

# Harvesting the Rain:

## Why the Need for a National Standard

Presented by

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NEW YORK  
22-24  
MARCH  
2023

NEW YORK  
22-24  
MARCH  
2023



# Do we really need a design standard?





# Above Ground Water Storage





# Above Ground Water Storage



# Water Quality ??





# System Maintenance ??

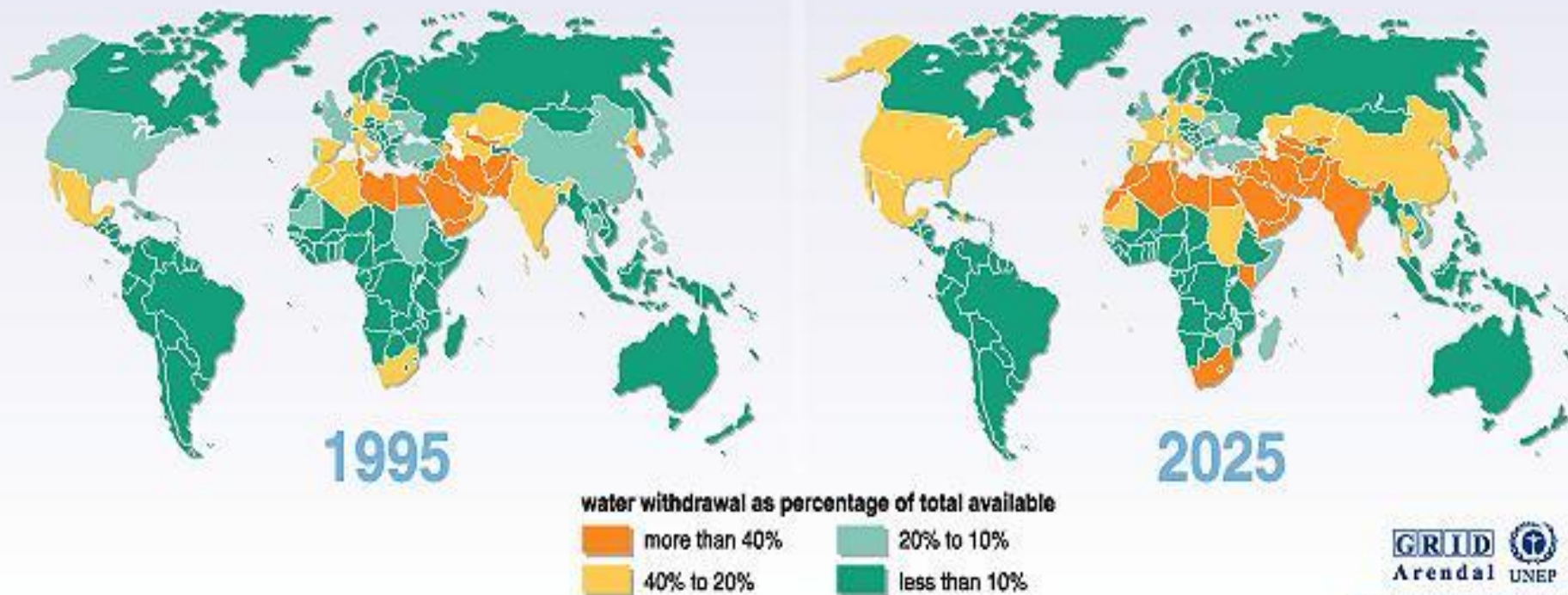


Rainwater collection system typical to Northern Kentucky



# Worldwide Water Shortage

## Freshwater stress



GRID  
Arendal UNEP

GRAPHIC DESIGN: PHILIPPE REKACEMCZ

Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

# Large Scale Rainwater Collection





# NATIONAL / INTERNATIONAL GUIDELINES

**WHO** – World Health Organization

**ERCSA** – European Rainwater Catchment System

**Australia** – Guidance on use of Rainwater Tanks

**Canada Mortgage & Housing Corporation** – Rainwater Harvesting

**India** – Bangalore Rainwater Club

**EPA** – Managing Wet Weather with Green Infrastructure

**USGBC** – LEED WE Credits

**ASLA** – Sustainable Sites

## The Texas Manual on Rainwater Harvesting

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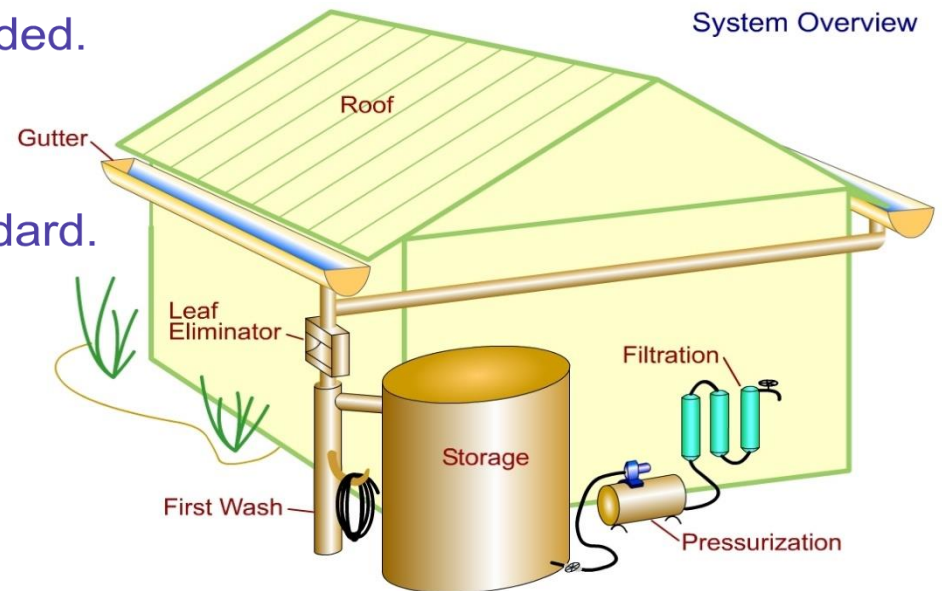


Texas Water Development Board

Third Edition

# Key Points for a Rainwater Standard

- Roof collection surfaces and Water Transport.
- Water Storage.
- Water Quality Management.
- Maintenance and Testing Recommended.
- Politics of developing a National Standard.





# Key Points for a Rainwater Standard

- Roof collection surfaces and Water Transport

# Roof Collection Surface

Naturally Cleanable

Non Toxic



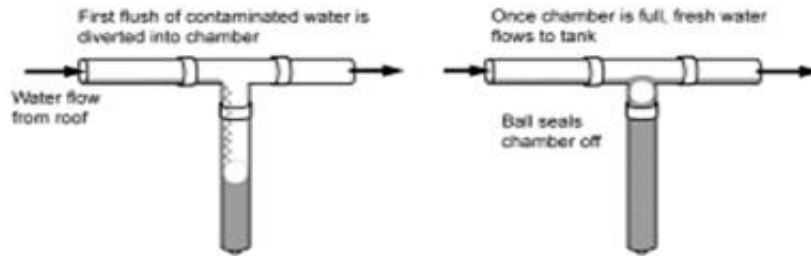
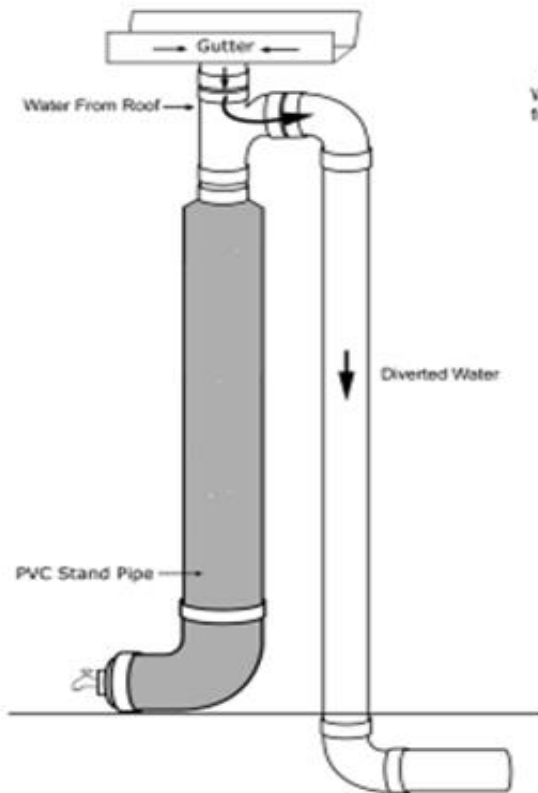


# Rainwater Pretreatment



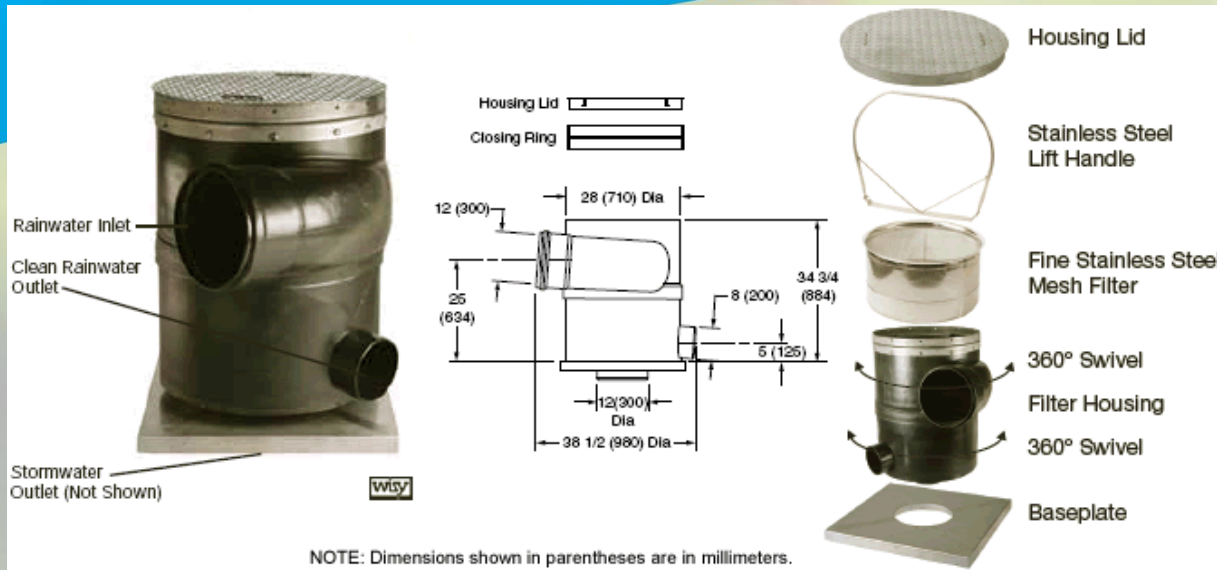
# Roof washer – cont.

## First Flush Diverters

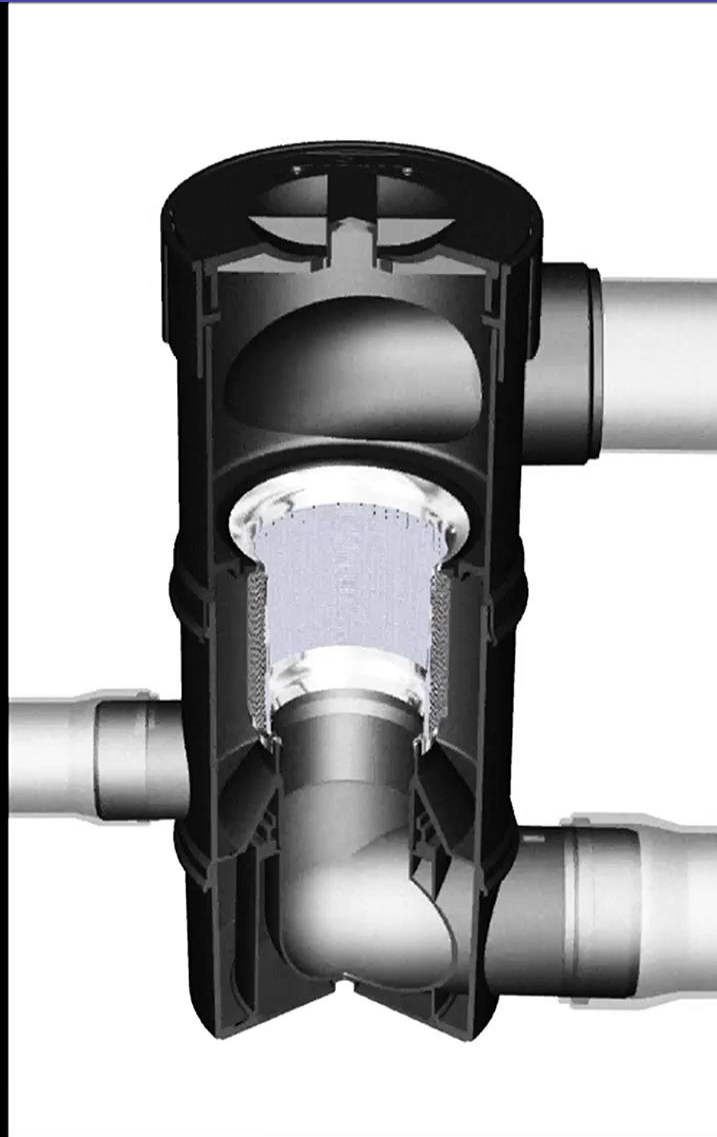




# Examples of RWH Pre-filtration



# Centrifugal Roof Washers





# Key Points for a Rainwater Standard

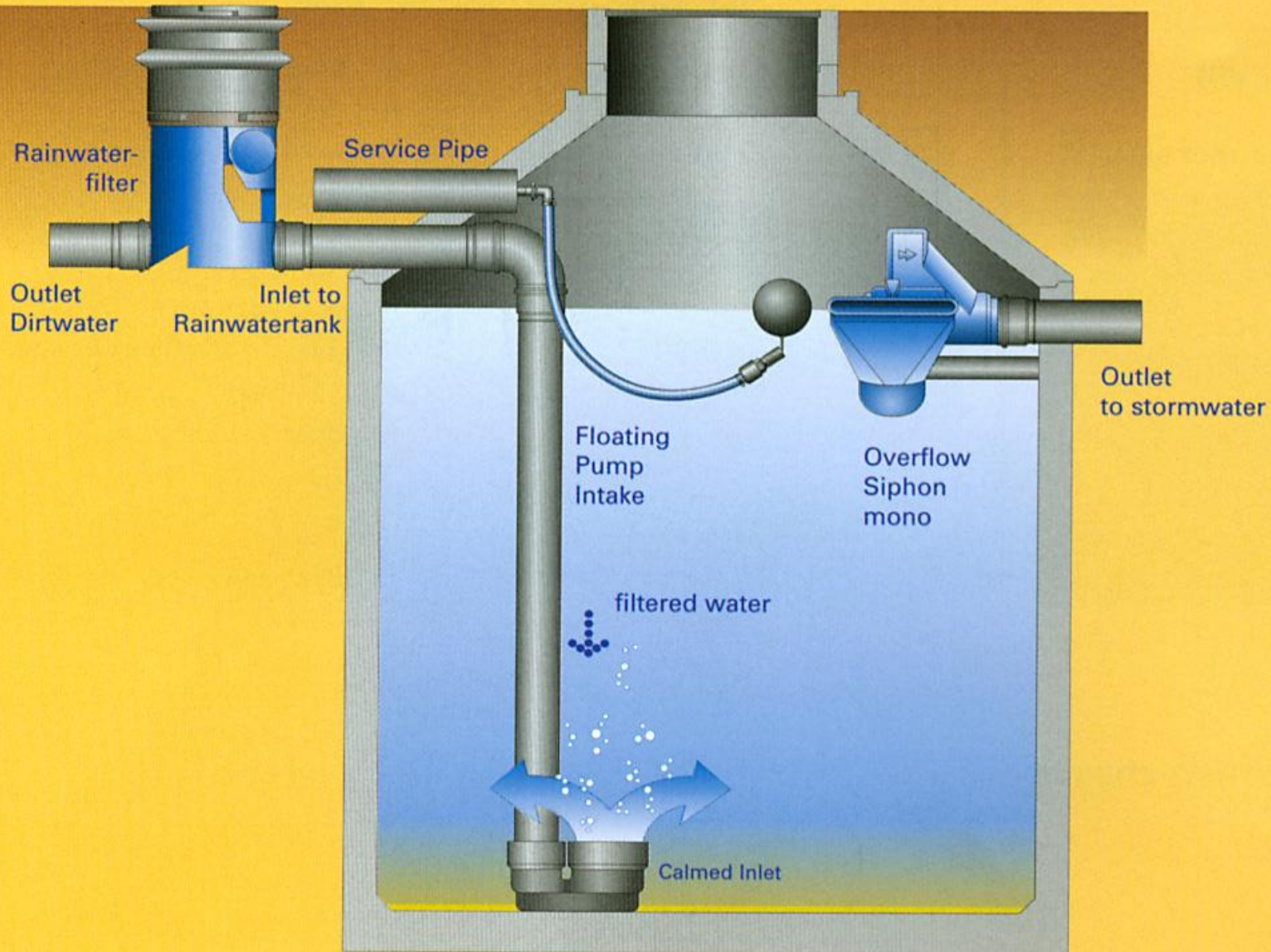
- Roof collection surfaces and Water Transport
- Water Storage

# Water Storage Cistern Types





# Calmed Inlet and Floating Valve Out-take

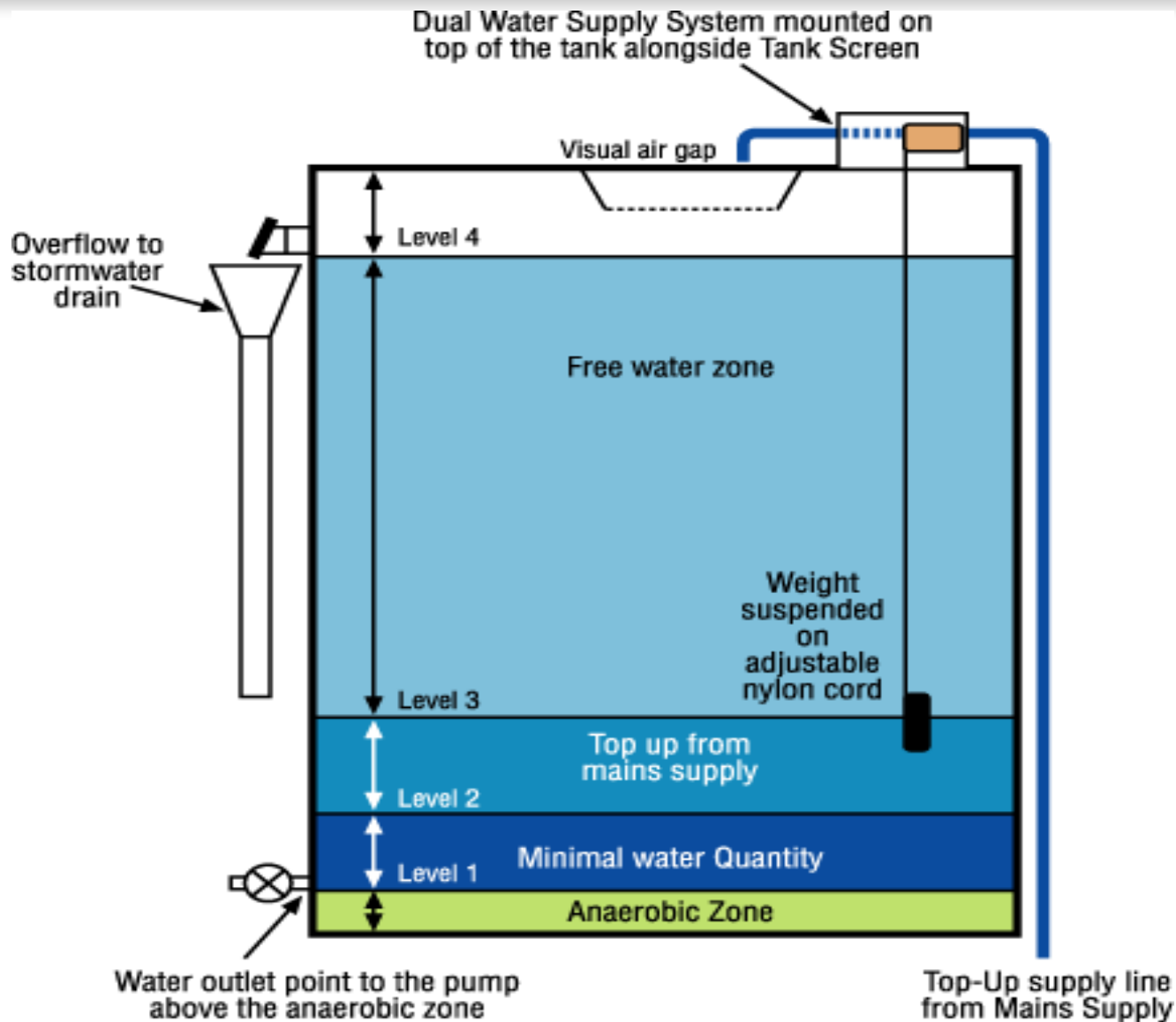


# “Tank Vacuum” Overflow





# Rain Harvesting Tank Top Up



# Underground RW Tank





# Key Points for a Rainwater Standard

- Roof collection surfaces and Water Transport
- Water Storage
- **Water Quality Management**

# Roof Water Quality Results: Tank In and Out

Item	Roof	Tank Surface	Tank Outlet	HWS
Fecal Coliforms (CFUs/100 ml)	113	119	0	0
Total Coliforms (CFUs/100 ml)	310	834	127	0
HPC (CFUs/ml)	1318	3256	351	3
Pseudomonas (CFUs/100 ml)	49,825	6,768	4,433	0
Ammonia (mg/L)	0.39	0.1	0.11	0.18
Nitrate (mg/L)	0.25	0.06	<0.05	<0.05
Lead (mg/L)	0.015	<0.01	<0.01	<0.01
Zinc (mg/L)	0.55	0.25	0.17	0.15

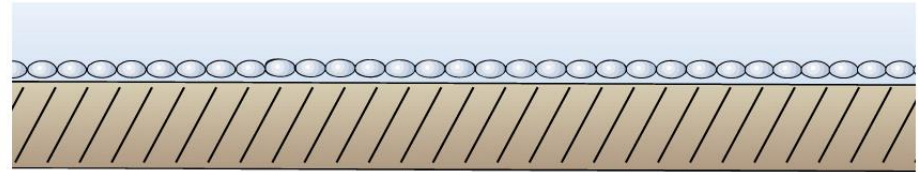


# Biofilms in rainwater storages

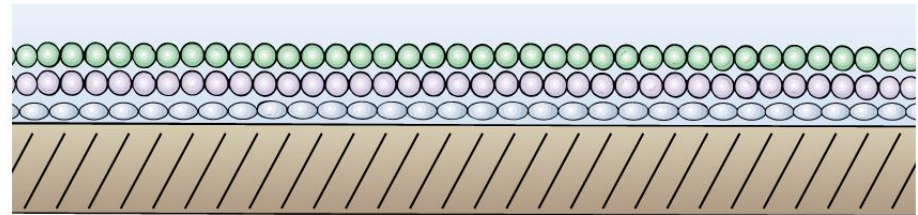
## Growth of Biofilms

- a) Initial colonisation by single type of bacterium
- b) Development of more complex layers with multiple bacteria
- c) Mature bio-film with cell aggregates, interstitial pores and conduits

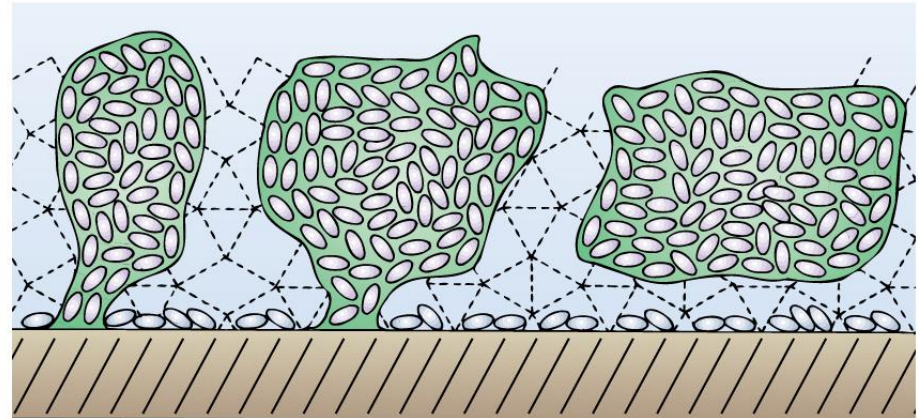
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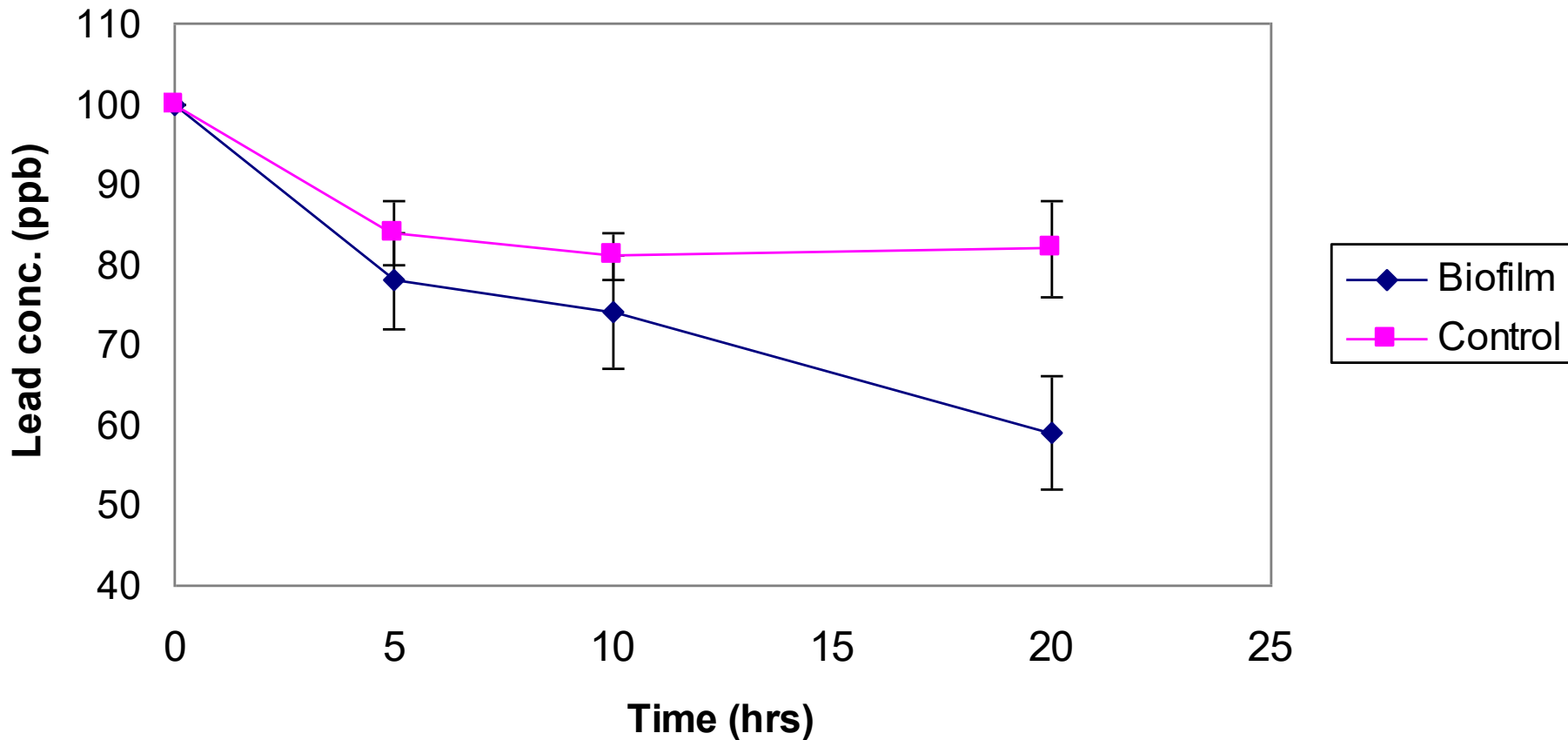
(a)



(b)

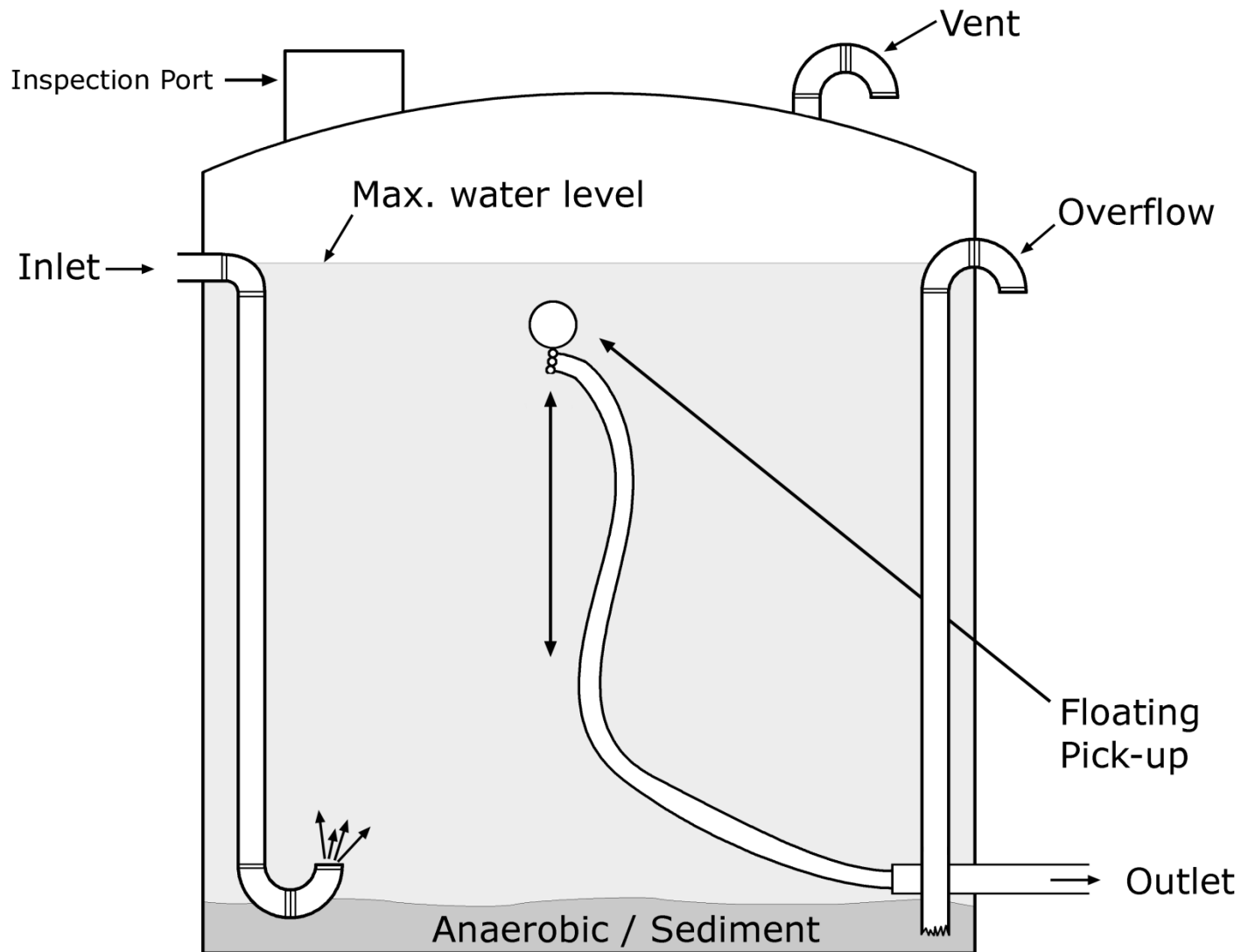


# Pb<sup>2+</sup> uptake by in-vitro cultivated bio-film





# Cistern Design Schematic



The patented  
**WISY Floating Suction Filters**



Engineering with nature

available with fine or coarse filters, in different sizes  
with different hose connections also connectable to  
WISY's flexible hoses

Floating Suction **Fine** Filter

**S A F F**



normal size



Up to 2" intake

Floating Suction **Coarse** Filter

**S A G F**



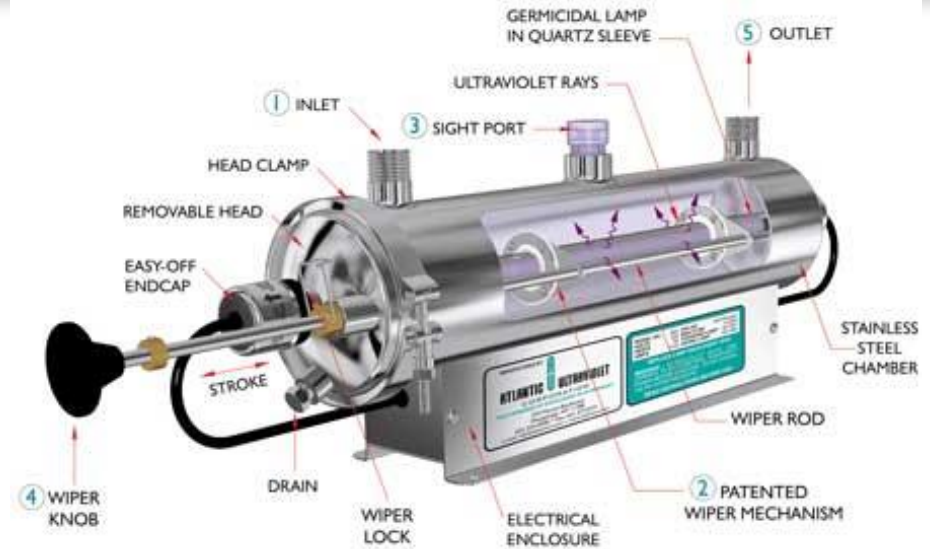
for pre-filtered  
water



# Tank Water Quality : At Various Elevations in Tank

Location or Criteria	FC (CFU/100 ml)	TC (CFU/100 ml)	Pseudomonas Spp. (CFU/100 ml)	Heterotrophic plate count (CFU/ml)
Surface	108	1,050	3,100	1,050
Mid depth	34	900	780	427
Bottom	55	862	4,060	1,252
Cold tap	<1	200	412	76
Hot tap	0	2	<1	<1
Guideline	0	0	NA	200

# Small to Medium Sized Projects



## Ultraviolet Water Sanitizing Stations

# Large Scale Water Treatment





# Key Points for a Rainwater Standard

- Roof collection surfaces and Water Transport
- Water Storage
- Water Quality Management
- **Maintenance and Testing Recommended**

# Stored Water Standards: ARCSEA

Water quality test.

1. The quality of the water for the intended applications shall be verified at the point of use in accordance with the requirements of the jurisdiction following requirements.
2. Non-potable water shall be tested every 12 months. Potable water shall be tested every 3 months.
3. If the tested water does not meet the requirements of Table 707.13.10, then the rainwater collection system shall be emptied, cleaned and re-commissioned.

Parameter	Intended End-Use Quality Level	
	Non Potable <sup>a</sup>	Potable <sup>b</sup>
<b><u>Escherichia coli (E. coli)</u></b>	<b>&lt; 100 CFU / 100 ml</b>	<b>None Detected</b>
<b>Protozoan Cysts</b>	<b>&lt; 10 cysts / 100 ml</b>	<b>None Detected</b>
<b>Viruses</b>	<b>—</b>	<b>None Detected</b>
<b>Heterotrophic Plate Count (HPC)</b>	<b>—</b>	<b>Less than 500 CFU/ml</b>
<b>Turbidity</b>	<b>&lt; 10 NTU</b>	<b>&lt; 0.3 NTU</b>

<sup>a</sup> Suitable for toilet and urinal flushing, washing machine makeup, and other approved applications in occupied space for environments with non health impaired occupants.

<sup>b</sup> Potable water standards meet the U.S. Environmental Protection Agency's drinking water standard for pathogens.

**Note: Monitoring requirements vary greatly from state to state. Consult state and local guidelines for monitoring requirements.**



# Point of Use Non- Potable Water Standards: Uniform Plumbing Code Green Plumbing Supplement

## 505.9.4 Minimum Water Quality.

1. The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the public Authority Having Jurisdiction.
2. In the absence of water quality requirements determined by the Authority Having Jurisdiction, the minimum treatment and water quality shall also comply with Table 505.9.4

Application	Minimum Treatment	Minimum Water Quality
<u>Car washing</u>	<ul style="list-style-type: none"> <li>• <u>Debris excluder or other approved means in compliance with Section 505.9.10.</u></li> <li>• <u>100 Micron (100 µm) in compliance with Section 505.9.11 for drip irrigation.</u></li> </ul>	N/A
<u>Subsurface and drip irrigation</u>	<ul style="list-style-type: none"> <li>• <u>Debris excluder or other approved means in compliance with Section 505.9.10.</u></li> <li>• <u>100 Micron (100 µm) in compliance with Section 505.9.11 for drip irrigation.</u></li> </ul>	N/A
<u>Spray irrigation where the maximum storage volume is less than 360 gallons (1363 L)</u>	<ul style="list-style-type: none"> <li>• <u>Debris excluder or other approved means in compliance with Section 505.9.10.</u></li> <li>• <u>Disinfection in accordance with Section 505.9.8.</u></li> </ul>	N/A
<u>Spray irrigation where the maximum storage volume is equal to or greater than 360 gallons (1363 L)</u>	<ul style="list-style-type: none"> <li>• <u>Debris excluder or other approved means in compliance with Section 505.9.10.</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Escherichia coli: &lt; 100 CFU/100 mL</u></li> <li>• <u>Turbidity: &lt; 10 NTU</u></li> </ul>
<u>Urinal and water closet flushing, clothes washing, and trap priming</u>	<ul style="list-style-type: none"> <li>• <u>Debris excluder or other approved means in compliance with Section 505.9.10.</u></li> <li>• <u>100 Micron (100 µm) in compliance with Section 505.9.11.</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Escherichia coli: &lt; 100 CFU/100 mL</u></li> <li>• <u>Turbidity: &lt; 10 NTU</u></li> </ul>
<u>Ornamental fountains and other water features</u>	<ul style="list-style-type: none"> <li>• <u>Debris excluder or other approved means in compliance with Section 505.9.10.</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Escherichia coli: &lt; 100 CFU/100 mL</u></li> <li>• <u>Turbidity: &lt; 10 NTU</u></li> </ul>
<u>Cooling tower make up water</u>	<ul style="list-style-type: none"> <li>• <u>Debris excluder or other approved means in compliance with Section</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Escherichia coli: &lt; 100 CFU/100 mL</u></li> </ul>



# Point of Use Water Standards Testing Requirements

## 4.10.2 Water Quality Maintenance

a. The quality of the water for the intended application shall be verified at the point of use in accordance with the minimum requirements of Table 4.1, complying with the testing procedures set forth in the Standard Methods for the Examination of Water and Wastewater.

b. Non-potable water shall be tested every 12 months. Potable water shall be tested every three months. If *Legionella pneumophila* is detectable in amounts greater than 10 CFU/ml at the point of use, appropriate disinfection will be required.

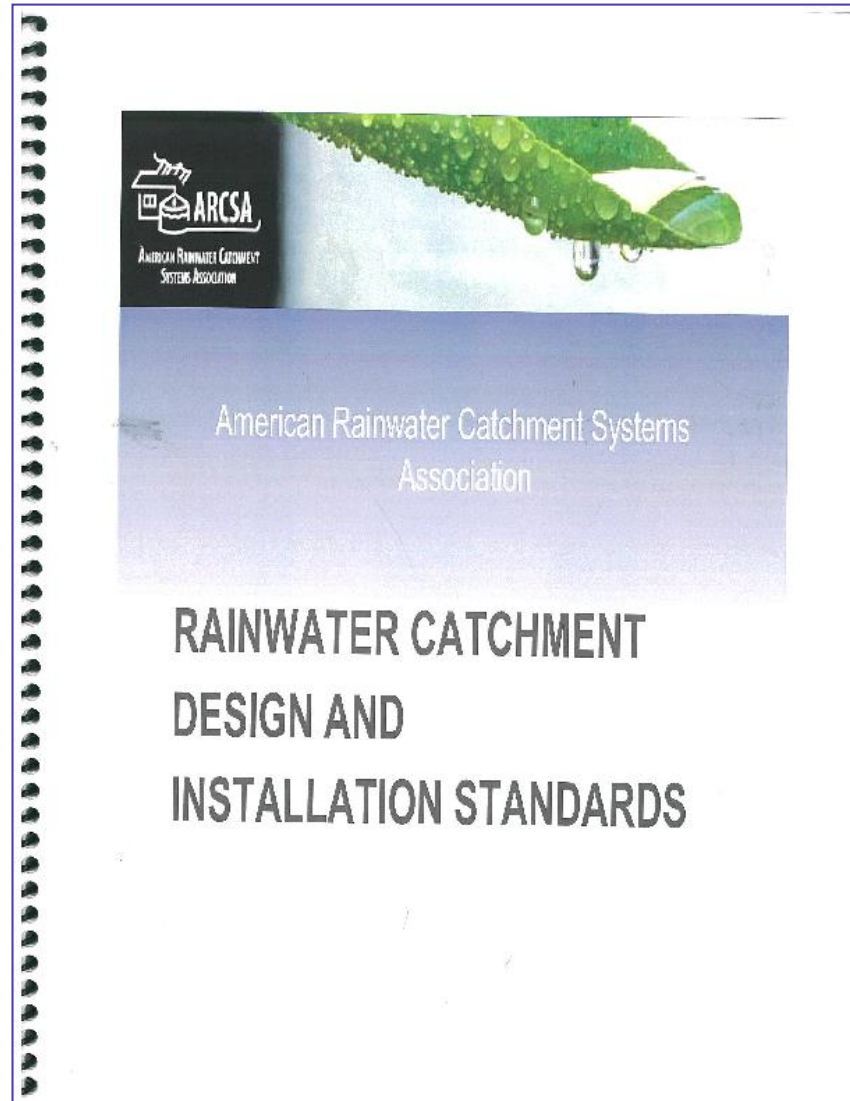
c. Maintenance: Non-Potable

(1) Non-potable water shall not be applied aboveground in a spray application (irrigation, powerwash, etc.) without appropriate disinfection for airborne bacteria.



# Politics

# First National Rainwater Design “Guideline”





# American National Standard



# Stormwater Standard

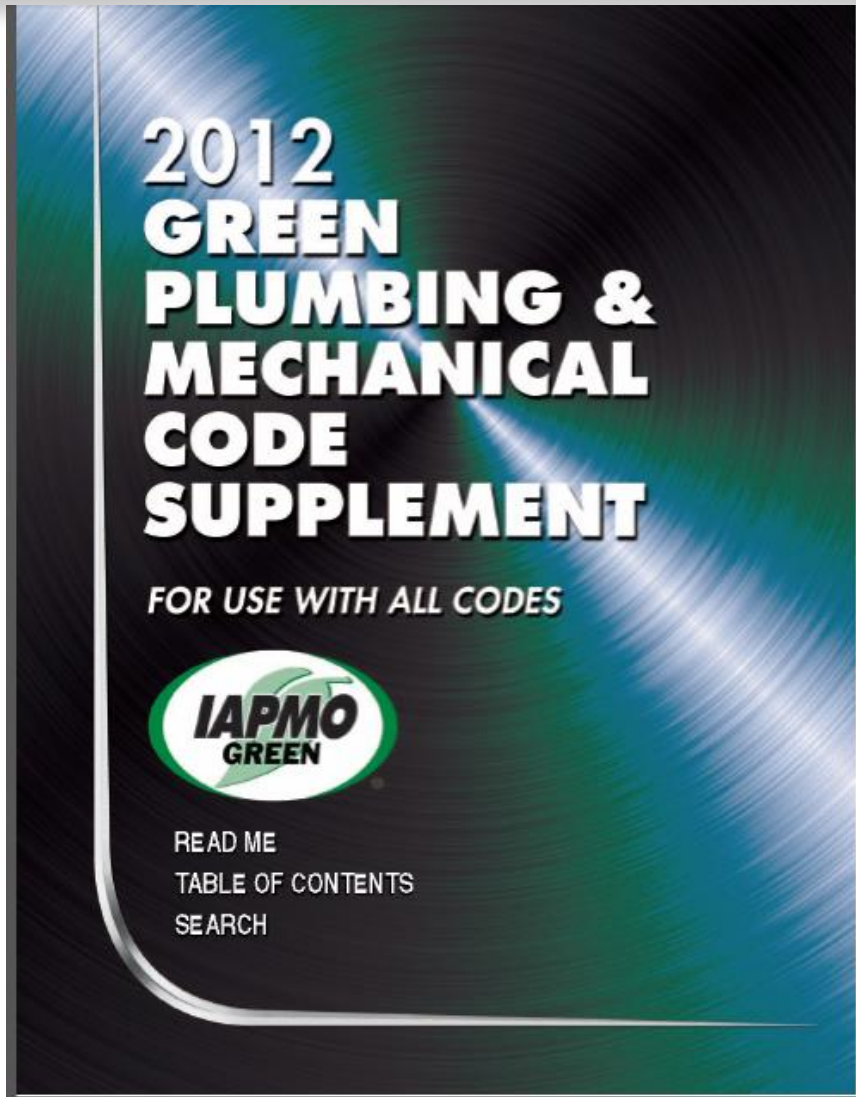


PLUMBING ENGINEERING & DESIGN STANDARD

## ARCSA/ASPE/ANSI 78-2015: Stormwater Harvesting System Design for Direct End-Use Applications




# Progress Made




**2012  
GREEN  
PLUMBING &  
MECHANICAL  
CODE  
SUPPLEMENT**


*FOR USE WITH ALL CODES*



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PUBLIC VERSION 1.0, MARCH 2010

- ASHRAE/USGBC/IES STANDARD 189.1-2009  
STANDARD FOR THE DESIGN OF HIGH-PERFORMANCE GREEN BUILDINGS -  
A JURISDICTIONAL COMPLIANCE OPTION OF THE IGCC
- ICC® 700-2008 NATIONAL GREEN BUILDING STANDARD™ -  
FOR RESIDENTIAL OCCUPANCIES *(by reference)*



ASHRAE THE AMERICAN INSTITUTE OF ARCHITECTS  
IES LEED ICC



# In Summary

# Do we really need a design standard?



# Do we really need a design standard?



PLUMBING ENGINEERING & DESIGN STANDARD

## ARCSA/ASPE/ANSI 63-2013: Rainwater Catchment Systems

SPONSORING  
ORGANIZATIONS





# Where Standards were applied



: Library, Bertrum, TX



artist of kids n rain.JPG

# Questions ??



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[www.IRHA-h2o.org](http://www.IRHA-h2o.org)

