



WHO IS IN CHARGE?

Maintain the Integrity of your Design by
Controlling What Goes in and out of the Tank

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Grundfos Headquarters Brookshire, Texas

Presenter G Edward Van Giesen
RainCycle Watts Water Technologies

TECHNICAL REALITIES IN COMMERCIAL RAINWATER HARVESTING



- What goes into the tank?
- How does it go in?
- How is it installed?
- How is it retrieved?
- How is it maintained?

IMPORTANCE OF EARLY COMMUNICATION



Early coordination among mechanical, electrical, and plumbing professionals clarifies responsibilities and reduces errors.

Benefits of Coordination

Projects with coordinated efforts have fewer change orders, smoother installation, and better system performance.

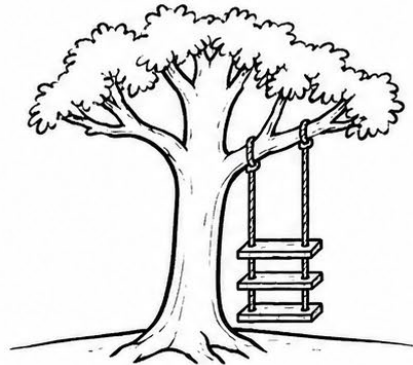
Even a relatively small rainwater system can be a major commitment



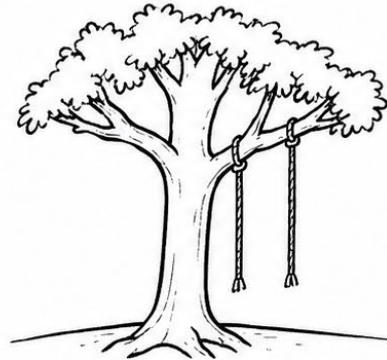
What is the intent here?

FROM IDEAS TO FRUITION

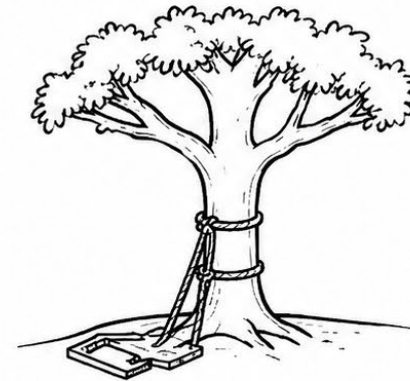
**EVEN THE MOST SEASONED HAS TROUBLE
COPING WITH THE AMBIGUITIES.**



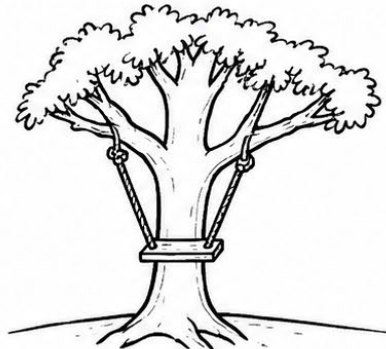
As Architect Drew It



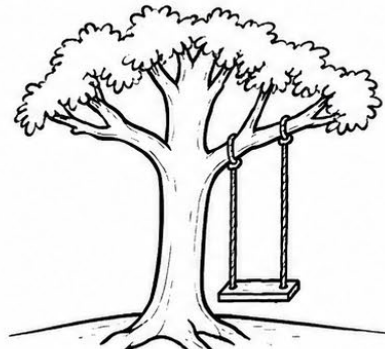
As Estimating Bid It



As Engineering Designed It



As Shop Fabricated It



As Field Installed It

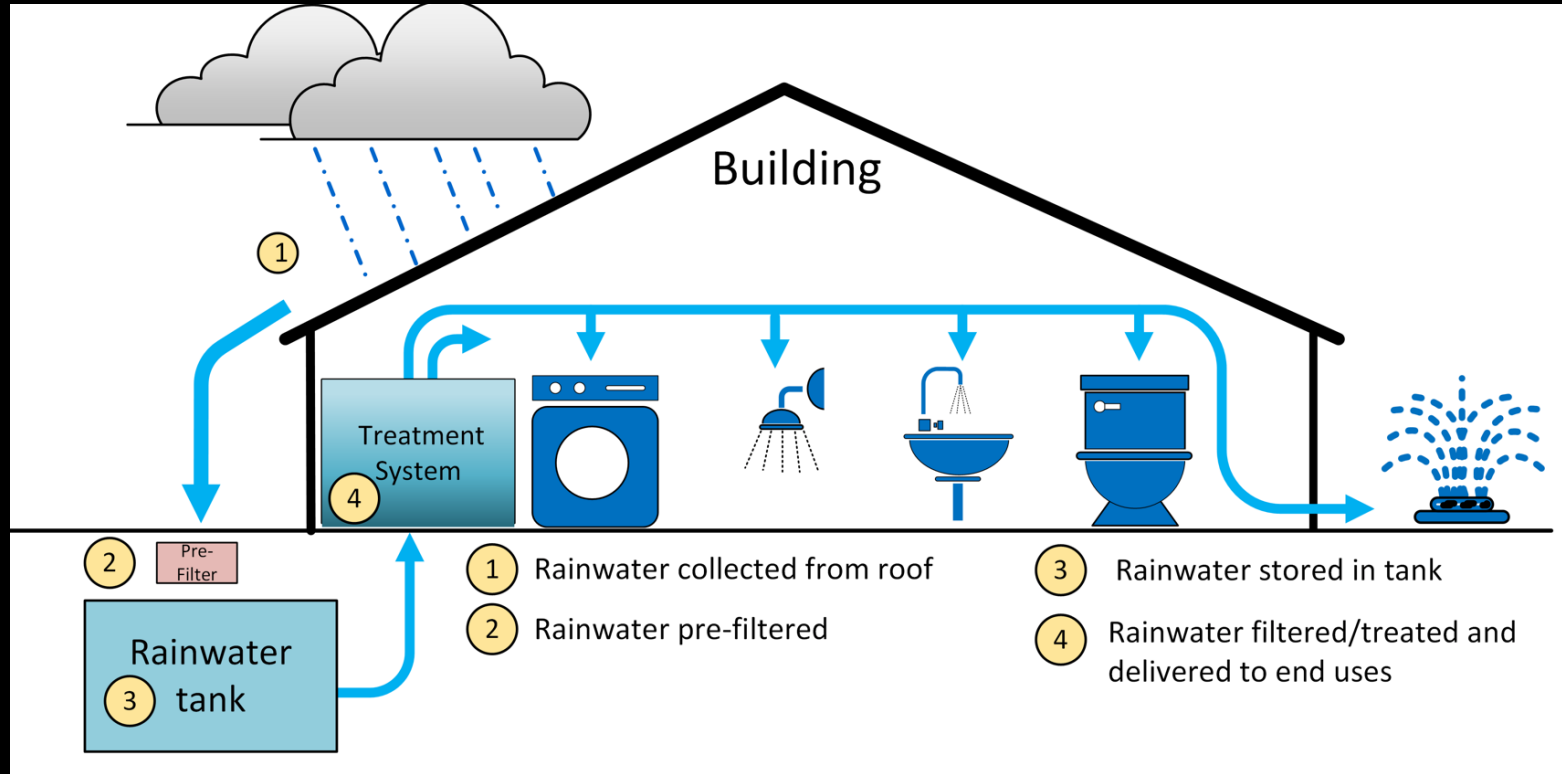


What The Owner Wanted

**THE STRUGGLE TO UNDERSTAND IS CARRIED OUT
RELENTLESSLY BY THE MOST CONSCIENTIOUS**



RAINWATER SYSTEM OVERVIEW



Think Solutions, Not Products!

WHAT YOU SEE IS NOT ALWAYS WHAT YOU GET

Site-Specific Design Challenges

Systems are often custom-designed and site-specific, increasing coordination risks among multiple trades involved.

Hidden Tank Locations

Tanks located below grade or outside buildings lead to overlooked design assumptions and difficult problem correction.

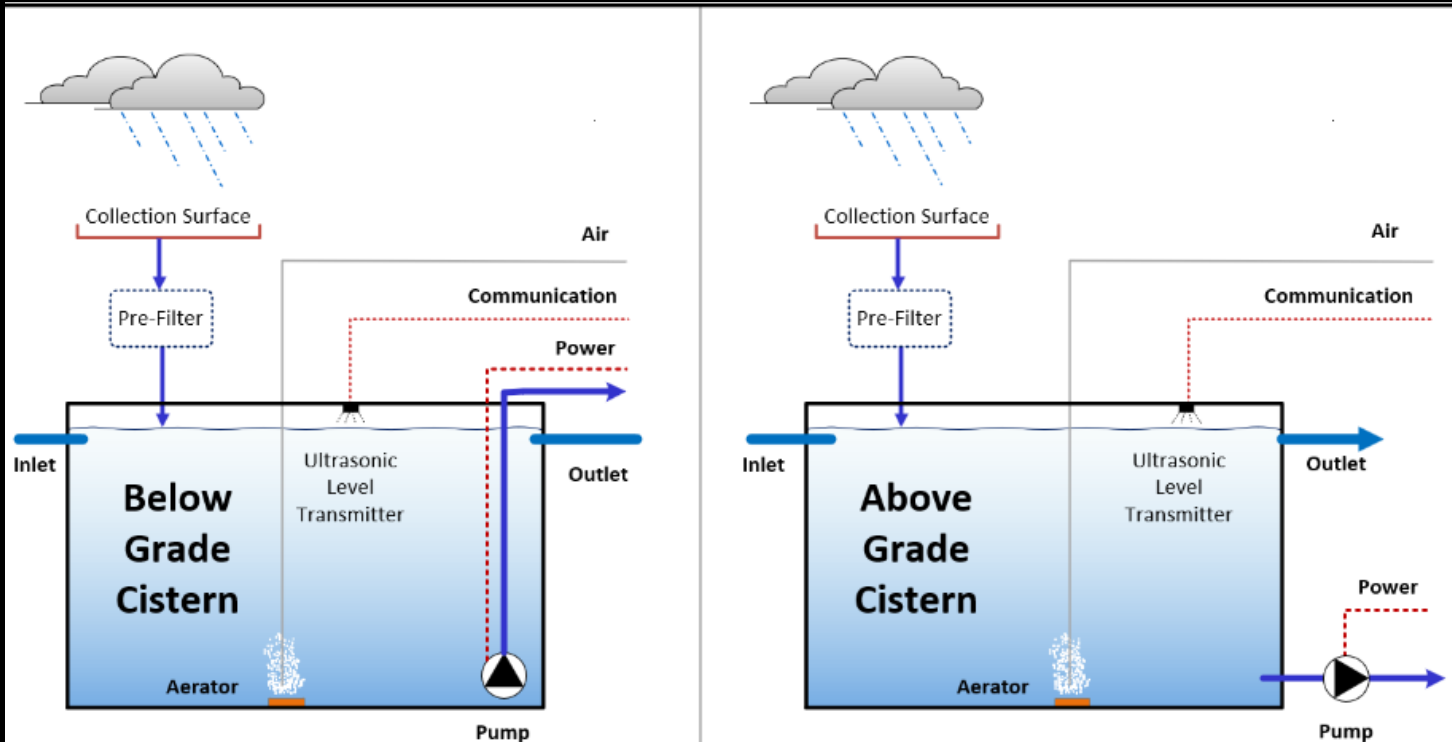


Where's the Rainwater System?

What's not seen is often overlooked.



TWO BASIC CISTERN TYPES



BELOW GRADE

- AERATOR
- **INTERNAL** PUMP
- LEVEL SENSOR
- INLET PIPE
- OVERFLOW PIPE

ABOVE GRADE

- AERATOR
- **EXTERNAL** PUMP
- LEVEL SENSOR
- INLET PIPE
- OVERFLOW PIPE



Above-Grade Tank Benefits and Challenges

- Easy inspection and visibility
- Maintenance can be easy or challenging depending on equipment placement

When Selecting tank type and location balance:

- Costs
- Constructability
- Access, and maintenance
- With aesthetics and program goals

Below-Grade Tank Advantages

- Saves surface space
- Provides natural temperature stability

Below-Grade Placement Challenges

- Increases installation costs
- Often gets forgotten
- Overlapping professional responsibilities

TANK TYPES AND PLACEMENT OPTIONS



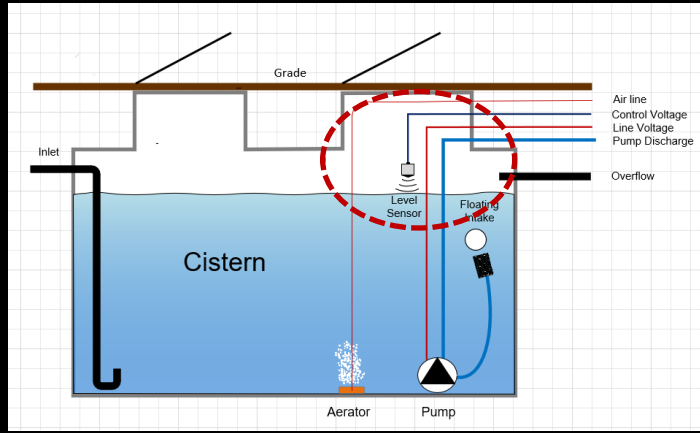
BELOW GRADE CISTERN MANWAY ACCESS

Voltage Separation and Labeling

- Line and control wires should be separated and clearly labeled.
- Run wires in separate conduit for each voltage class.

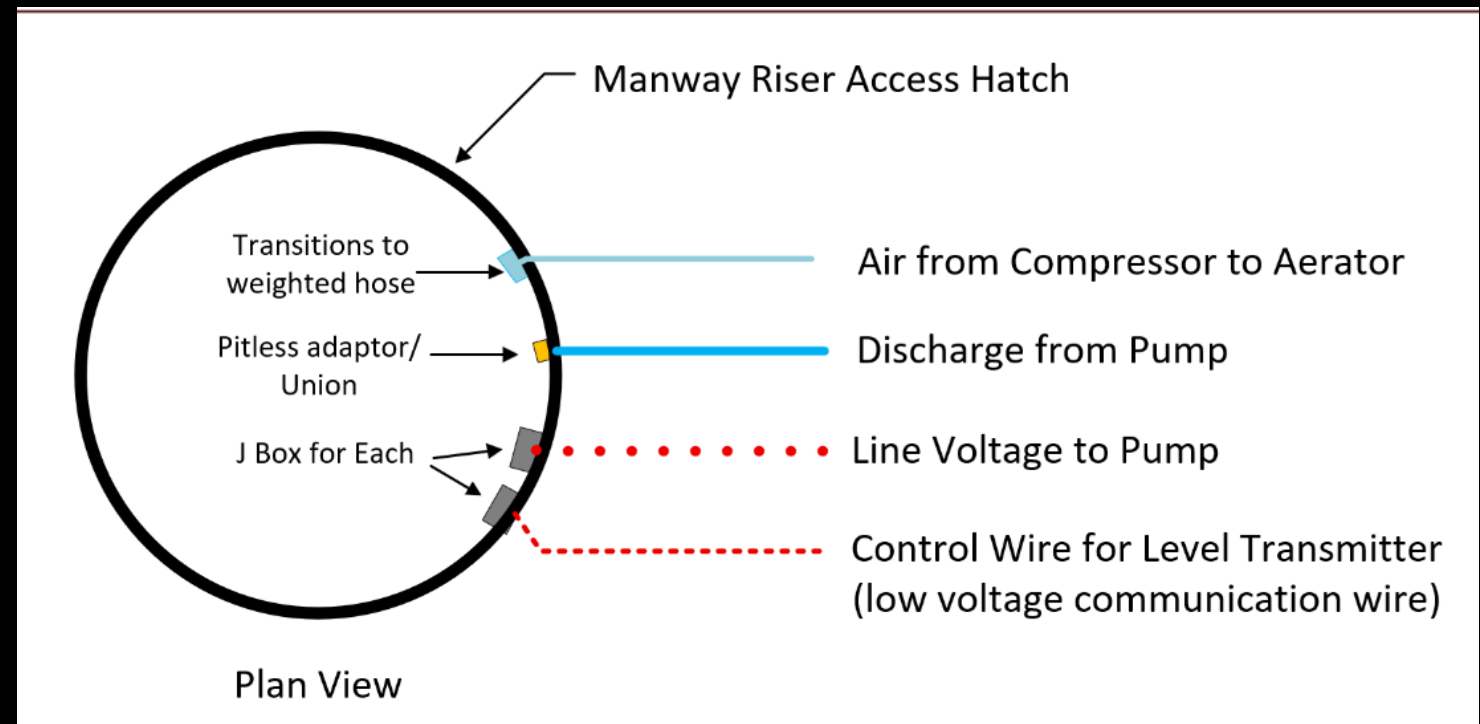
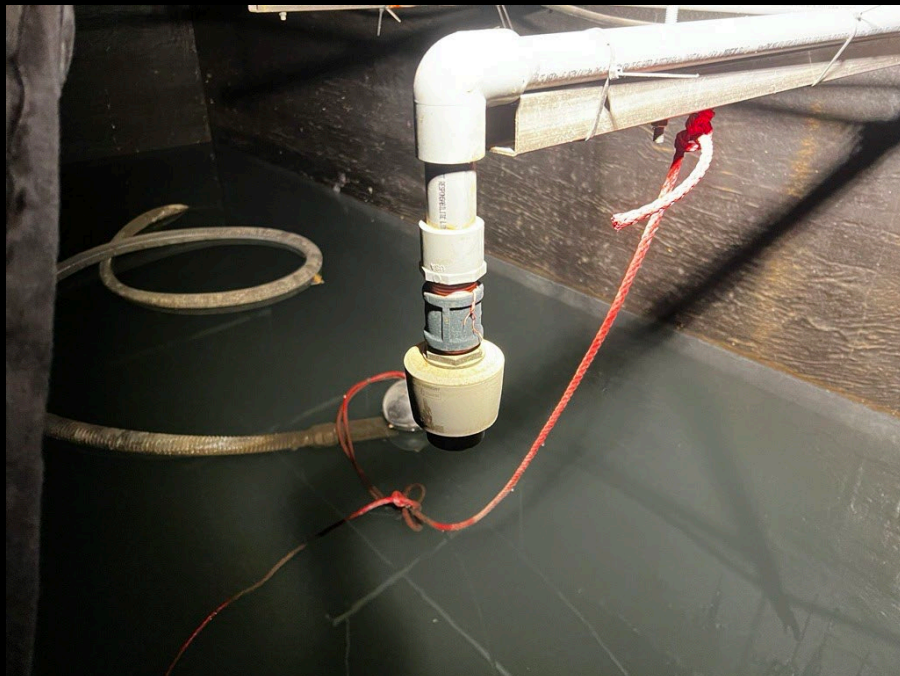
Wet Location Rated Connections

All electrical connections must be rated for wet or damp locations and comply with electrical codes.



Level Sensors

Create consistent installation details



LONG TERM CARE OF SYSTEM



- **Difficult access equals less dedication to maintenance**
- **Include two access openings for larger tanks.**

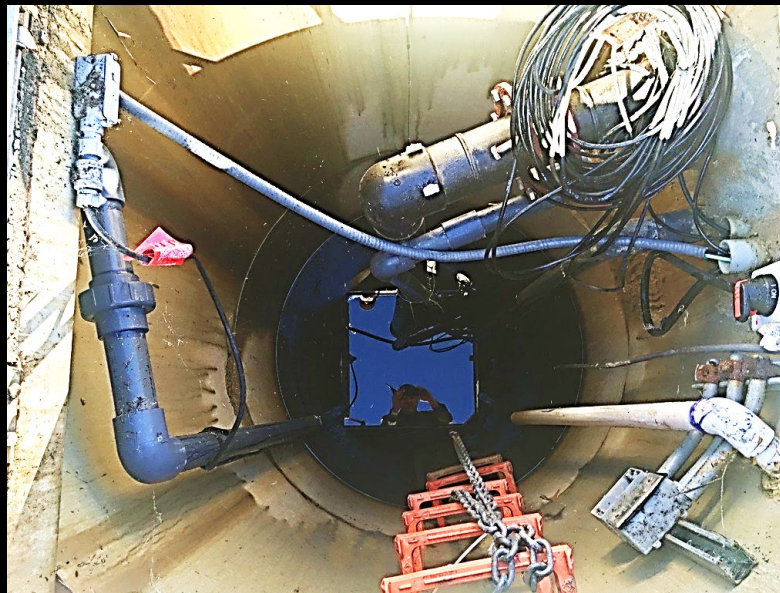


The pitless adapters are below the frost line.

Maintenance Accessibility

Design must include

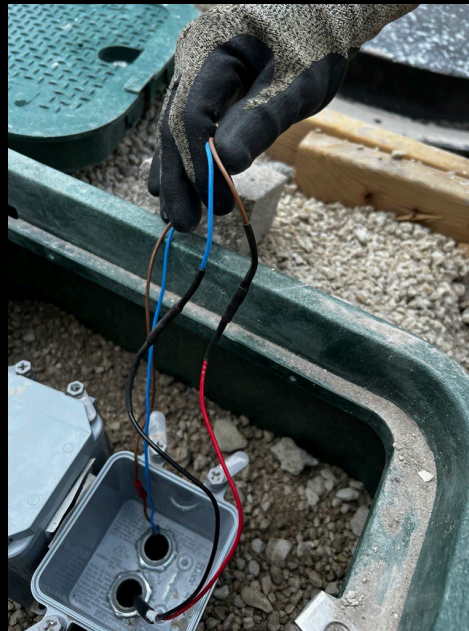
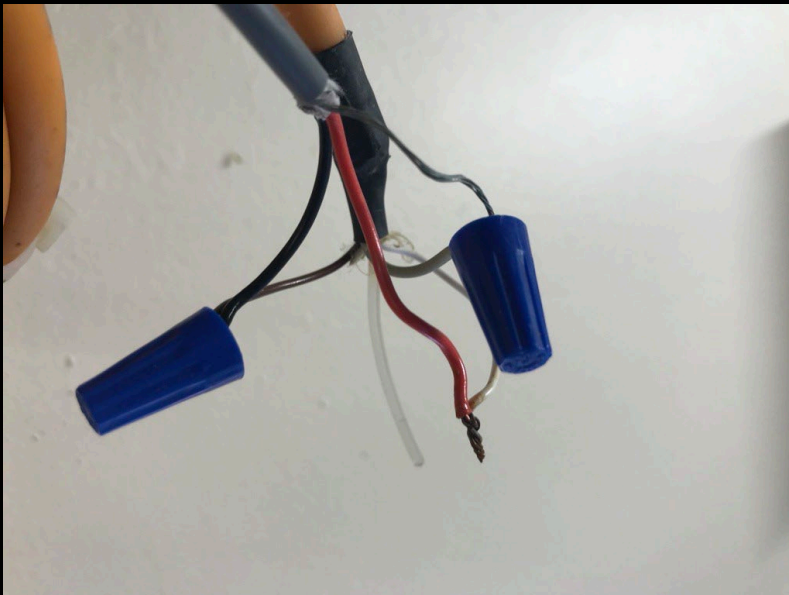
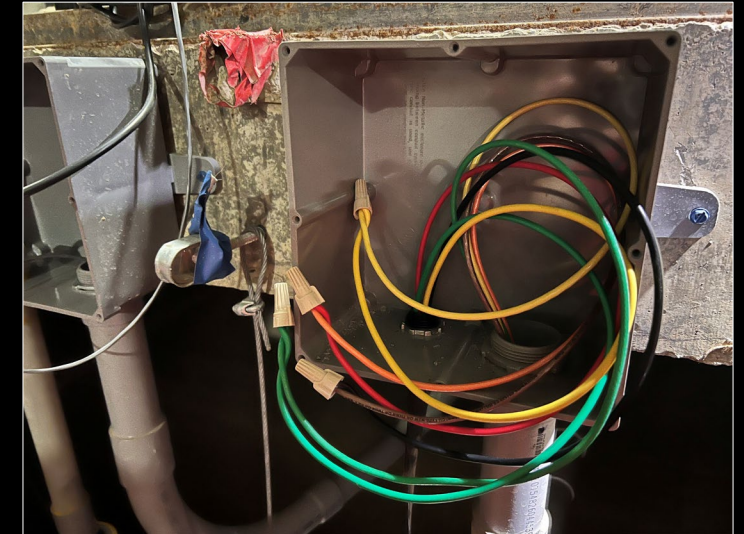
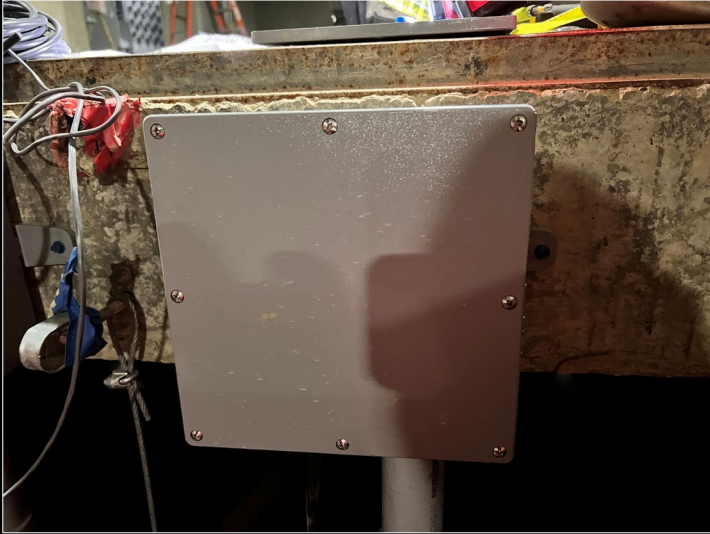
- Accessible disconnects,
- Adequate slack with wires
- Clear wiring diagrams



Frost Line Considerations

Most discharge lines are pressurized and subject to freezing

ELECTRICAL CONNECTIONS INSIDE THE MANWAY ACCESS



Electrical Box Placement Options

- Junction boxes can be placed inside tanks, within risers, or outside, balancing protection and maintenance ease.
- Install them at arm's length from access point.

Maintenance Accessibility

- Equipment should be accessible without requiring confined space entry.

Heat Shrink connections inside tanks (control voltage and line voltage)

ELECTRICAL CONNECTIONS INSIDE THE MANWAY ACCESS

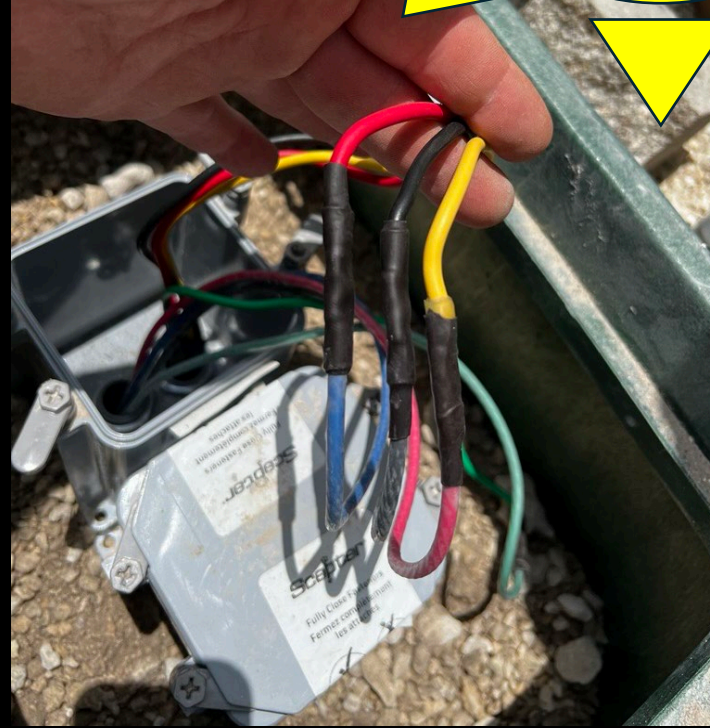
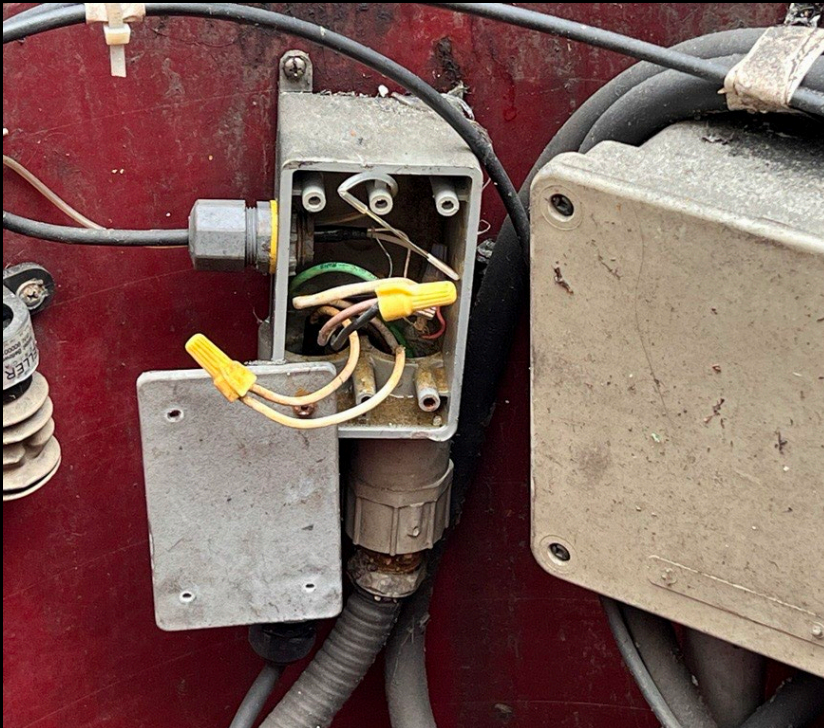
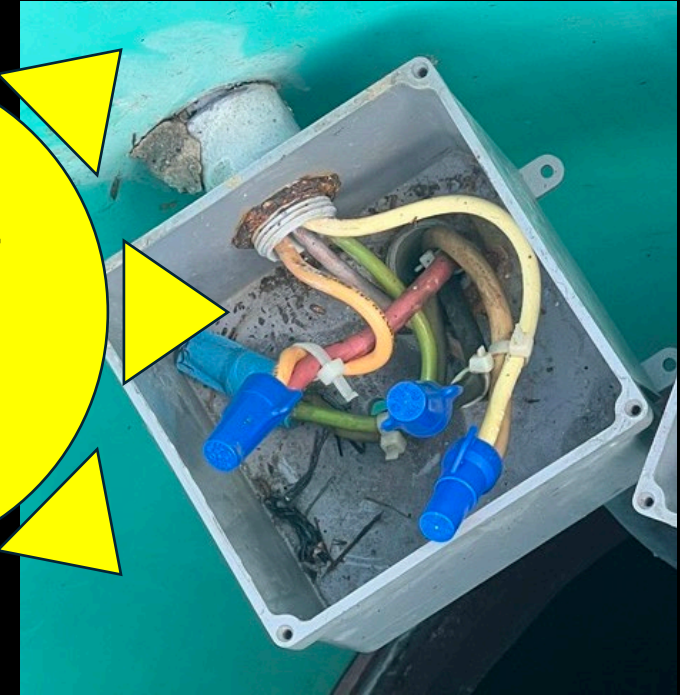
Balancing Protection and Service

Effective design balances environmental protection with realistic maintenance regimes

Conduit and Sealing Details

Proper conduit routing, strain relief, and sealing at tank penetrations are essential to avoid water and contaminant intrusion.

Note
Account for dissimilar wire size in connections





MANWAY ACCESS LIDS

INSIDE THE BUILDING



Strategic Access Location

Access points should be secured, labeled, and identifiable by building operator **after construction.**



Impact on Maintenance and Costs

Most manufactured tanks to be installed with two lids



Importance of Adequate Access

Essential for:

- Inspection
- Cleaning
- Pump removal and troubleshooting to Ensure system reliability.

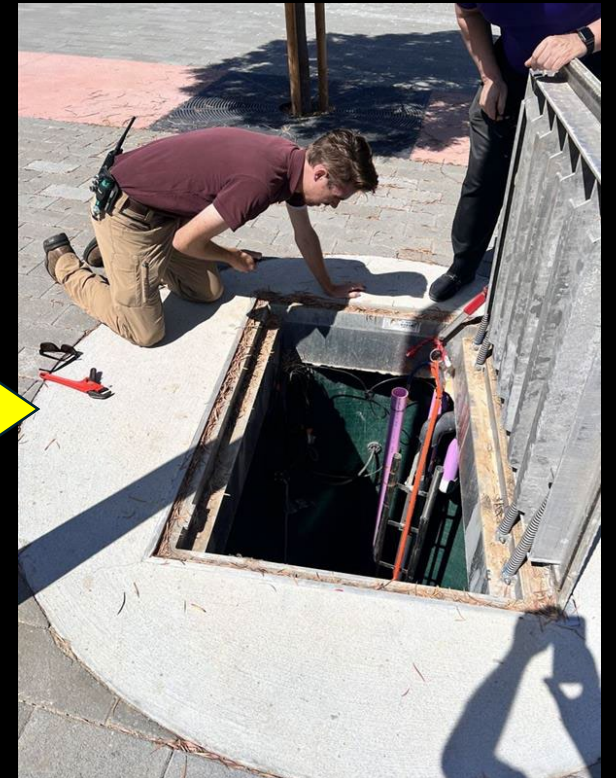
Designing for Size and Safety

Access openings must be large enough for safe entry and removal of equipment, following local codes and safety standards.



MANWAY ACCESS LIDS

OUTSIDE OF THE BUILDING



Strategic Access Location

Access points should be conveniently located to avoid removing landscaping or pavement, facilitating routine maintenance.

Impact on Maintenance and Costs

Poor access leads to skipped maintenance, system degradation, and increased long-term repair costs.

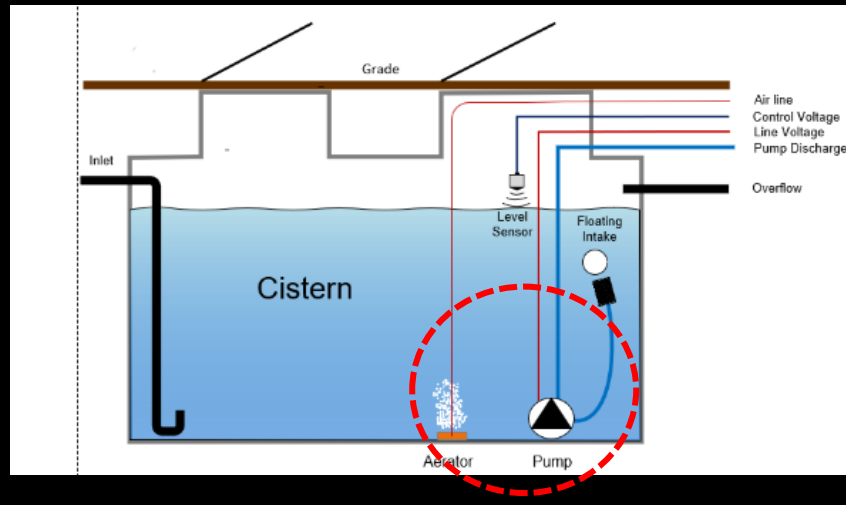


COVERS & LIDS



TIMING IS EVERYTHING!

PUMPS AND AERATOR



Importance of Adequate Access

- Inspection
- Cleaning
- Pump removal
- System Troubleshooting



Pump Types and Roles

- Submersible pumps will eventually need servicing
- Provide means of removal with SS chains or woven poly ropes

Note: Lugs for handling Pump

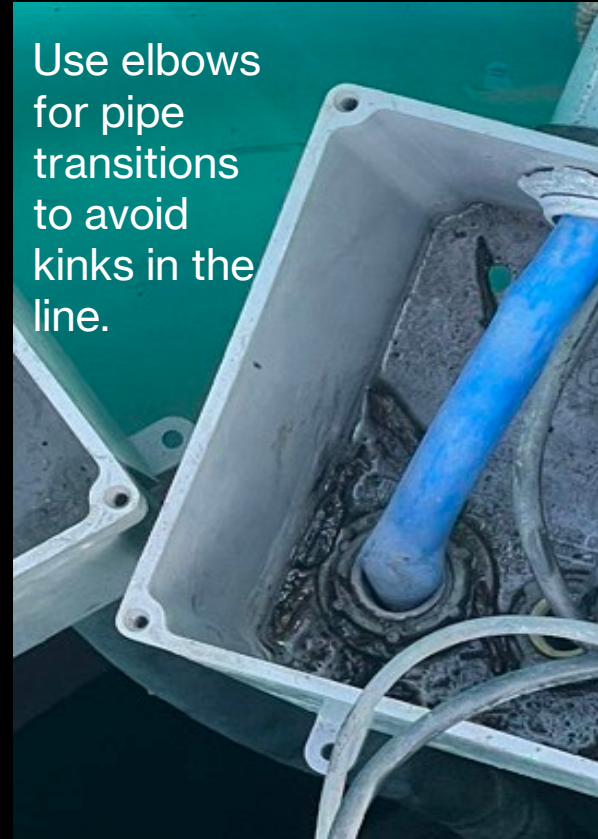
Aeration

Purpose of Aeration

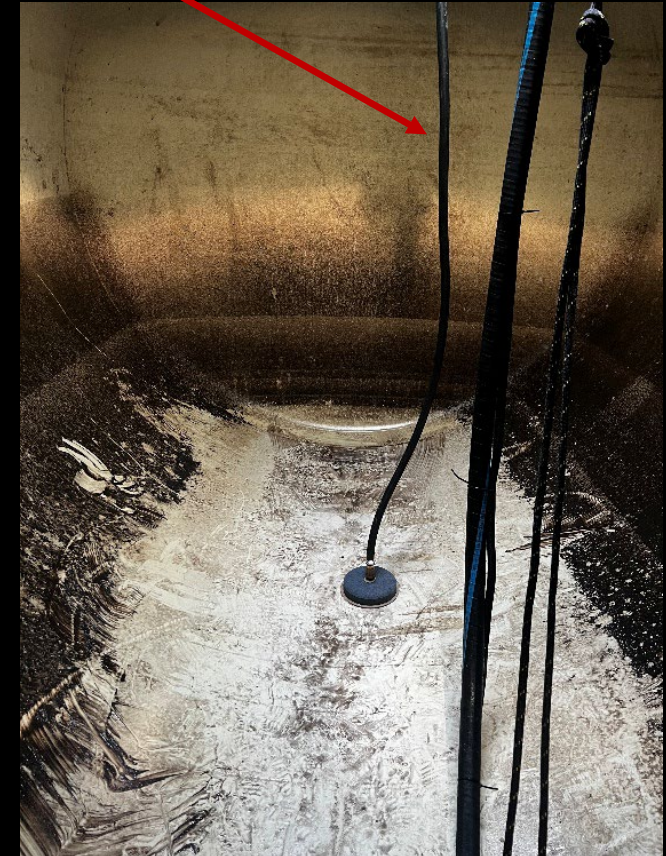
Aeration improves water quality by reducing odors and preventing anaerobic conditions in rainwater tanks.

Internal Placement and Pump Coordination

- Proper placement of aeration diffusers avoids air entrainment at pump intakes, preventing cavitation and damage.
- Place aerator away from pump intake



- Use weighted hose inside tank

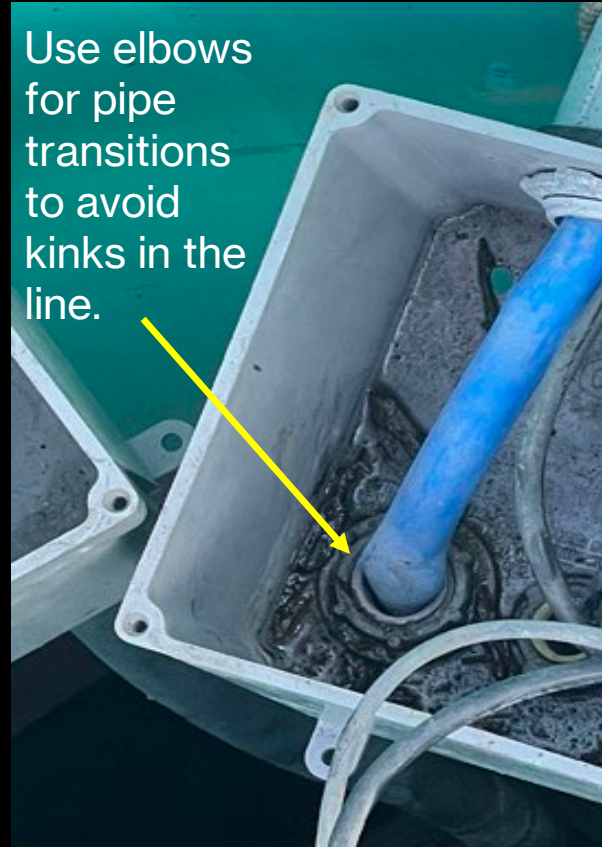


Material and Penetration Considerations

Air lines require

- Appropriate materials selection
- Sealed penetrations to prevent intrusion of soil or animals
- Rigid copper or plastic between mech. room and tank is typical

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PUMPS

Pump Intake Placement

- Proper intake location avoids sediment suction.
- Incorporate floating extractors on suction side of pump



Hose Compatibility in the Tank

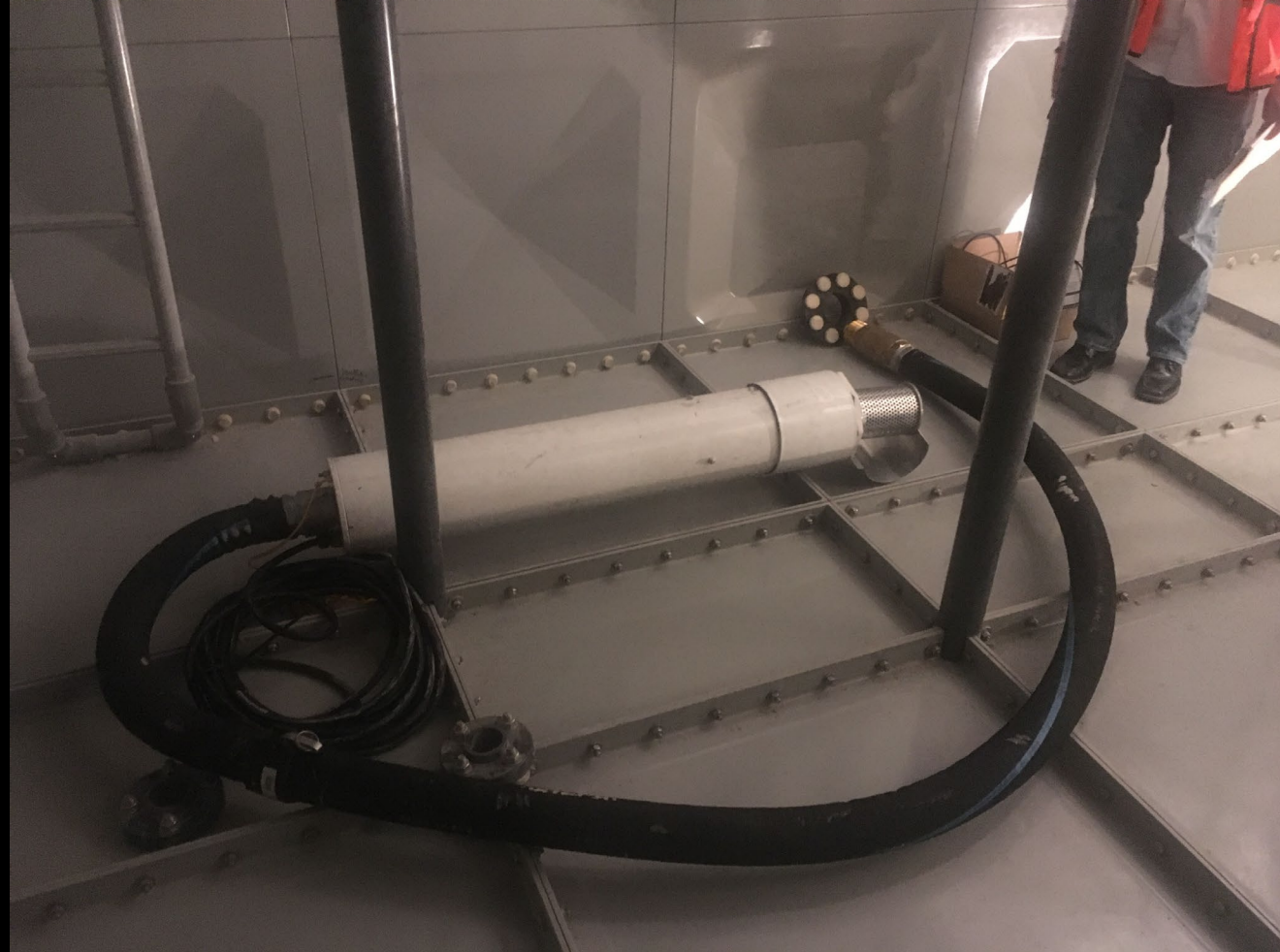
Take into account:

- Size
- Weight (anti-buoyancy)
- Materials suitability
- Pressure – negative and positive



Materials Compatibility

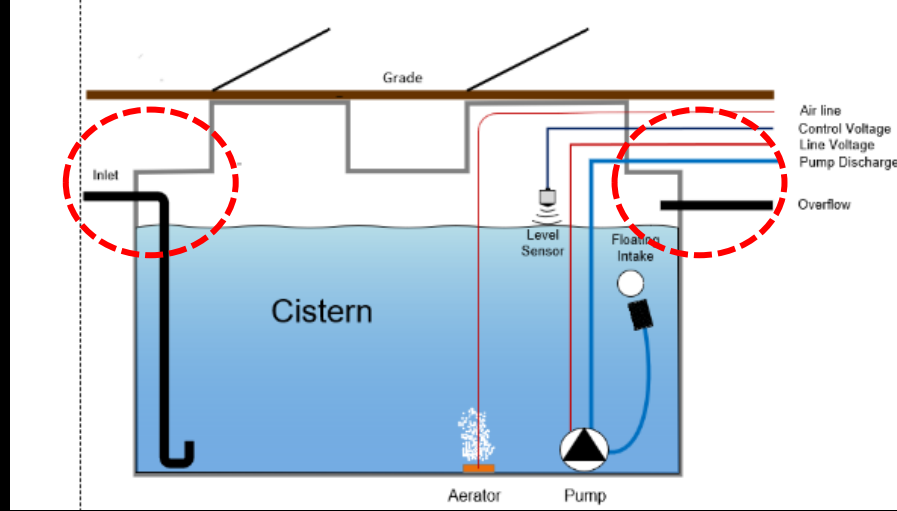
Use flexible hose on submersible pumps on the intake and discharge compatible with underwater applications.



INLET AND OVERFLOW

Specify Responsibilities

Prevent intrusion of mud, sand and other debris during installation.



Tank Penetrations

- Allow for inlet and outlet on opposite ends of the tank.
- Provide for a calming inlet.

On larger FRP tanks this is molded into tank body.

On bolted steel tanks this may be internal or external to the tank body.

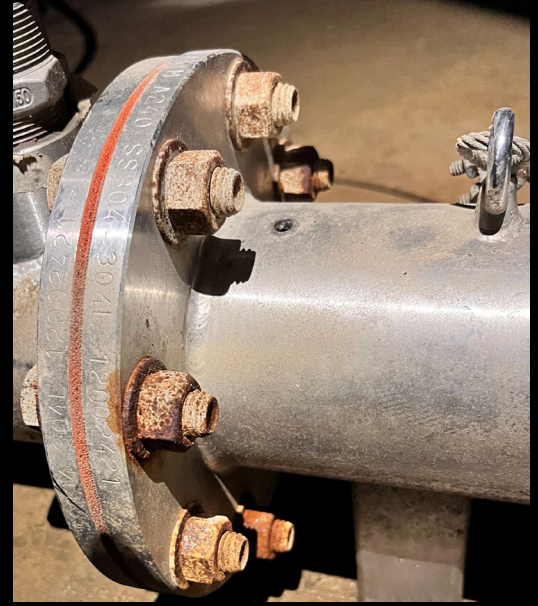
MATERIALS COMPATIBILITY

Nature of Rainwater

Rainwater is aggressive pH 5.5 – 6 generally, slightly acidic with low mineral content. Avoid dissimilar metals in contact with the water and each other

Benefits of Thoughtful Design

When specifying a rainwater system, include all the details, including anything that touches the stored rainwater.



Rule of Thumb

- Avoid aluminum, ferrous metals
- Rely on Plastic and Stainless



AVOID THESE INSTALLATION STRATEGIES

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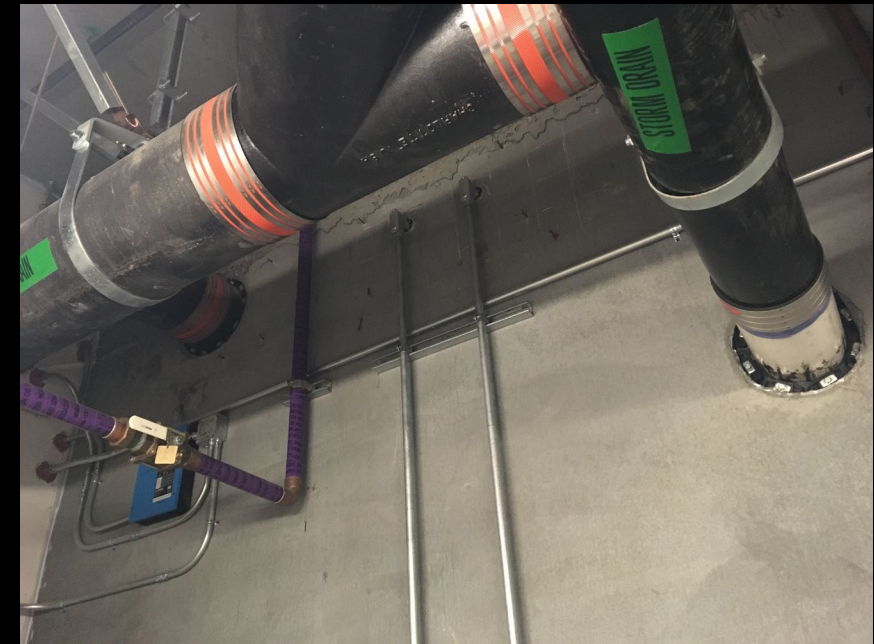


Penetrations too far from access!



Importance of Adequate Access

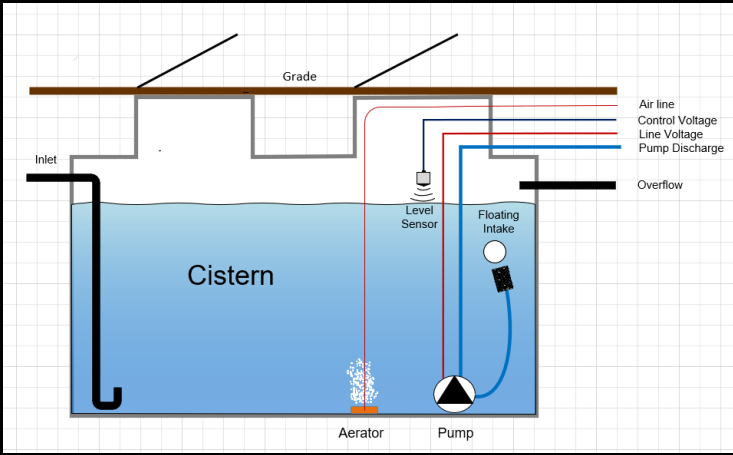
Adequate tank access to anything in the tank is essential for inspection, cleaning, pump removal, equipment inspection/troubleshooting.



Designing for Size and Safety

Access openings must be large enough for safe entry and removal of equipment, following local codes and safety standards.

AVOID THESE INSTALLATION STRATEGIES

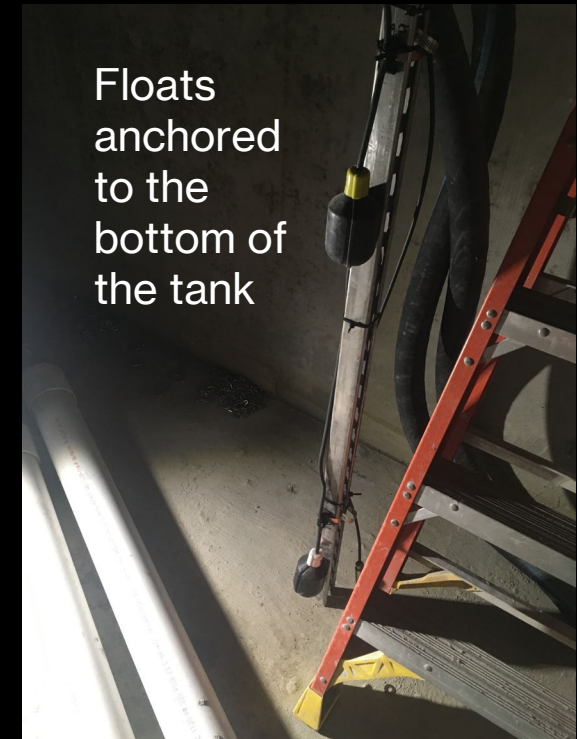
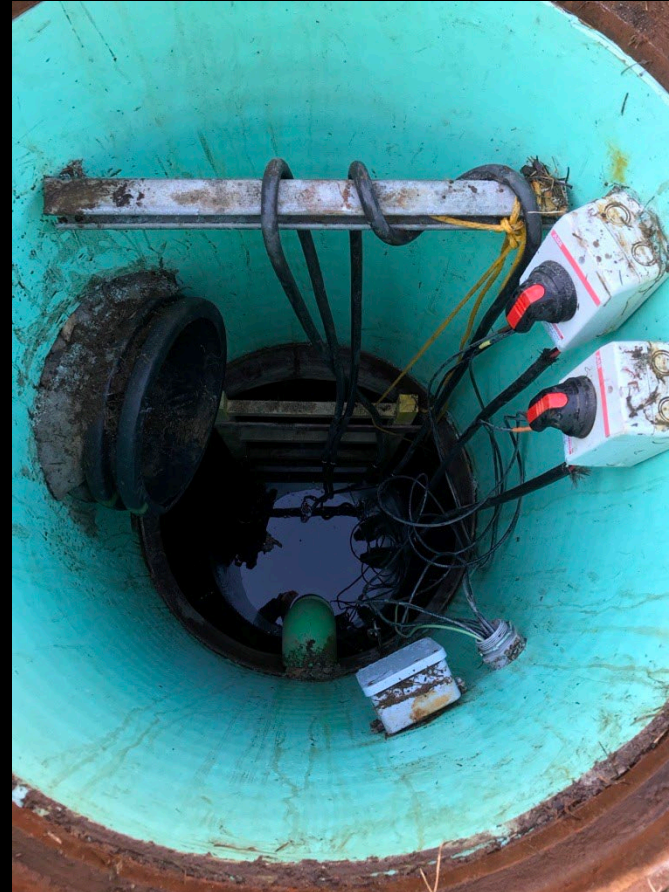


Design Clarity for Installation

Clear design of air line routing, balancing valves, air gaps, and pipe to hose transition locations reduces installation errors and operational risks.



Electrical connections subject to submergence



Floats anchored to the bottom of the tank

INLET PRE-FILTRATION **WHAT'S THE PURPOSE**



Water Inlet and Filtration

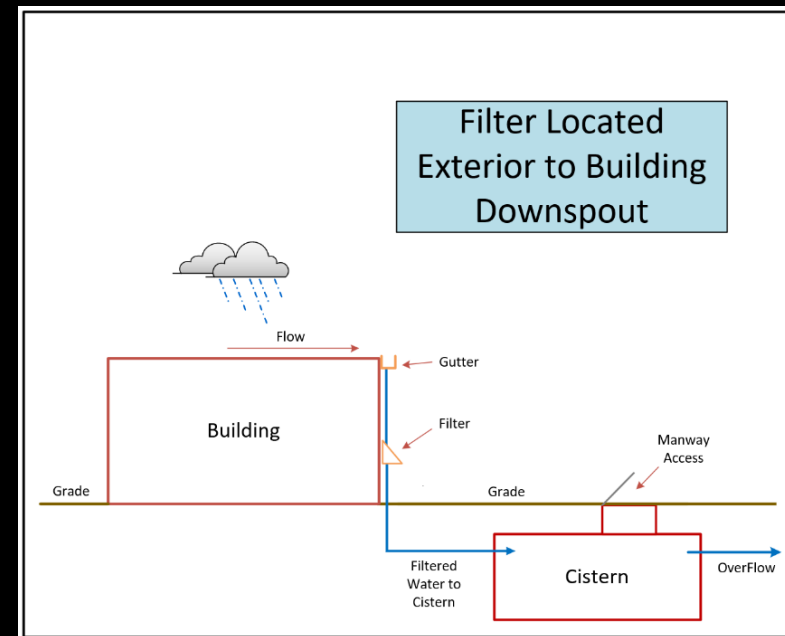
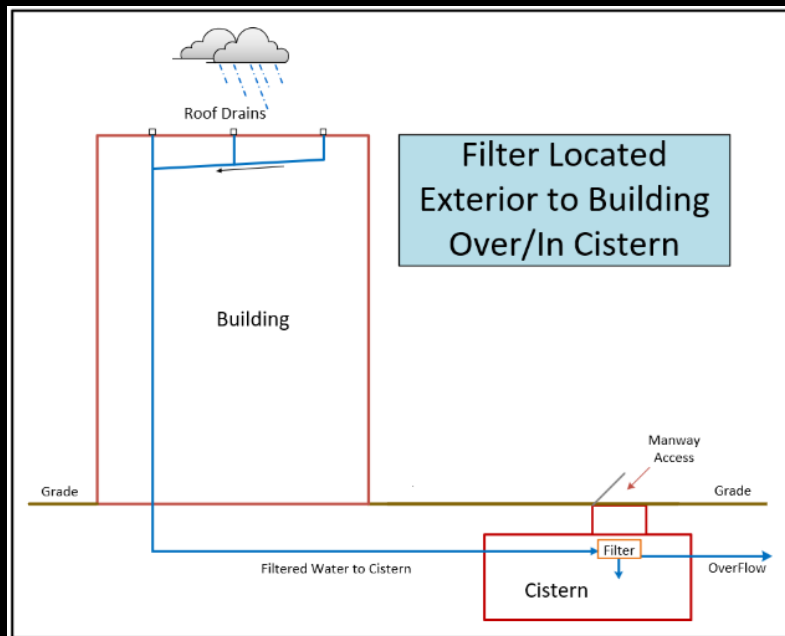
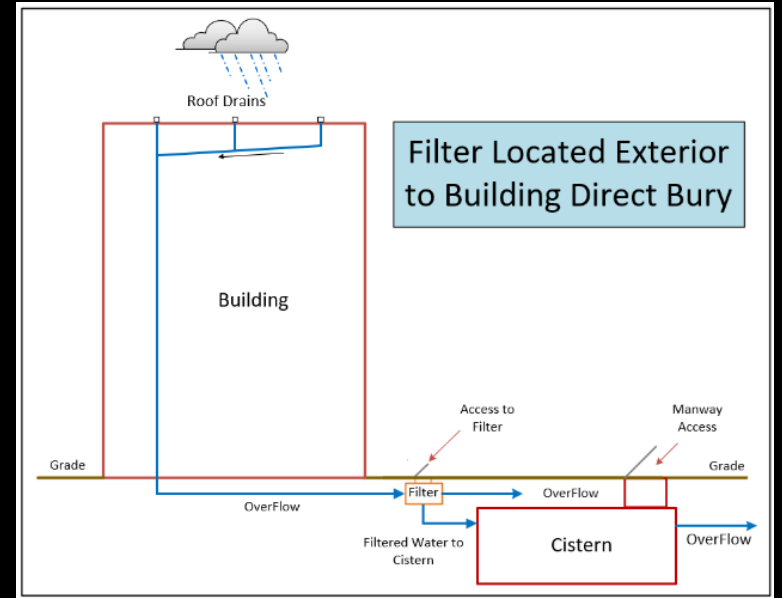
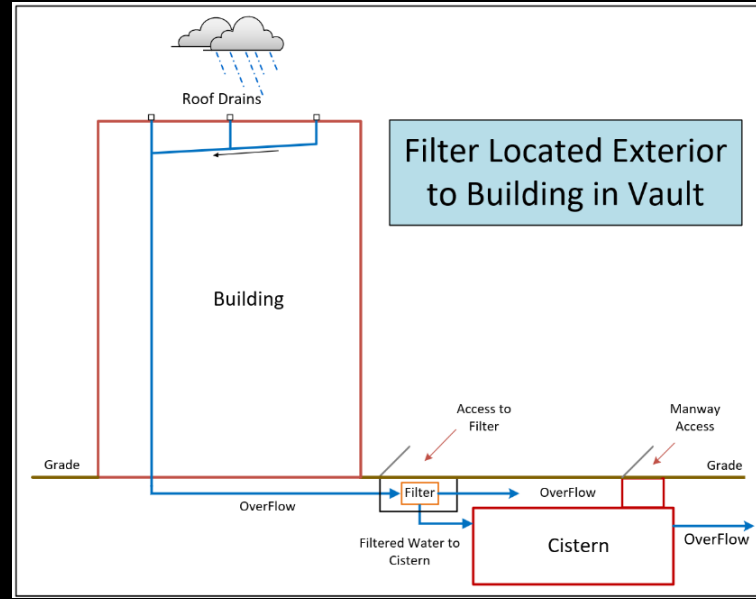
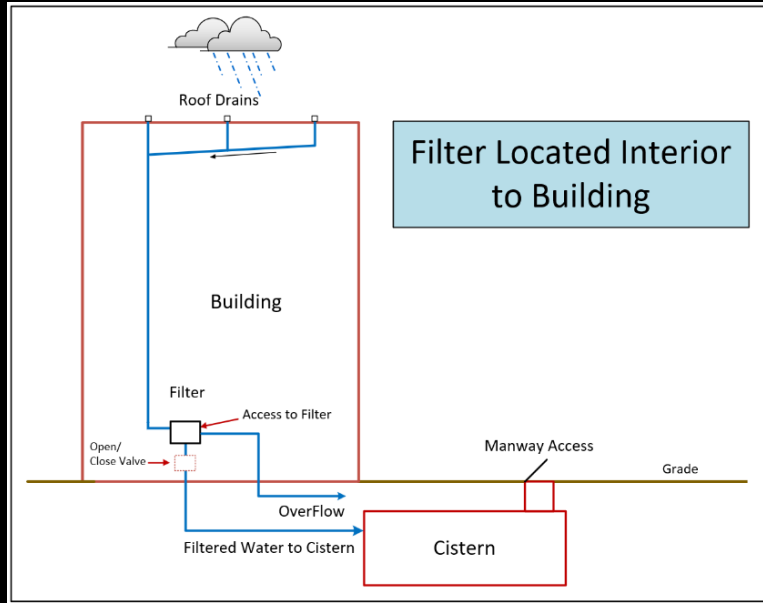
- Inlet pre-filters mitigate sediment buildup

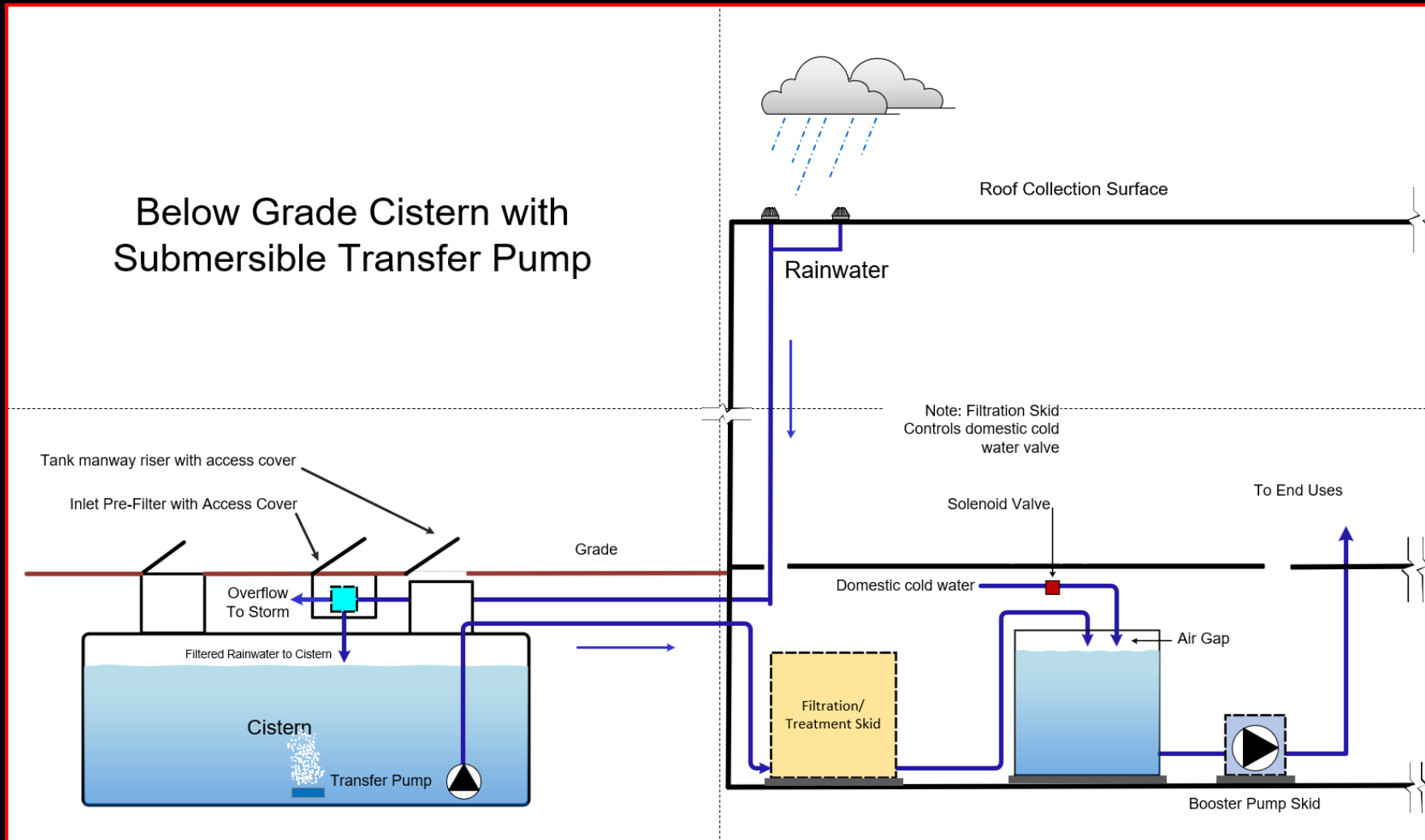
Collection Surfaces

- At grade surfaces are challenging and pose threats to the entire health of the system.
- Rainwater picks up debris along the way from collection surface to storage

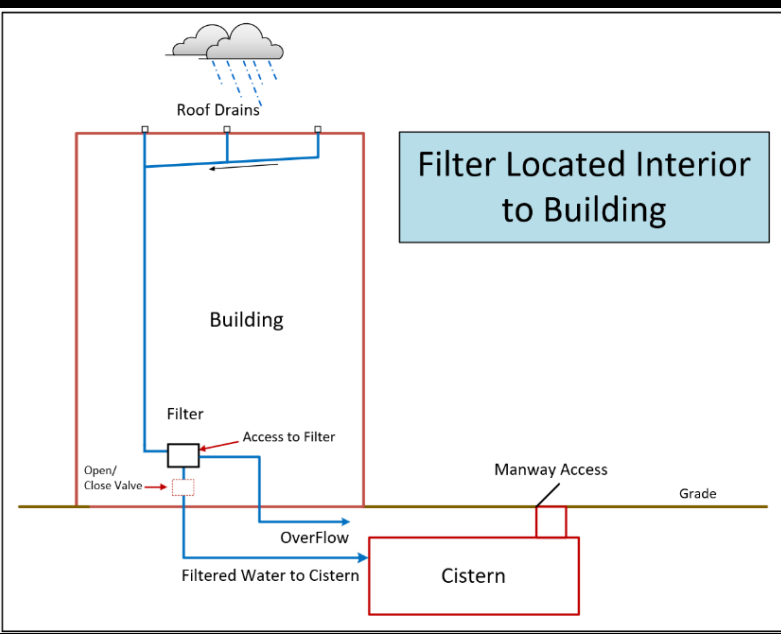


PRE-FILTER LOCATION AND POSITION





WATER OUTLET AND DISTRIBUTION



Bypass Flow Configuration

- Pre-Filters must include built-in overflows.
- This is essential requirement to mitigate risks from heavy rain events and clogged filter screens.

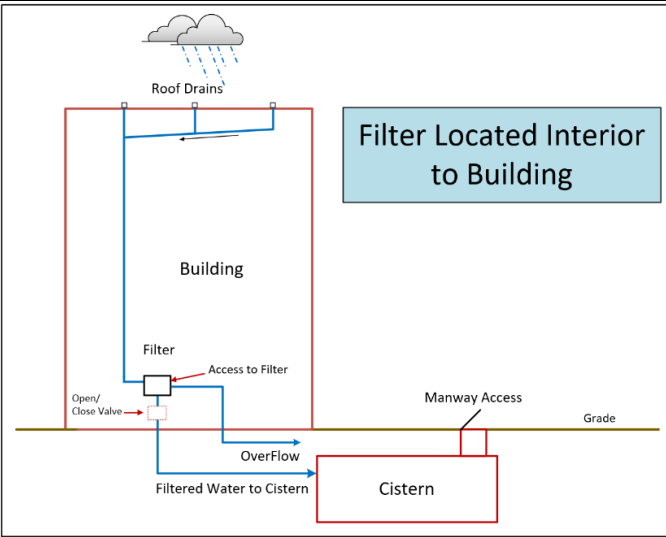


Can they be accessed for maintenance?



Bypass Flow Configuration

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- This is essential requirement to mitigate risks from heavy rain events and clogged filter screens.



Filter located in super difficult location to access

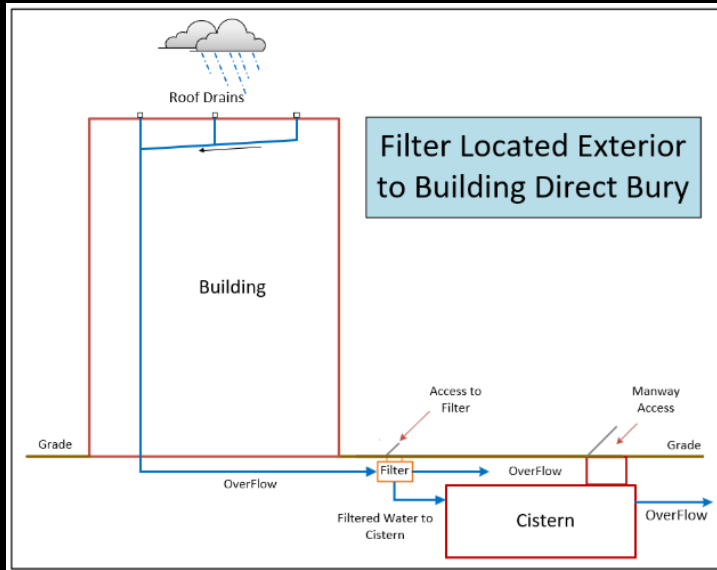
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Indoor Pre-Filter Installation

Installing pre-filters inside buildings allows easier maintenance and freeze protection but needs careful space and drainage planning.

DIRECT BURY TYPE



Location on property

- Mark location for future reference
- Incorporate maintenance into building's program
- Access points should be conveniently located to avoid removing landscaping or pavement, facilitating routine maintenance.



HOW ARE THEY BE SERVICED?

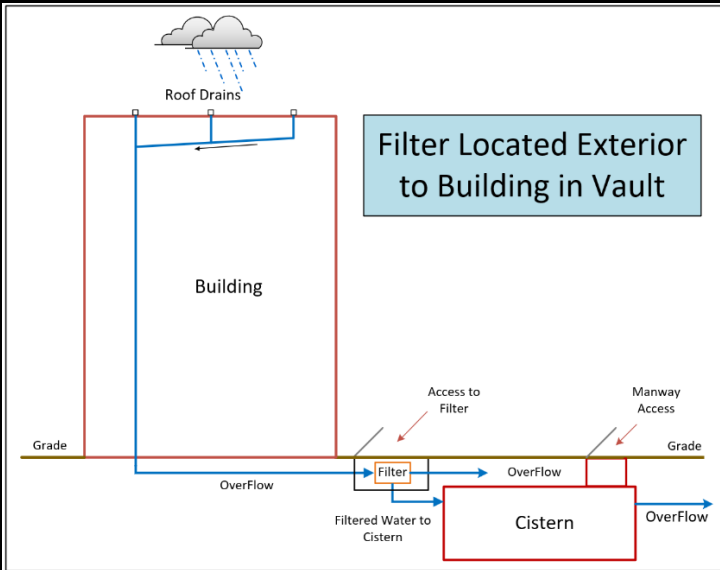
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Access to Filter for Maintenance

- Extend “riser” access to grade with secure access point
- Compaction not to exceed filter capacity



BELOW GRADE CONCRETE VAULT



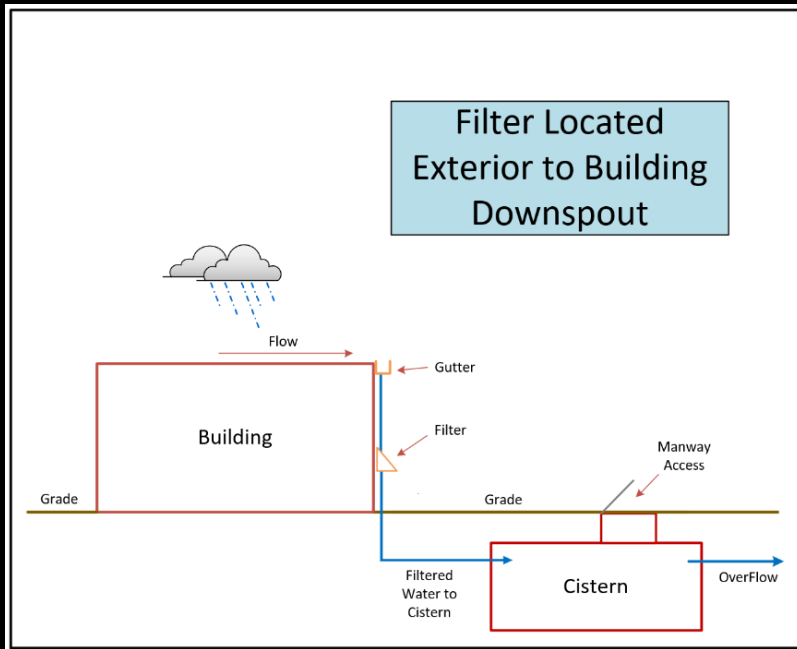
Underground Pre-Filter Placement

- Keep debris out during construction
- Provide appropriate load rated lid.



DOWNSPOUT TYPE

INSTALL IN EASY TO ACCESS LOCATION



FIRST FLUSH

- Diverts initial runoff containing highest contaminants
- Dramatically improves water quality in the cistern



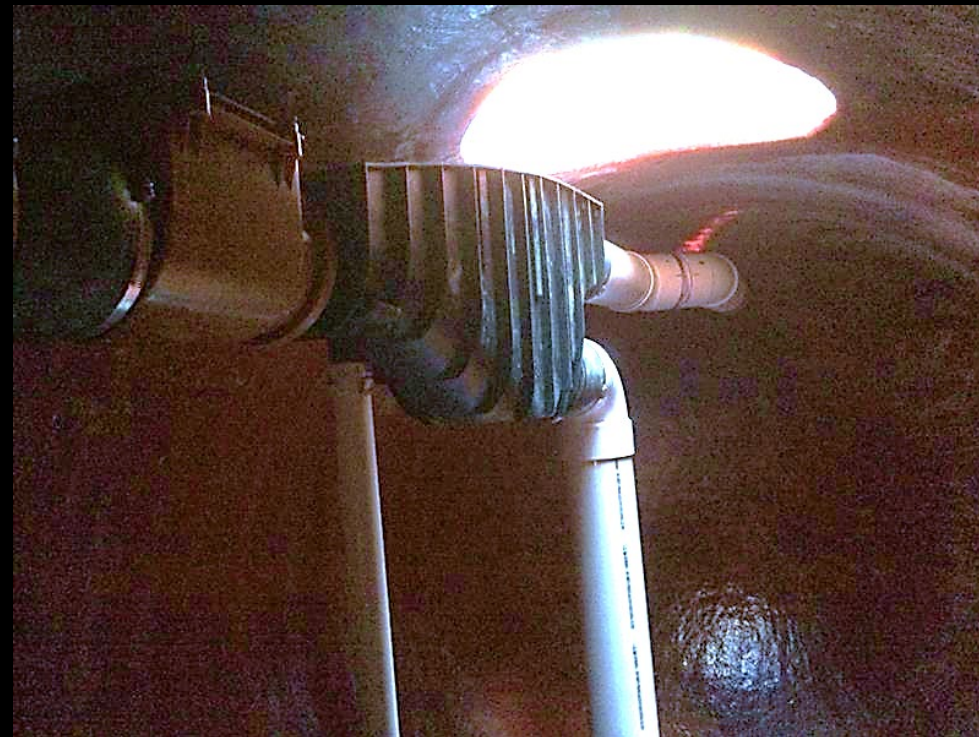
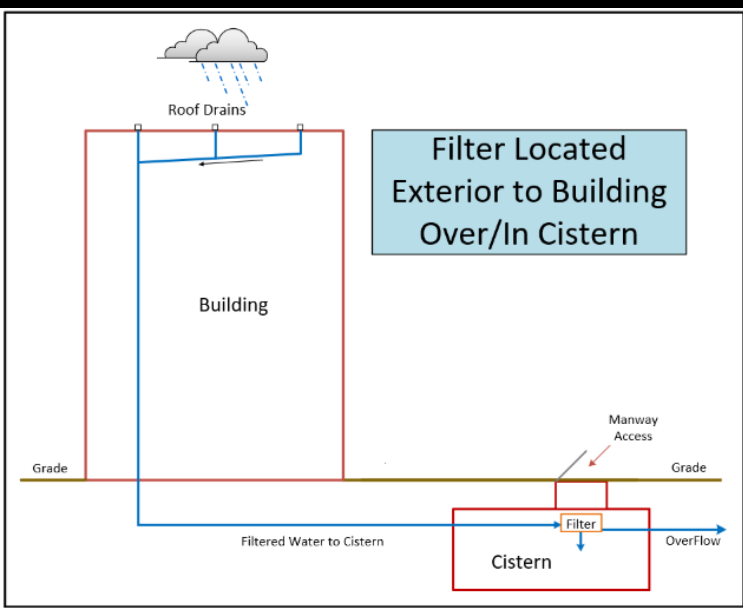
PLACE UNITS ABOVE THE SNOW LINE IN COLD CLIMATES



OVER/IN TANK

Underground Pre-Filter Placement

Placing filters underground suits large sites but poses challenges like confined access, groundwater intrusion, and requires safe maintenance design.



Tank-Integrated Pre-Filters

Filters inside tanks reduce external equipment but complicate servicing due to limited tank access for cleaning or replacement.

TANK ACCESSIBILITY

Safety

Platforms provide safe access to tank lids and pre-filters



Overlapping Engineering Roles

- Coordination between Civil and Mechanical is vital
- This is a solution not a group of parts



Coordination Challenges

Gaps in scopes create confusion during construction.



Mud in the tank is not good!

- Often the result of poor communication between trades and engineering

The Sky's the limit!



Thank you!

Questions?

Edward Van Giesen
RainCycle National Sales Manager
Edward.vangiesen@wattswater.com
706 910 2685