

*Ecotoxicology and stormwater have more in common than one might think. An ecotoxicologist studies chemicals in the environment: where they come from, what effect they might have on animals and people, and how to reduce these chemicals and negative effects in the environment. Studies have found stormwater is a major pathway into our local waterbodies for many chemicals of concern.*

*Understanding how to provide long-term, cost-effective stormwater treatment is a shared goal.*



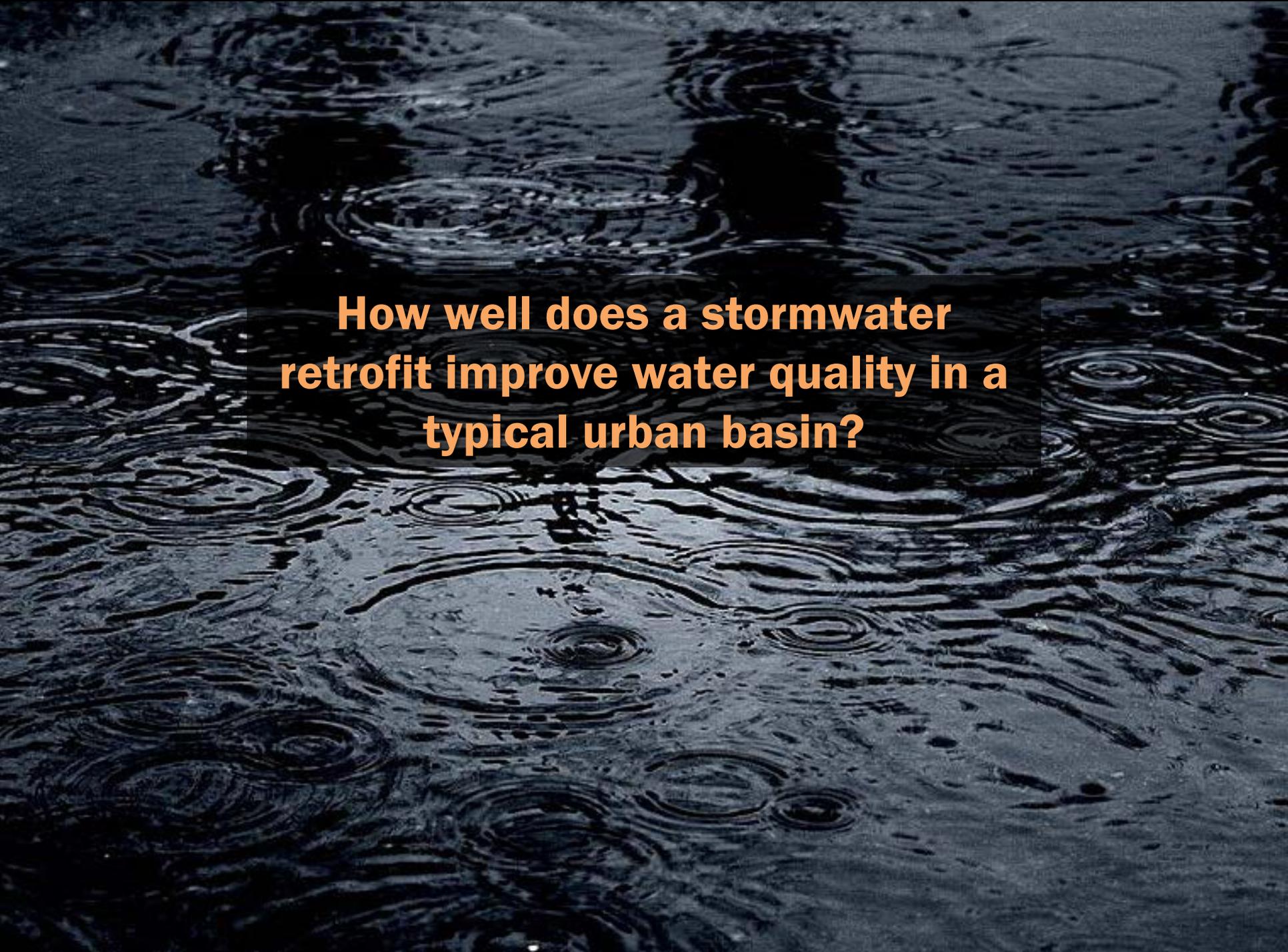
**Stormwater Retrofits for  
Treating Highway Runoff:  
Echo Lake**



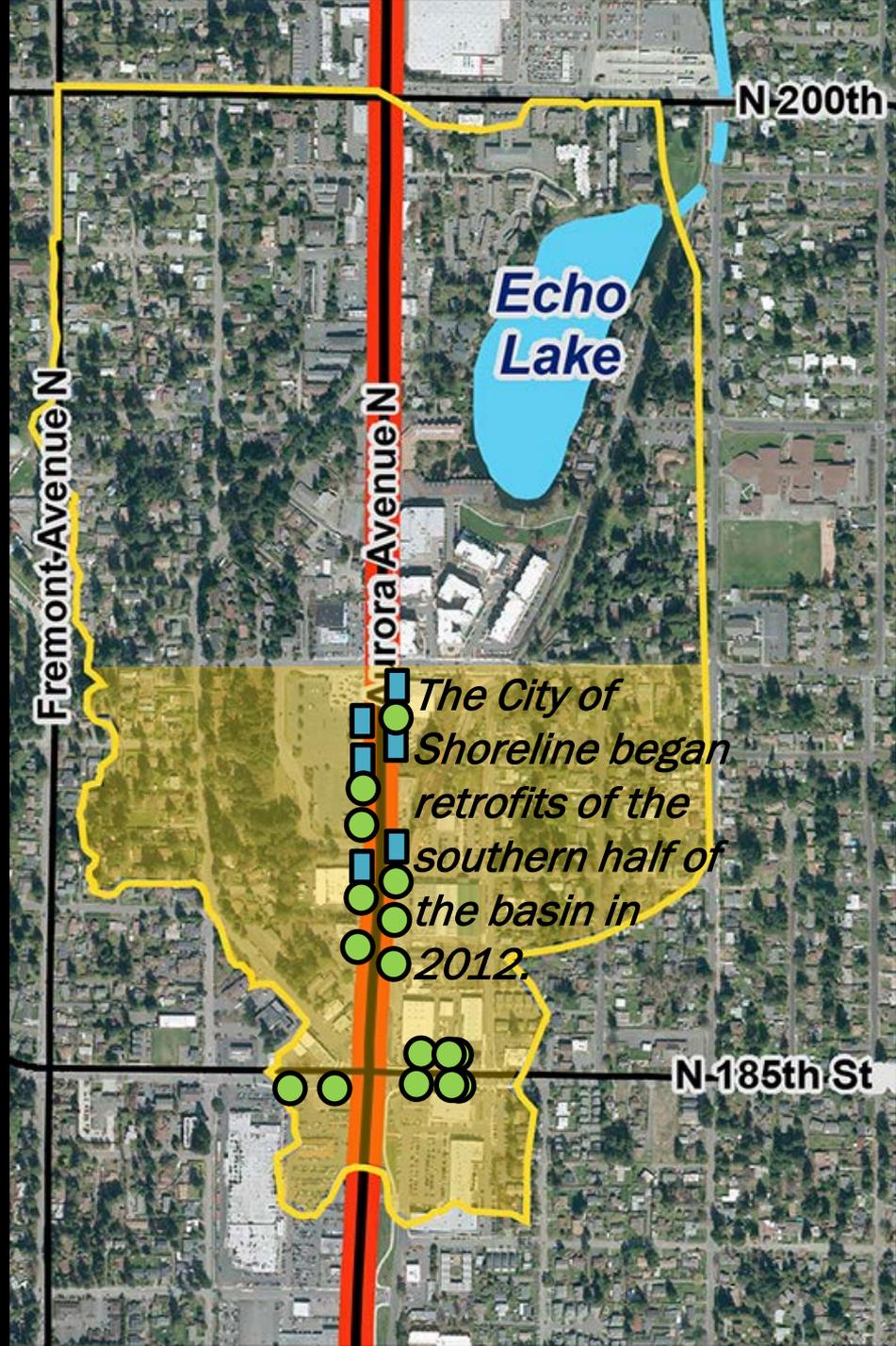
Status &  
trends

Effectiveness  
studies

Source  
identification



**How well does a stormwater retrofit improve water quality in a typical urban basin?**



*Included in presentation:*

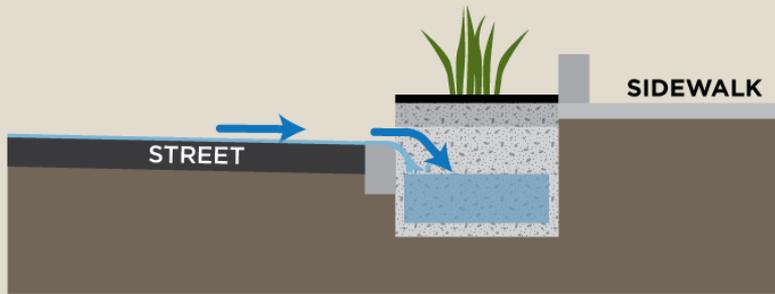
3 Bioretention  
Planter Boxes

1 Filterra

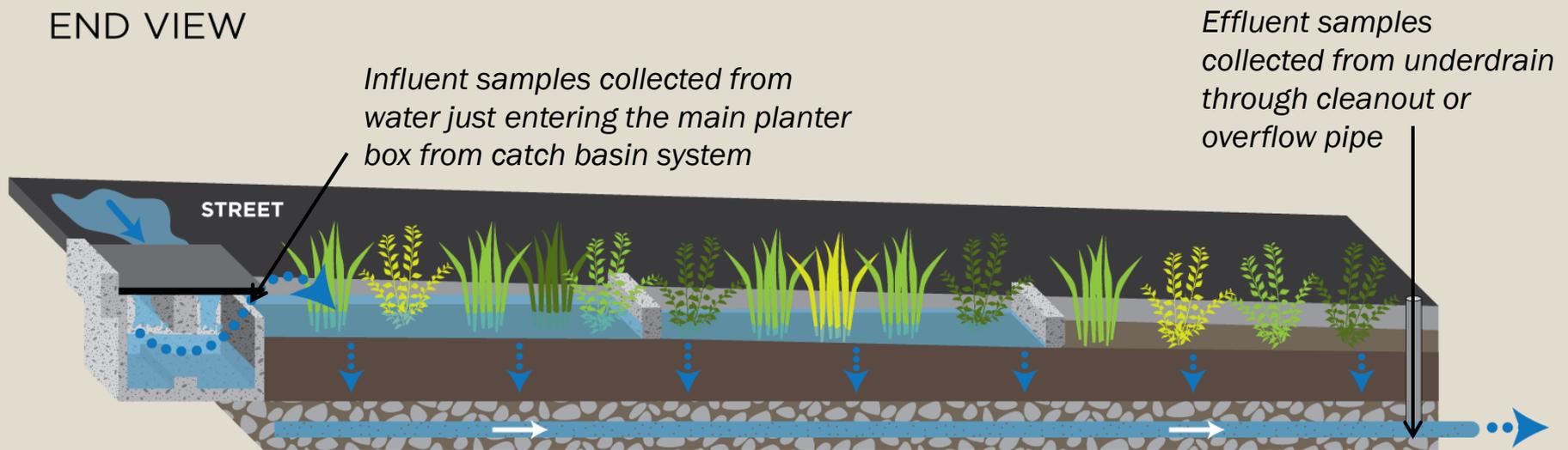


# Bioretention Planter Boxes (Rain Gardens):

- 60/40 sand/compost mix
- Designed for enhanced treatment
- Runoff from roadway enters catch basin system before entering main planter box
- Concrete lined = no infiltration
- Perforated PVC pipe underdrain



END VIEW

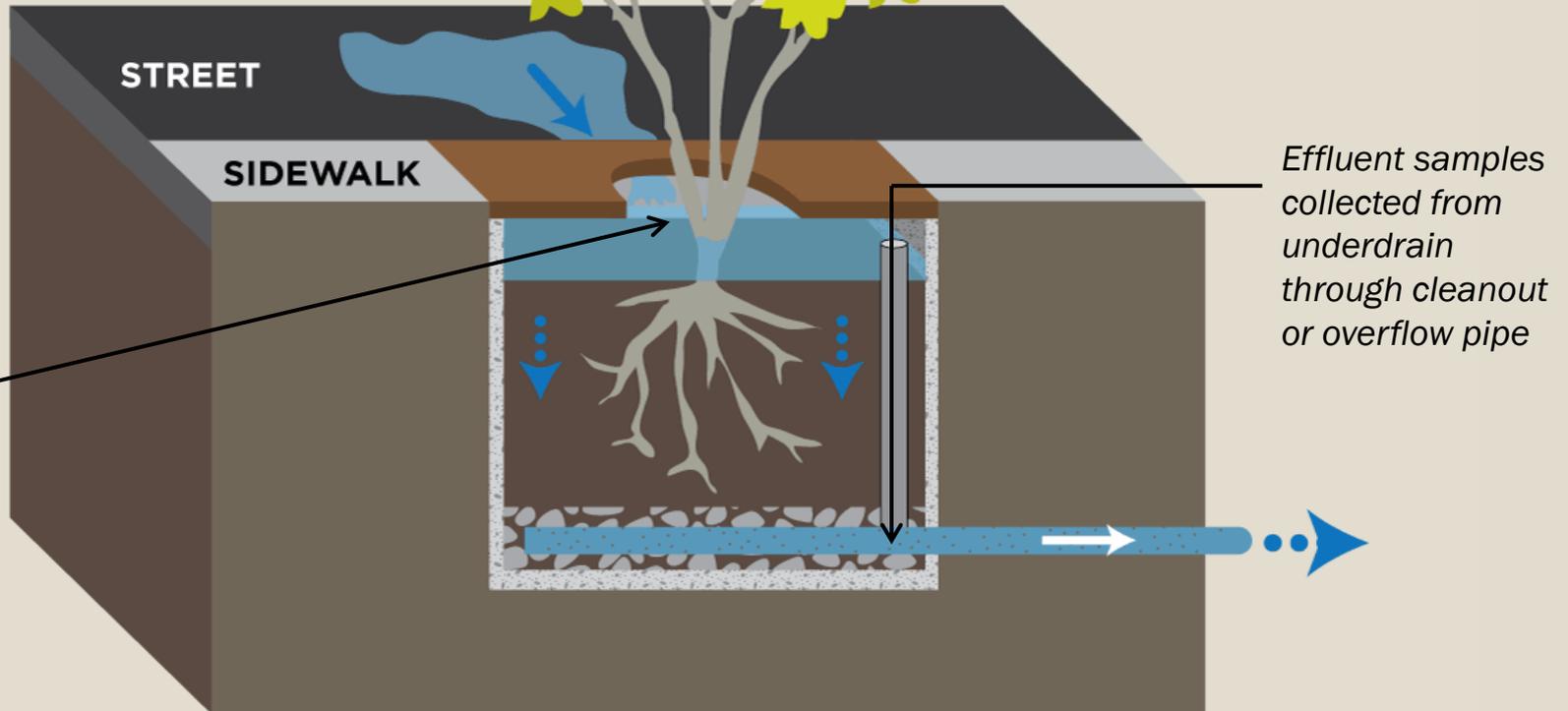


SIDE VIEW

# Filterra:

- Proprietary media
- Designed for enhanced and phosphorus treatment
- Runoff from roadway enters directly into Filterra

- Concrete lined = no infiltration
- Perforated PVC pipe underdrain



*Influent samples collected from water just entering the Filterra*

*Effluent samples collected from underdrain through cleanout or overflow pipe*

*There are two additional things that make this study unique and valuable.*



*One of these treatment features has been around awhile. Many bioretention studies focus on brand new installations, but these bioretention planter boxes, as well as the Filterra, were online for three years before we started sampling. This is valuable because we need to understand the long-term effectiveness of our installations.*

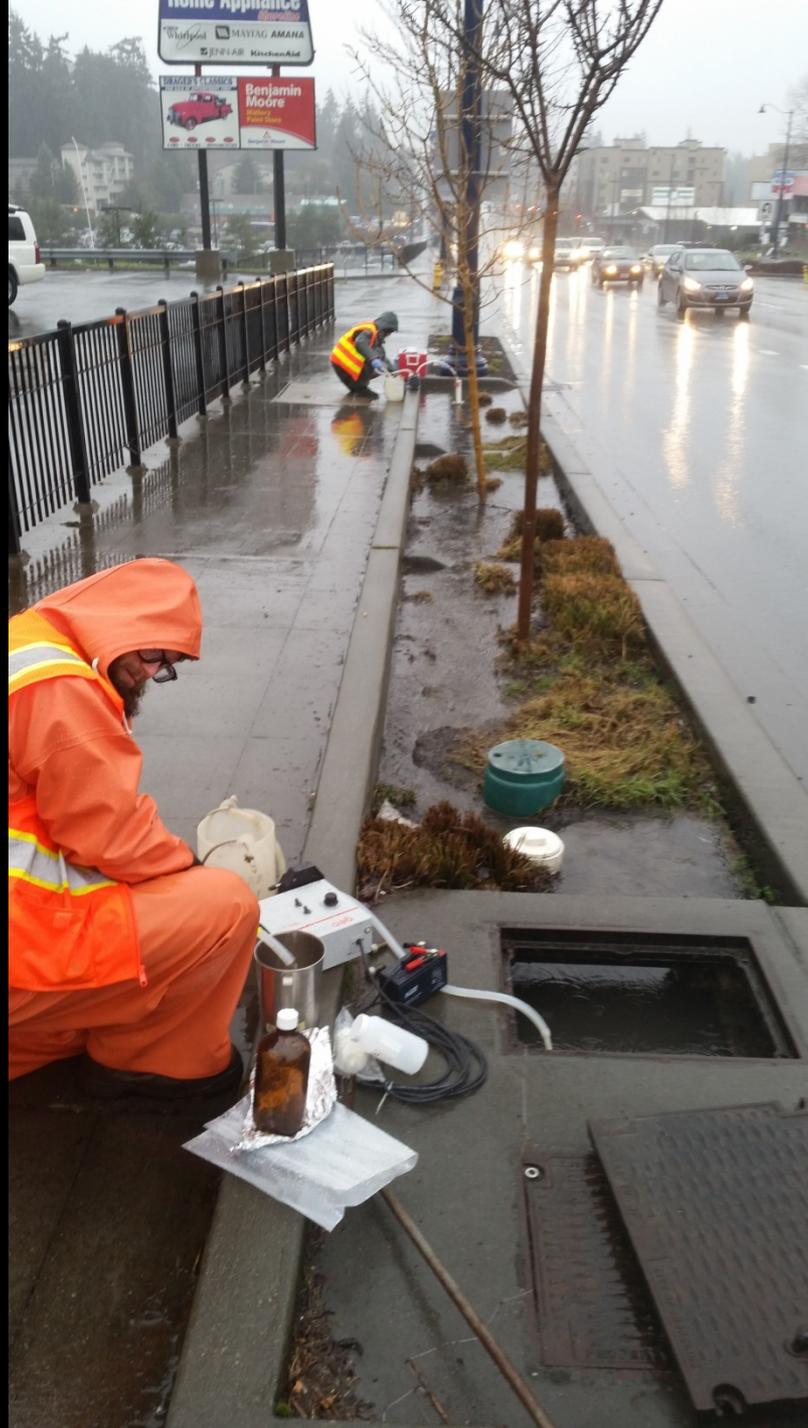


*Two, this study looked at some chemicals that are infrequently included in stormwater studies.*

*PCBs are a group of chemicals developed in the 30s that had a range of uses including additives for construction materials, like paints and caulk. The US banned PCB production in the 70s, but they are so persistent that they are a continuing environmental and human health issue.*

*Several local studies have found stormwater to be a major pathway for these chemicals into our waterways.*

**PCBS**



*Basic study design:*

samples at  
the inlet and  
outlet

**Dec 2015 -  
Feb 2017**

5 to 8 storms  
at each site

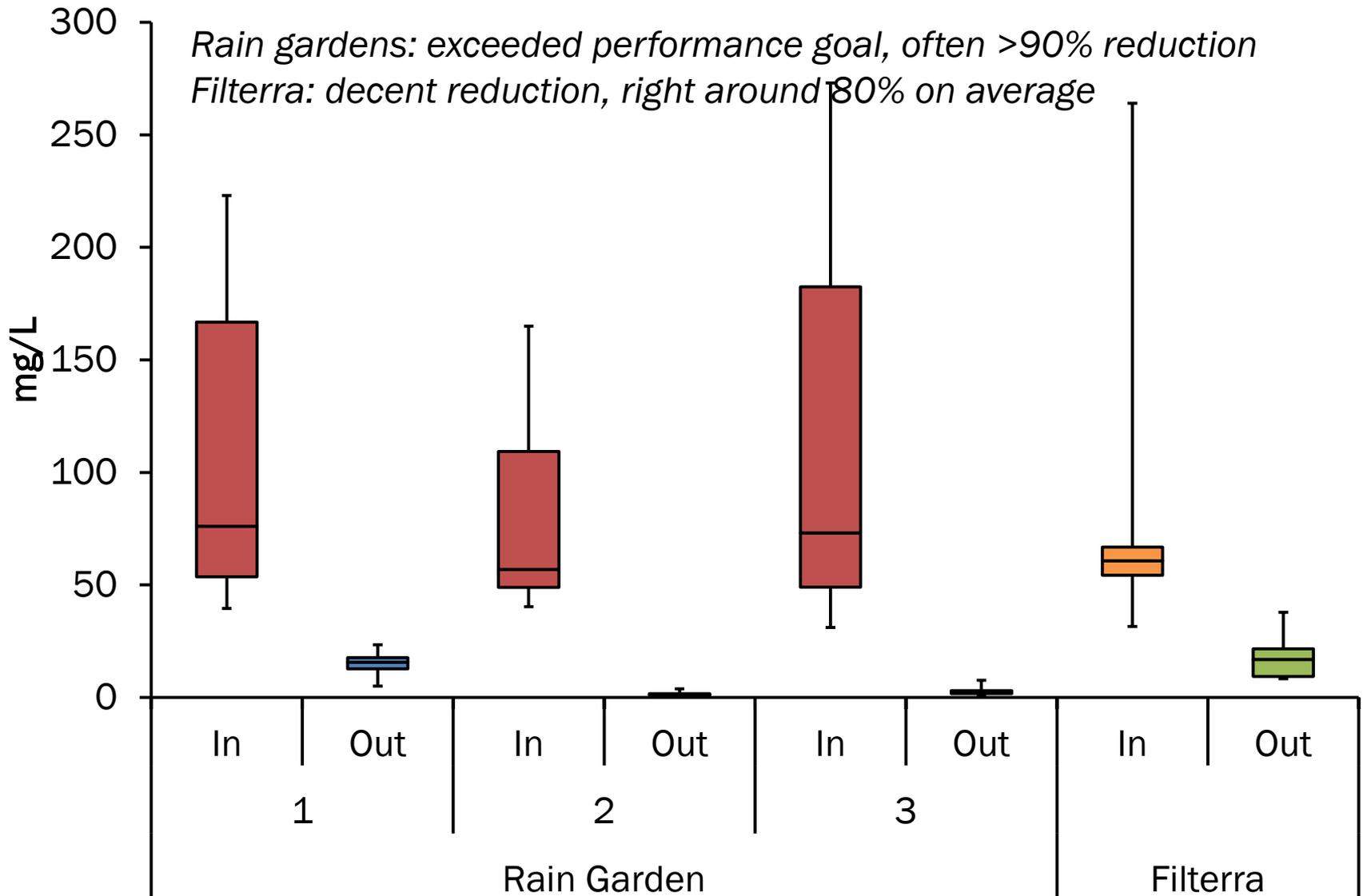
**IN**

**OUT**

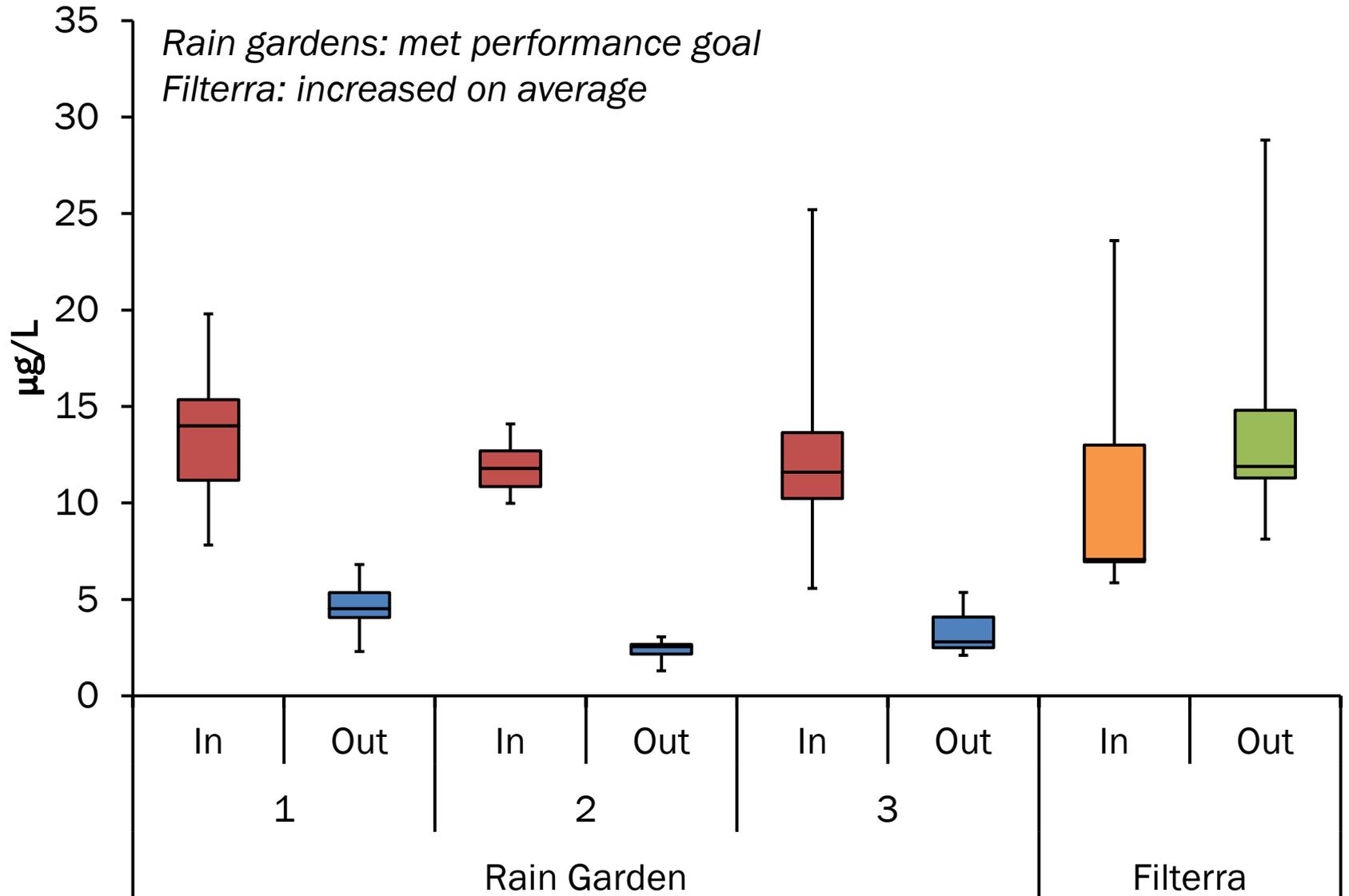
**VS**



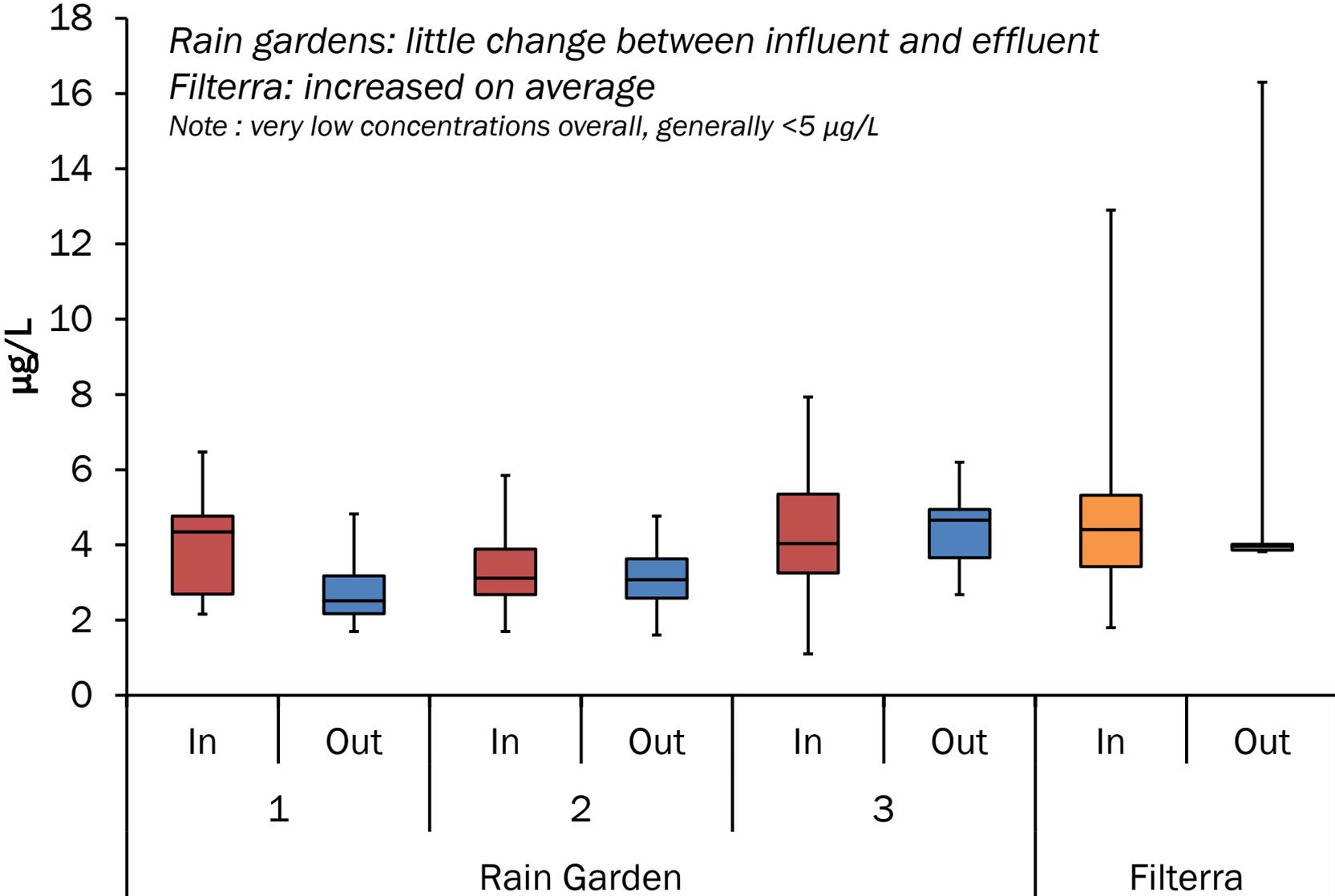
# Total Suspended Solids



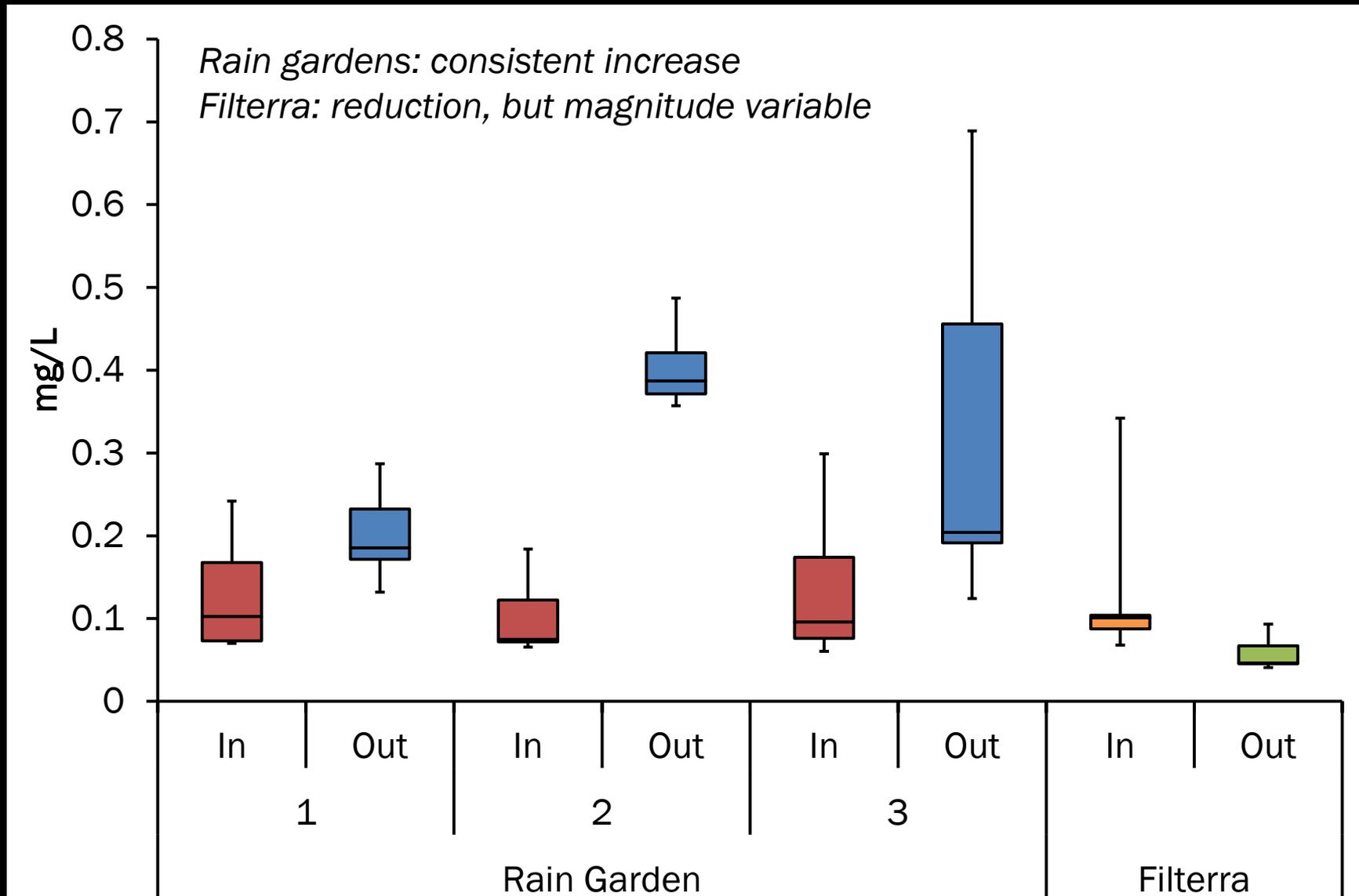
# Dissolved Zinc



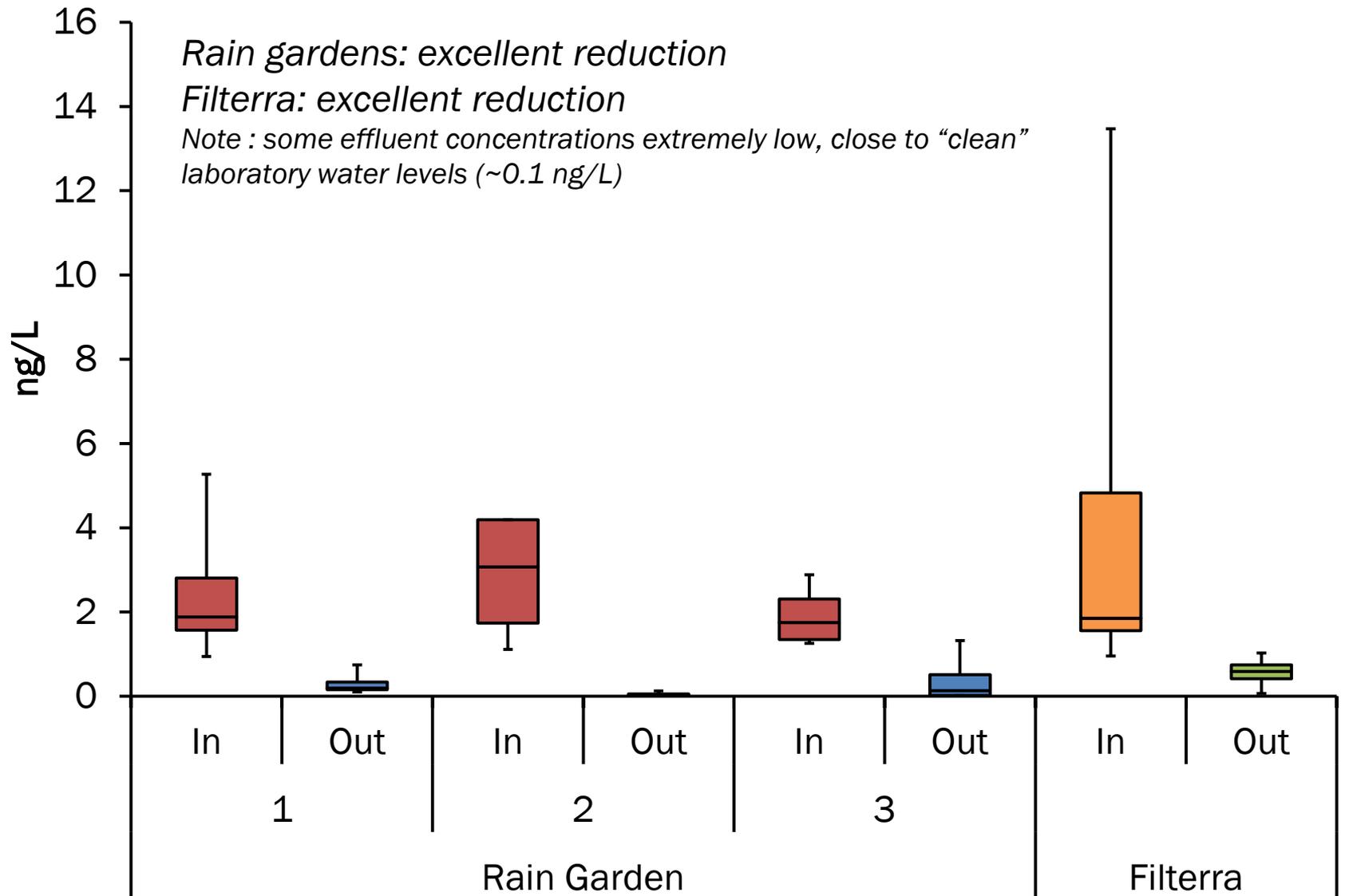
# Dissolved Copper



# Total Phosphorus



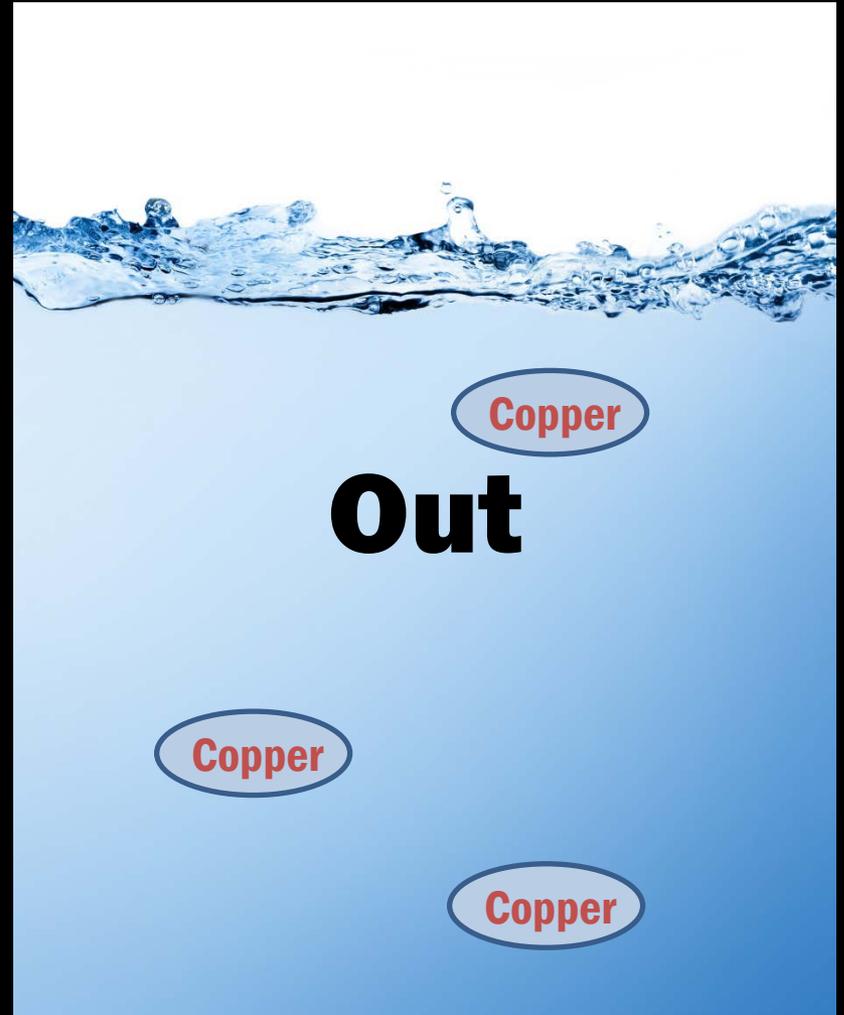
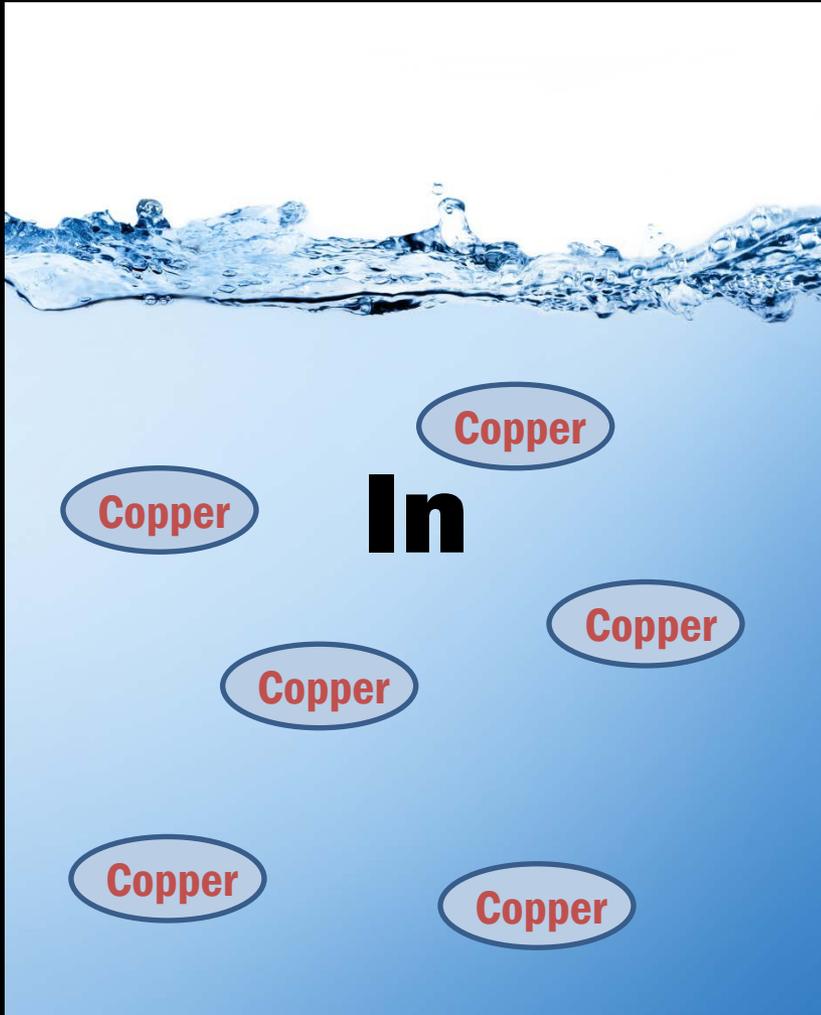
# Total PCBs



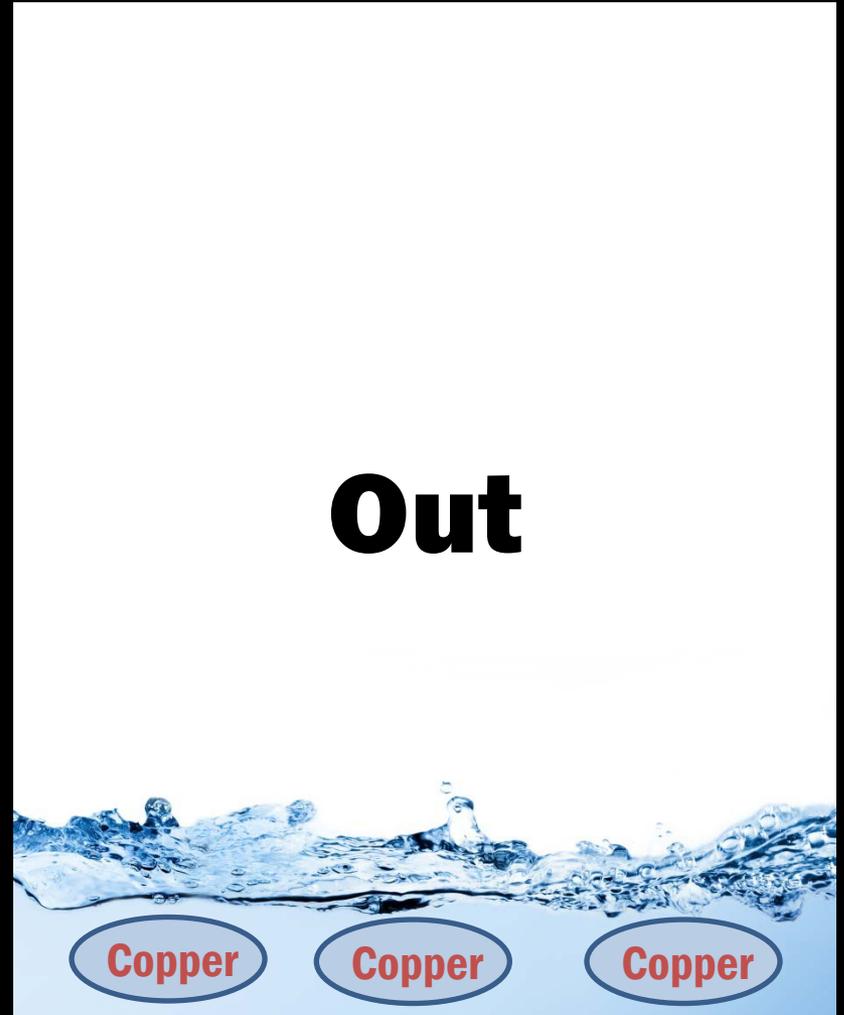
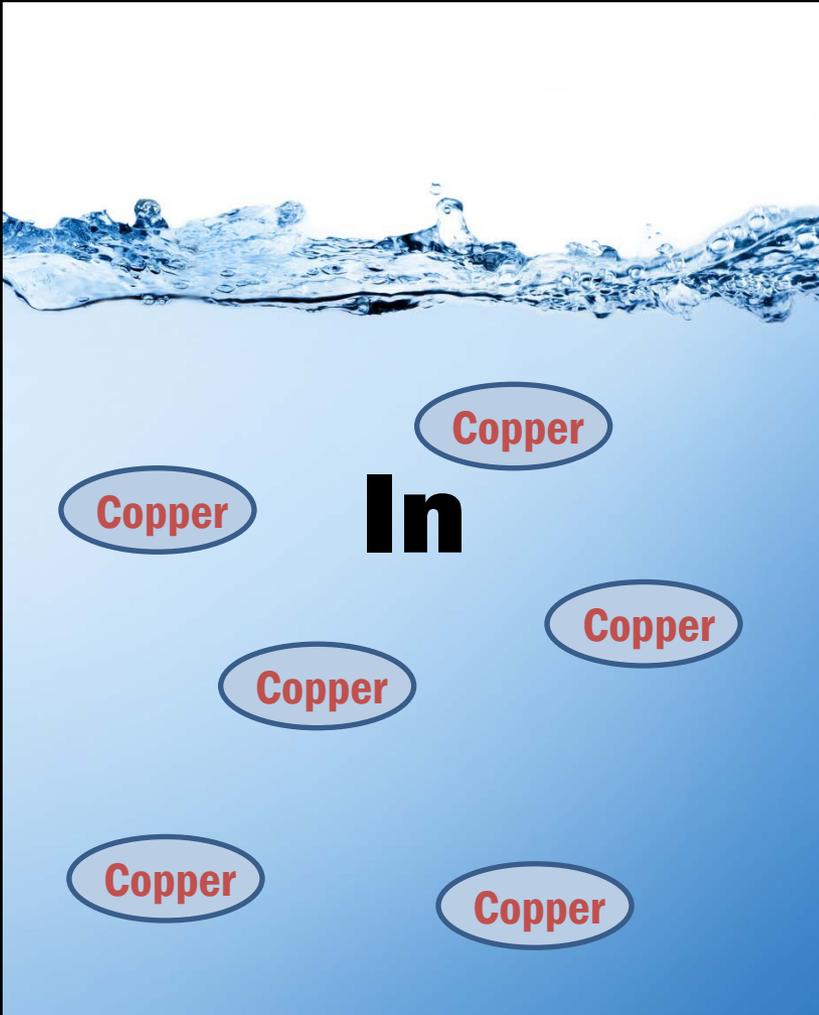


*How is flow reduction is related to  
pollutant reduction?*

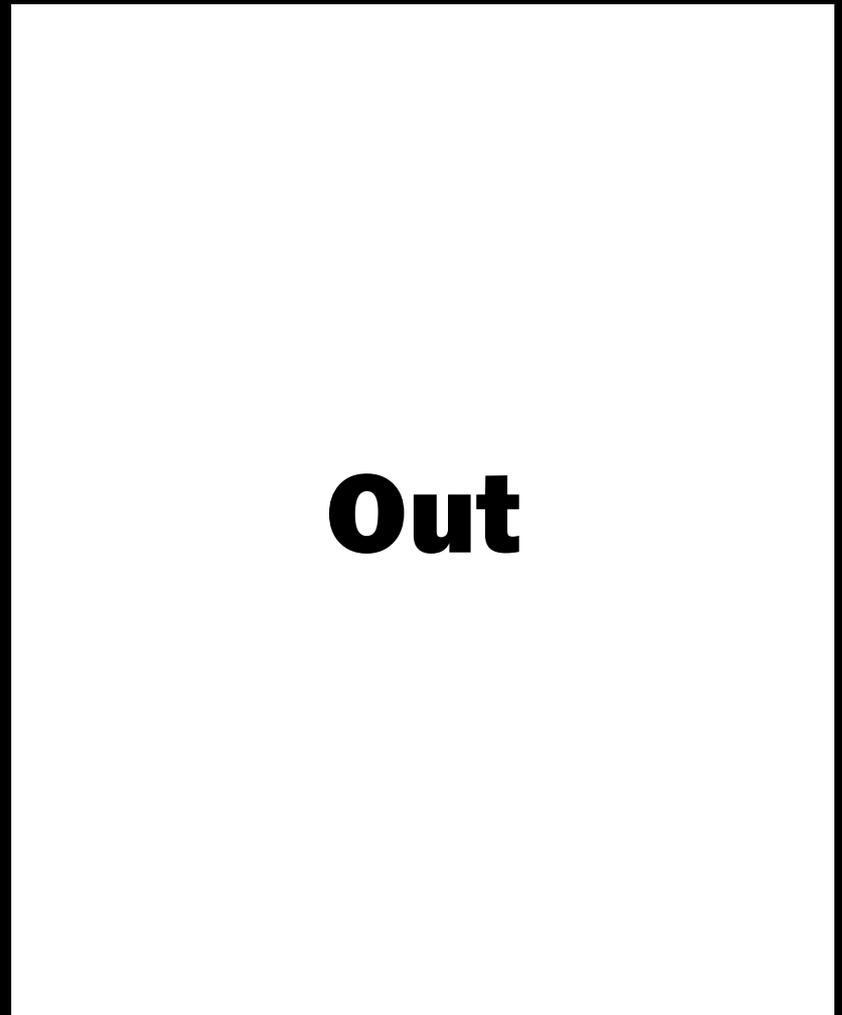
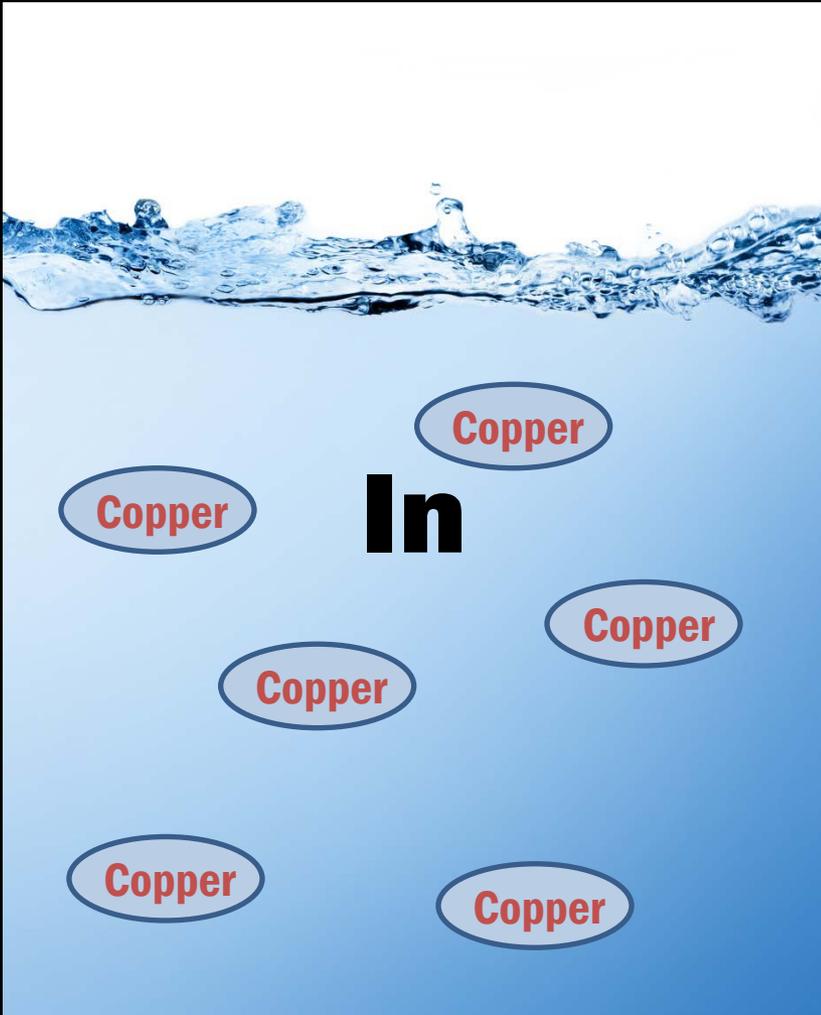
Let's imagine a BMP that doesn't change flow. If 6 copper ions come in and 3 go out that means the *concentration is lower* because there is *less copper* in the water



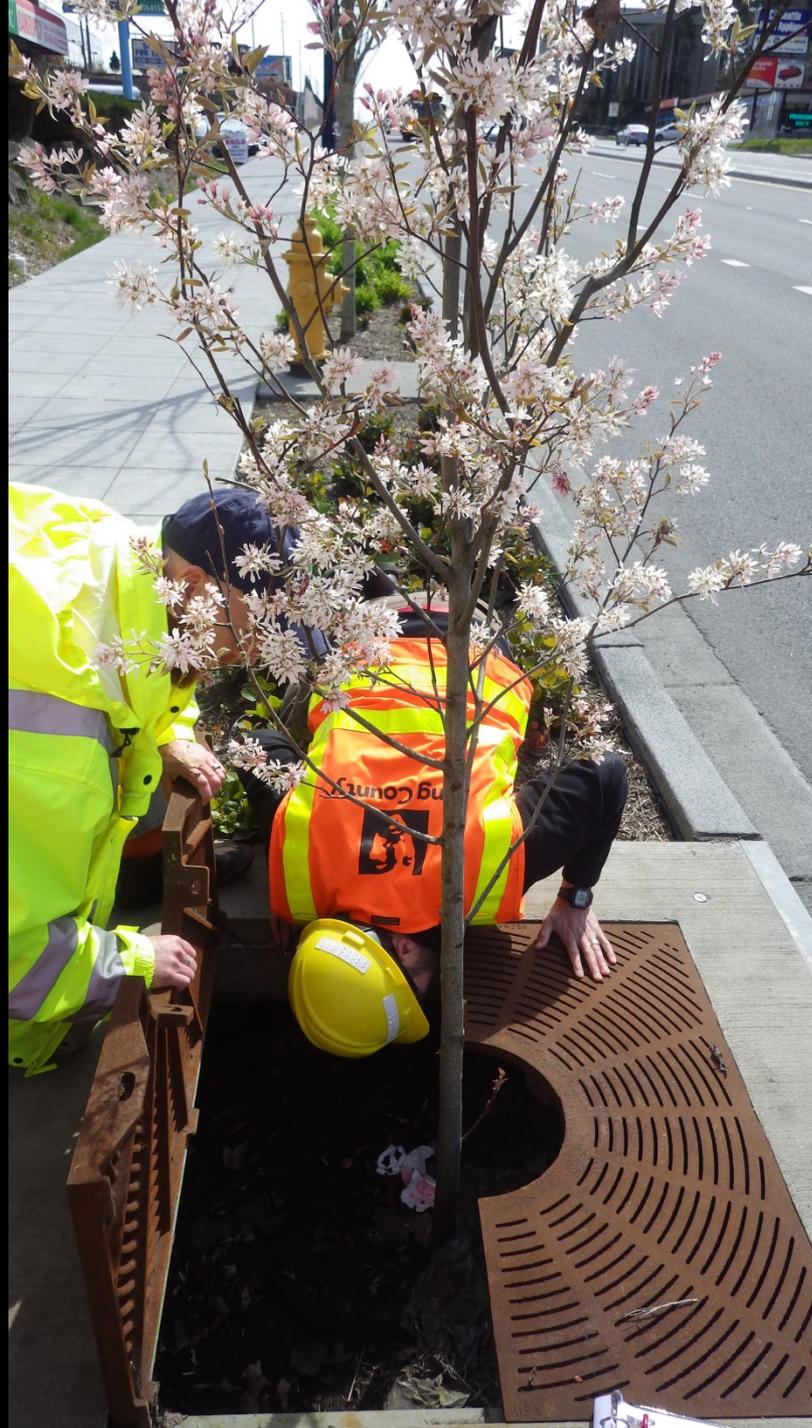
But what if that BMP also reduced flow? Now there is *still less copper* in the water but the *concentration is higher*.



*This could be happening at the rain gardens where we saw major reductions in flow. In fact, effluent was only present during periods of intense rainfall.*



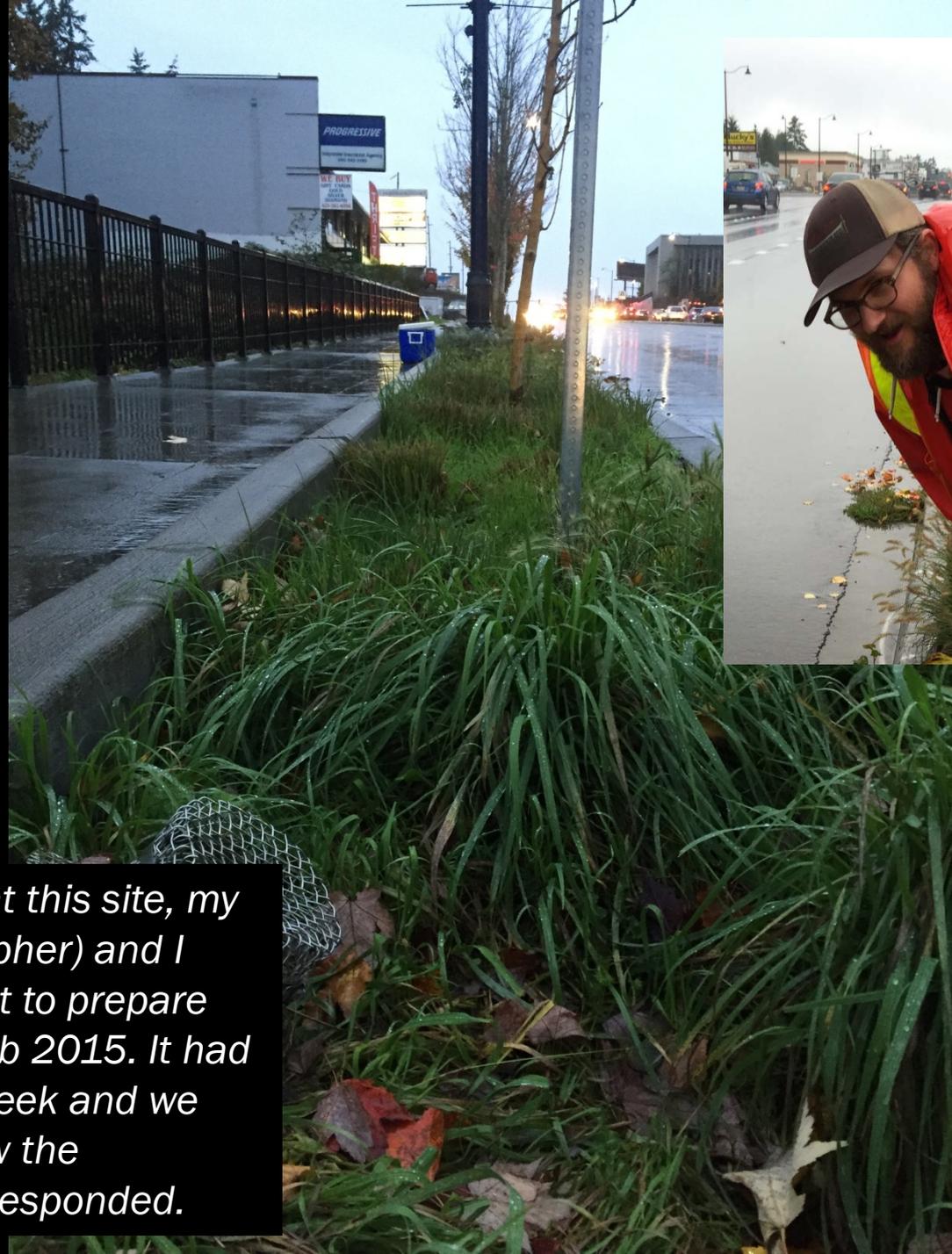
*We don't know how much volume reduction was provided by the Filterra, because the design prevented us from visually observing the effluent. We would guess that the Filterra provided less volume reduction compared to the rain gardens, because the installation was smaller, providing less media for absorption.*





(BIG caveat)

**These were not functioning when the  
project started.**



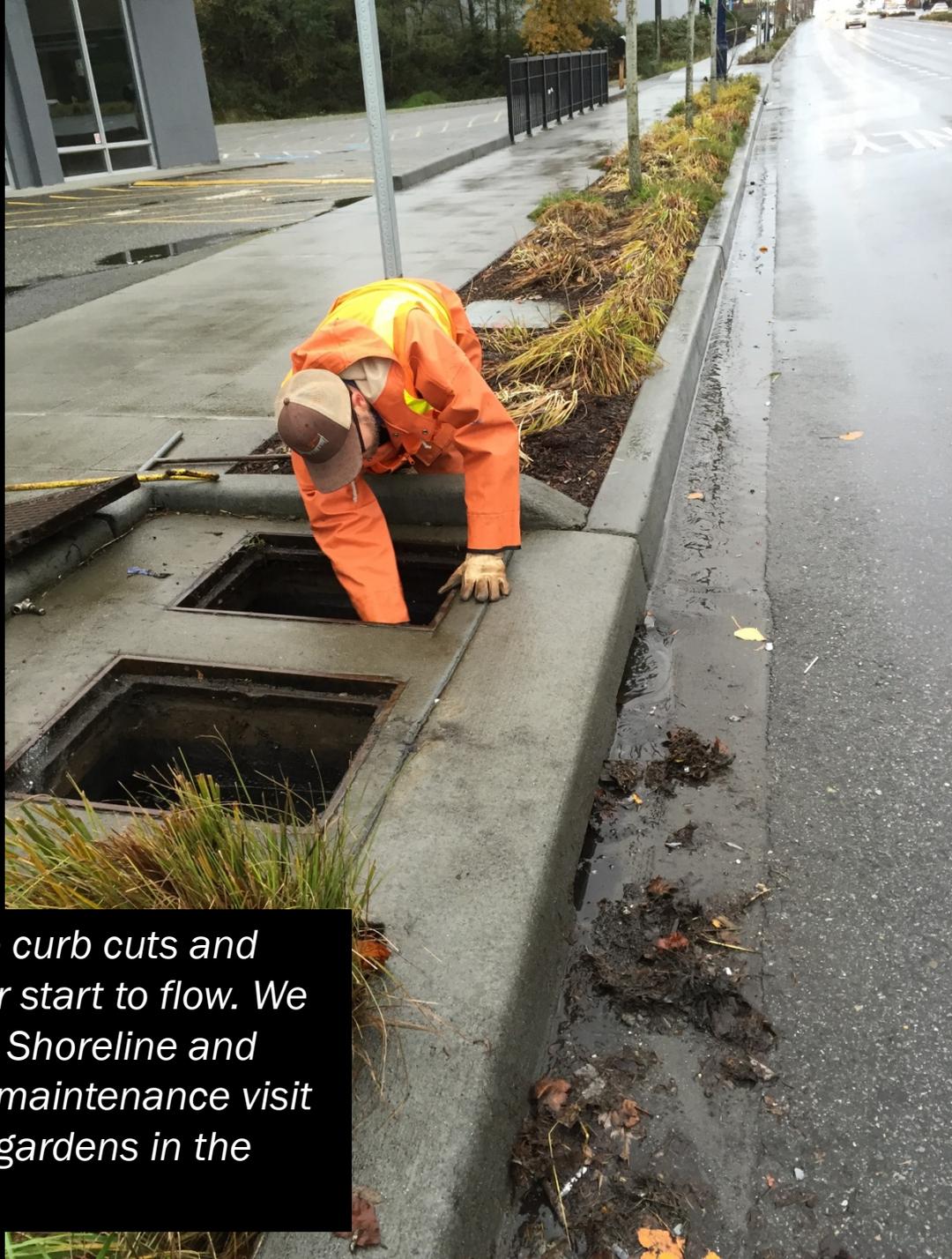
*Before sampling at this site, my field lead (Christopher) and I planned a site visit to prepare for the study in Feb 2015. It had been raining all week and we wanted to see how the installations had responded.*



*The first rain garden looked pretty dry...*



*We looked in from the street, and saw dirt and debris had plugged the small curb cut, completely blocking the runoff from the highway. The other rain gardens were in a similar state.*



*We cleared all the curb cuts and watched the water start to flow. We talked with City of Shoreline and they scheduled a maintenance visit for the other rain gardens in the area.*



*Christopher visited the site a few weeks later to find a small amount of debris in the curb cuts, which had again completely blocked the stormwater from entering. We decided to visit the site as often as every other week to keep the curb cuts clear.*



*Now the Filterra curb cuts were bigger and were clear, but*



*When we opened up the lid, the Filterra was flooded and not draining.*



*Sediment had clogged the media, and so the City of Shoreline replaced the media that summer.*



*Unfortunately, less than two years later, towards the end of sampling, the Filterra were clogged again. This means media replacements have been needed every 2 to 3 years at this site.*



*We need to prioritize designing these treatment installations to minimize maintenance requirements. Because...*

**Bioretention can provide effective stormwater treatment, but only if the stormwater can get in.**

# Acknowledgements

- Brandi Lubliner – Ecology SAM Coordinator
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