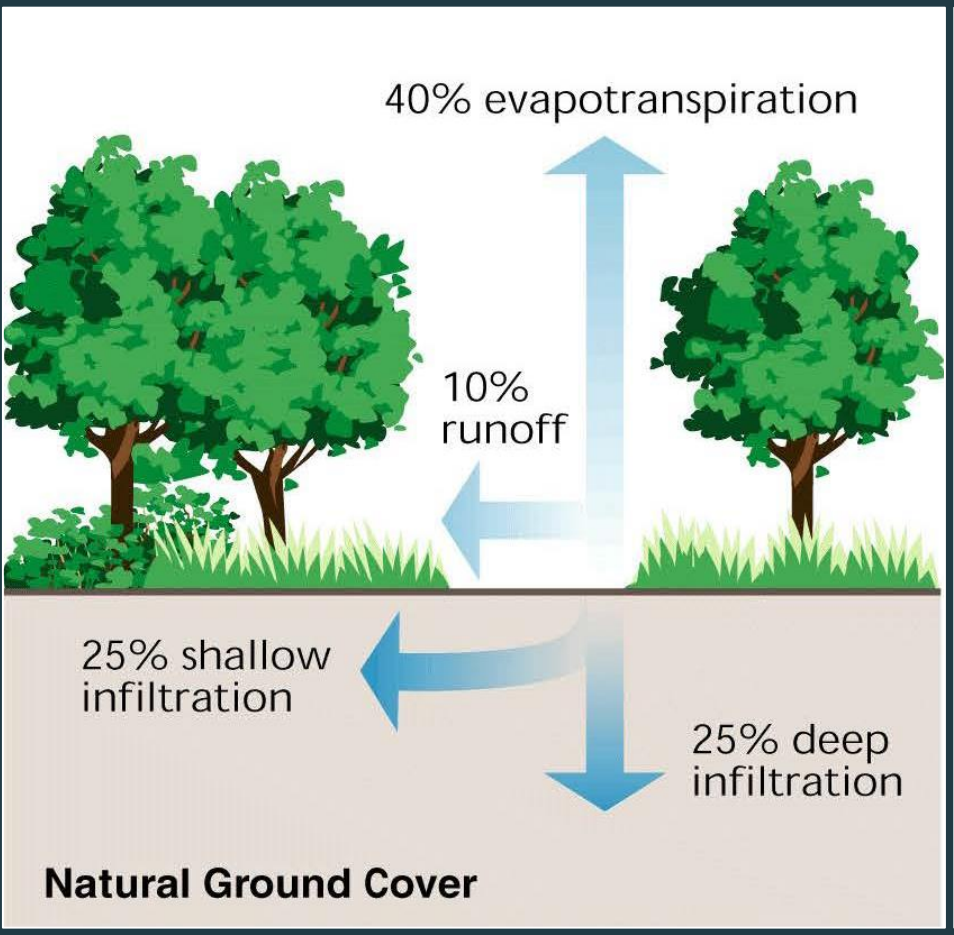
- Rainwater harvesting may need to be supplemented with water from other sources, especially during extended dry periods or droughts
- Systems require regular maintenance after installation
- Storage systems can take up space around the house
- Standardized construction guidelines for systems are lacking

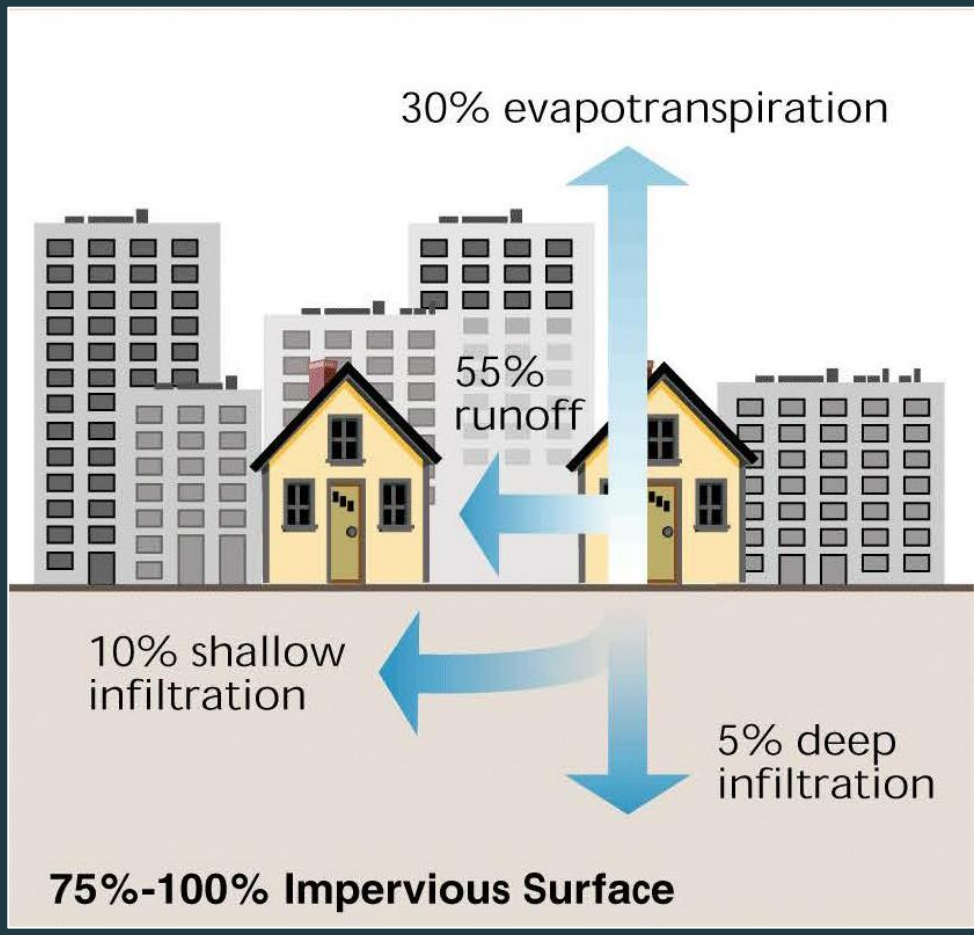
Legal Aspects

Senate Bill 198, 2013-2014: Illegal for a homeowners association to prohibit:

- Installing rain barrels or a rainwater harvesting system
  - Can require screening or shielding to obscure view of tanks
- Using drought-resistant landscaping or water-conserving natural turf
- Composting of vegetation
- Installing underground drip irrigation

Impervious Surface Causes Increased Runoff





Potential Rainfall Collection Volume

For every 1” of rain:

- Each square foot of a collection surface footprint generates about 0.6 gallons of water:

Total Gallons H_2O = Square Feet of Footprint X 0.6 Gallons/ft^2

~In other words~

- Each 2,000 square feet of collection surface generates 1,200 gallons of water

Average Monthly Rainfall in Bellville

January	2.8
February	2.9
March	3.3
April	4.1
May	4.1
June	3.5
July	2.3
August	2.5
September	3.5
October	3.5
November	3.5
December	3.2

Average annual total rainfall in Bellville is 40 inches

Monthly Rainfall Collected/2,000 ft^2 in Bellville

	Ave. Monthly Rainfall (in)	Catchment (ft^2)	Gal/ft^2	Collection (gal/month)	Amount in tank (gal)
January	2.8	2,000	0.6	3,360	
February	2.9	2,000	0.6	3,480	
March	3.3	2,000	0.6	3,960	18,840
April	4.1	2,000	0.6	4,920	
May	4.1	2,000	0.6	4,920	
June	3.5	2,000	0.6	4,200	
July	2.3	2,000	0.6	2,760	
August	2.5	2,000	0.6	3,000	
September	3.5	2,000	0.6	4,200	
October	3.5	2,000	0.6	4,200	
November	3.5	2,000	0.6	4,200	
December	3.2	2,000	0.6	3,840	

Average of Monthly Rainfall in Bellville (gal/ft^2)

	Ave. Monthly Rainfall (gal/ ft^2)
January	1.7
February	1.8
March	1.7
April	2.0
May	2.5
June	2.1
July	1.4
August	1.5
September	2.1
October	2.1
November	2.1
December	1.9

Average annual total rainfall in Bellville in gal/ft^2 is 22.8 gallons

What Can Fall on Your Roof?

Protect water quality from the beginning to avoid clean-up later

Questions to Consider

- Subdivision restrictions?
- How much water can I catch from my roof?
- Estimated cost of tank/s?
- Can I afford a tank I will be proud of, or do I need to hide a less expensive tank?
- Is storage available under a porch, patio or in a basement?

Form vs. Function

Functional considerations only, or are aesthetics also important?

Rain Barrels

"Gateway Drug to Rainwater Harvesting"

Making a Rain Barrel

- Recycled food grade plastic containers, wine barrels, etc.
- Clean
- Supplies needed:
  - ¾” brass faucet with male threads
  - 1” paddle bit to drill hole
  - Silicone or Teflon tape to seal threads
  - If thin-walled barrel, add electric conduit nut on inside and tighten or bulkhead fitting
- Drill hole about 4” from bottom, cover threads and screw in faucet and attach nut on inside if needed

Making a Rain Barrel Video

Nicely painted barrel with small overflow but directed towards plants.

Other shapes and materials

More Imagination!

Making the Most of Your Tank

Color of the tank affects the temperature of the water and the amount of algal growth

Screen Out Mosquitoes and Trash

- Use window screening or other fine mesh to screen water
  - If open top, screen whole top
  - If with lid:
- Cut hole in the lid and screw down screen
- Cut 6” round hole in top, insert 1 gal planting pot with:
  - Screen glued into bottom
  - Rocks filling pot half way up
  - Insert thicker vent screen or something similar
  - Make sure overflow doesn’t open water for mosquitoes
- Add mosquito dunks if there is an issue

Components

Site Selection

Roof and Collection Surface

Conveyance

Primary Filtration

Foundation for Tank

Tanks

Tank Parts

Secondary Filtration

Pumps and Pressure Tanks

In Home Use

Site Selection for Tanks

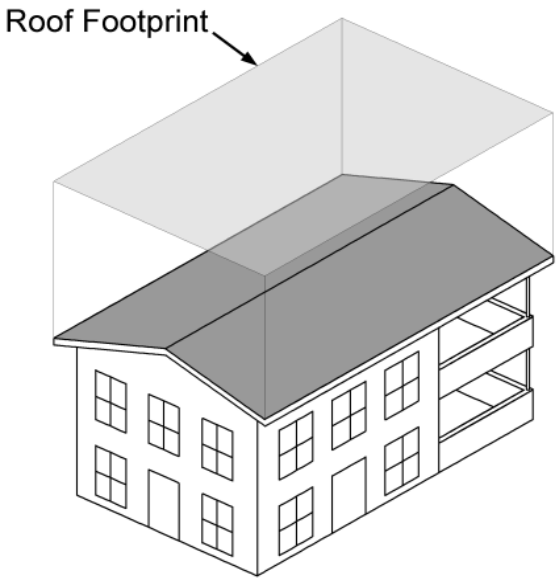
- Soil type – trenching, leveling, digging
- Elevation – gravity flow or use pump to storage tank
- Distance tanks will be from the house
- Distance to electricity, filters, freeze protection
- Smaller size tanks I could install myself
- Type of foundation under the tank (consider size)
- Underground or larger, specially designed tanks may require excavation or a professional

Roofs and Collection Surfaces

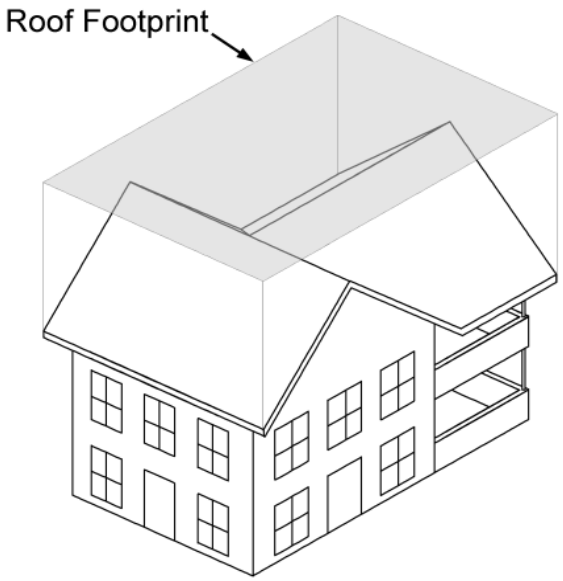
Unique Catchment Surfaces

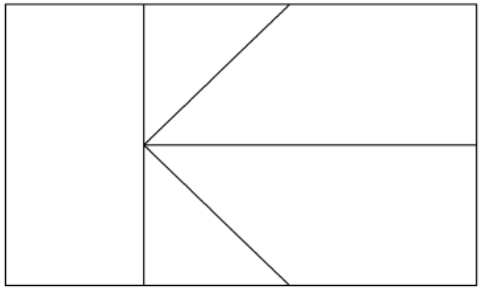
Catchment Surface

Footprint of the Collection Surface

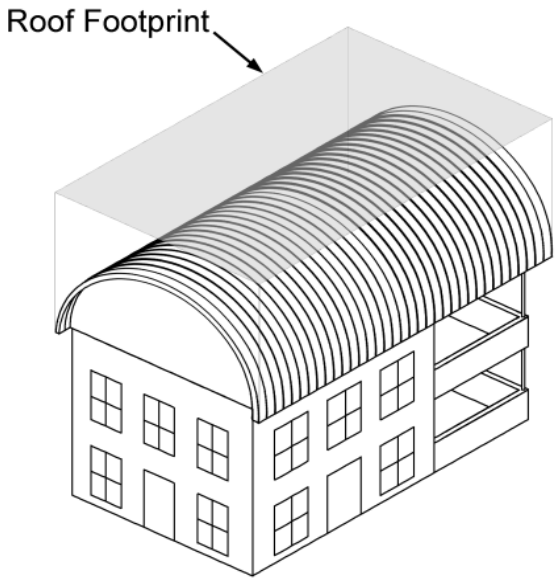


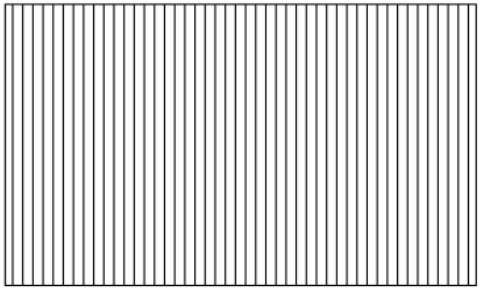
Roof Footprint





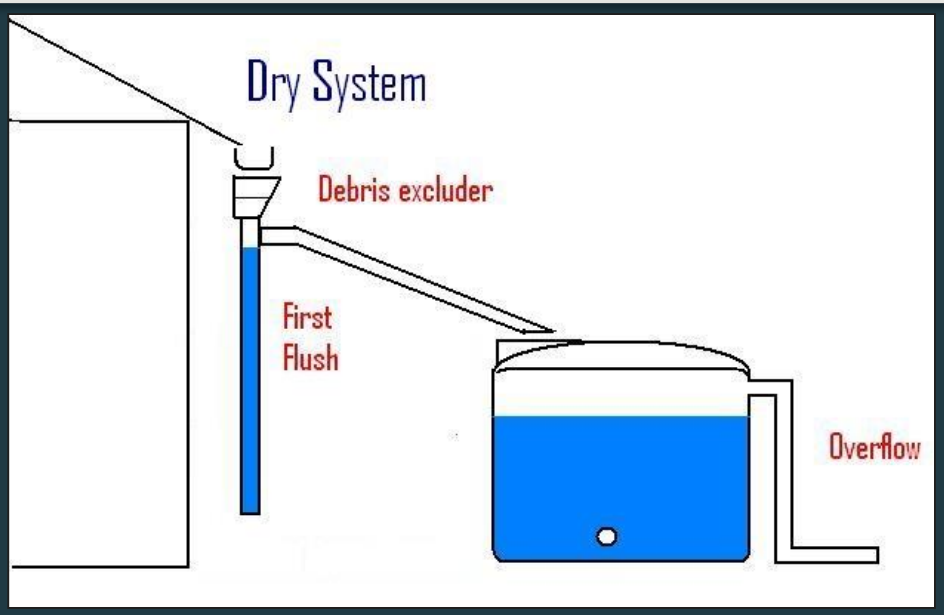
Roof Footprint

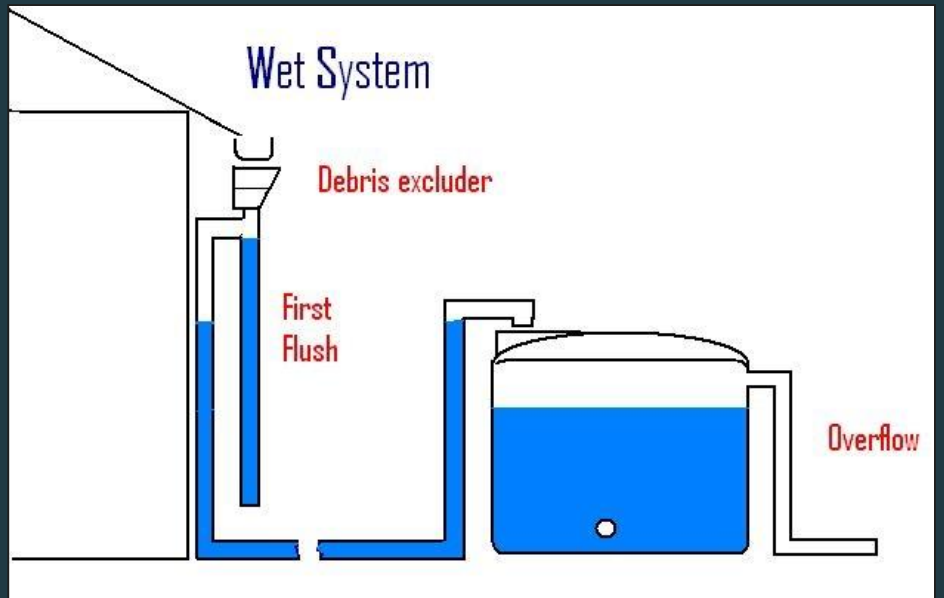


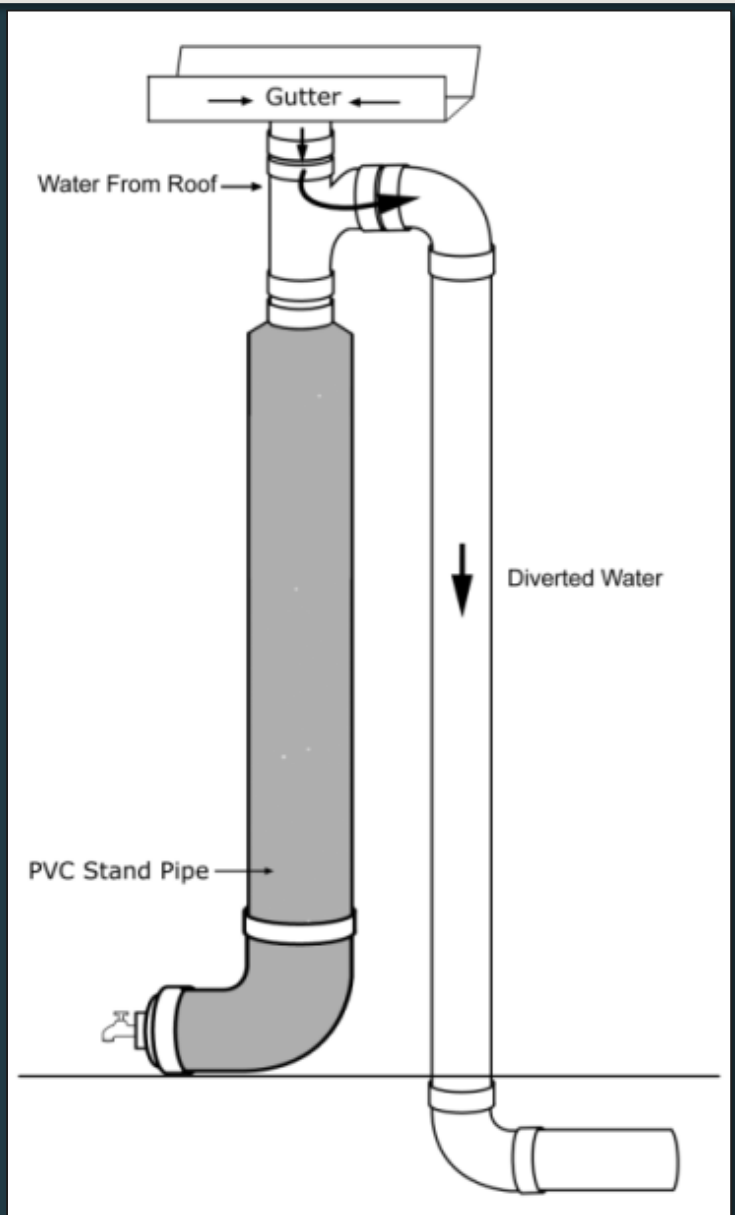


Roof Footprint

Conveyance


Dry System
Debris excluder
First
Flush
Overflow


Wet System
Debris excluder
First
Flush
Overflow


Gutter
Water From Roof
Diverted Water
PVC Stand Pipe

Gutters And Downspouts

Gutters

- Materials: vinyl, seamless aluminum, galvanized steel, stainless steel, copper
- Slope toward the downspout 1/16”per 1’ to 1/16” per 10’
- Tilt out ½” to prevent water seeping into the walls
- Expansion joints for runs over 40’
- Hangers every 3’
- Use splash guards in valleys
- Number of downspouts varies with size and surface area – 1 per 1,000 square feet surface
- 1 square inch of outlet per 100 square foot of roof surface

Sizing Gutters

- Should be sized to adequately move rainwater runoff from a 100-year storm
- Generally, should be at least 5 inches wide

Downspouts

- Provide one square inch of downspout area for every 100 square feet of roof area
  - For example, a 2” x 3” downspout (6 square inches) can accommodate runoff from a 600 square foot roof
  - A 3” x 4” downspout (12 square inches) can accommodate runoff from a 1,200 square foot roof
- The same rule can be used for circular PVC piping

Problems Do Occur!

Gutter sloping wrong direction. Downspout on the other end.

Non-traditional Downspouts

Different Gutters and Downspouts

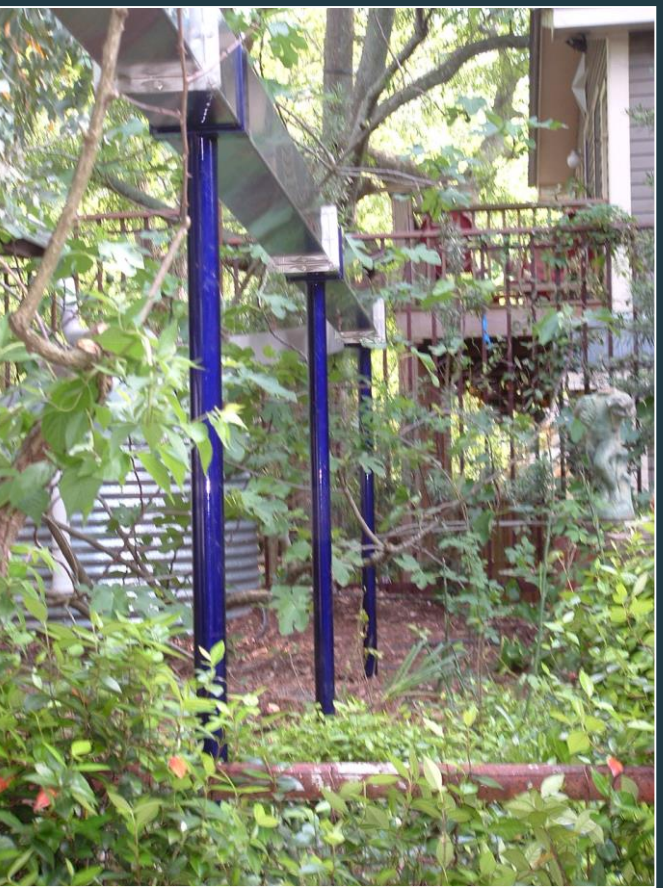
More Non-traditional Downspouts

Government Canyon State Natural Area, San Antonio

Secure the Gutters

Slope on Gutters

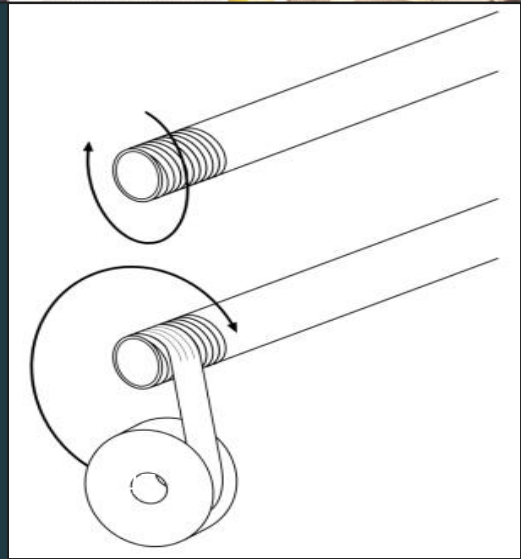
Gutters with a slope of ½” per foot can serve an area almost 2 times as large as a gutter with a slope of 1/8” per foot.



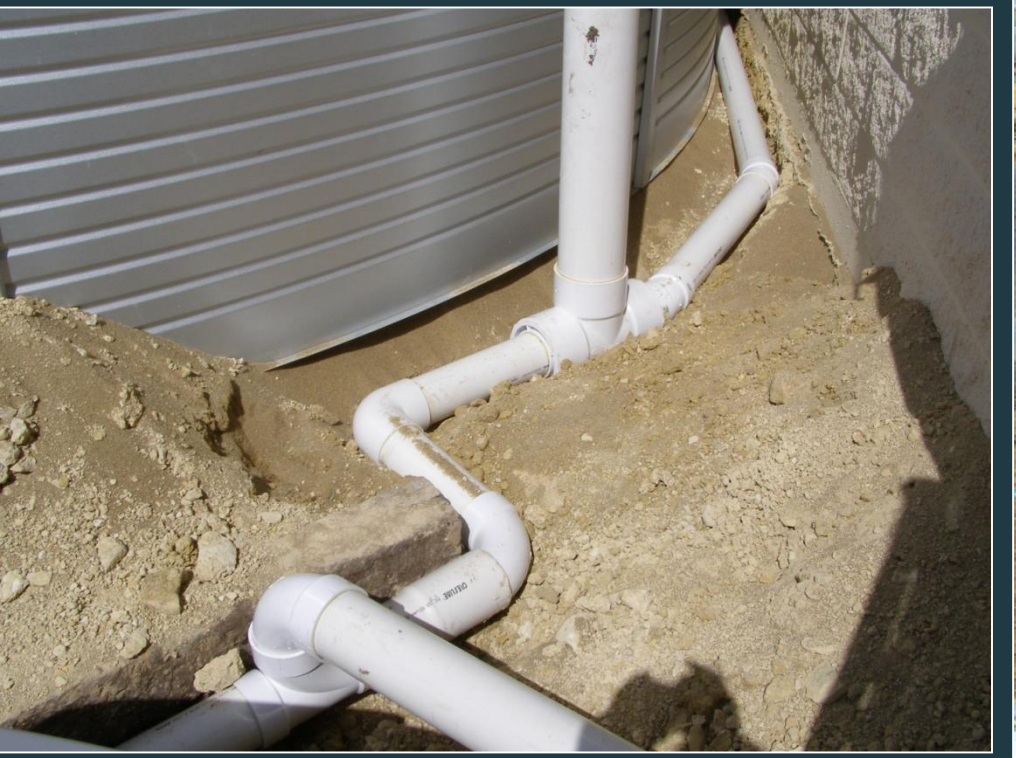
Imagination Never Hurts!

Piping for RWH

- PVC to metal threaded – often leak
  - PVC – external threads - male
  - Metal – internal – female = best
  - Brass—preferred over steel
- Teflon tape – same direction as external threads (joint compounds not recommended)
- Never use gray pipe to carry water
- Never use white to carry electricity
- Always use purple pipe for nonpotable water



Curves Strengthen Conveyance in Soil



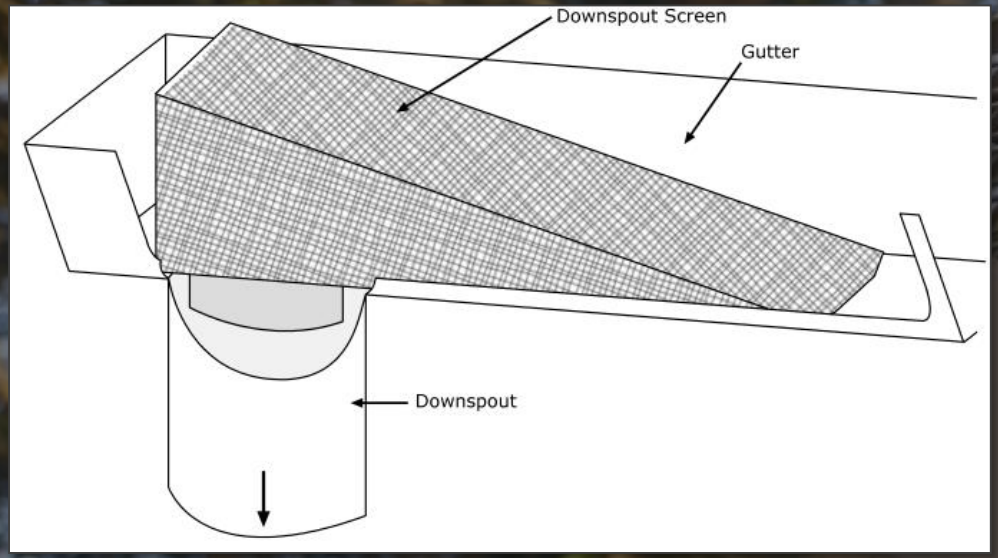
Preferred

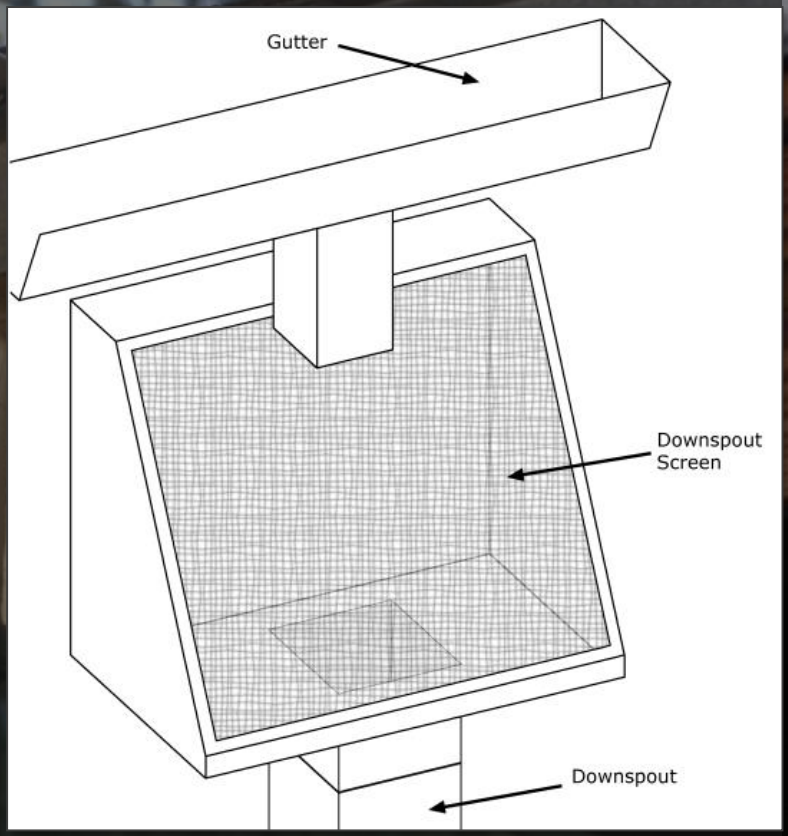
Not recommended

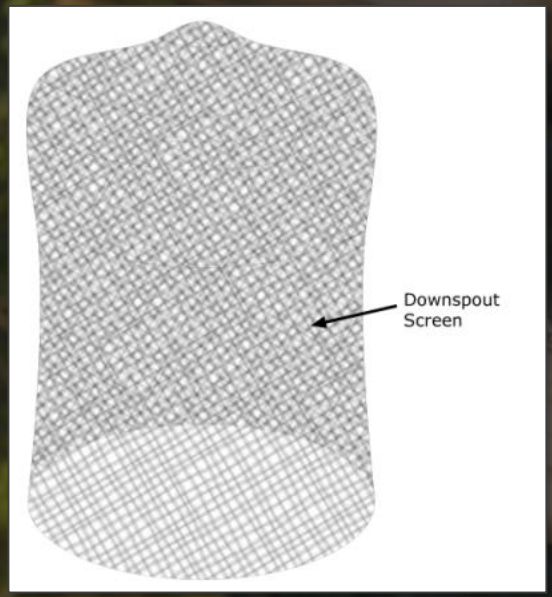
Primary Filtration

- Leaf screens
- Downspout filters
- Strainer baskets
- Self cleaning filters
- First flush diverters

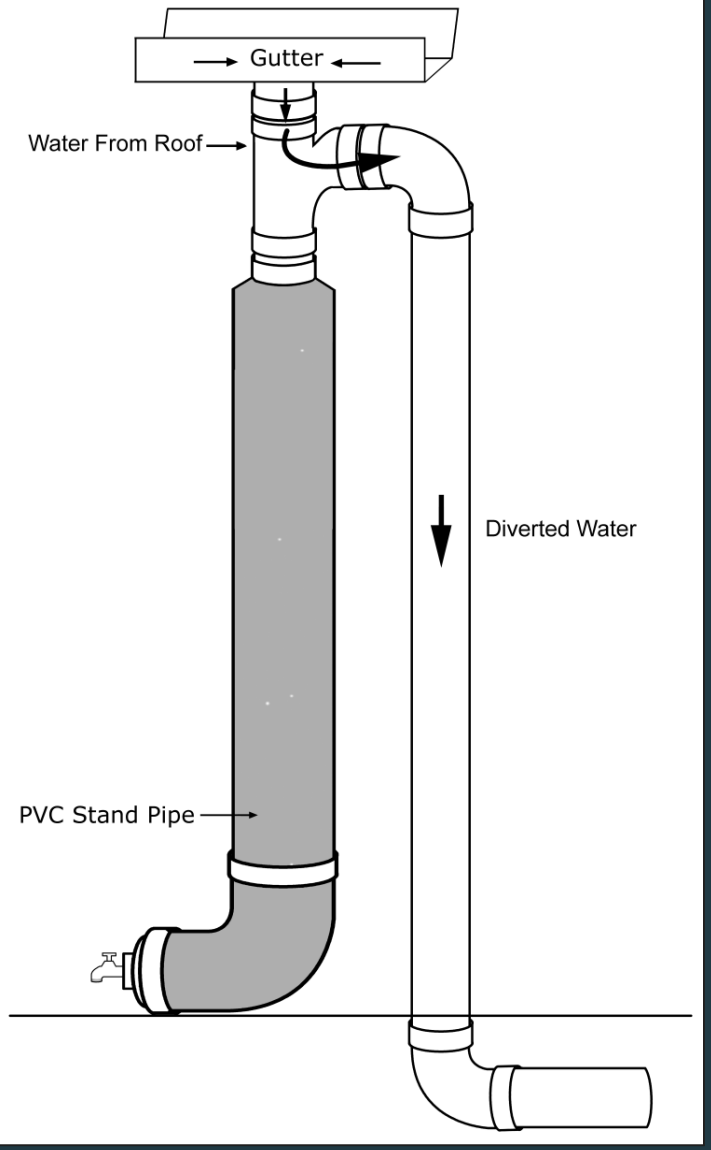
Screens and Gutter Guards

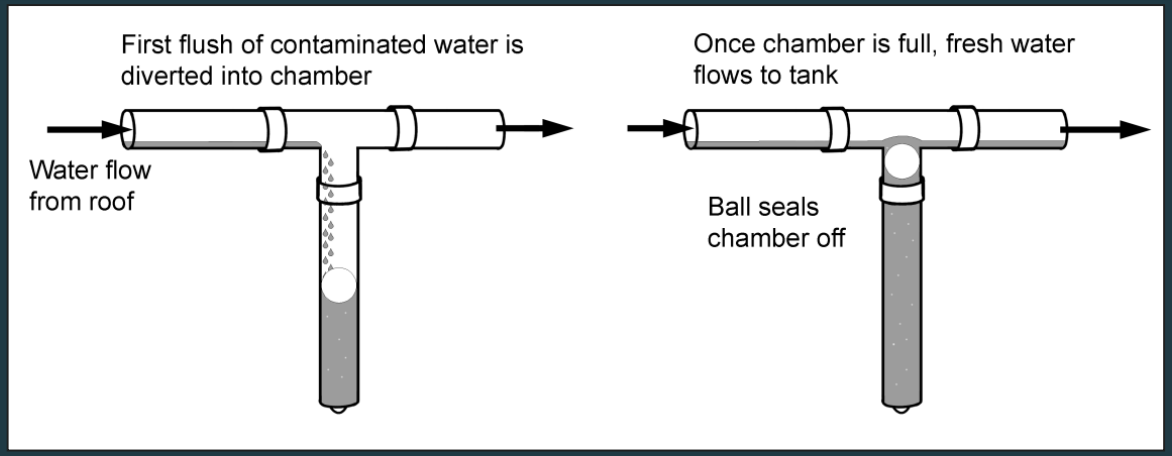




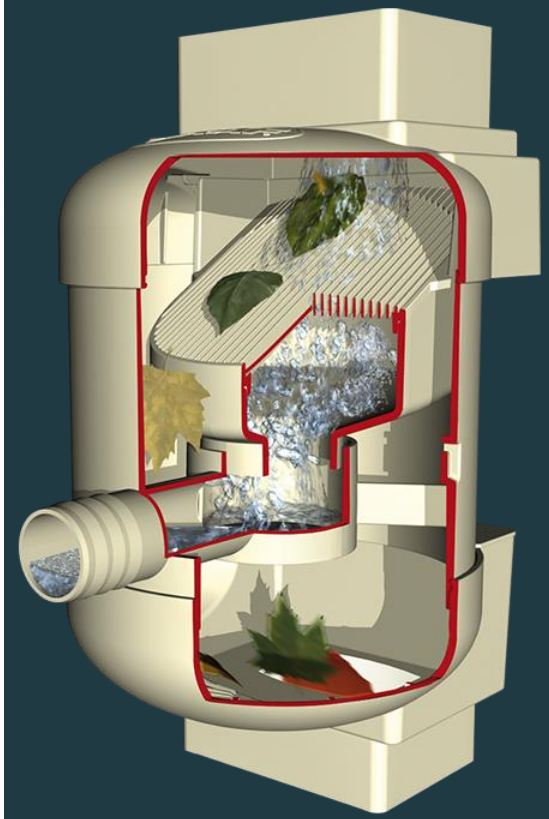


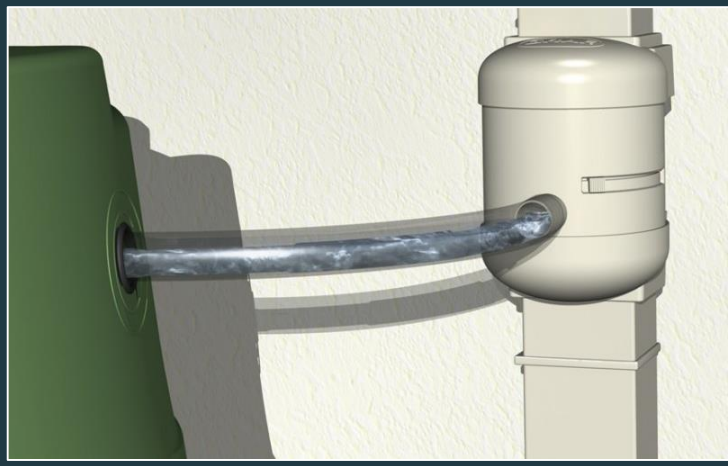
First Flush Diverters

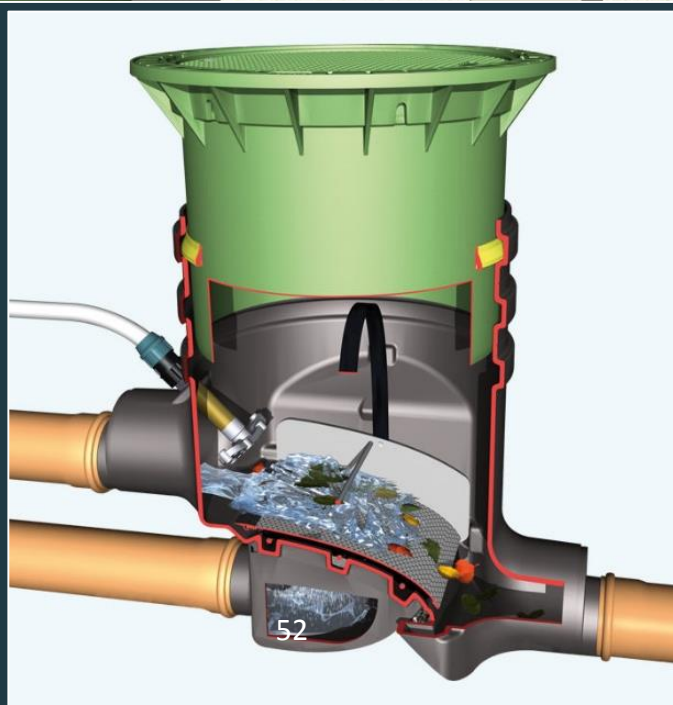




More Filters







Foundation For Tank

Pad Preparation

- Tank pads – level, no rocks or roots
  - Sand, fine gravel, soil
  - Do not let the base underneath the tank wash or erode away due to overflow
- Gravity feed from the gutters, or
- Collect into smaller storage and pump into larger storage
- Longer distances – more resistance/friction; larger pipe needed
- Larger tanks may require cement foundation
- Jurisdiction of local ordinances

Tank Support

Foundation needs to be strong and safe

Water weighs 8.3 pounds/gal

3000 gallons = 24,900 pounds

Water Pressure= .4 pounds/column foot

Tanks

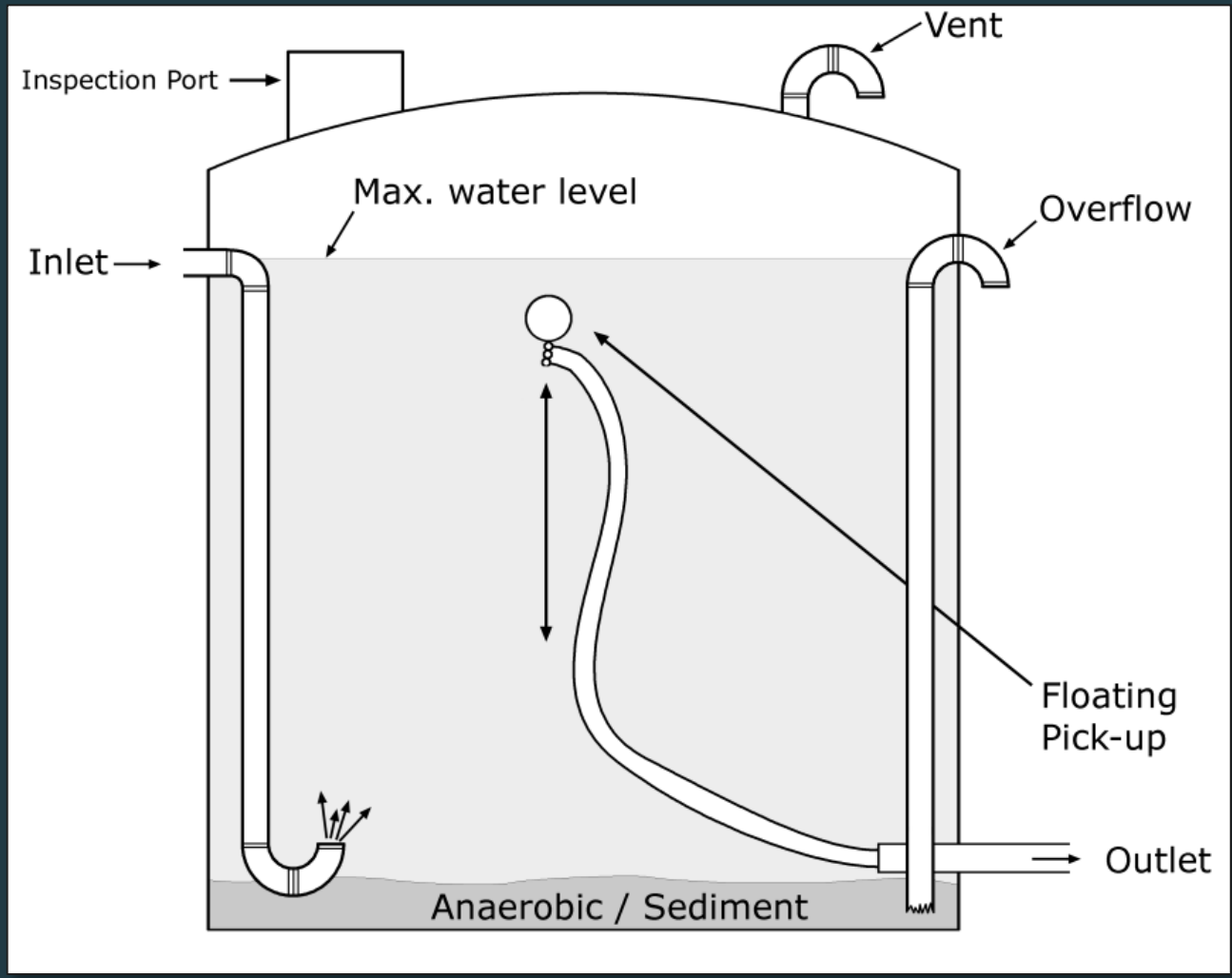
Tanks

- Well constructed and water tight
- Food grade plastic liner for potable water
- Size: how much do I need and how much can I collect?
- Cost: $ .35 (maybe) ➡ $2.25+ per gallon collected

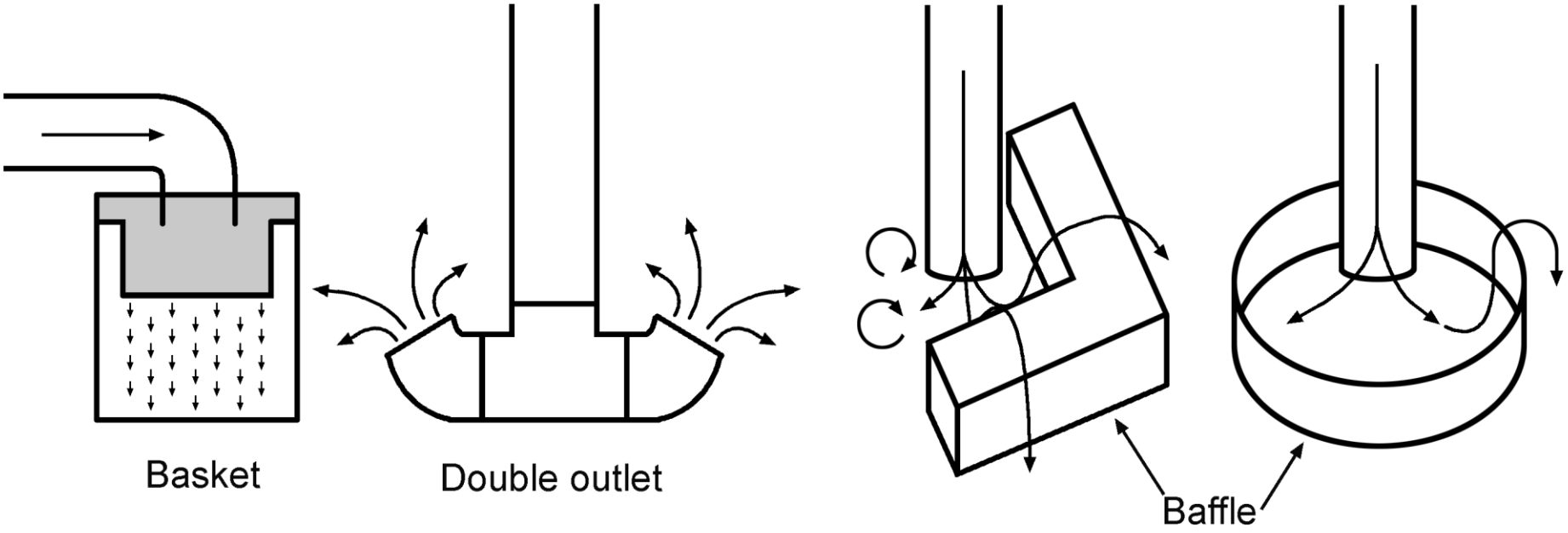



Water Going In and Out of Tank

- Inlet – side or top or bottom
- Outlet - 4 inches from bottom
- Overflow - side near top
- Inspection port
- Vent



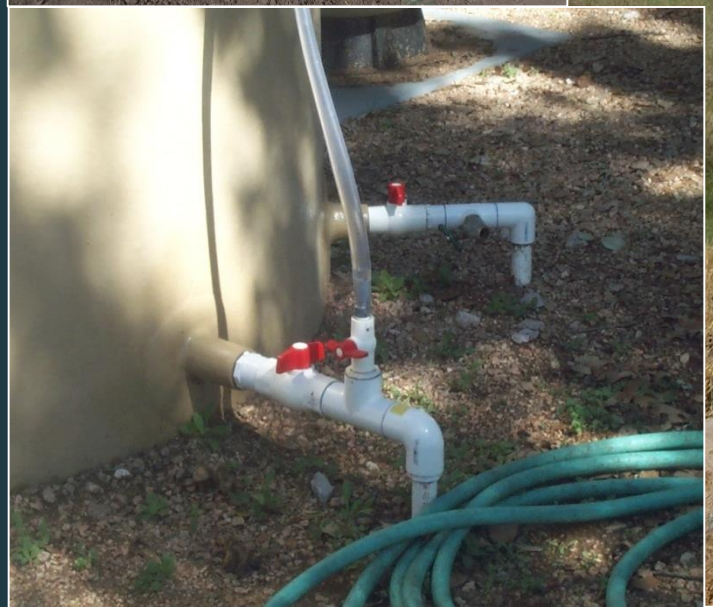
Types of Calming Inlets



Overflow Pipe

- Allows water out of the tank when full instead of backing up into the gutter
- Should be same size or larger coming out of tank than the inflow pipe
- Should be covered to prevent animals seeking water

Tank Water Level Gauges



Non-conventional Tanks






Where to Hide That Ugly Tank?

Two 1,440 gallon tanks under master bedroom

Tank Storage Options

Built in Angleton in 2006, this system survived when Hurricane Ike hit Galveston in 2008.

The 3,000 gal black polyethylene tank is hidden behind the cedar picket fence. A pressure tank and pump are inside the building.

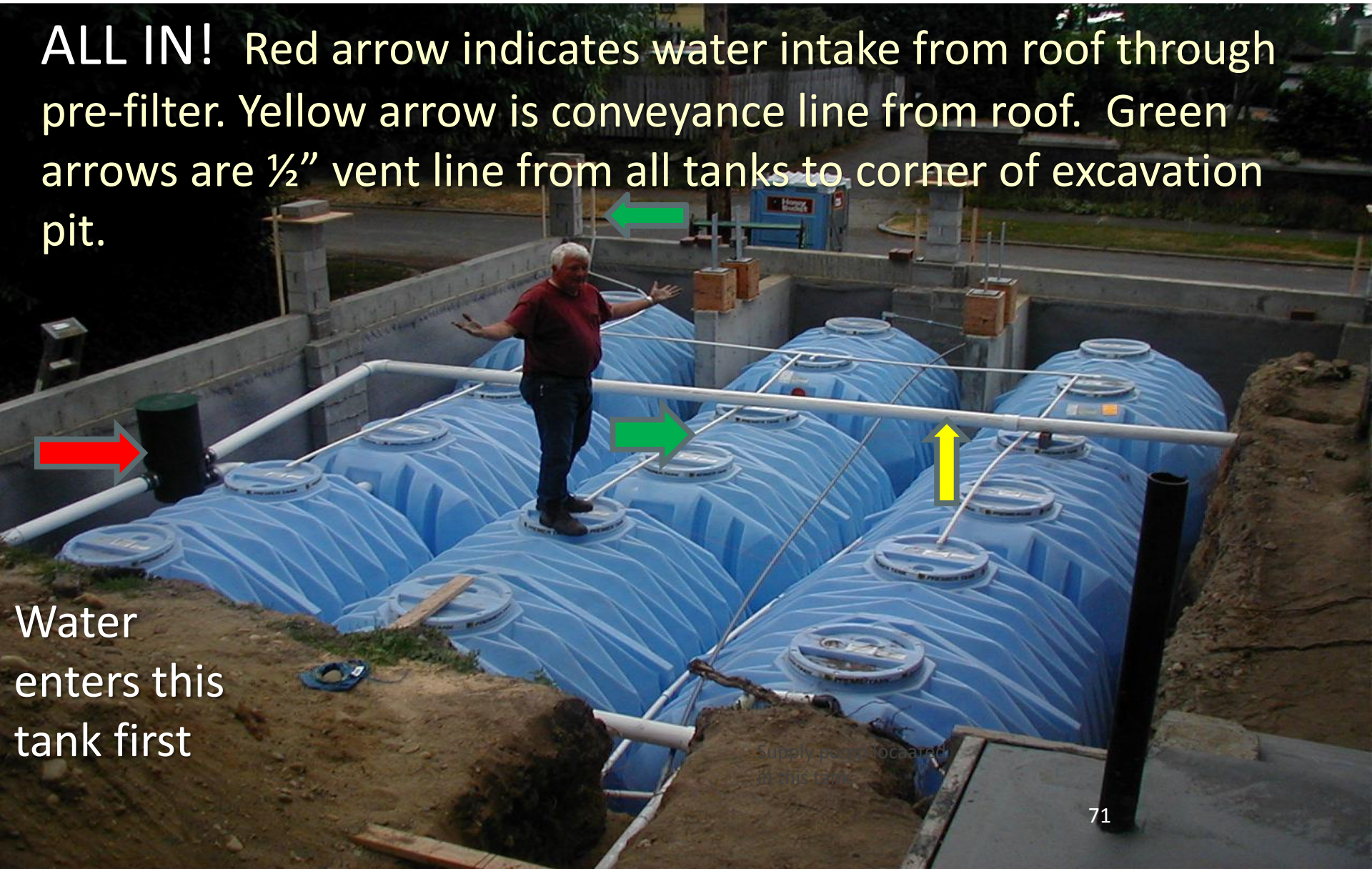
Cable Prevented Movement by Hurricane Ike

Concrete Tank

Water storage in concrete while the top serves as a patio

Hiding the Tank

Hiding Those Tanks



Hiding Tanks - Same Location as Previous Slide

Finished installation under grass and patio is 14,400 gallons

Hiding the Tanks

Installation of Below Ground System

- Two 2,500 gallon Norwesco tanks
- WISY filter and Grunfos pump

Hiding Those Tanks

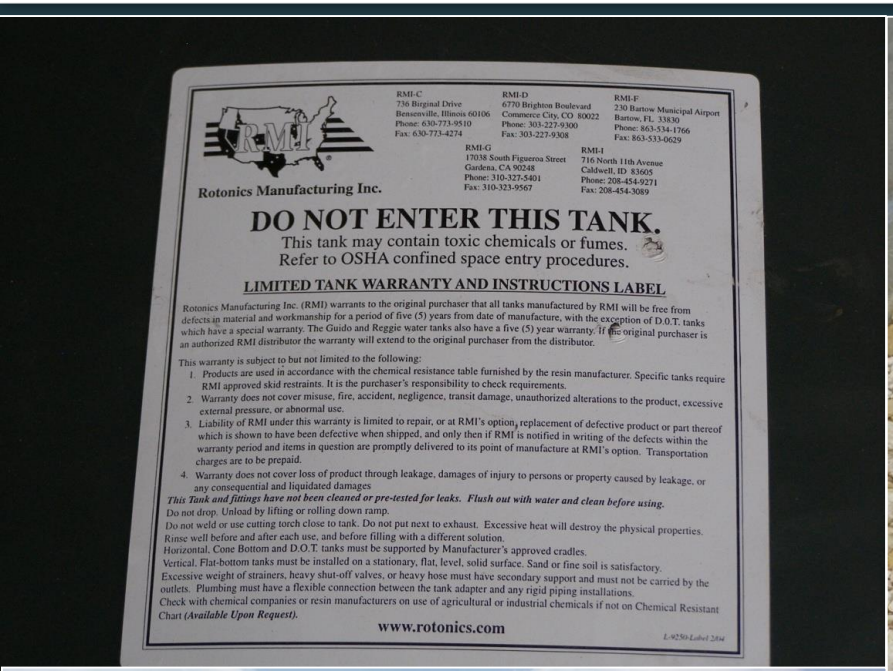
ARCSA
American Rainwater Catchment Systems Association

Non-Traditional Tank Options

Watering trough substitute for rain barrel

- Lower profile, yet more water

Precautions



Non-Potable Water Warning

Underground Tanks are Upwardly Buoyant

Buoyant force (lbs) = Volume of underground tank (cubic feet) X 62.4 pounds per cubic foot

- 200 gallon tank divided by 7.5 gallons per cubic foot = 26.7 cubic feet
- 26.7 x 62.4 pounds/cubic feet = **1664.2 pounds of buoyant force**
- **Reinforced concrete weighs about 150 lbs/ft^3**

Additional Water Pressure

Water pressure = .434 pounds/column foot
Weight of 1 gallon = 8.34 pds

Pumps and Pressure Tanks

Pumps

Centrifugal 230VAC

Submergible

Piston Pump 115 VAC

- May need intake screen
- May need to divert some water back to reservoir to cool pump (prevent deadhead)
- Consider pressure
  - Loose 1 psi for every 2.3 feet of head
  - Drip irrigation may require certain pressure (25 psi)

Secondary Filtration, If Needed

1. Pass water through a 50 micron filter, and then through
2. Two 5 micron filters, and finally through a
3. UV (ultraviolet lamp) filter

Resources

Texas A&M University website:
http://rainwaterharvesting.tamu.edu

Healthy Lawns and Healthy Waters website:
hlhw.tamu.edu

Texas Water Development Board website:
https://www.twdb.texas.gov/innovativewater/rainwater

American Rainwater Catchment Systems Association website: www.arcsa.org