RAINWATER HARVESTING
A PIECE OF THE WATER MANAGEMENT PUZZLE

The nuts and bolts of rainwater harvesting. How to construct a rainwater catchment system

Billy Kniffen

Texas AgriLife Extension Service

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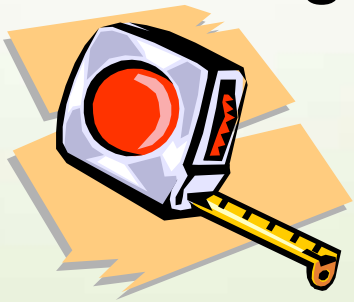
Rural Open Space

Urban Residential

Water Mgt.

Urban Commercial

Planning



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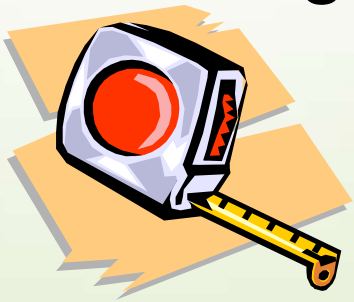

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Open Space
Nature's First Rain Catchers

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Catching Water On The Land

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Big Bluestem, Indian grass and Compass Plant

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Change Species or Grazing Strategy?

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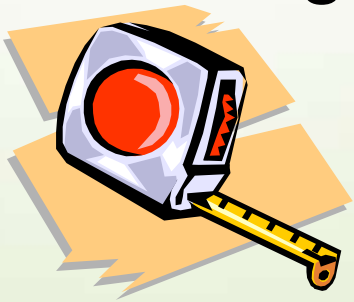

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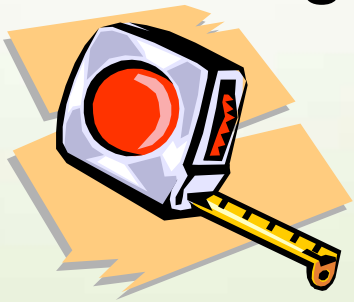

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Junction Medical Hospital


GARDEN CENTER

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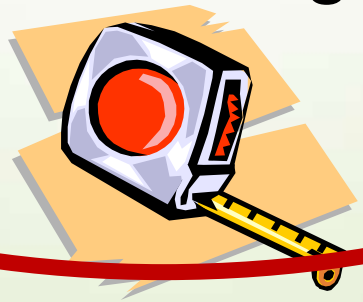

We All Live In The Watershed

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Roof-Reliant Landscaping™

Rainwater Harvesting with Cistern Systems in New Mexico




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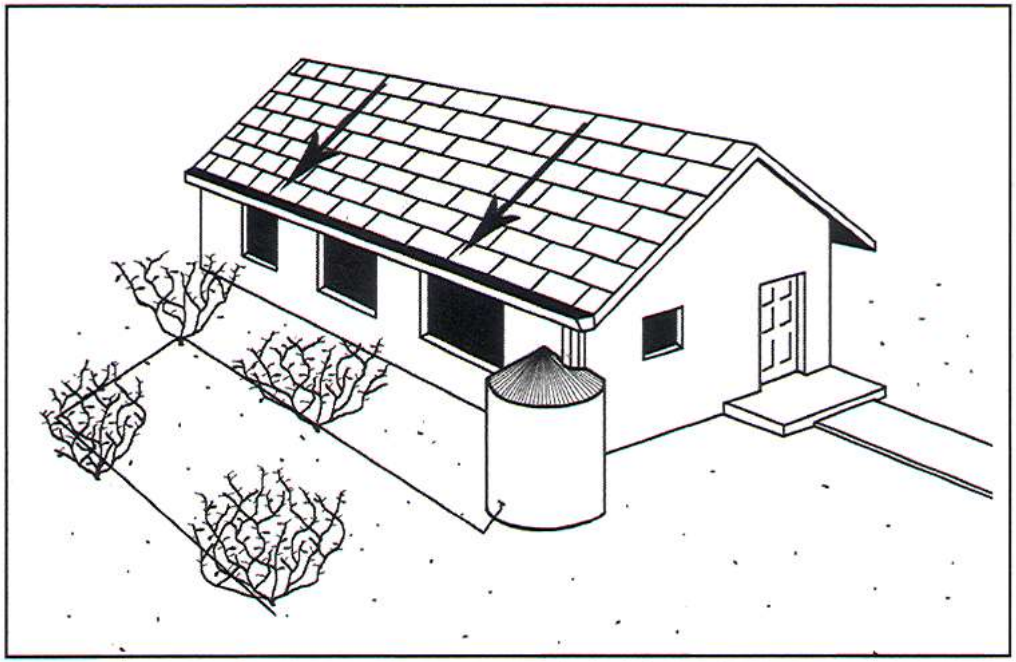
New Mexico Office of the State Engineer

1-800-WATER-NM • www.ose.state.nm.us

The New Mexico Office of the State Engineer supports the wise and efficient use of the state's water resources and, therefore, encourages the harvesting and use of rainwater from residential and commercial roof surfaces for on-site landscape irrigation and other on-site domestic uses.


New Mexico

Complex /Active Rainwater Harvesting



Complex water harvesting system with roof catchment, gutter, downspout, storage and drip distribution system.

How to Collect Rainwater

- .6 gallons per square foot roof per 1” rainfall
- 2,000 sq. foot roof X 0.6g (1" rain) = 1,200 gal.
- 1,200 gal. X 20" rainfall per year= 24,000 gal/yr

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Texas AgriLife Extension Service Rainwater Harvesting Calculator

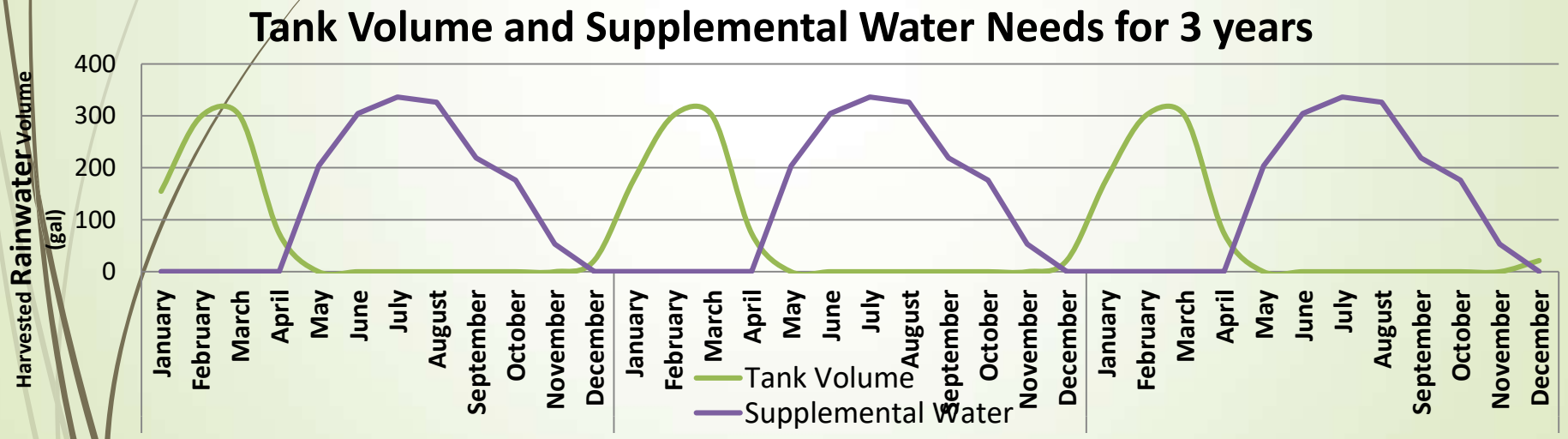
To use the calculator fill in all highlighted input values.

Input Values	
Catchment area (ft²):	150
Collection efficiency (%):	95
Initial tank volume (gal):	0
Tank size (gal):	300
Plant water use coeff:	1
Irrigated area (ft²):	100
Monthly indoor demand (gal):	0

Avg. monthly rainfall (in)		Avg. PET (in)	AC Condensate (gal)
January:	3	1.79	0
February:	3.1	2.12	0
March:	2.4	3.3	0
April:	0.6	4.49	0
May:	0.2	4.73	0
June:	0.1	5.03	0
July:	0	5.4	0
August:	0.1	5.38	0
September:	0.3	3.94	0
October:	0.4	3.4	0
November:	1.1	2.42	0
December:	1.8	2.22	0
Total:	13.1	44.22	0

Yearly Percent Average Rainfall (%)	
Year 1:	100%
Year 2:	100%
Year 3:	100%

Supply/Demand Calculator
http://rainwarerharvesting.tamu.edu



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Rain Intensity – Texas – 3-4”/Hour

- 4” per hour
- 0.042 Gallons per minute per square foot

- 1000 sq’ x 0.042 = 42 gallons/minute
- Affects:
  - Gutter size,
  - Number and size of downspouts
  - Size of conveyance piping

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Sizing Gutters

1/16” slope/ft. and 2” per hour

3 gutter – 340 sq’

4” gutter – 720 sq’

5” gutter – 1250 sq’

Vertical Piping/Downspouts

- **2" – 23 gpm 1,088 sq' roof**
- 3" – 67 gpm 3,220 sq' roof
- 4" – 144 gpm 6,920 sq' roof

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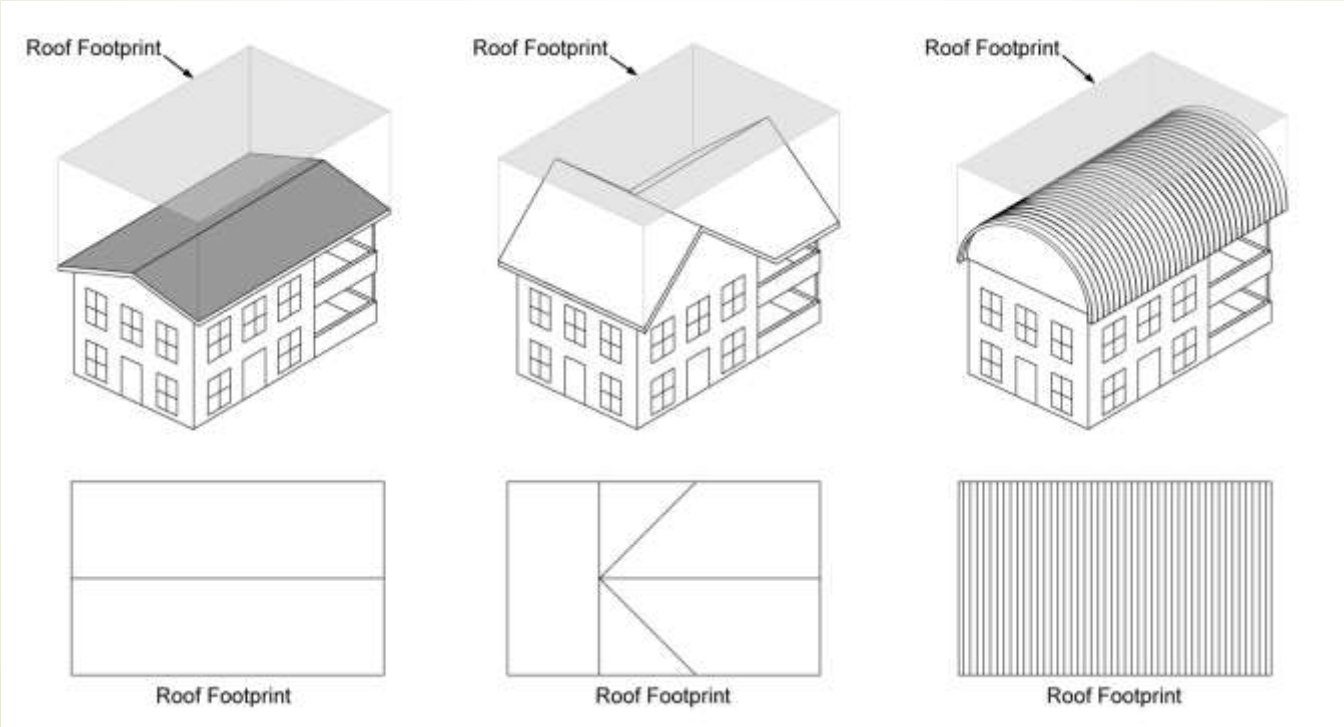
Conveyance Piping Sizing: Horizontal Pipe

Size of Pipe	1/8”/ft. slope gpm	1”/hr	2”/hr	3”/hr	4”/hr	6”/hr
3”	34	3288	1644	1096	822	548
4	78	7520	3760	2506	1880	1253
5	139	13360	6680	4453	3340	2227
6	222	21400	10700	7133	5350	3566
8	478	46000	23000	15330	11500	7670

Supply

- **Dripline** of the building



Roofs and Collection Surfaces

How Big Does The Roof Need To Be?

5’ diameter
Pi times radius squared
3.14 x 2.5 x 2.5 = 20 square feet
20 x .6 = 11.8 gallons per 1” rain
4” = Full Tank

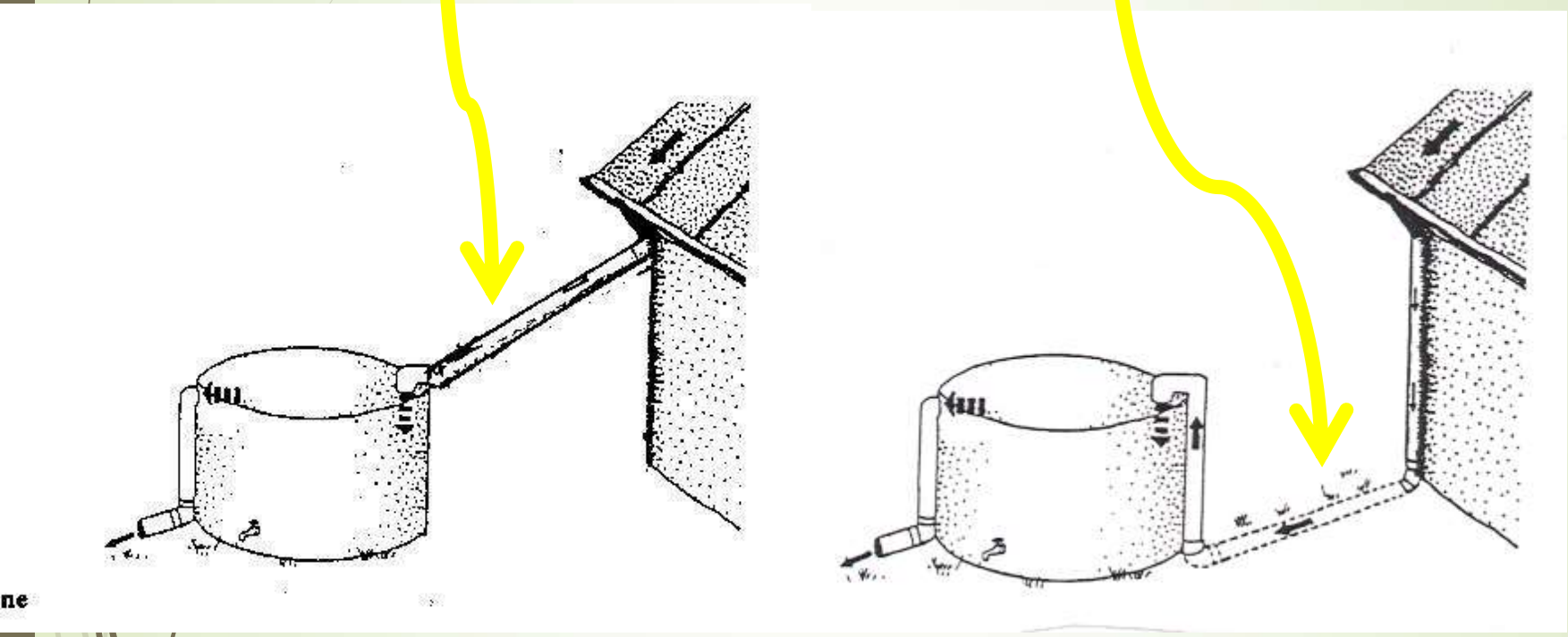
20 inches = Filled 5 times/yr

Filled 10 Times!

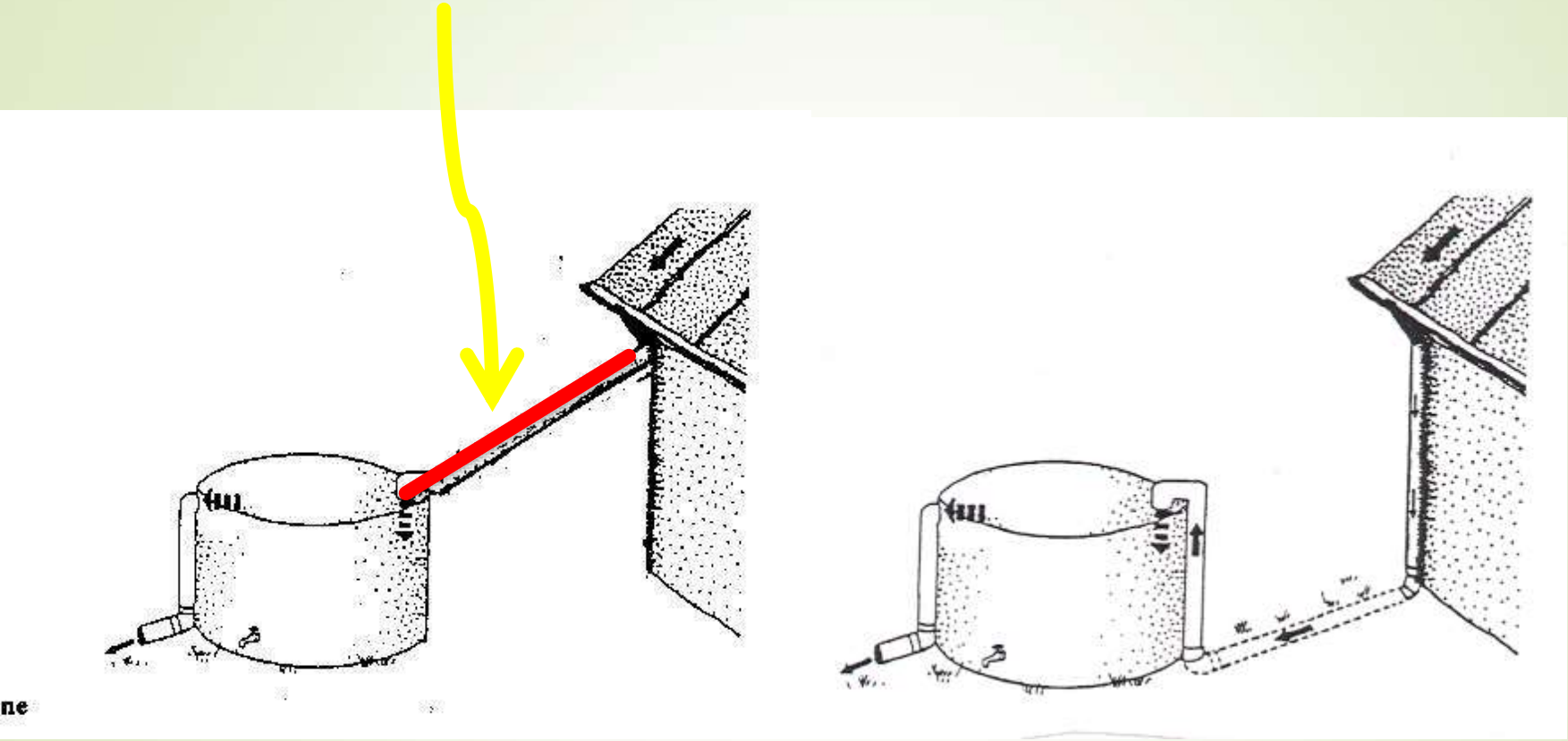
15 Times - Rain Saucers

Gutters and Downspouts

Dry Line vs. Wet Line



Dry Line vs. Wet Line



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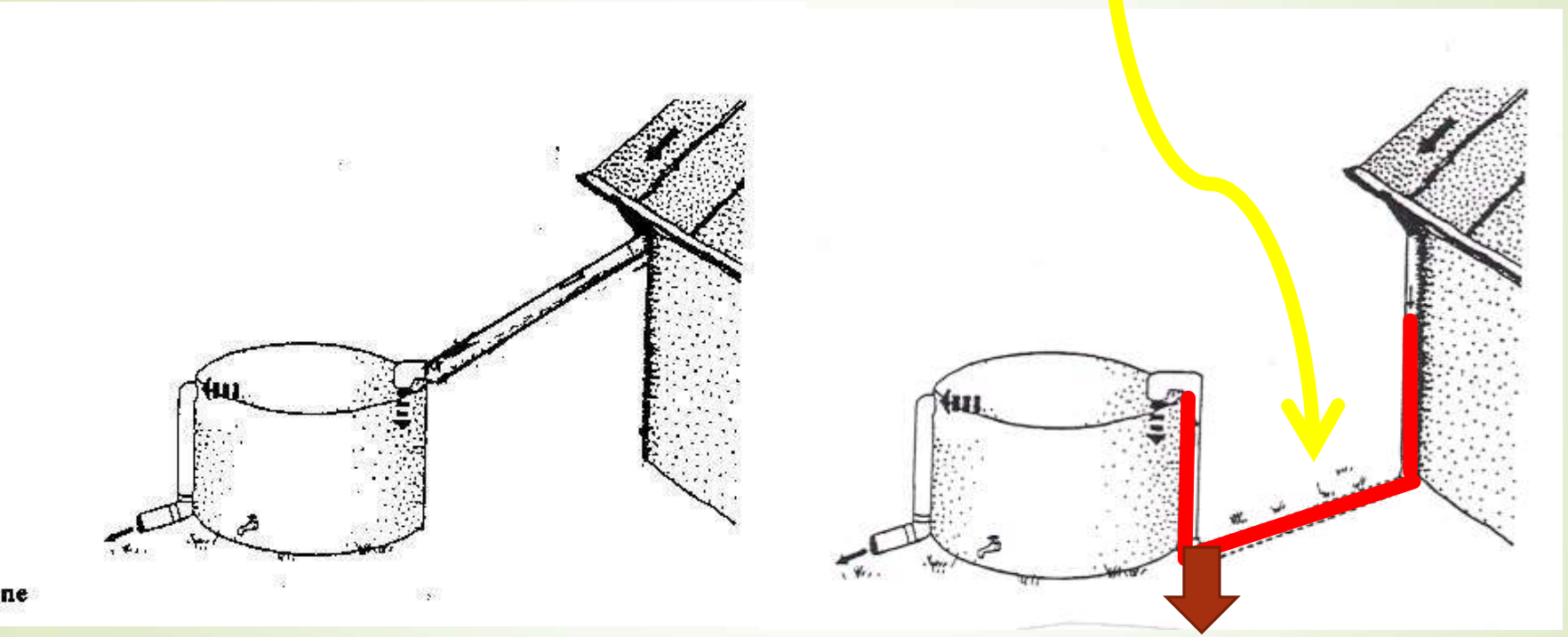
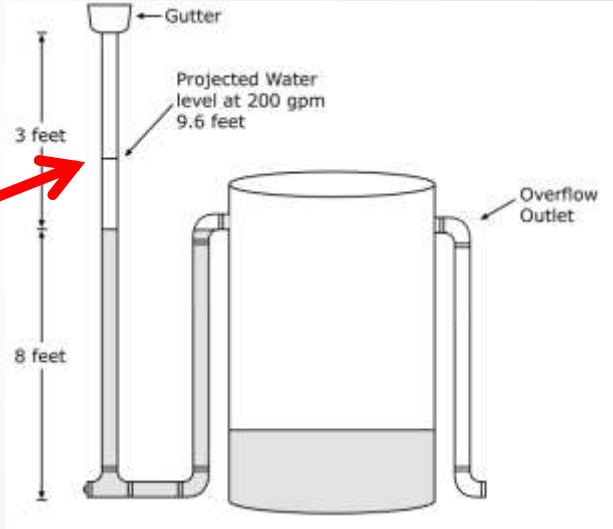


Hazen-Williams - Excel

Hazen-Williams Friction (Pressure Loss) Calculator

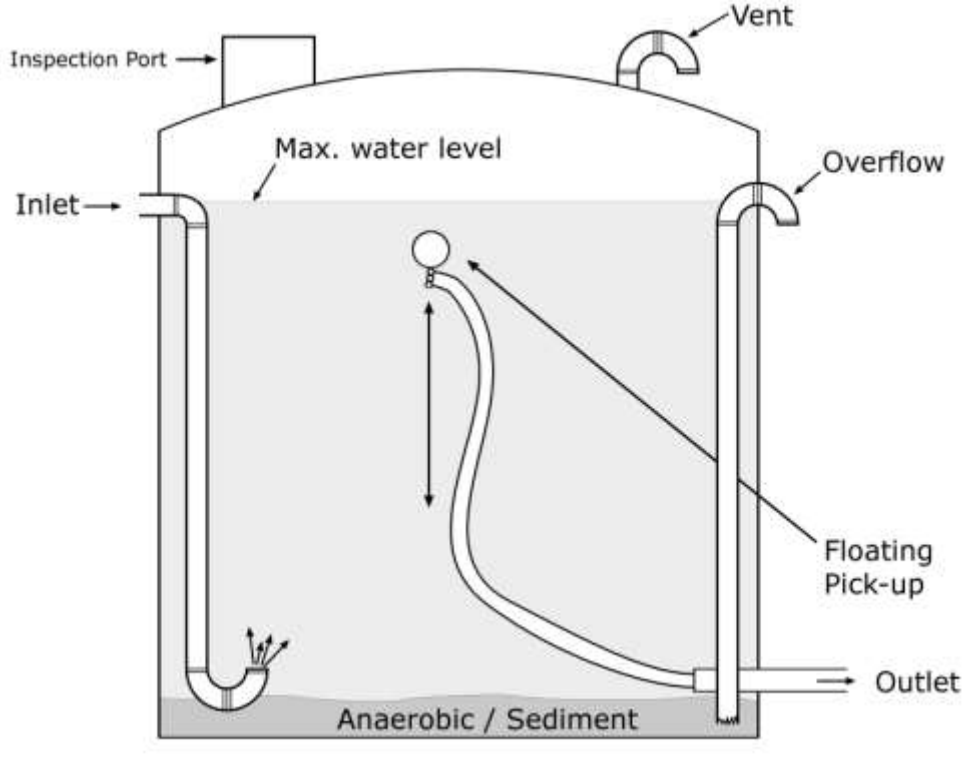
	Input
Actual pipe diameter (in):	4.026
Friction coefficient:	140
Flow rate (gpm):	200
Length of pipe (ft):	69
	Output
Pressure loss (ft):	1.6
Pressure Loss (psi):	0.7

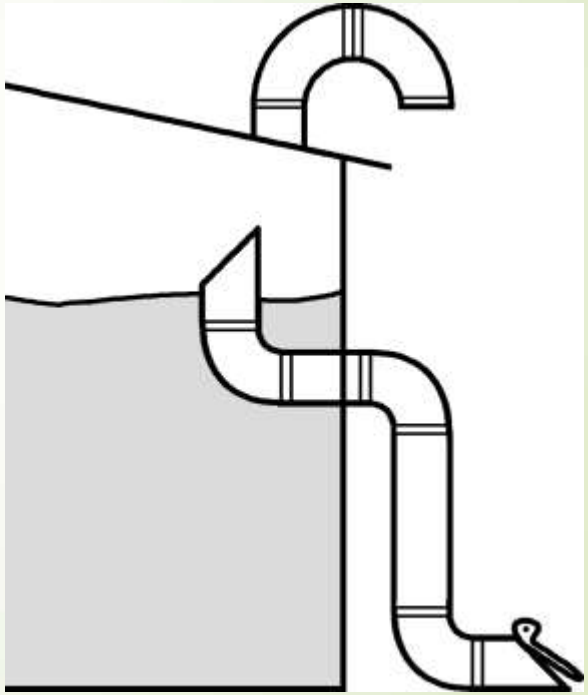



1
2
3
4
5
6
7


First Flush
Devices

Overflow –
From the Bottom or Skimming





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Color Makes A Difference In Water Temperature

Cisterns

What is it used for?

- Durable and water tight - material
- Size - where does it go & how much will you collect and need
- Cost - $ .50 - 2.25+ per gallon collected


GARDEN CENTER

Pumps

Centrifugal
230VAC

Submergible

Piston Pump
115 VAC

Sump Pump

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Distribute Water to Desired Location

- Drip Irrigation
- Rain Garden and Bird Baths
- Wildlife and Livestock
- In home Use

Types of Drip Irrigation

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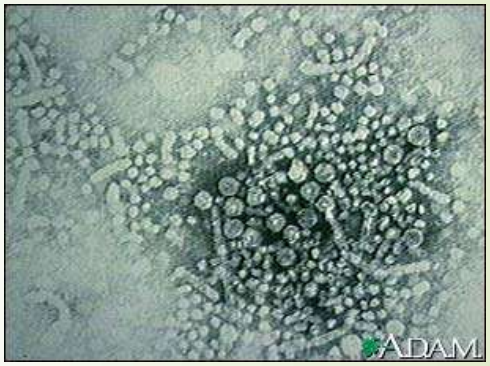
Potable Systems

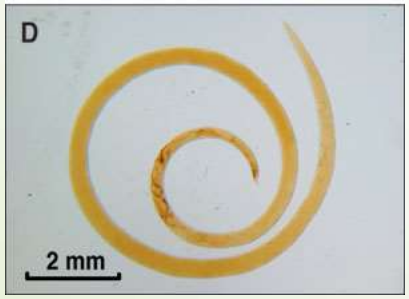
Getting Rid of: The Bugs

Bacteria

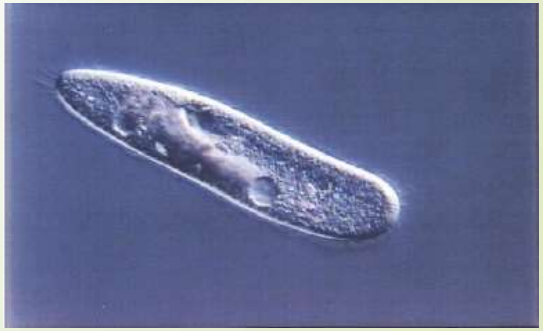
Virus



Parasites

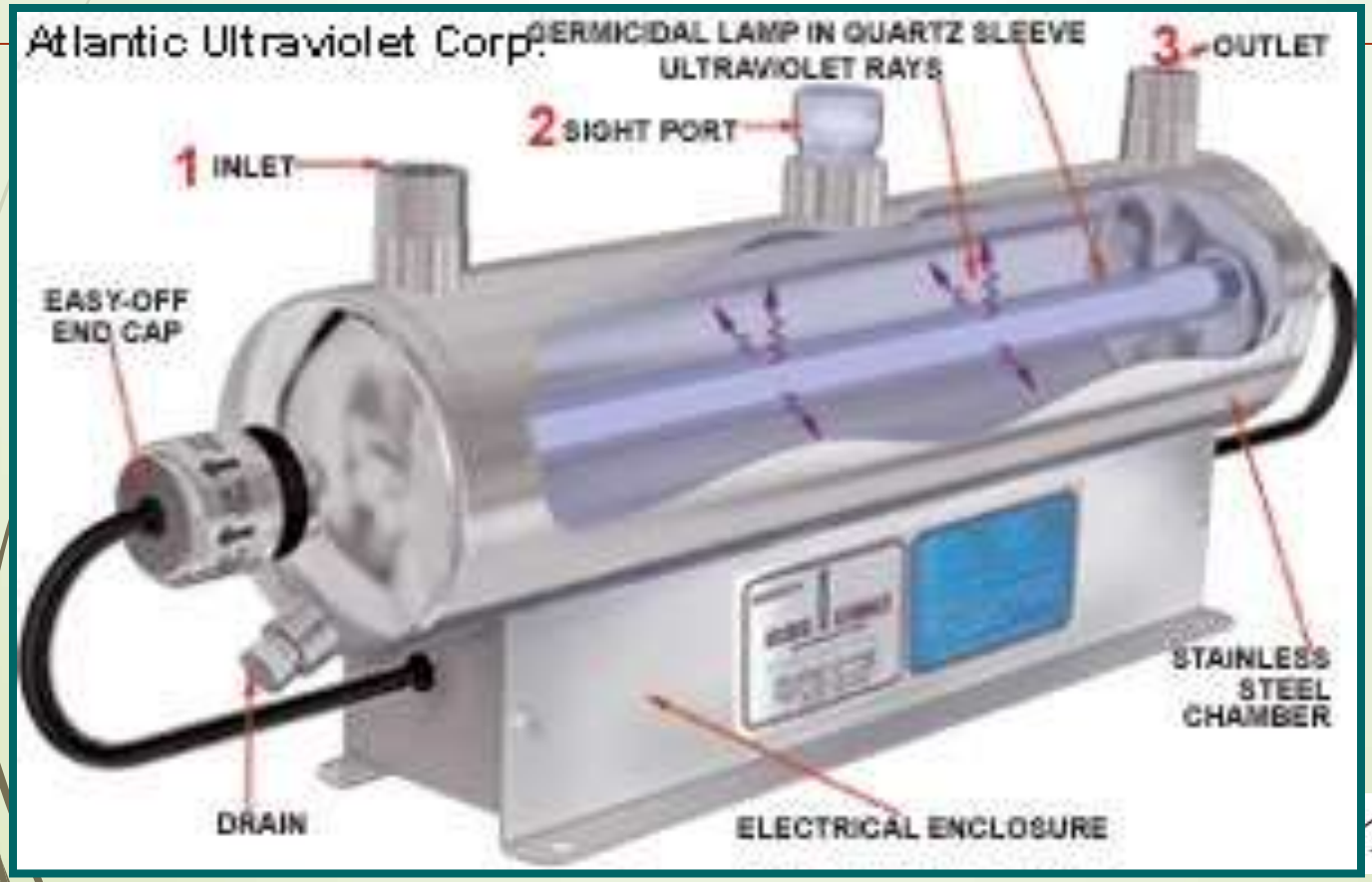


Protozoa



Ultraviolet Light Disinfection

- Electromagnetic energy (UV light) from source lamp is emitted into a chamber through which water passes



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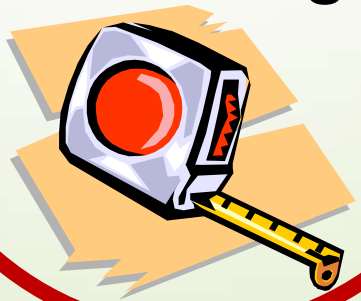

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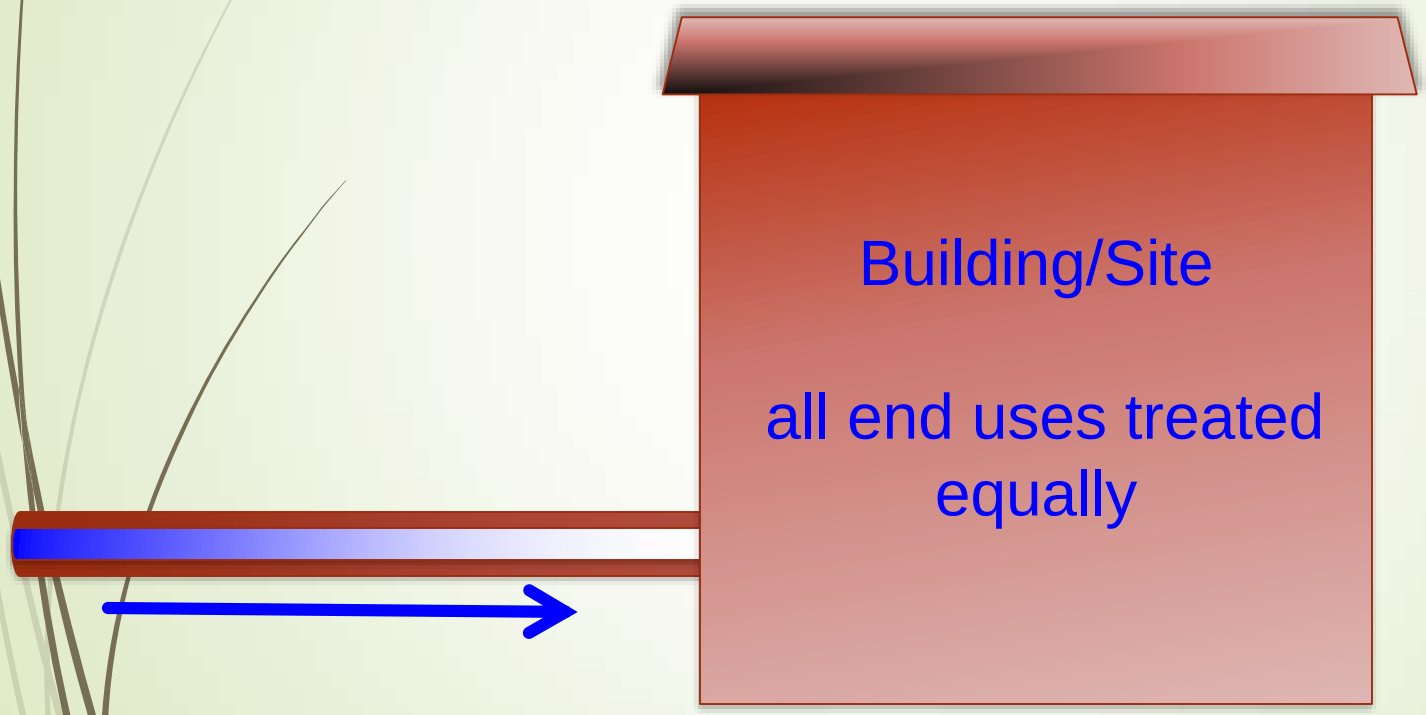
Current Water Supply Paradigm



Municipal, Well or Other Supply Line represents an **unlimited** supply of Potable water for all end uses.

New Water Supply Paradigm.

Municipal Potable supply line for specific uses

- Non-Potable (Rainwater) Supply line for non-potable uses, represents a **finite** amount.

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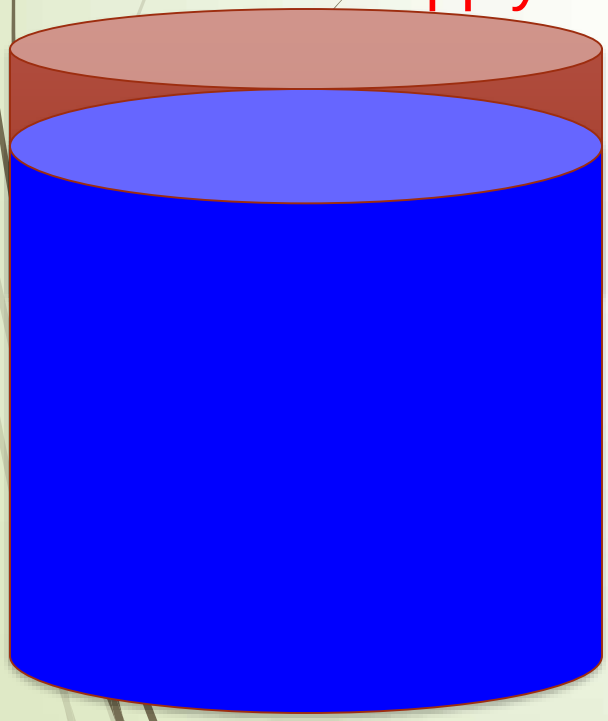
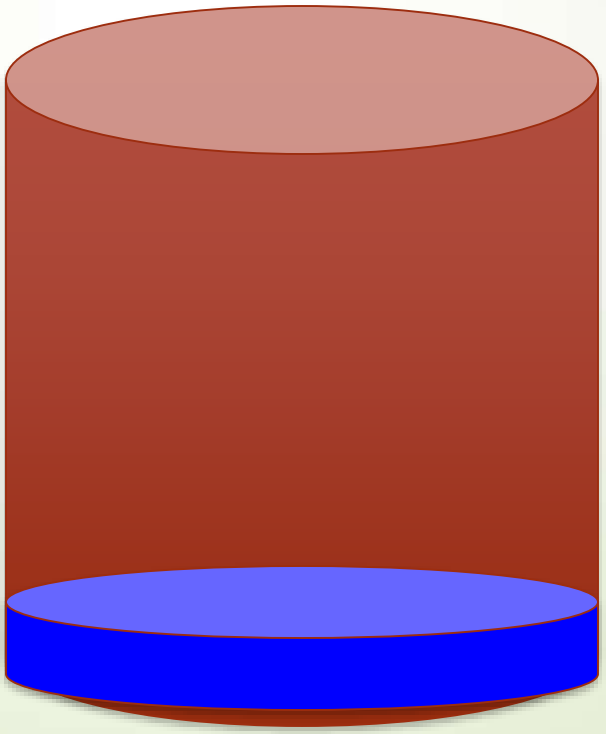
Three approaches to rainwater/stormwater management

Cistern managed for water supply

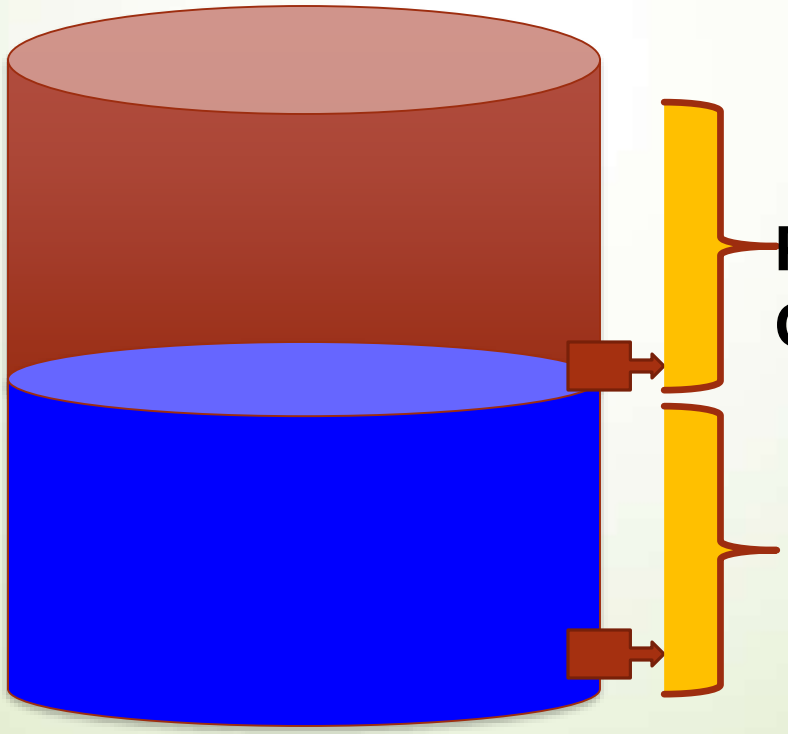


Cistern managed for stormwater control



AND

Cistern managed for BOTH water supply and managed for stormwater control or fire protection



For Stormwater Or Supply

For Supply or Fire Protection

The Bullitt Foundation officially opened its Bullitt Center …. including net zero energy, waste and water……. a - 56,000-gallon basement cistern.

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"There is not going to be enough water in the future,"

- The solution? Build thousands of reservoirs in the basements (and around) of buildings, sufficient to hold water to meet the needs of the current and future residents of a city

Peeling back the pavement

A Blueprint for Reinventing Rainwater Management in Canada's Communities

POLIS Project
Ecological Governance
University of Victoria
Law Centre Environmental UNIVERSITY OF VICTORIA

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Santa Fe County Ordinance

- Laws & Regulations
  Santa Fe County, New Mexico, was the first municipality in the United States to create an ordinance requiring any new structure, 2500 heated s.f. or more, to have a rain harvesting system. This ordinance applies to both commercial and residential projects, with commercial projects requiring a higher percentage of total capture as well as larger storage reservoirs.

HB 645 – 2003 Texas Legislature

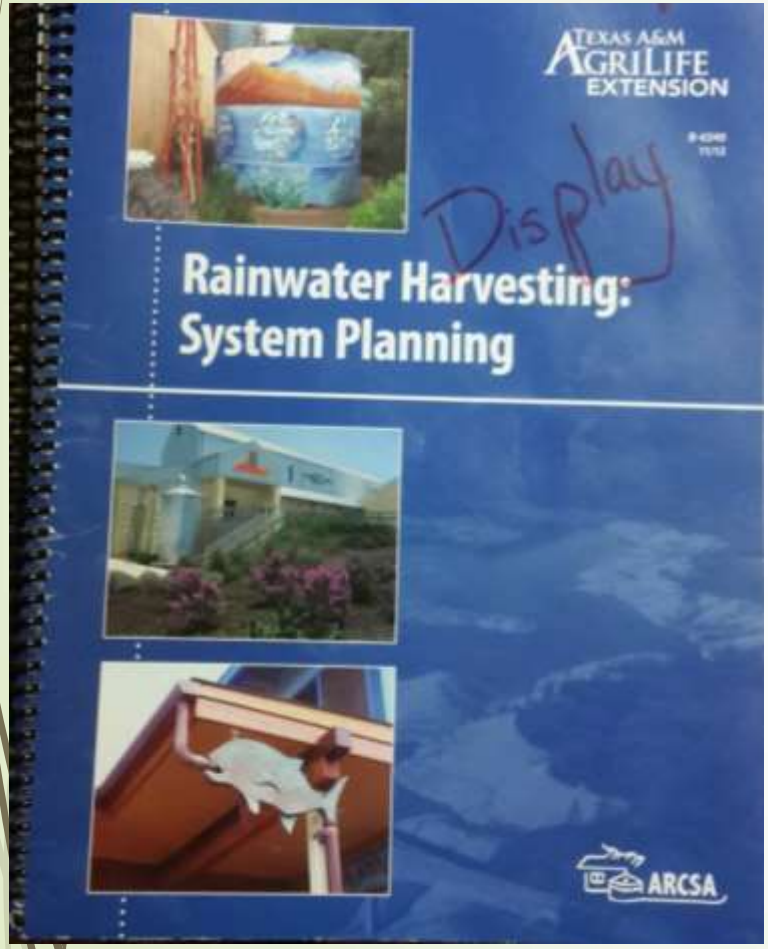
- Prevents homeowner associations from implementing new covenants banning outdoor water-conserving measures
  - Composting
  - Water efficient landscapes
  - Drip irrigation
  - Rainwater harvesting installations

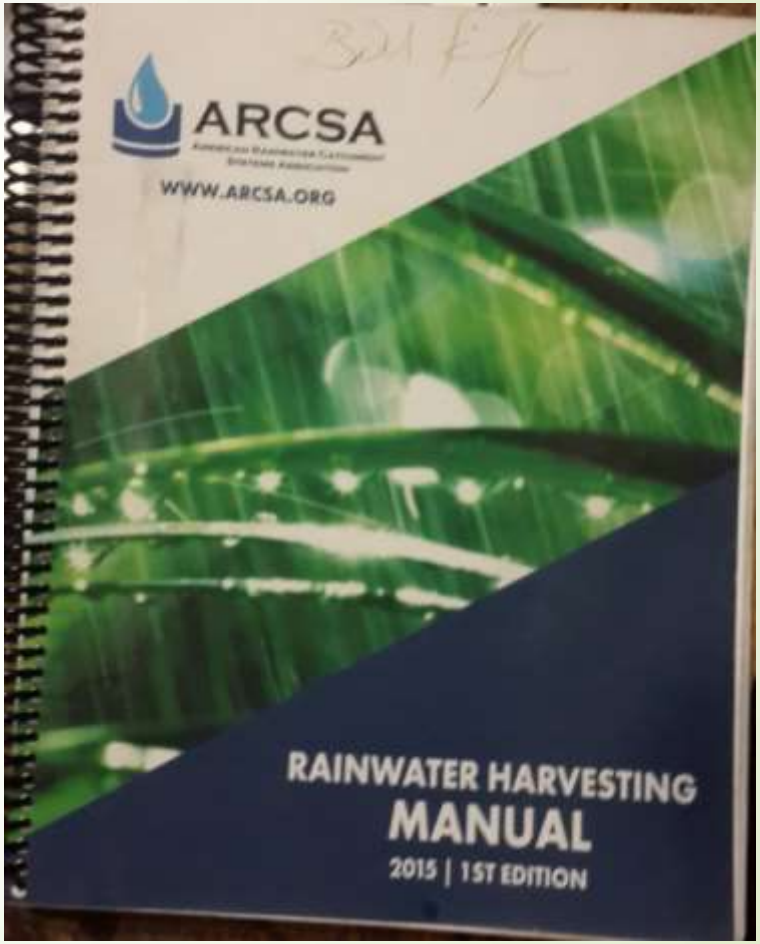
2011- H.B. No. 3372 / S.B. No. 1073

- (1) on-site reclaimed system technologies, including **rainwater harvesting**, condensate collection, or cooling tower blow down …….be incorporated into the design and construction of:
- (A)**each new state building with a roof measuring at least 10,000 square feet**;

Resources

- **ARCSA website www.arcsa.org**
- **Texas A&M University http://rainwaterharvesting.tamu.edu**
- **Texas Water Development Board http://www.twdb.texas.gov/**





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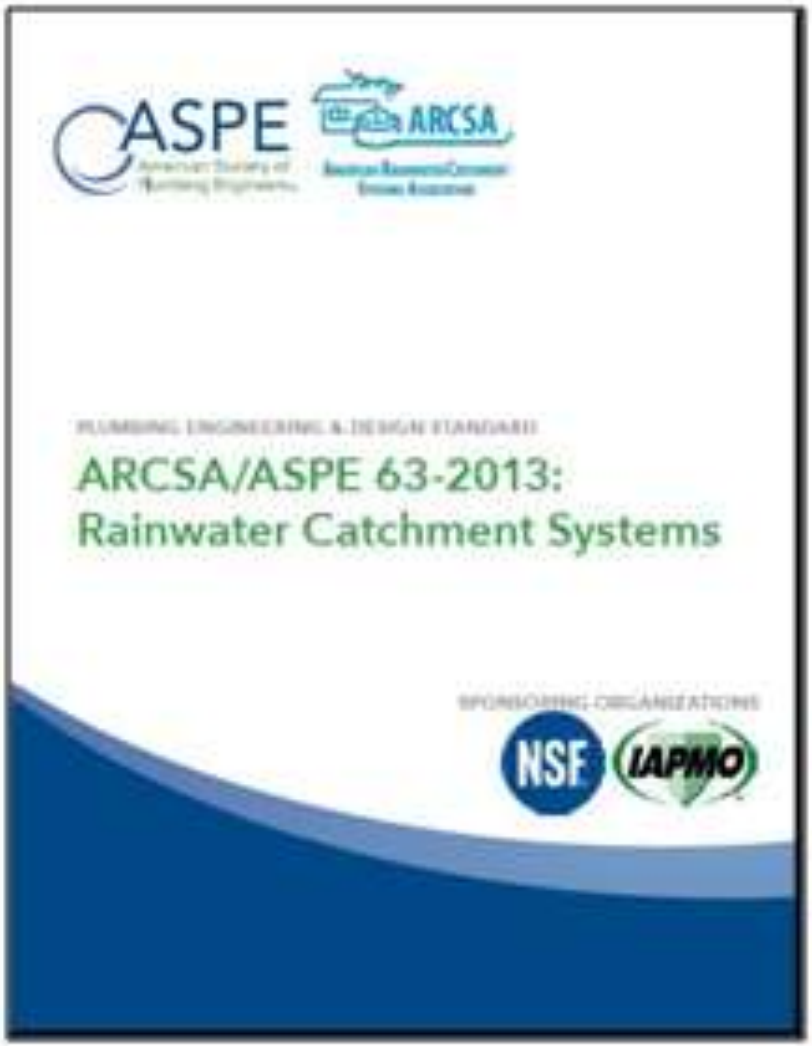
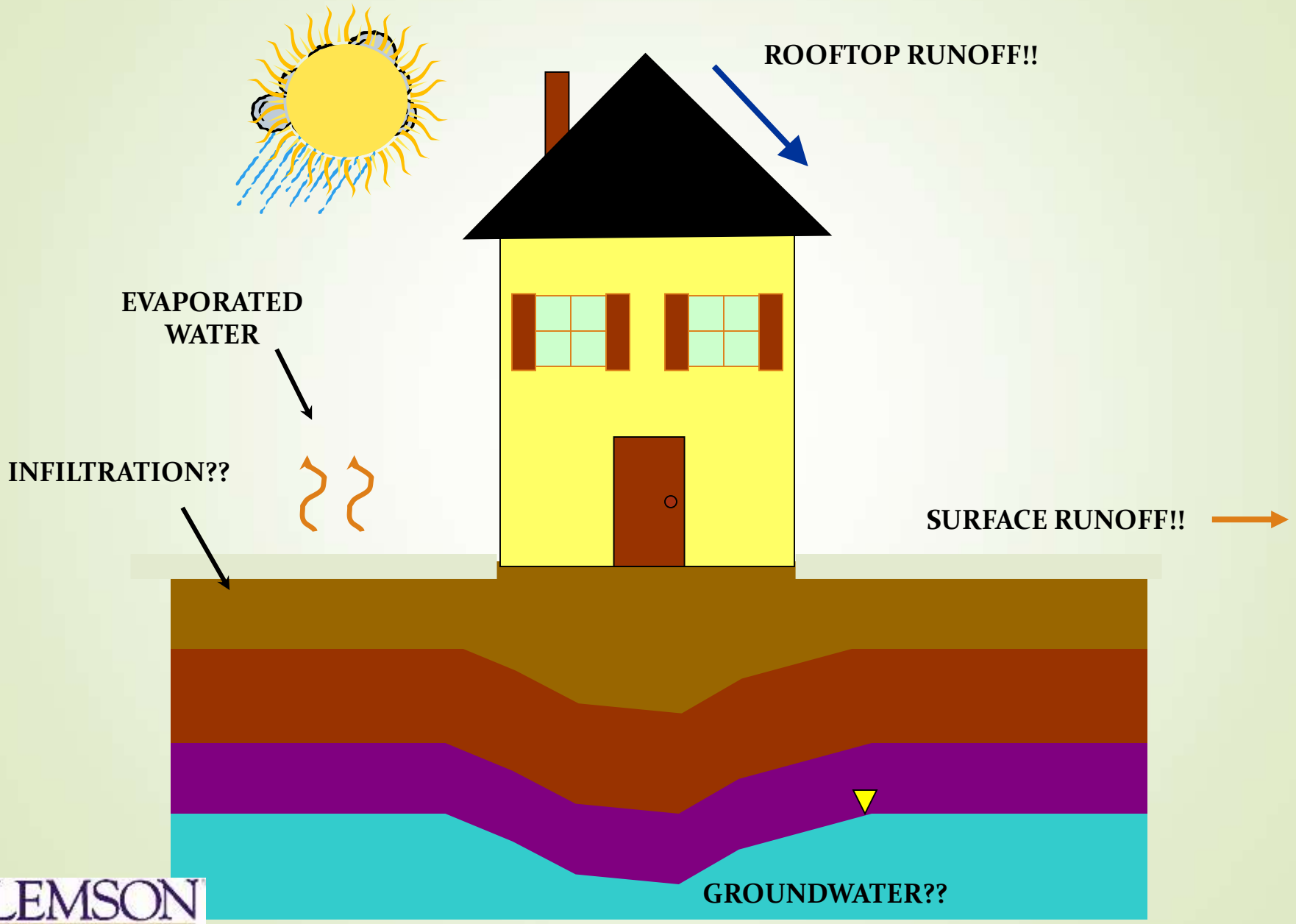
Now an ANSI Standard



Urban Water Budget – Pavement and Rooftop Scenario



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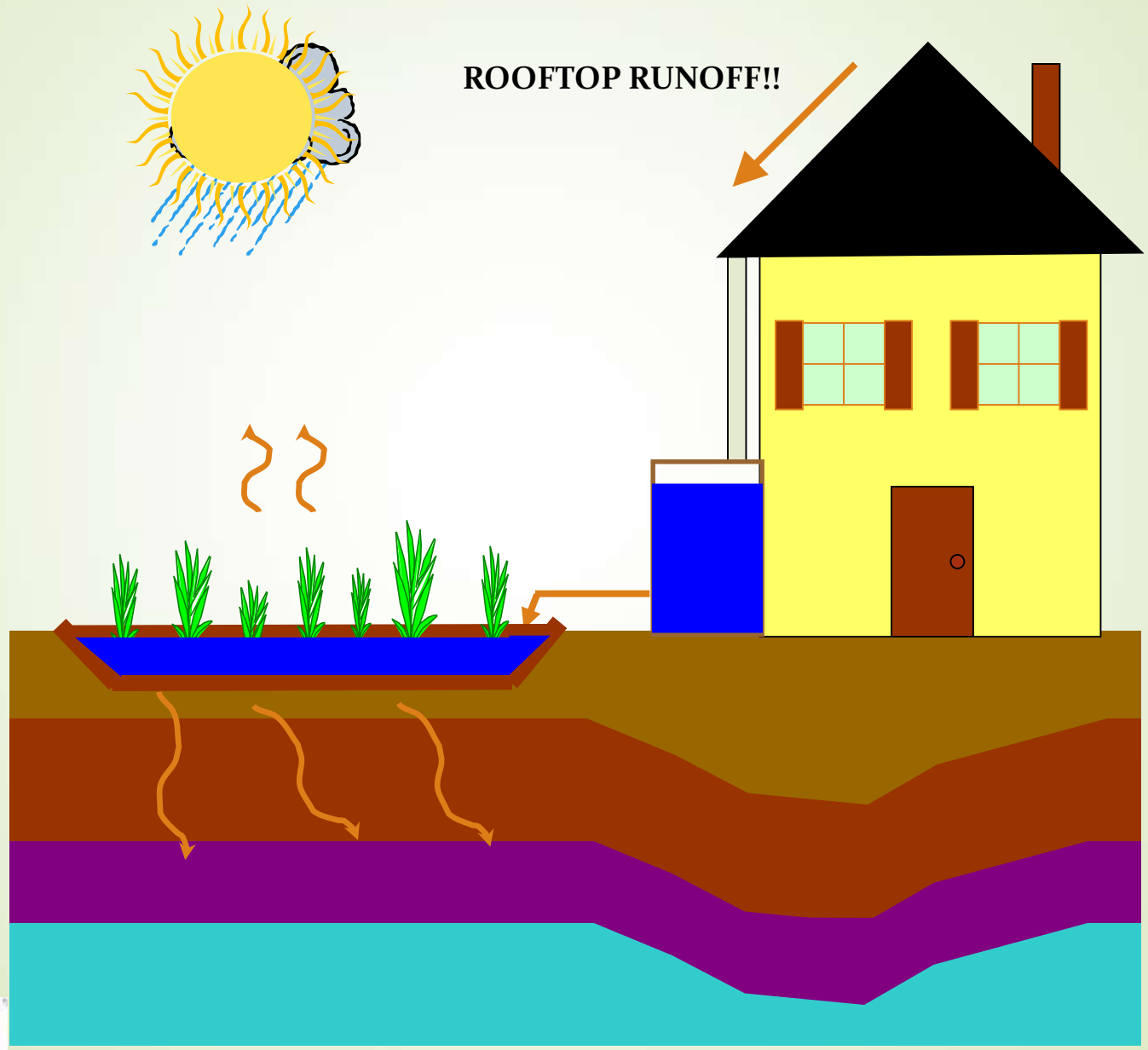
Urban Water Budget – Rainwater Harvesting Scenario



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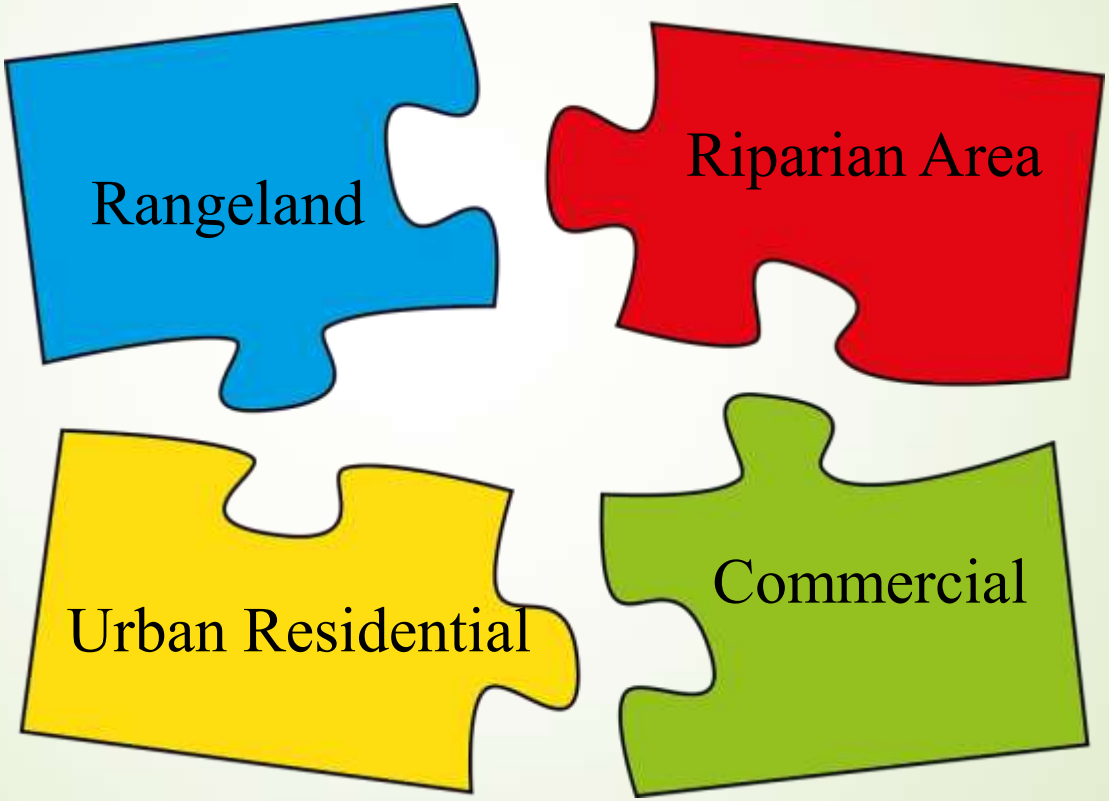
Each Piece of the Puzzle Is Important



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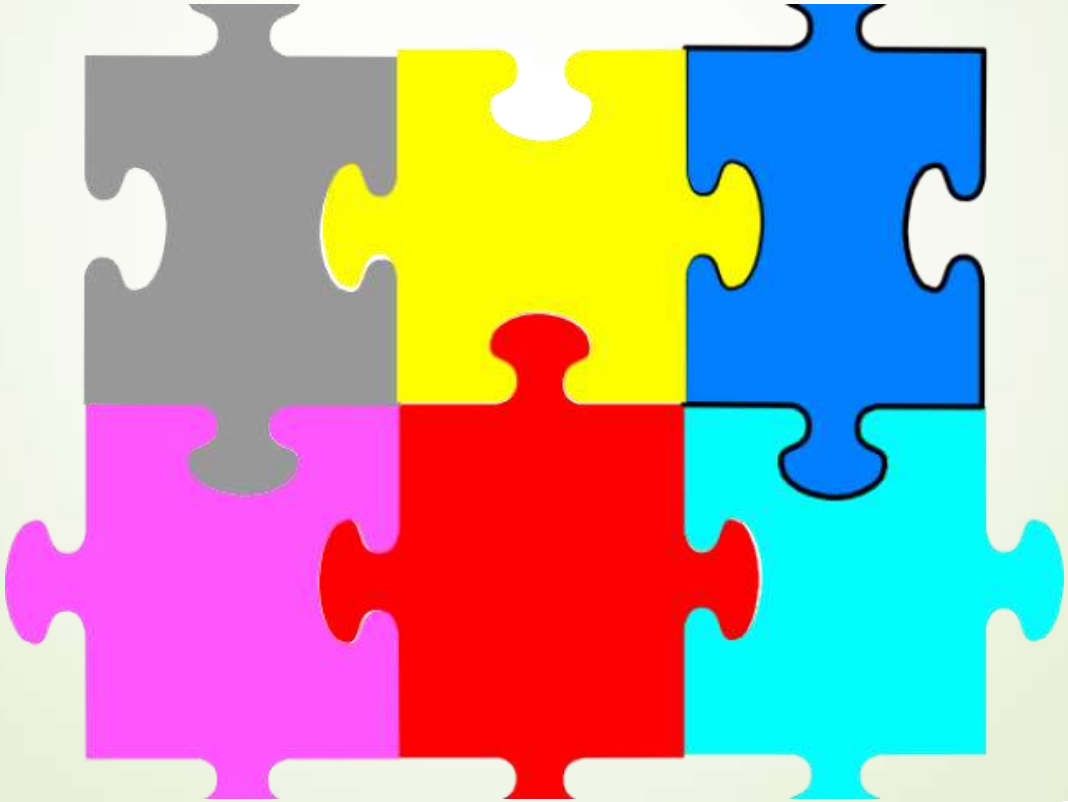
Managing Our Watershed and River Requires **TEAMWORK**



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Rainwater Harvesting

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