

Responding to Low Building Water Use: Concerns and Best Practices for Facility Managers



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*Information for Building Owners, Building Managers,
Health Officials, and Building Occupants*

More information here... www.PlumbingSafety.org



[COVID-19 Response](#)

[Camp Fire Response](#)

Thank you for visiting. This website is designed to provide information to persons who drink water in buildings, as well as building construction, plumbing, water utility, education, and public health sectors. Together, we are working to understand how to make certain the water you use at home, at work, and at schools is safe. Please contact us if you have any questions at awhelton@purdue.edu.

Partner Institutions:



A Resource for All

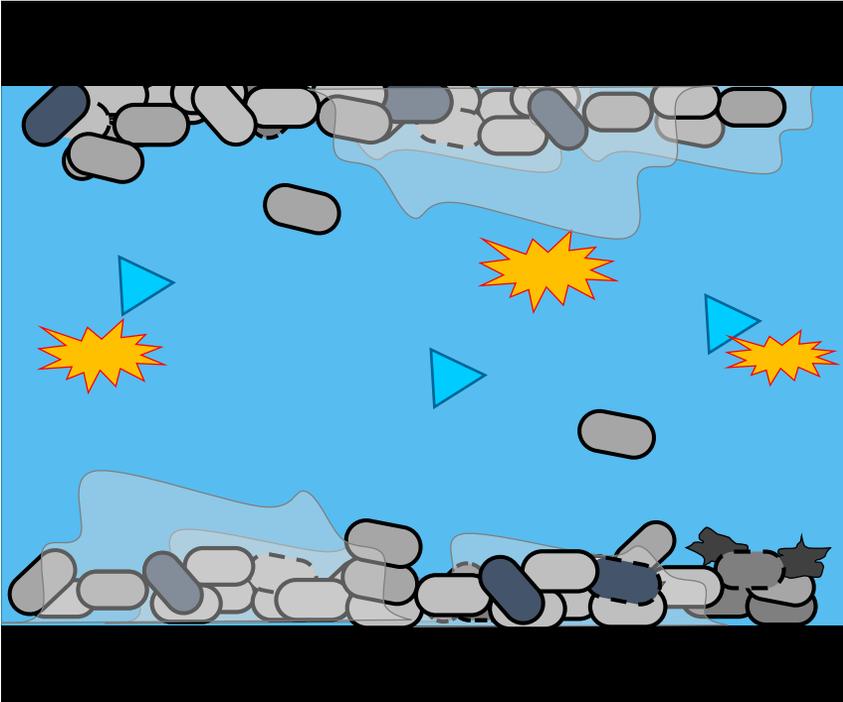
- ✓ Plumbing news
- ✓ Plumbing education videos
- ✓ Plumbing explainers
- ✓ List of projects
- ✓ Scientific opinions
- ✓ Resources → presentations
- ✓ Scientific reports
- ✓ External plumbing docs

COVID Specific Building Water Safety Support Resources

Stagnation causes water to get older

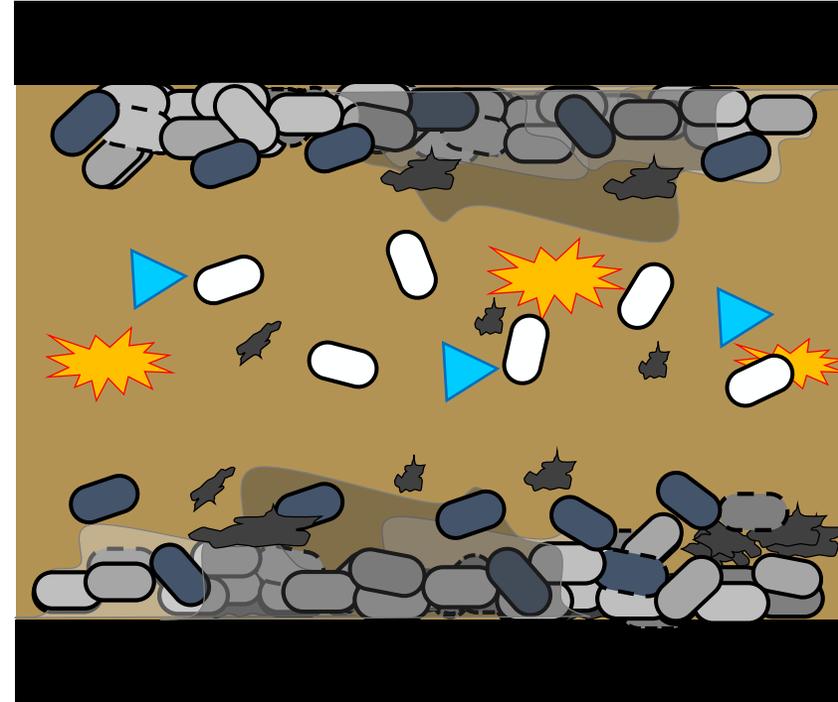
Normal water use refreshes:

- disinfectant residual & 
- corrosion control 



Old water (not refreshed):

- bacterial growth & 
- corrosion not controlled 



Disinfectant in water – used to reduce microbial growth in water, typically chlorine

Corrosion control – used to reduce metals leaching, stabilizes pH and may add chemicals

Prior to the pandemic, stagnation posed health risks

During short-term stagnation, high concentrations of metals and harmful organisms have been found in building water systems. A few issues include...

- **Copper** can leach from pipes (an exceed safe limits in just 48 hours sometimes)
 - This can increase to toxic levels causing gastrointestinal distress
- **Lead** can also leach from water system components
 - Lead causes developmental issues with children
- **Harmful organisms** (e.g., *Legionella pneumophila* and other opportunistic pathogens) grow
 - Many of these organisms cause respiratory illness
 - Other infections can occur

These reactions have not been studied in the long-term

Watch on YouTube: [Why Does Water Quality Change Inside Buildings?](#)



U.S. National Science Foundation RAPID Award 2027049
**Shutdowns and Consequences - Extreme
Plumbing Stagnation and Recommissioning**



1. Support to the plumbing and public health sectors on building water safety guidance and decisions
2. Building water safety review due to prolonged stagnation with experts from 8 private and public sector organizations
3. Field testing to determine how impacted building water safety is in actual large buildings
4. Lab testing to determine how to fully recover contaminated building water system devices and equipment
5. Help transform public awareness

Helping



SAFE WATER ENGINEERING

#2. Review paper

Collaborative effort

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Northeastern University



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Considerations for Large Building Water Quality after Extended Stagnation

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What actions can be taken to *prevent* water quality deterioration?

Normal use:

- Building water management plans

Extended stagnation/low-use

- Periodic flushing
- Change water heater operation
- Drain plumbing?

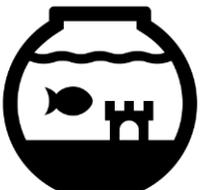
COVID-19 considerations:

- Utility mains also have stagnation
- Slow ramp-up of economic activity



What actions can be taken to *deal with* water quality deterioration?

- Recommissioning plumbing
 - System integrity checks
 - Flushing (and cleaning)
 - Shock disinfection
 - Testing
- Professional help might be needed
 - Address complex mechanical and treatment equipment
 - Develop effective flushing plans
 - Perform shock disinfection safely (thermal or chemical)
 - Perform accurate testing



How do organisms cause disease?

Multiple exposure routes

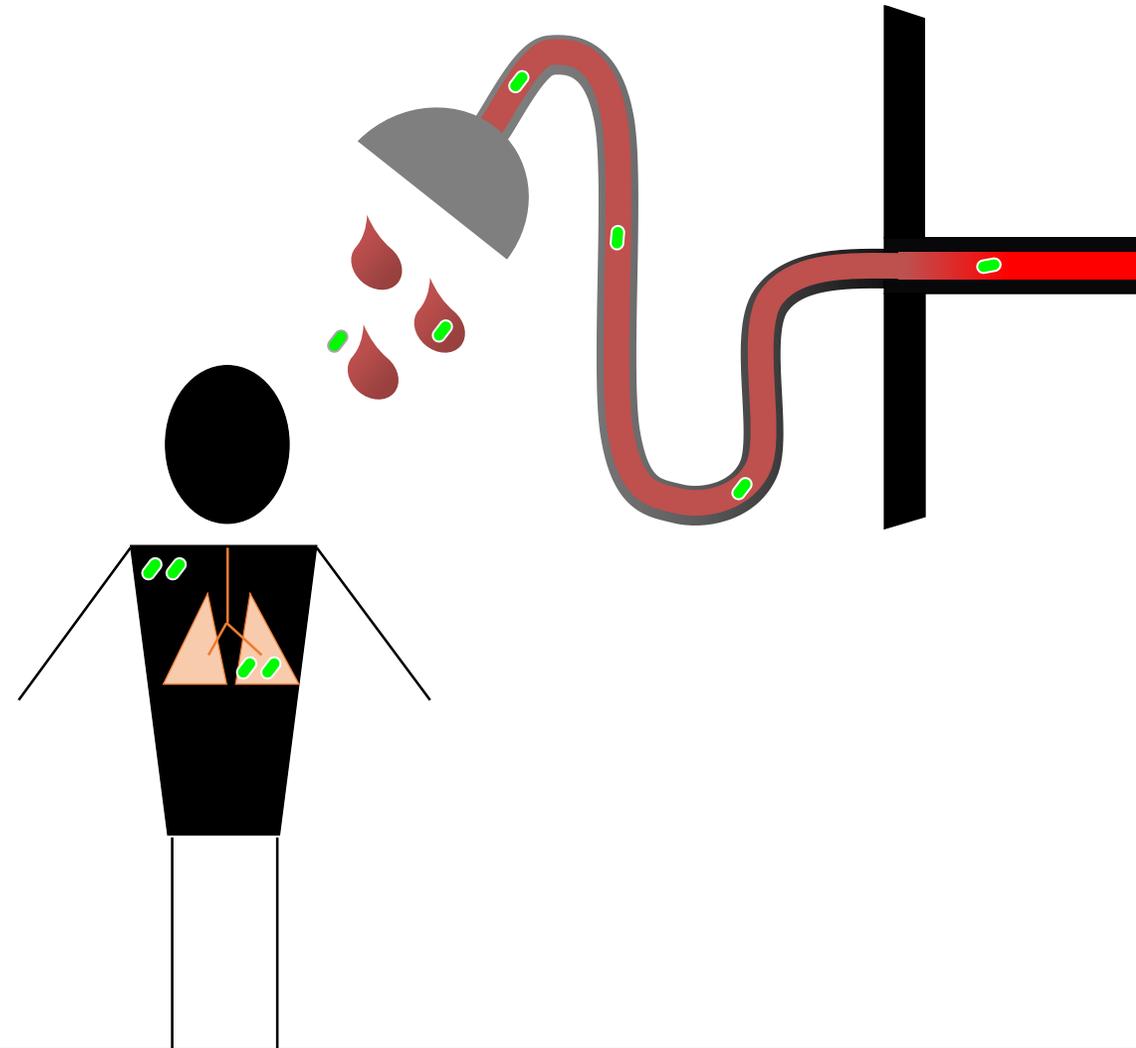
- Drinking
- Inhalation
- Dermal (skin, eyes, wounds)

Multiple exposure activities

- Showering
- Anything with splashing/aerosols

Typically affect only vulnerable populations, but anyone can be affected

- Immunocompromised
- Certain pre-existing conditions
- Elderly



Precautions

- Personal protective equipment (PPE)
 - OSHA and other agencies recommend respirators if Legionella is suspected
- Reducing exposure
 - During flushing (especially initial), many “tricks” to reduce exposure
 - Cover toilets, showerheads, faucets, reduce splashing
- Temporary closures of facilities
 - Temporarily forbidding high-risk exposure activities (showering)
 - Temporarily closing facilities to concentrate use
- Technical considerations
 - Flooding, cross-connections, dealing with waste
 - Pressure issues with high flowrate flushing



Who should be involved?

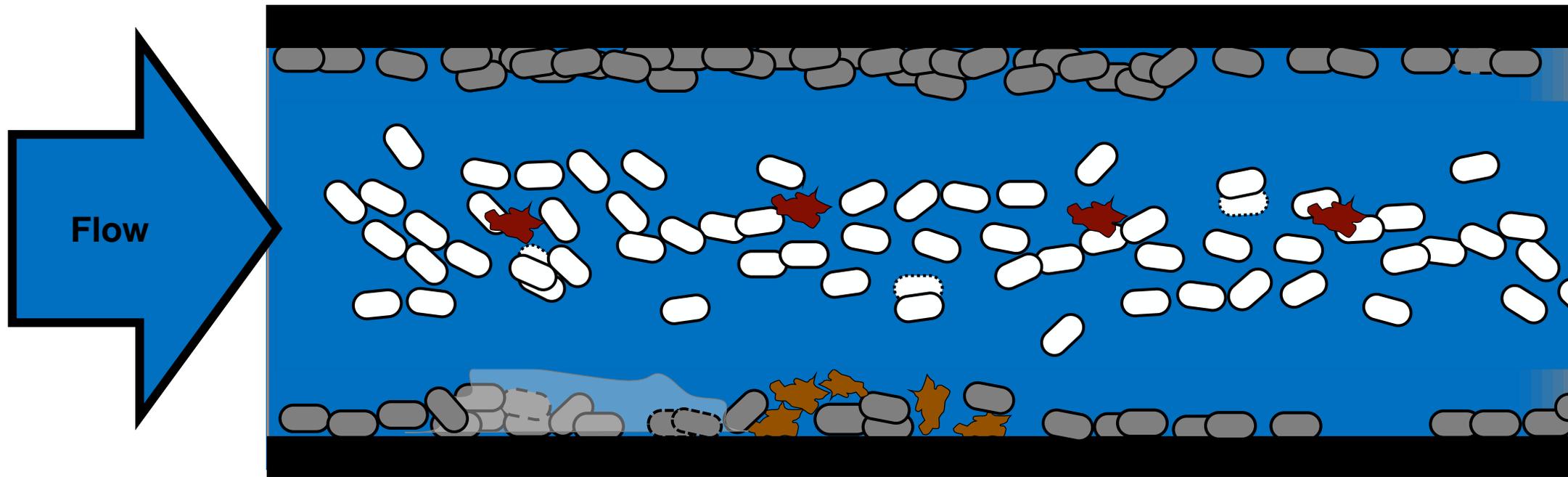
- Developing guidance
 - Many government (and non-government) agencies doing this
- Communication about risks
 - Public health officials
 - Building owners?
 - Utilities
- Taking action (flushing, disinfecting)
 - Building owners can task maintenance/facilities managers
 - Plumbers, contractors, engineers may need to be involved
 - Utilities

Flushing achieves 3 goals

Goal 1: Remove materials that accumulate in water during stagnation

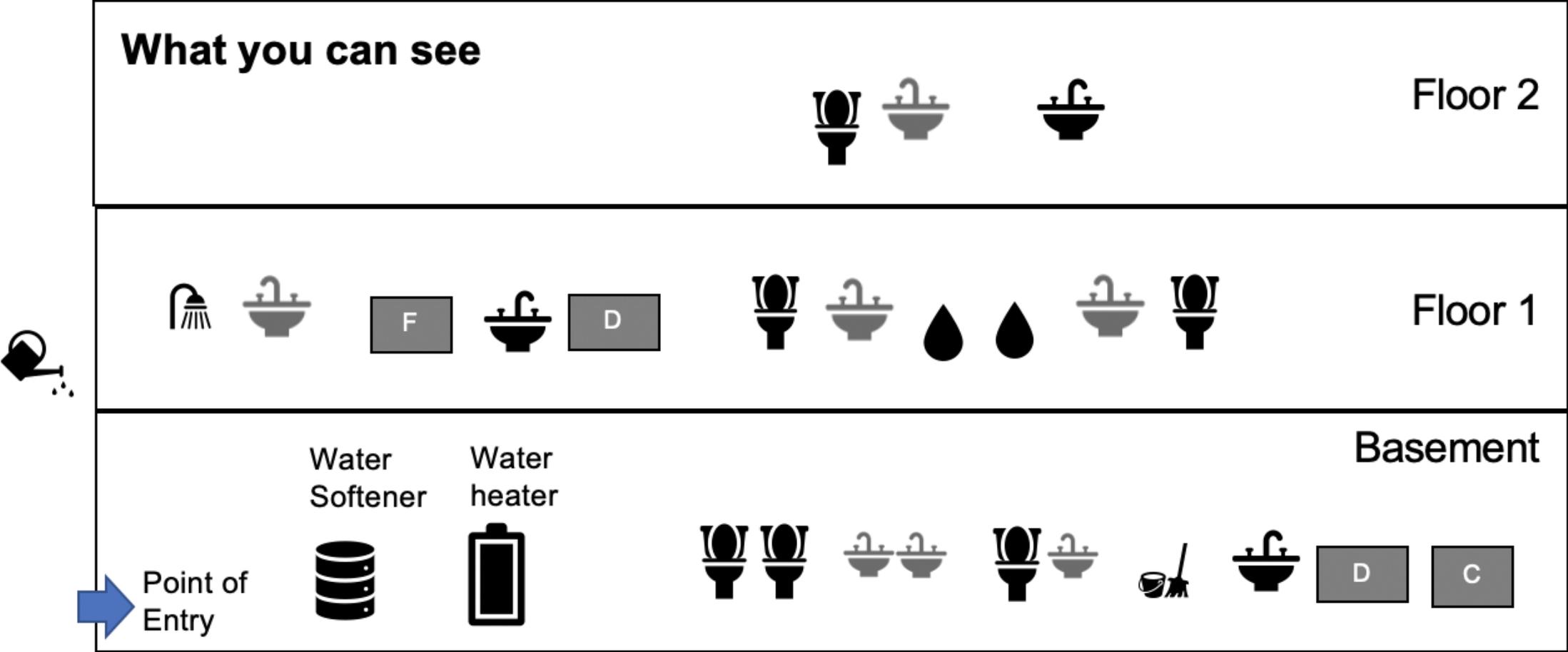
Goal 2: Remove some biofilms and sediments,
(if done at sufficiently high enough speeds)

Goal 3: Bring fresh water into pipes



Slide adapted from our YouTube video series

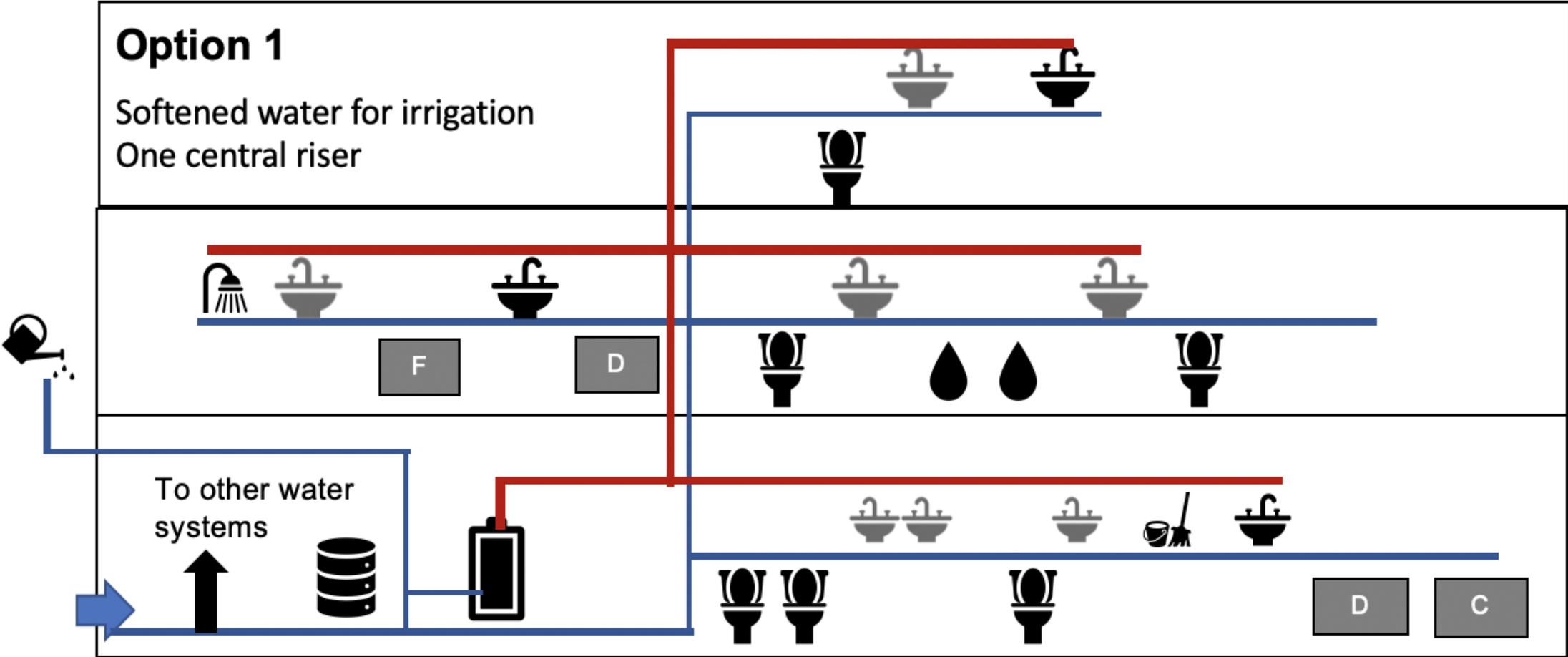
Understanding plumbing configuration



Legend

Pipes		Hot	Sinks		Kitchen		Toilet		Shower		Appliances
		Cold			Bathroom		Fountain		Irrigation		F - fridge
				Janitorial						D - dishwasher	
										C - water cooler	

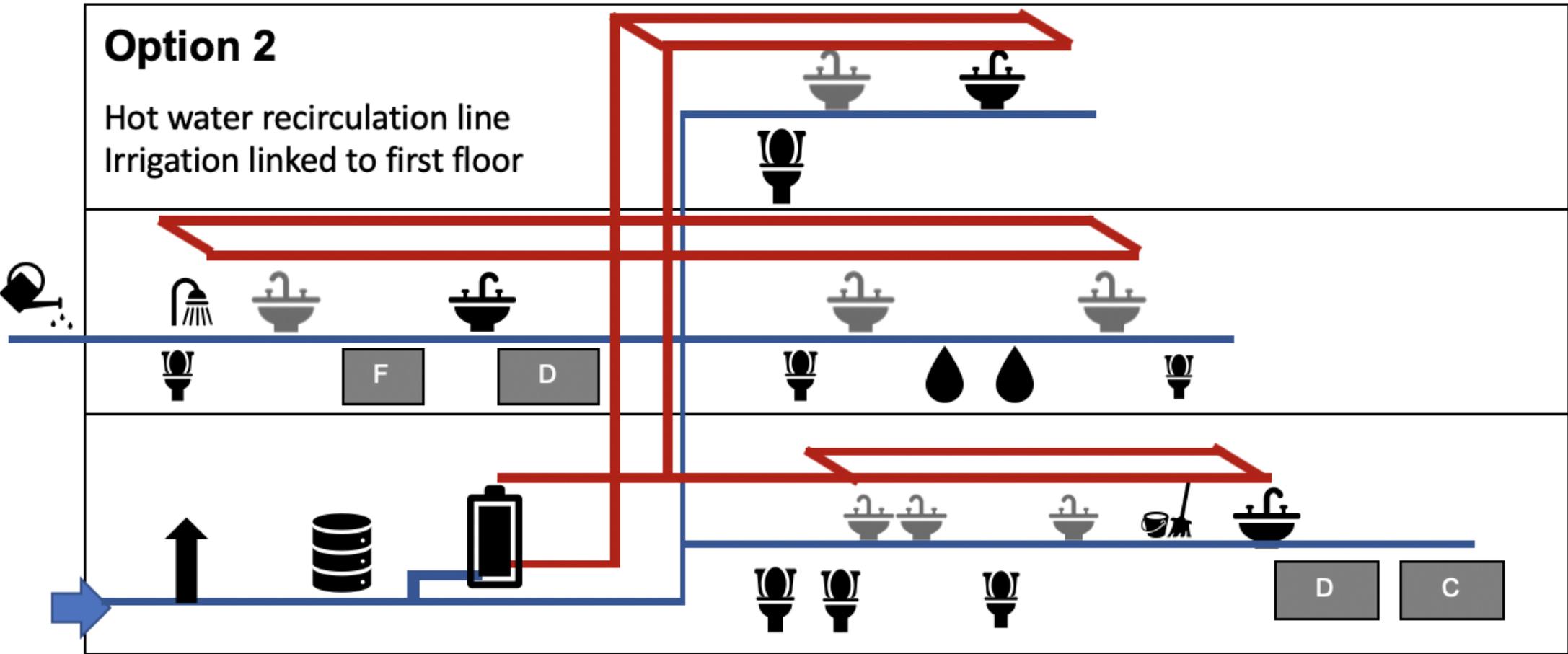
Understanding plumbing configuration



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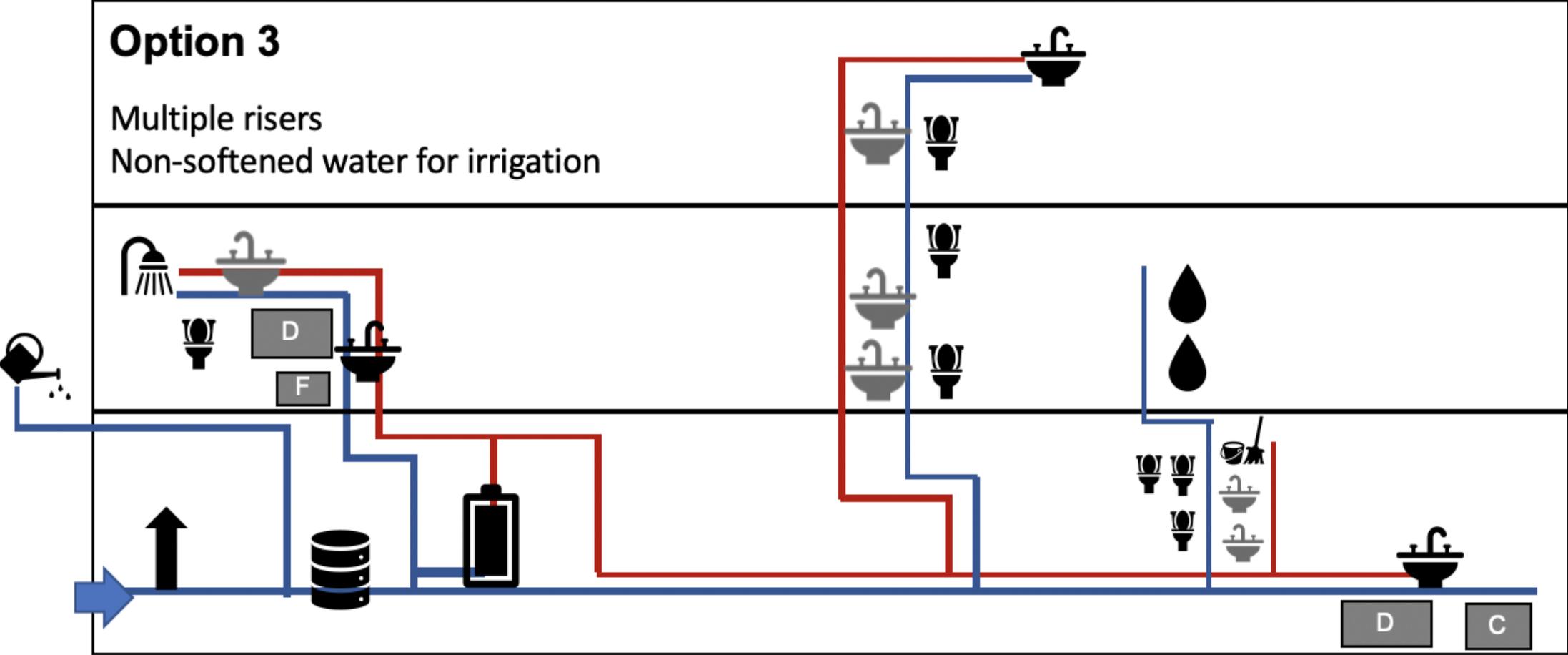
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Understanding plumbing configuration

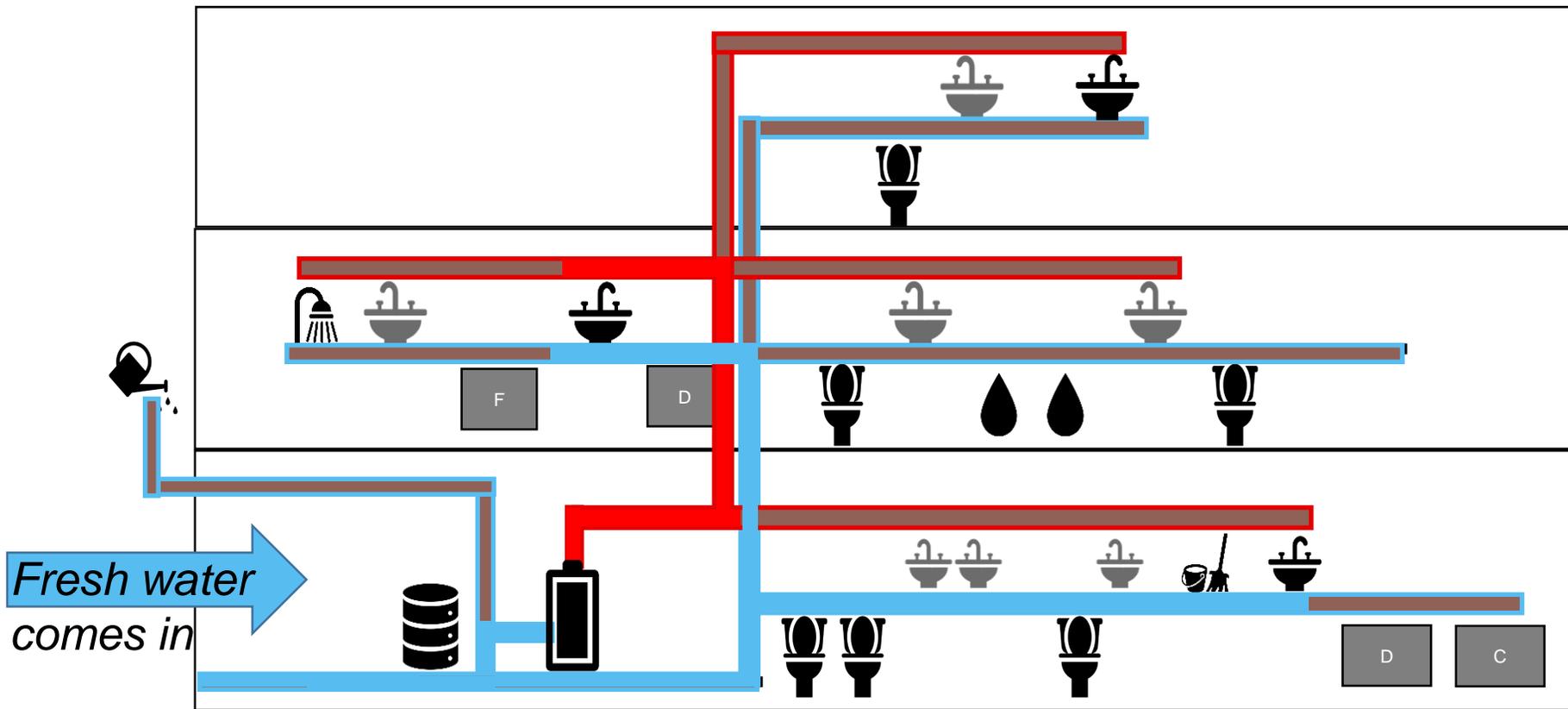


Legend

Pipes	Hot	Sinks	Kitchen	Toilet	Shower	Appliances
	Cold		Bathroom	Fountain	Irrigation	
			Janitorial			F - fridge
						D - dishwasher
						C - water cooler

Incomplete flushing

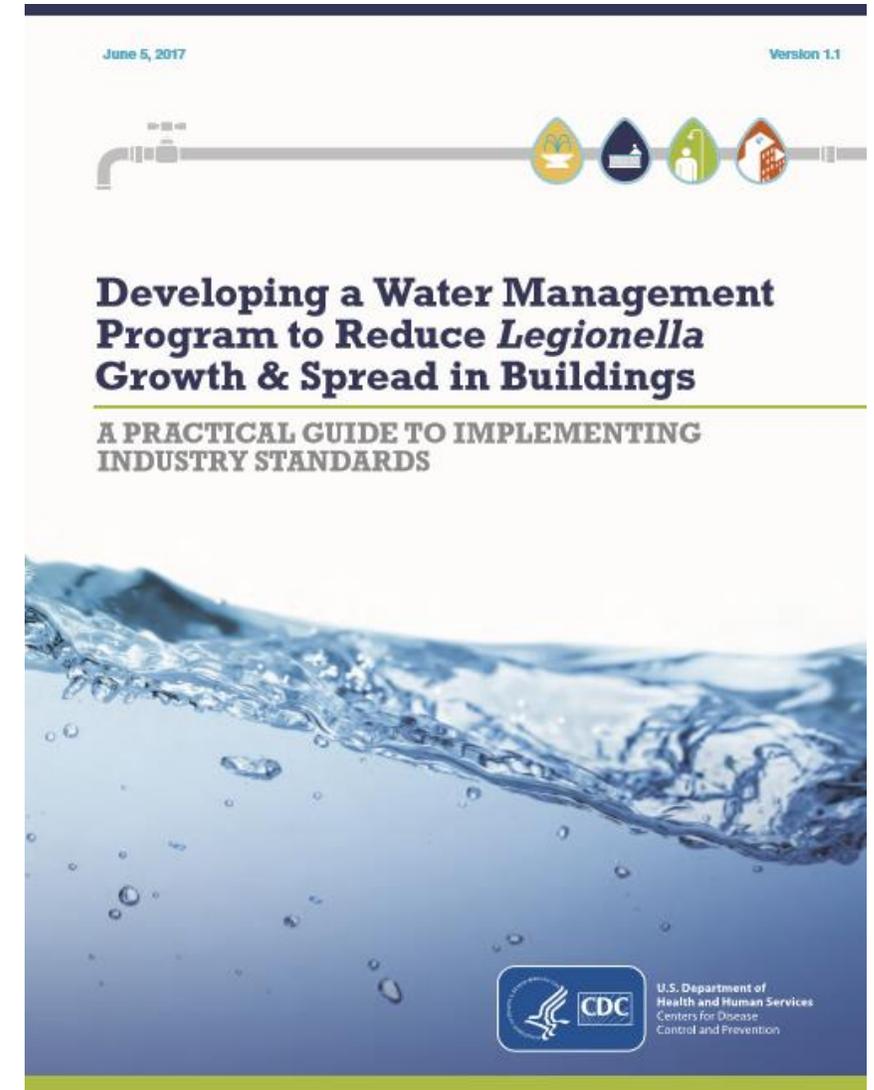
Incomplete flushing fails to get fresh water all the way to all water outlets



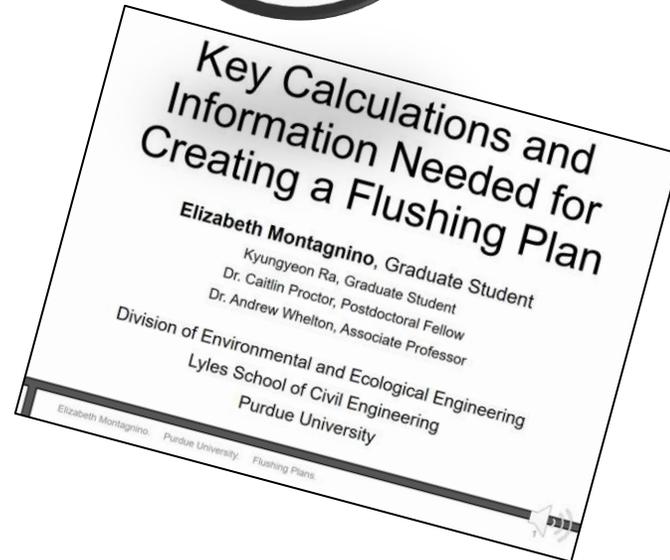
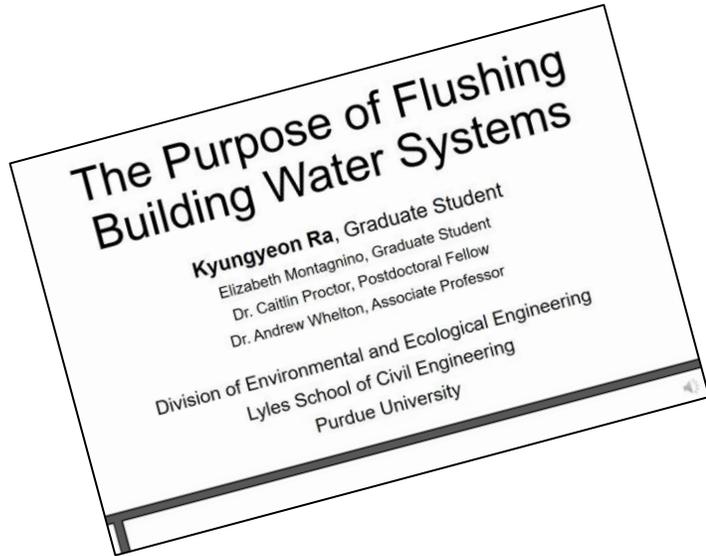
Slide adapted from our youtube video series

10 actions building owners should consider

1. Contact government public health department, they may have specific requirements.
2. Communicate info provided by the health department to occupants.
3. Don't have a building water management plan? Document everything.
4. Flush at least weekly. *More frequent is better.* Document! Create a flushing plan.
5. Conduct maintenance: Aerators, POU/POE treatment devices, water heaters, shower-wand tubing, etc.
6. Start an inventory of building water system components
7. Use an inexpensive digital handheld disinfectant analyzer to monitor in-building levels. Document!
8. Contact a plumber or engineer for assistance
9. Do not shock disinfect, drain plumbing, shut off water heaters and recirculation loops without expert help. Major issues can develop.
10. Reach out to us if you have questions.



Learn how to create a building flushing plan



Visit our
Plumbing Safety
YouTube
Channel for Short
Education Videos

Example Procedure for Flushing an Actual School Building

April 6, 2020, Version 1

I. Background

Sometimes buildings are shutdown or experience long-periods of low occupancy and the water inside the property plumbing stagnates. Water can stagnate inside the building pipes and tanks, but also in the buried water service line that transports drinking water from its source to the building. Stagnation allows for contaminant levels of metals such as lead and copper to increase in the water. Microbes are also likely to grow. Under routine building water use, the amount of contamination in water is not typically a problem, but long stagnation periods can cause water quality to deteriorate to unacceptable levels. To remove this water from the property plumbing, a procedure was developed based on as-built construction drawings and experience inside the building. The procedure below is provided to help demonstrate the steps needed to flush the stagnant water from the plumbing of a specific building and replace it with fresh water from the water utility main buried out in front of the property.

This guidance was developed using as-built drawings for an actual building where the characteristics were known. **Factors of safety were not applied.** Due to non-ideal flows commonly encountered in plumbing, stated flushing times may need to be increased. In a prior study for flushing home interior faucets the factory of safety applied was 10. So, all flushing times may need to be 10% longer. No safety factors were applied.

	Building Characteristics
Year Built 2011	
Size:	<ul style="list-style-type: none">• 2 floors (1st floor: classrooms, auditorium, two gyms, and cafeteria; 2nd floor: mechanical attic)• All water only located on first floor• The building area is 200,000 square feet, while the total area for the property (including sporting fields) is 3,378,152 square feet• There are 12 different building sections (A, B, C, D, E, F, G, H, J, L, K) and each has various uses.
Water Transport and Use on Property:	<ul style="list-style-type: none">• A public water system (PWS) delivers chloraminated drinking water to the property through a buried service line.• PWS water used for drinking, appliances, hot water, and irrigation.• After passing through the water meter, an 8 inch PVC pipe service loop circles entire school campus [3,481 feet, volume 9,089 gallons]. Some branches exist that convey water to a field house, concession stand, and yard hydrants (a 2 inch existing fire hydrant branches off from the fire line around the building to near the concession stand, and few others are located outside the building).• 4 inch irrigation pipe line also branches off from the fire line around the building. In this document, flushing of the irrigation line is not included. The building service line and building itself is only the focus.• Water enters the school building by traveling through this loop, and then into a 4 inch ductile iron pipe [160 ft, volume 104 gallons]
Devices:	<ul style="list-style-type: none">• Two point-of-entry water softeners (52.36 gallons each, one used at a time)• Four water heaters (130 gallons each)• Total four hot water recirculation loops, one heater for each loop (a 150°C loop for the kitchen and three 120°C loops for domestic water)

Professionals like you have a key role to play in keeping building water safe

1. Millions of buildings across the U.S. have now been affected by low to no water use.
2. Care must be taken to minimize building water system stagnation and water quality impacts.
3. Building owners should consult their health departments.
4. Our website contains education materials and guidance documents.
5. If you have a question reach out. You're not alone.



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