

# Innovative Technologies Rainwater Harvesting Workshop

April 25, 2012

Green Partnership for Greater Cincinnati  
Greater Cincinnati Foundation  
City of Cincinnati



# Code Changes Harvesting Rainwater Cincinnati's Approach...

Stewardship

Leadership

Collaboration

# Our road to success...

A City Ordinance

Focus on a pilot project

Define Agencies Having Jurisdiction

Assess and address all concerns

Research best practices and applicable standards

Apply a national standard code

Craft language for the agencies' and community's needs

# Cincinnati's vision.... Build Greener Buildings



## INNOVATIVE WASTEWATER TECHNOLOGIES

	NC	SCHOOLS	CS
Credit	WE Credit 2	WE Credit 2	WE Credit 2
Points	2 points	2 points	2 points

Reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures (e.g., water closets, urinals) or nonpotable water (e.g., captured rainwater, recycled graywater, on-site or municipally treated wastewater).

### Requirements

#### NC, SCHOOLS & CS

##### OPTION 1

Reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures (e.g., water closets, urinals) or nonpotable water (e.g., captured rainwater, recycled graywater, on-site or municipally treated wastewater).

# Initial Stages...

April, 2011 Resolution

Supported by the Greater Cincinnati Foundation



## Resolution 2011-01

Creation of a GPGC Rain Water Harvesting Task Force

– and –

Approval to seek funding



WHEREAS, The Green Partnership for Greater Cincinnati ("GPGC") is a collaboration of six local institutions ("Partners") to promote sustainable practices for the individual institutions and to promote programs that have the support of all Partners and that benefit our community;

AND WHEREAS, Storm water issues, specifically Combined Sewer Overflow issues, are of significant concern to our community and some of the Partners;



AND WHEREAS, Utility costs, specifically water and sewer related expenses for the Partners' facilities, can affect the operational costs for each of the Partners;



AND WHEREAS, It has been reported to the Steering Committee of the GPGC that environmental benefits and utility cost savings have been achieved in other United States' communities by the application of Rain Water Harvesting ("RWH") for non-potable use (toilet flushing, for instance);



AND WHEREAS, It has been reported to the Steering Committee of the GPGC that obstacles currently existing within our community that preclude the Partners and other members of the community from implementing RWH techniques;



AND WHEREAS, A Partner, Cincinnati Public Schools, has requested the assistance of the GPGC to facilitate the removal of such obstacles so that the RWH system originally planned for Dater Montessori made be connected;



# Initial Stages...

April, 2011 Resolution

Supported by the Greater Cincinnati Foundation

City motion to investigate codes

City of Cincinnati



Roxanne Qualls  
Councilmember

201100661

April 26, 2011

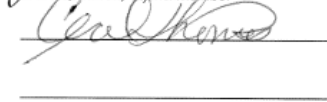
### MOTION

We move that the administration report to council within 30 days on what changes need to be made to the building/municipal code and any other city regulations to enable rainwater harvesting in Cincinnati, and to prepare the necessary ordinances. Current codes and regulations do not adequately address rainwater harvesting; as a result, the city does not have a clear permitting process for rainwater harvesting systems.

  
Roxanne Qualls, Vice Mayor

  
Laure Quinlivan, Councilmember





### STATEMENT

Cincinnati has the fifth highest volume of combined sewer overflow (CSO) in the nation, which has affected water quality in Mill Creek, the Little Miami River, the Great Miami River, the Ohio River and many tributaries. The Metropolitan Sewer District (MSD) must meet the requirements of a federal mandate, or Consent Decree, to reduce CSOs and eliminate sanitary sewer overflows (SSOs). Project Groundwork, MSD's program for meeting the Consent Decree, is the biggest public works program ever undertaken in Hamilton County. As part of Project Groundwork, MSD is evaluating the effectiveness of smaller-scale, sustainable stormwater controls, including rainwater harvesting, that could replace or supplement traditional stormwater management practices.

The United States uses more water per capita than any other country. However, recent sustained droughts in the Southeast and Southwest, and predictions for imminent water shortages because of population growth and the impact of climate change, have driven state and local governments to look at



# Initial Stages...

## April, 2011 Resolution

Supported by the Greater Cincinnati Foundation

City motion to investigate codes

## Formation of Task Force

- 37 Members representing 18 Departments & Agencies
- Meetings began in June 2011
- Started with a pilot project



### Rain Water Harvesting Task Force

Version: 7/11/2011

#### Background

In the fall of 2009, the GPGC Steering Committee discussed potential projects that could be undertaken during 2010. One such project is rain water harvesting. Most of the Partners have attempted to implement rainwater capturing and reuse for non-potable applications. These attempts were not successful due to impediments within the existing regulatory process. It was concluded that members of the Steering Committee should investigate the viability of the GPGC undertaking a leadership position on this subject during 2010.

During 2010, multiple meetings have occurred with a variety of organizations both within the GPGC Partner organizations and with other organizations that have valuable knowledge on the subject.

At the October, 2010 GPGC Steering Committee Meeting, it was agreed to form a GPGC Task Force regarding rain water harvesting and reuse for non-potable applications. It was also agreed to have the Task Force focus on a specific project to achieve definable outcomes quicker. One of the Partners, Cincinnati Public Schools, requested assistance of the GPGC regarding a rain water system at Dater Montessori. It was discussed and agreed that this opportunity provided an ideal Project for the Task Force.

It was concluded in later Steering Committee Meetings that this project would receive proper attention if the Project Team could be professionally facilitated and include a consultant who could bring national best practices for consideration. A grant request was submitted to the Greater Cincinnati Foundation to underwrite the meeting facilitation and consultations for the GPGC, and a grant was awarded by the GCF to the GPGC received in April, 2011.

#### Task Force Project

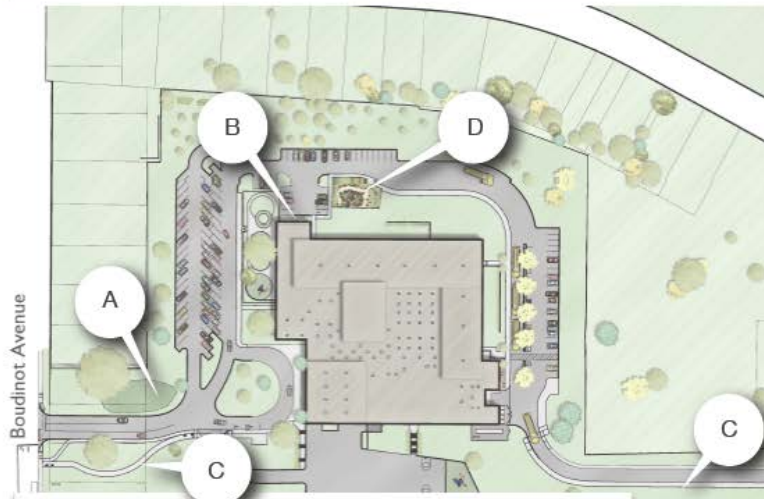
The Project is to connect an existing rain water harvesting and reuse system at Cincinnati Public Schools' Dater Montessori School. This system has been constructed yet is neither connected to the plumbing systems nor is it operational. This Project provides a specific, focused, tangible, and definable opportunity for the Task Force. Should the Task Force be successful in developing an acceptable process by which this system can be connected and used, there will be direct benefits for most every Partner of the GPGC. Also, it is likely that an additional result of this Project will be developing a successful regulatory process such that other, similar systems can be constructed in the future.



THE GREEN PARTNERSHIP FOR GREATER CINCINNATI | PO Box 30093, Cincinnati, OH 45220 | [green@theacraff.com](mailto:green@theacraff.com)

# Cincinnati's vision for using rainwater inside a building....

## Dater Montessori School



**Congratulations!**

Your renovated school building has been designed to meet LEED Silver Certification (pending). The renovation included adding wall and ceiling insulation, completely new mechanical, electrical, plumbing and control systems to provide state of the art energy efficiency.

### SITE

The site has been designed to include transportation via bus and bikes, low-emitting and fuel efficient vehicle parking spaces, dark-sky compliant light fixtures and of course, space for the "Meadow Maze", water efficient landscaping.



Constructed in 1966 your renovated school has been rebuilt with sustainable, green features!



A

Storm water detention swale for controlling storm water runoff and to reduce storm water sent to rivers and streams.



B

Rain barrels hold rainwater collected from the roof. Use rainwater instead of city water to water your gardens!



C

Bikers can now use bike lanes and bike racks. More bikers means less car and bus pollution.



# Rainwater Harvesting Task Force Subcommittee...

Specific Departments and Agencies have authority to make decisions and standards for the community...



## Rainwater Harvesting Task Force Goals...

Permit Dater Montessori School

Develop standards for others to follow in Cincinnati

Amend City Plumbing Code

Coordinate the findings for others in GCWW / MSD service area

# Significant Concerns...

Jurisdiction for Water Quality

Backflow Prevention Standard

Model Code

# Which agency has jurisdiction in Cincinnati?

Conflicting responsibility:  
OEPA and GCWW

- OAC 3745-95-02:

*Solution must be approved by  
GCWW and OEPA*

- ORC 6109.13:

*Solution must be approved by  
OEPA*



GREATER CINCINNATI  
WATER WORKS

# Jurisdiction RESOLVED

Dec. 2011

OEPA Confirmed GCWW has jurisdiction for:

- Non-potable use
- Water quality standards
- Protecting the public water supply



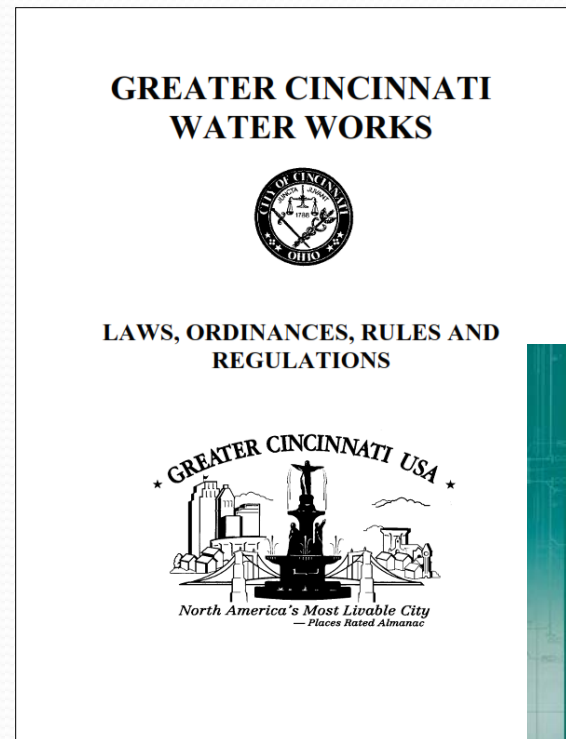


# Backflow preventers RESOLVED

GCWW Rules details  
procedure and  
application

Planning Department,  
Plumbing Inspections  
confirms OPC Standard

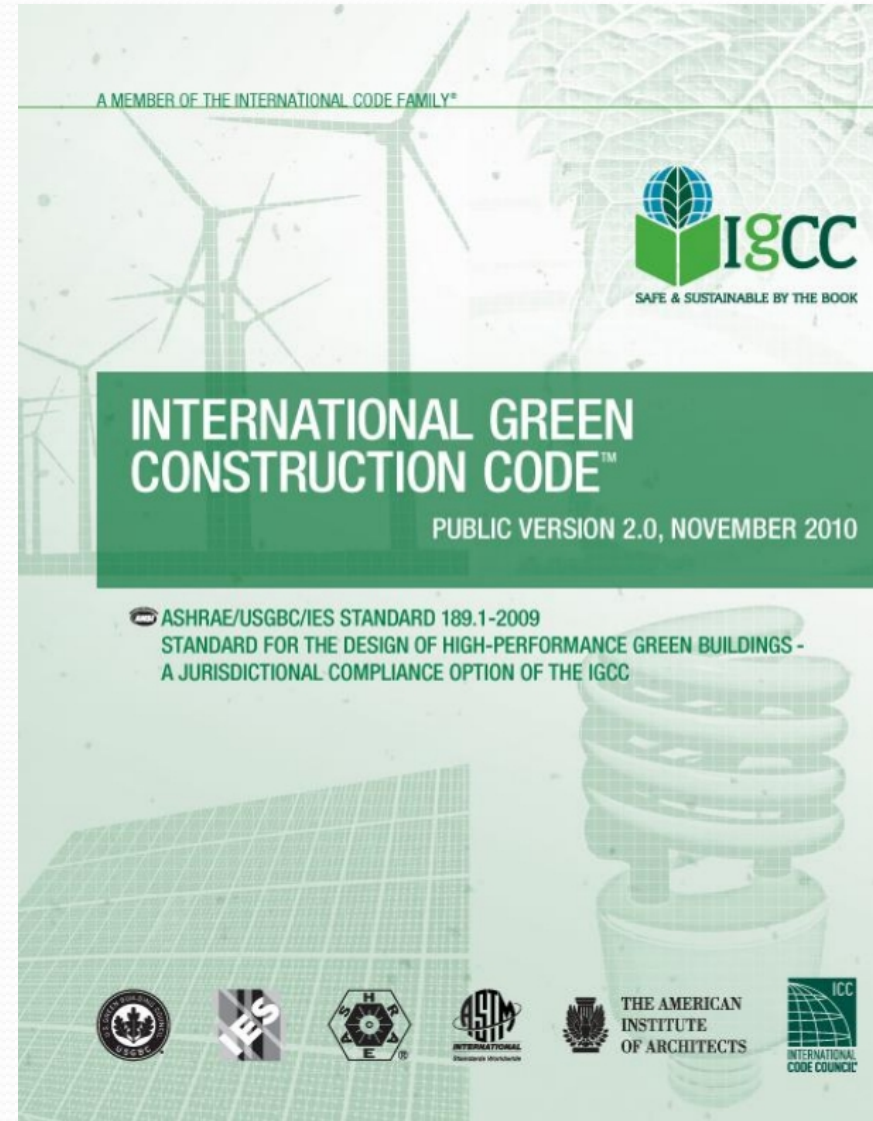
- Existing standards are acceptable
- No significant modification is needed



## Model Code needed...

A national standard model code is expected

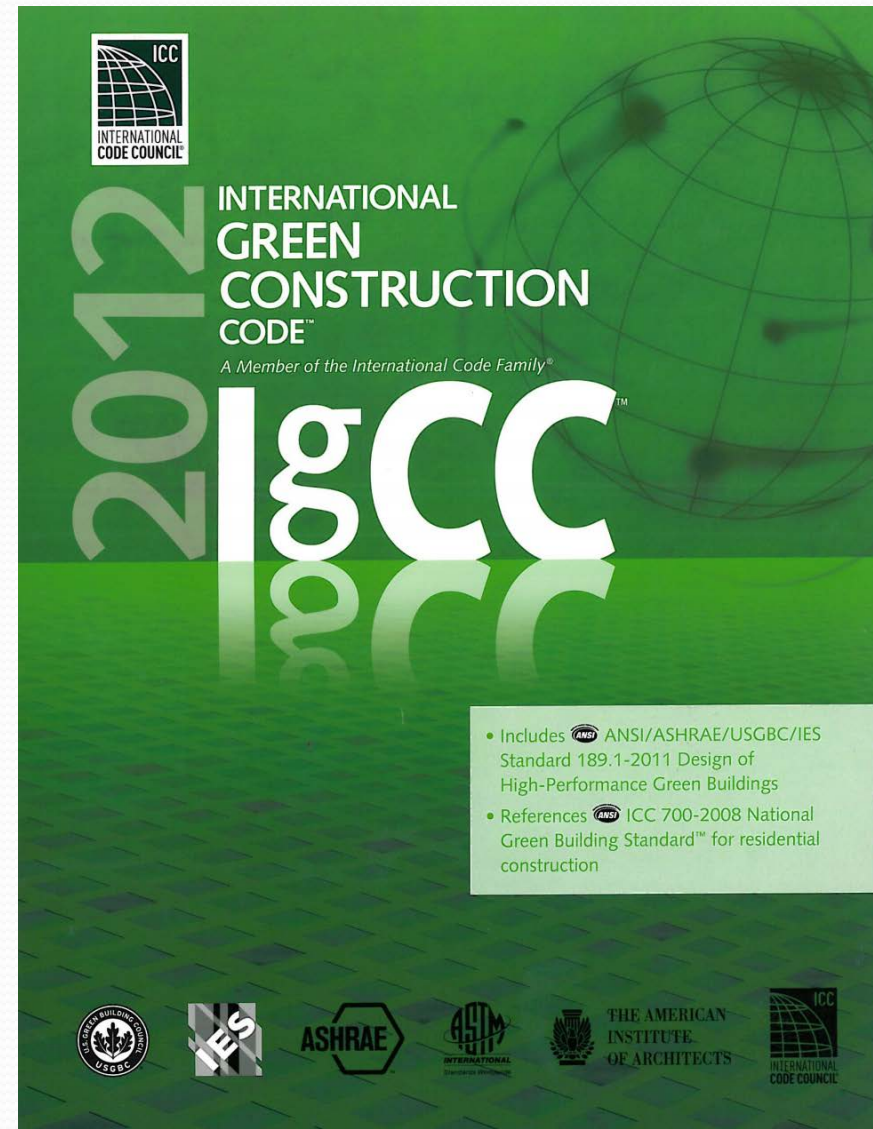
- Final Draft version to be approved Nov 2011
- Standard for Dater and others
- Department of Planning can compare Dater against the standard



## Code now available

A national standard is now available: IgCC

- Approved March 2012
- Provides a code for our community to follow and Planning Department enforceable standards



## Significant details that were addressed...

- Jurisdiction for Water Quality
- Backflow Prevention Standard
- Model Code
- Water quality requirements
- Periodic inspections
- Certified maintenance protocol
- Metering

# Ordinance Passed...

Livable Communities Committee

City Council: April 10, 2013

## Overview:

- Allows use of Rain Barrels
- References IgCC Code
- Defines agencies having jurisdiction

City of Cincinnati  
An Ordinance No. 85 - 2013

SSS  
JRC/RAH

**MODIFYING** the provisions of Chapter 1105, "Plumbing Code," of the Cincinnati Municipal Code by amending Section 1105-03, "Drainage Required" and enacting new Section 1105-08, "Rainwater Harvesting" to permit rainwater harvesting in the City of Cincinnati.

WHEREAS, rainwater can be collected from surfaces on which rain falls and stored for later use; and

WHEREAS, developers, builders and citizens in Cincinnati have made known their desire to harvest rainwater in the City of Cincinnati; and

WHEREAS, certain laws of the City of Cincinnati and certain policies of the Metropolitan Sewer District of Greater Cincinnati ("MSD") and Greater Cincinnati Water Works ("GCWW") do not permit rainwater harvesting in the City of Cincinnati; and

WHEREAS, by motion dated April 26, 2011, Council directed the City Administration to identify and make necessary changes to the Cincinnati Municipal Code and other City regulations to enable rainwater harvesting in the City; and

WHEREAS, led by the City of Cincinnati's Office of Environmental Quality and the Green Partnership for Greater Cincinnati, numerous parties, including GCWW, MSD, the Department of City Planning and Buildings, and the City Solicitor's Office, came together to address Council's motion and formed the Rainwater Harvesting Task Force ("Task Force"), which is chaired by Robert L. Knight; and

WHEREAS, the Task Force has met periodically beginning in July 2011 and has spent countless hours developing a list of proposed revisions to the Cincinnati Municipal Code to allow for rainwater harvesting in the City of Cincinnati; and

WHEREAS, the Council desires to adopt the Task Force's recommendations to enable rainwater harvesting and to promote water conservation, quality and efficiency in furtherance of the health, safety and welfare of the citizens of the City of Cincinnati; now, therefore,

BE IT ORDAINED by the Council of the City of Cincinnati, State of Ohio:

Section 1. That Section 1105-03, "Drainage Required," of Chapter 1105, "Plumbing Code," of the Cincinnati Municipal Code is hereby amended as follows:



# Rainwater Harvesting Task Force Goals COMPLETED

Permit Dater Montessori School

Develop standards for others to follow in Cincinnati

Amend City Plumbing Code

Coordinate the findings for others in GCWW / MSD service area

# Items remaining...

Communication to community

Permitting fees

Metering / Sewer fees

Certified maintenance protocol

Department of Planning and Buildings....



## Rainwater Harvesting Tanks...

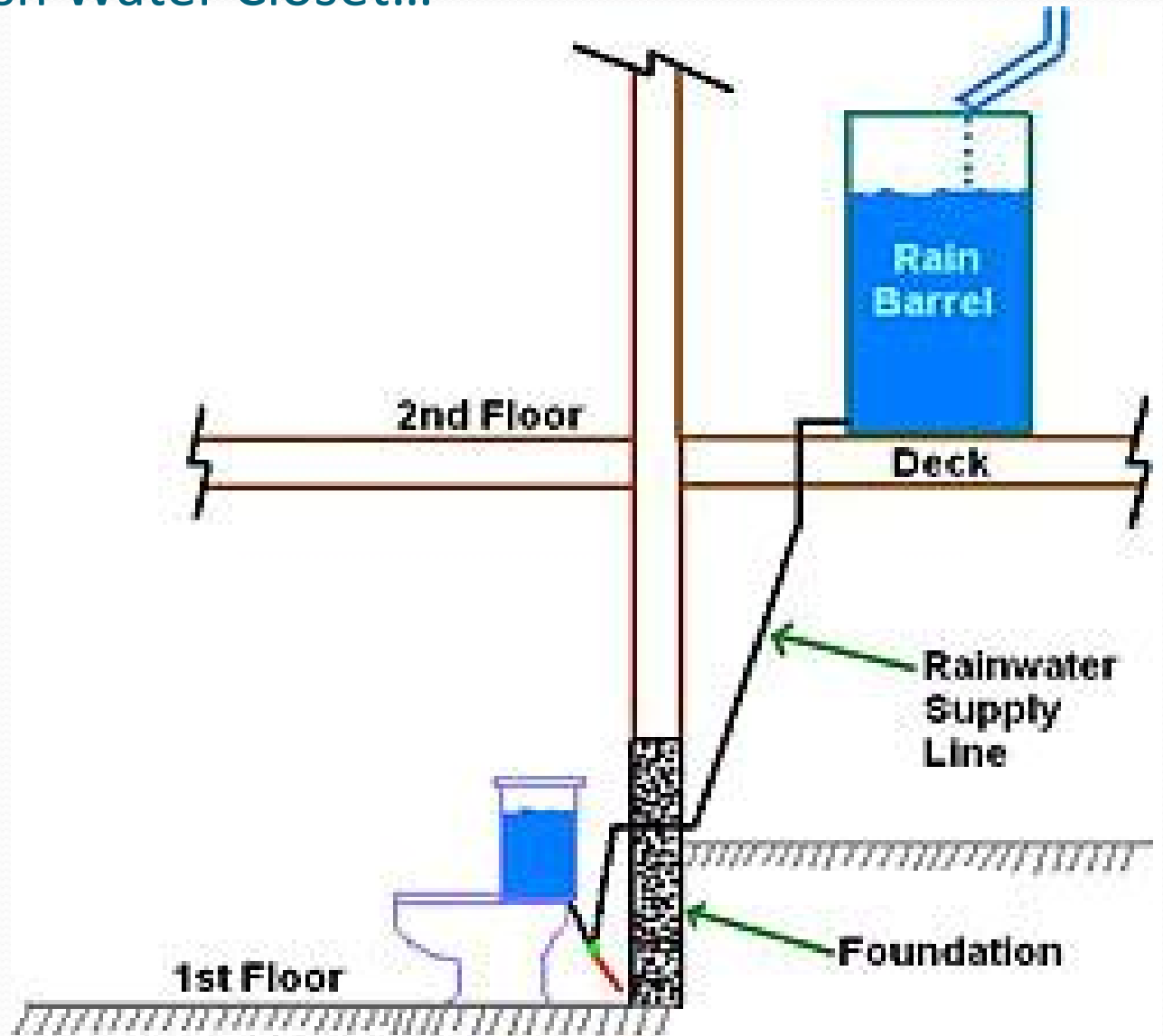


## Rain Barrel...

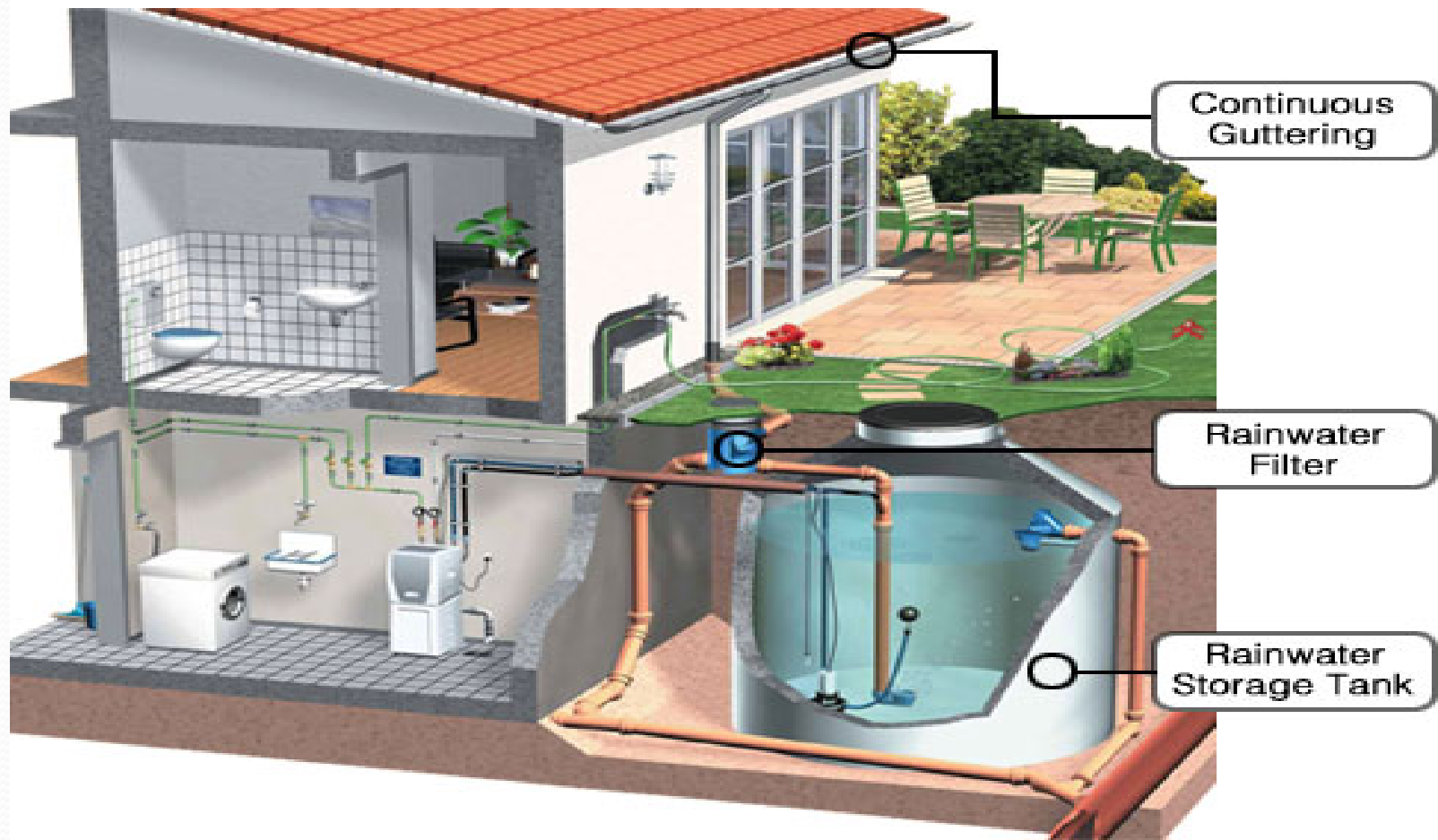




## Rain Barrel to Flush Water Closet...



# Rain Harvesting System...



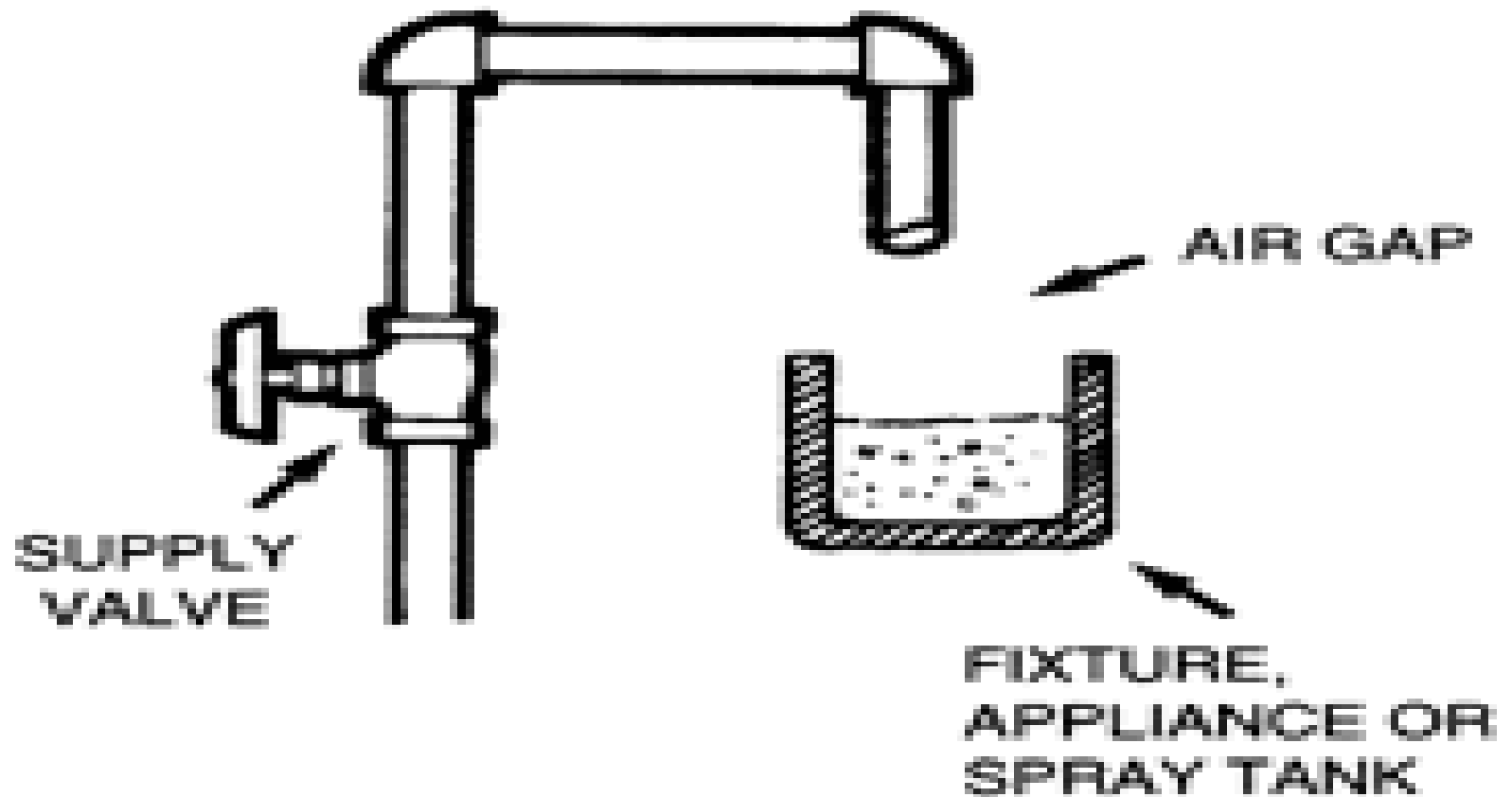
## Construction Documents Section 106...

- **106.5 Alternative engineered design.** *The design, documentation, inspection, testing and approval of an alternative engineered system shall comply with sections 106.5.1 to 106.5.3 of this rule.*
- **106.5.1 Design criteria.** *An alternative engineered design shall conform to the intent of the provisions of this code and shall provide an equivalent level of quality, strength, effectiveness, fire resistance, durability and safety. Materials, equipment or components shall be designed and installed in accordance with the manufacturer's installation instructions.*
- **106.5.2 Submittal.** *The registered design professional shall indicate on the application that the system is an alternative engineered design. The approval and permanent approval records shall indicate that an alternative engineered 4101:1-1-01 65 design was part of the approved installation. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.*
- **106.5.3 Technical data.** *The registered design professional shall submit sufficient technical data to substantiate the proposed alternative engineered design and to prove that the performance meets the intent of this code.*

## Bath Tub Faucet with Air Gap...



## Manual Fill Valve with Air Gap...





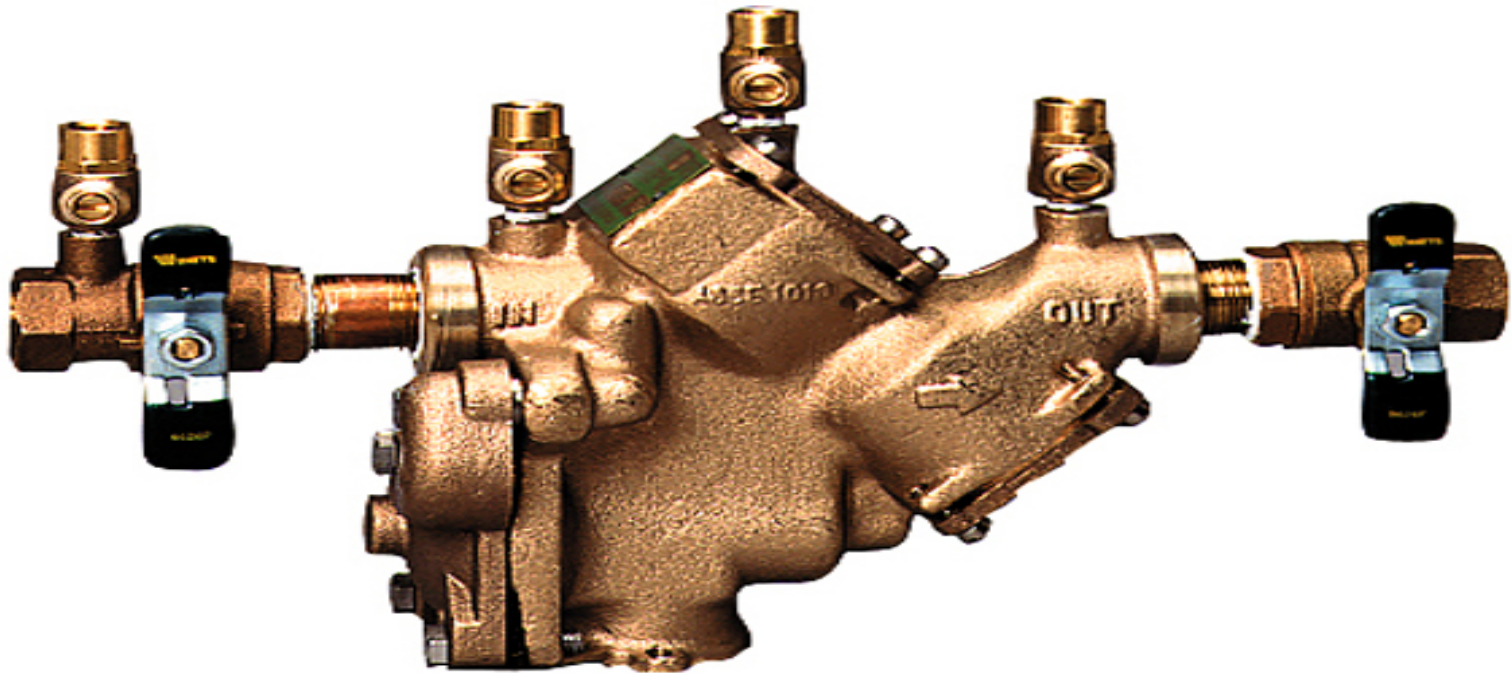
## 608.13 Backflow Protection...

- **608.13 Backflow protection.** Means of protection against backflow shall be provided in accordance with Sections 608.13.1 through 608.13.9.
- **608.13.1 Air gap.** The minimum required air gap shall be measured vertically from the lowest end of a potable water outlet to the flood level rim of the fixture or receptacle into which such potable water outlet discharges. Air gaps shall comply with ASME A112.1.2 and air gap fittings shall comply with ASME A112.1.3.

## Double Detector Check BFP...



# ASSE 1013 RPZ High Hazard BFP...



## Identification on Non Potable Water...

- **608.8 Identification of nonpotable water.** In buildings where nonpotable water systems are installed, the piping conveying the nonpotable water shall be identified either by color marking or metal tags in accordance with Sections 608.8.1 through 608.8.3. All nonpotable water outlets such as hose connections, open ended pipes, and faucets shall be identified at the point of use for each outlet with the words, “Nonpotable-not safe for drinking.” The words shall be indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material or shall be indelibly printed on the fixture. The letters of the words shall be not less than 0.5 inches in height and color in contrast to the background on which they are applied.

## Identifying Signage...





## Identifying Signage...

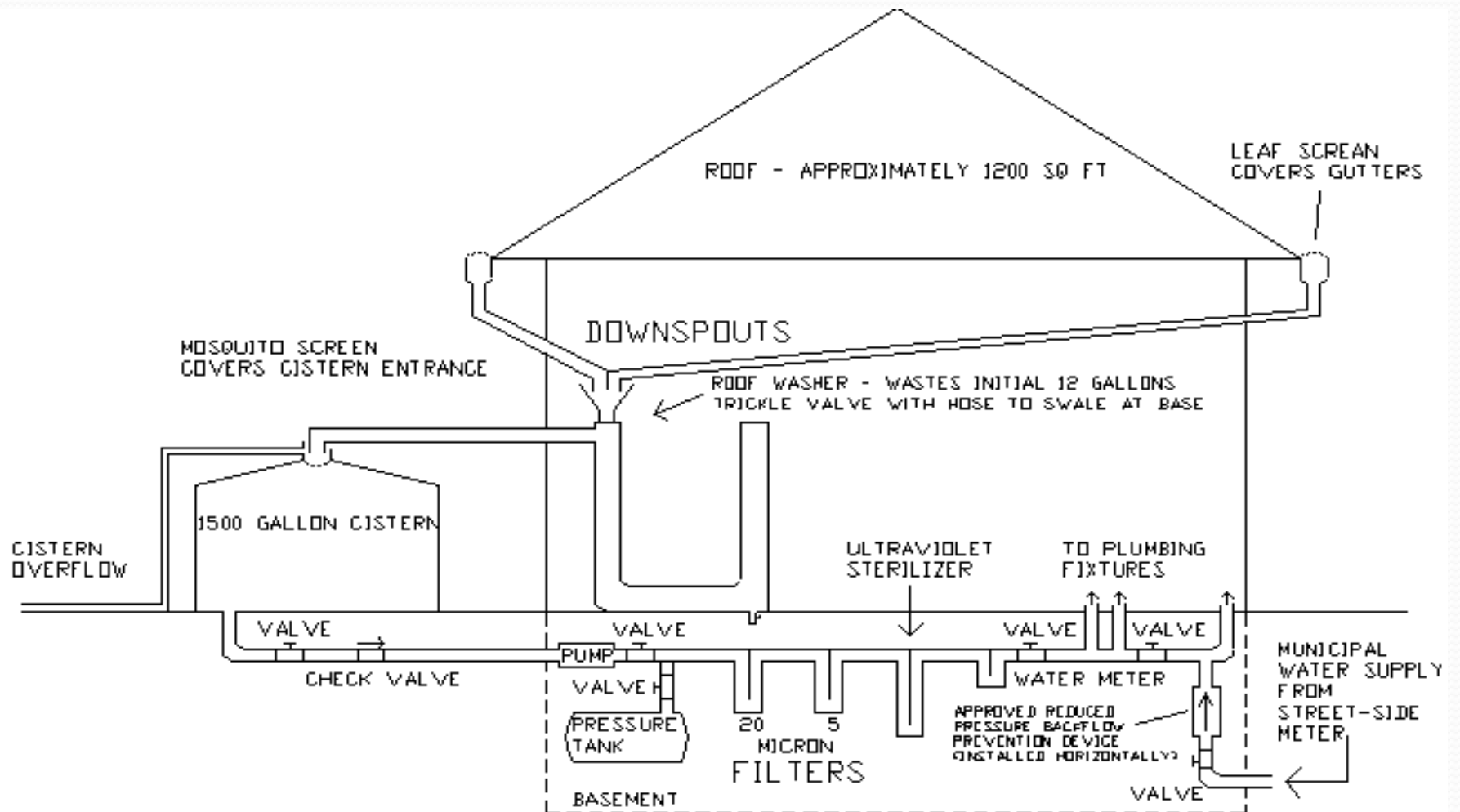


## Protection of Potable Water Supply...

- **608.1 General.** A potable water supply system shall be designed, installed and maintained in such a manner so as to prevent contamination from nonpotable liquids, solids or gases being introduced into the potable water supply through cross-connections or any other piping connections to the system.
- Backflow preventer applications shall conform to Table 608.1, except as specifically stated in Sections 608.2 through 608.16.10.
- **608.2 Plumbing fixtures.** The supply lines and fittings for every plumbing fixture shall be installed so as to prevent backflow. Plumbing fixture fittings shall provide backflow protection in accordance with ASME A112.18.1



# Cross Connection...



## Section 608 Protection of the Potable Water Supply...

- **608.8.1 Information.** Pipe identification shall include the contents of the piping system and an arrow indicating the direction of flow. Hazardous piping systems shall also contain information addressing the nature of the hazard. Pipe identification shall be repeated at maximum intervals of 25 feet (7620mm) and at each point where the piping passes through a wall, floor or roof. Lettering shall be readily observable within the room or space where the piping is located.
- **608.8.2 Color.** The color of the pipe identification shall be discernable and consistent throughout the building. The color purple shall be used to identify reclaimed, rain and gray water distribution systems.

## Construction Documents Section 106...

- **106.5 Alternative engineered design.** *The design, documentation, inspection, testing and approval of an alternative engineered system shall comply with sections 106.5.1 to 106.5.3 of this rule.*
- **106.5.1 Design criteria.** *An alternative engineered design shall conform to the intent of the provisions of this code and shall provide an equivalent level of quality, strength, effectiveness, fire resistance, durability and safety. Materials, equipment or components shall be designed and installed in accordance with the manufacturer's installation instructions.*
- **106.5.2 Submittal.** *The registered design professional shall indicate on the application that the system is an alternative engineered design. The approval and permanent approval records shall indicate that an alternative engineered 4101:1-1-01 65 design was part of the approved installation. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.*
- **106.5.3 Technical data.** *The registered design professional shall submit sufficient technical data to substantiate the proposed alternative engineered design and to prove that the performance meets the intent of this code.*

## Section 110 Appeals...

- ***110.1 Hearing and right of appeal, local board of building appeals.*** *Adjudication hearings shall be in accordance with sections 119.09 to 119.13 of the Revised Code, as required by section 3781.031 of the Revised Code, and the following:*
  - *1. Requests for hearing shall be within thirty days of the mailing date of an adjudication order. The local board shall schedule a hearing and notify the party. If the hearing concerns section 3781.111 of the Revised Code or rules adopted thereunder, reasonable notice of time, date, place, and subject of the hearing shall be given to any local organization composed of or representing persons with disabilities, as defined in section 3781.111 of the Revised Code, or if there is no local organization, then to any statewide organization composed of or representing persons with disabilities.*

## Section 110 Appeals (continued)...

- *1.1 For purposes of conducting adjudication hearings, the local board may require attendance of witnesses, production of records and papers, and may take depositions of witnesses in accordance with section 119.09 of the Revised Code.*
- *1.2 Testimony shall be under oath and, as outlined in section 109.1, a stenographic or mechanical record of testimony and other evidence 4101:1-1-01 78 submitted shall be taken at the expense of the local board of building appeals.*
- *1.3 The local board may postpone or continue any adjudication hearing on its own motion or upon the application of any party.*
- *1.4 The board shall keep a full and complete record of all proceedings which shall be open to public inspection.*

## Section 110 Appeals (continued)...

- *2. The Board shall render its decision **within thirty days after the hearing.***
- *3. Following the hearing, an order shall be entered on its journal, and the local board shall serve by certified mail, return receipt requested, upon the party affected thereby, a certified copy of the order and a statement of the time and method by which an appeal may be perfected. A copy of the order shall be mailed to the attorney or other representatives of record representing the party.*
- *4. Any municipal or county officer, official municipal or county board, or person who was a party to the hearing before the municipal or county board of building appeals, may apply to the **state board of building appeals** for a de novo hearing, **or may appeal to the court of common pleas** of the county in which he is a resident or in which the premises affected by such order is located.*

## Section 110 Appeals (continued)...

- *5. In addition, when the adjudication hearing concerns section 3781.111 of the Revised Code, or any rule made thereunder, any local organization composed of or representing persons with disabilities, or if no local organization exists, then any statewide organization representing persons with disabilities may file appeals as indicated in paragraph 4. of this section.*
- *6. Application for a de novo hearing before the state board shall be made no later than thirty days after the municipal or county board renders its decision.*



METROPOLITAN  
SEWER DISTRICT  
of greater  
CINCINNATI



# Rainwater Harvesting Metering Requirements-Single Tank Systems

Rainwater

All Secondary Meters To Be Installed/Maintained By Property Owner

MSD Billing Deduct Meter

MSD Billing Cancellation Meter

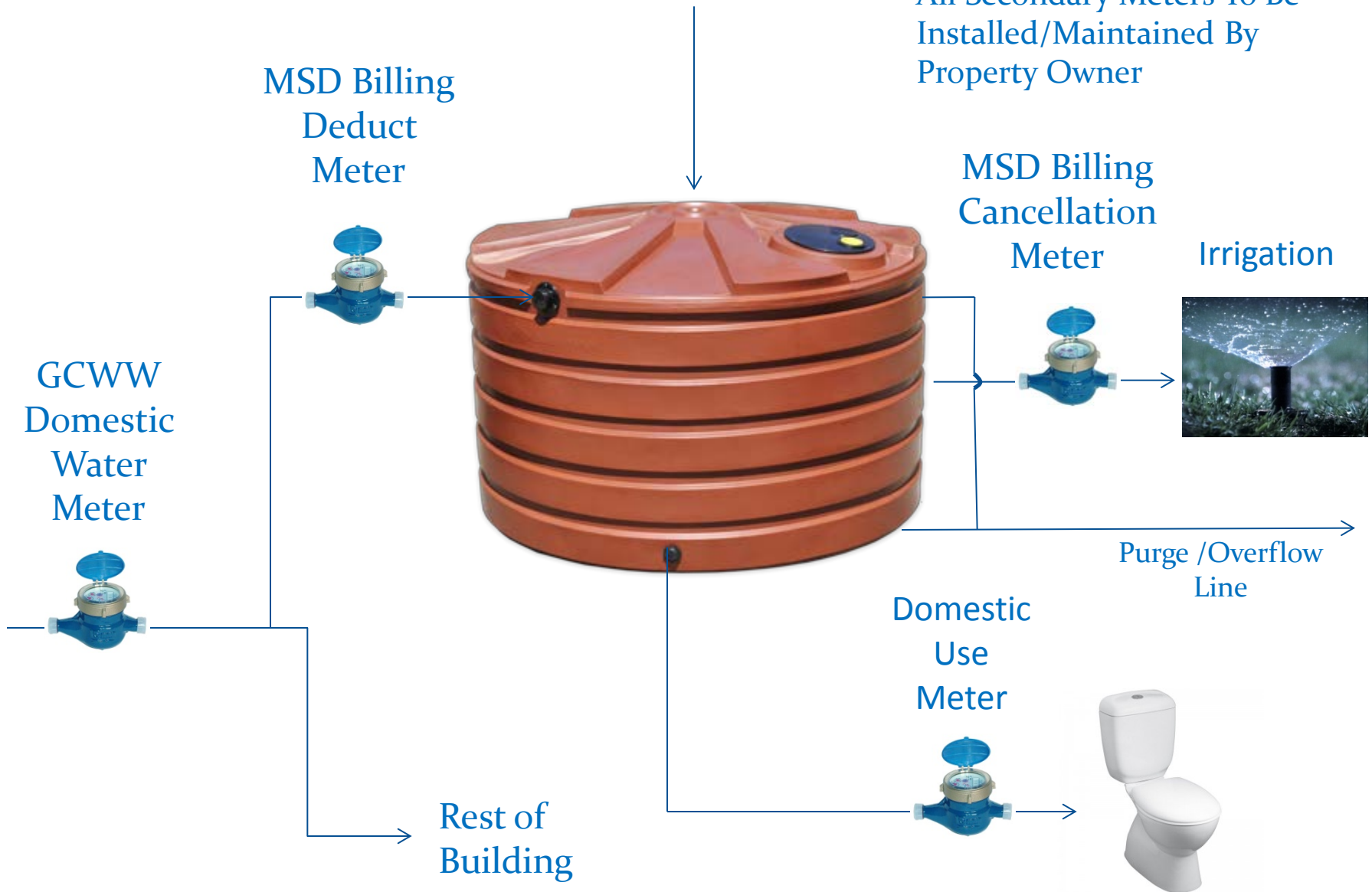
Irrigation

GCWW Domestic Water Meter

Purge /Overflow Line

Domestic Use Meter

Rest of Building



## Rainwater Harvesting Billing Requirements...

- Metering/Billing not required for harvesting tanks exclusively used for irrigation
- Single tank systems used for irrigation and non-potable uses are required to install meters per the diagram (flat billing allowed for residential/no meters required)
- Commercial systems using multiple tanks are eligible for flat billing (evaluated case by case and billing adjusted annually)



GREATER CINCINNATI  

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**WATER WORKS**

# Water quality requirements...

Water Quality Standards are established.

**TABLE 707.12.10  
RAINWATER QUALITY**

PARAMETER	VALUE
pH	6.0 – 7.0
Biological oxygen demand	Not greater than 10 mg/L
Nephelometric turbidity unit	Not greater than 2
Fecal coliform	No detectable fecal coli in 100 mL
Sodium	No detectable sodium in 100 mL
Chlorine	No detectable chlorine in 100 mL
Enteroviruses	No detectable enteroviruses in 100 mL

## Maintenance manuals...

No codes currently define the O&M Manual content

Necessary to ensure the public water supply is protected

Owner develop the O&M manual, for review and certification by the Planning Department

**707.13 Operations and maintenance manuals.** Operations and maintenance materials shall be supplied in accordance with 707.13.1 through 707.13.4.

**707.13.1 Manual.** A detailed operations and maintenance manual shall be supplied in hardcopy form with all rain-water collection systems.

**707.13.2 Schematics.** The manual shall include a detailed system schematic, the locations of all system components, and a list of all system components including manufacturer and model number.

**707.13.3 Maintenance procedures.** The manual shall provide a maintenance schedule and procedures for all system components requiring periodic maintenance. Consumable parts including filters shall be noted along with part numbers.

**707.13.4 Operations procedures.** The manual shall include system startup and shutdown procedures. The manual shall include detailed operating procedures for the system.



# Inspections...

To ensure the system has not been compromised.

Department of Buildings and Inspections – create:

- A defined inspection process
- Inspection fee
- Inspection schedule

**707.15.1 Water quality testing.** Collected rainwater shall be tested. Accumulated water to be tested shall be the result of not less than two rainfall events. Testing shall be in accordance with Sections 707.15.1.1 and 707.15.1.2.

**707.15.1.1 Test methods.** Water quality testing shall be performed in accordance with the latest edition of *APHA–Standard Methods for the Examination of Water and Wastewater* and in accordance with Sections 707.15.1.1.1 and 707.15.1.1.2.

**707.15.1.1.1 Annual tests required.** Accumulated rainwater shall be tested prior to initial use and annually thereafter for *Escherichia coli*, total coliform, heterotrophic bacteria and cryptosporidium.

**707.15.1.1.2 Quarterly tests required.** Accumulated rainwater shall be tested prior to initial use and quarterly thereafter for pH, filterable solids, residual chlorine if disinfection is used, and turbidity. The pH shall be tested in accordance with ASTM D 5464; filterable solids shall be tested in accordance with ASTM D 5907; residual chlorine shall be tested in accordance with ASTM D 1253 and turbidity shall be tested in accordance with ASTM D 6698.



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