

# Assessment of Enterococci in Groundwater and Stormwater at the Miami Beach Park View Canal

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**Enterococci** → Fecal Indicator Bacteria (FIB) used to assess risk of gastrointestinal disease when in contact with water.



MIAMI

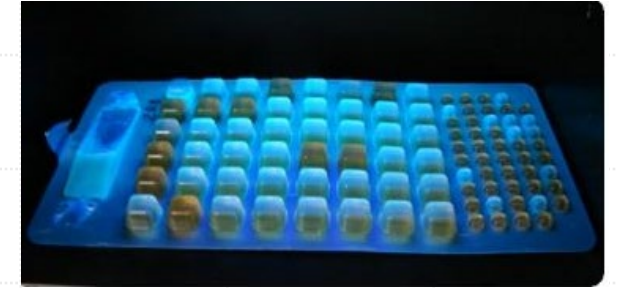


# Ways to Measure the Sources of FIB

## 1) By culture (or growth)

If grow, indicates a viable bacteria (cause infection)

Culture required by State for beach monitoring

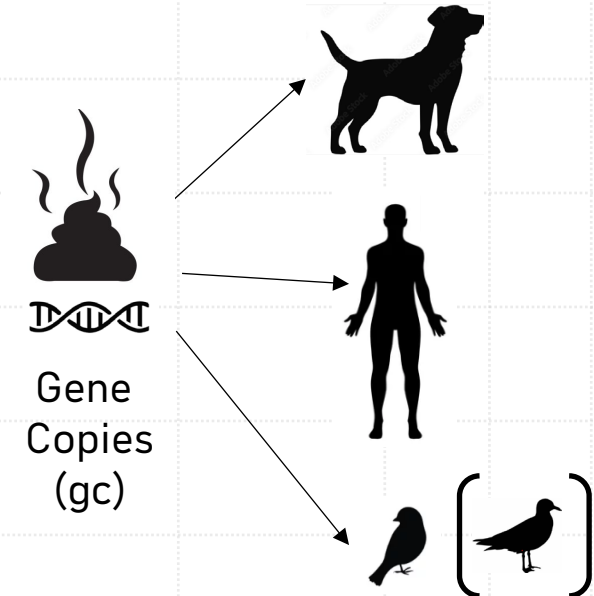


Most Probable Number (MPN)

## 2) By genomic analysis (measure the DNA)

If detected, can be viable or non-viable

- Measures enterococci (Enterol1A)
- Measures microbial source tracking (MST) markers
  - Dogs
  - Humans
  - Birds (Gulls)



# Understanding Regulatory/Guideline Levels

## Enterococci

Agency	Purpose	Single Sample Limits (MPN/100 mL)
FDOH	Recreational Beach Use	70
FDEP	Class III (Recreation)	130
US EPA	Primary Contact	130
US EPA	Kayaking turbulent water	164
US EPA	Kayaking calm water	371
US EPA	Fishing	391

REGULATORY  
FOR BEACHES  
(NOT DESIGNED  
FOR CANAL)

EPA GUIDELINE

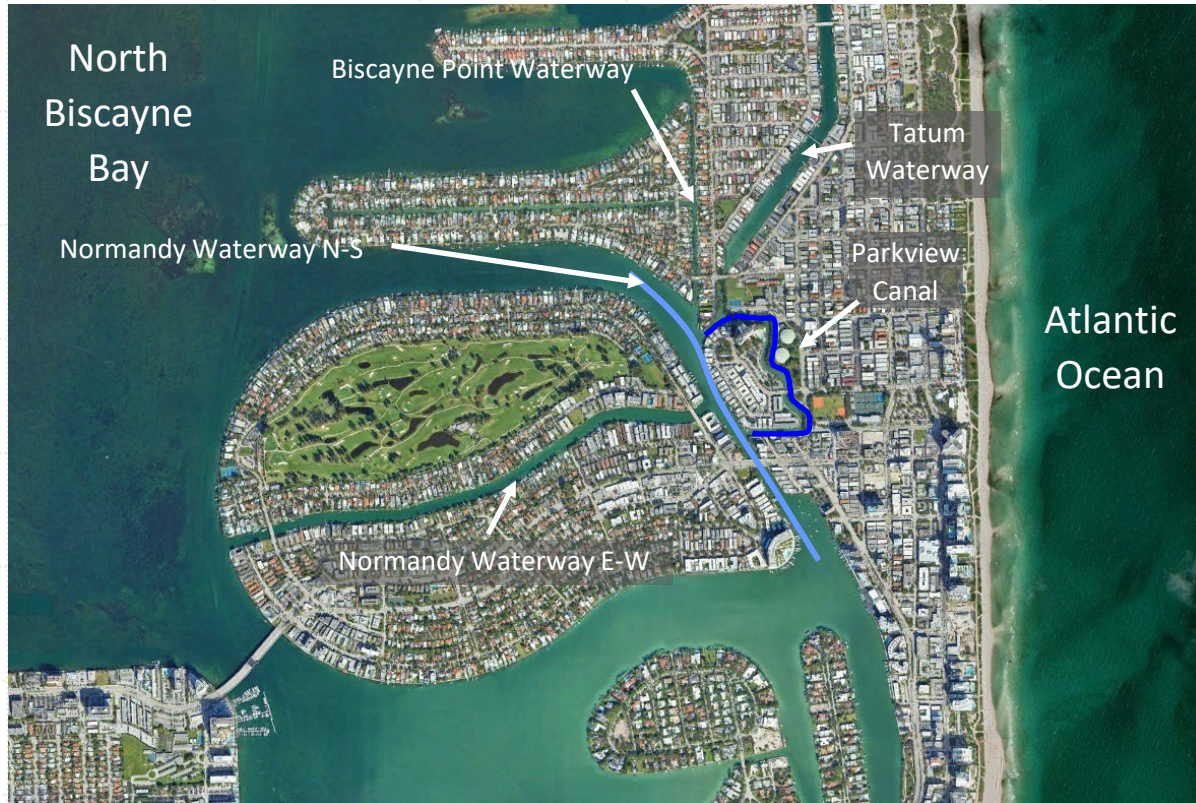
## MST (Research-based Guidelines for Recreational Beach Use)

Marker	Single Sample Limits (GC/100 mL)
Human	525
Dog	N/A
Bird (Gull)	200,000

RESEARCH  
RECOMMENDED  
FOR BEACHES



# PVC has Limited Natural Flushing within an Impaired Bay





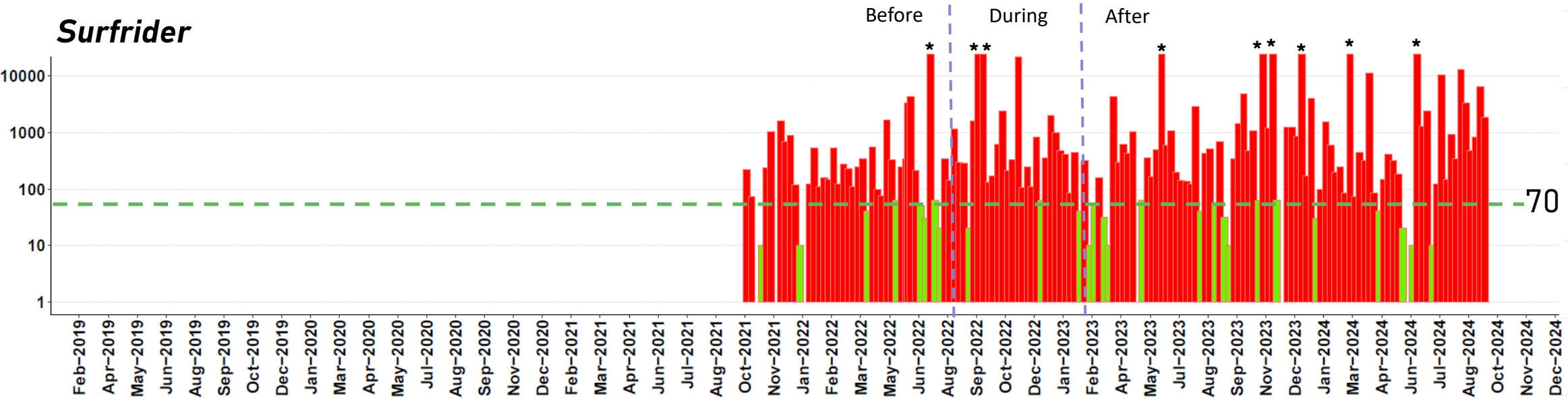
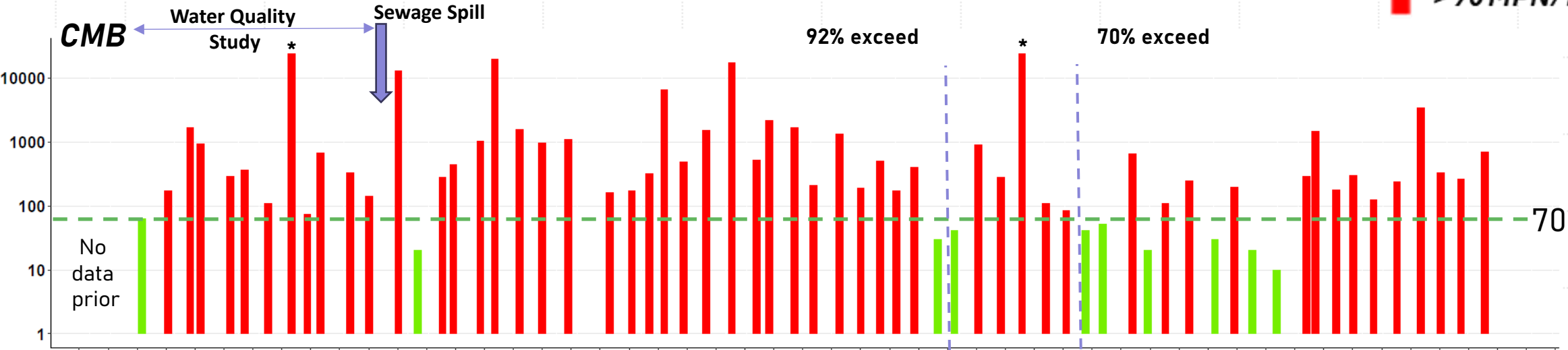
81.3-acre catchment  
No first flush treatment





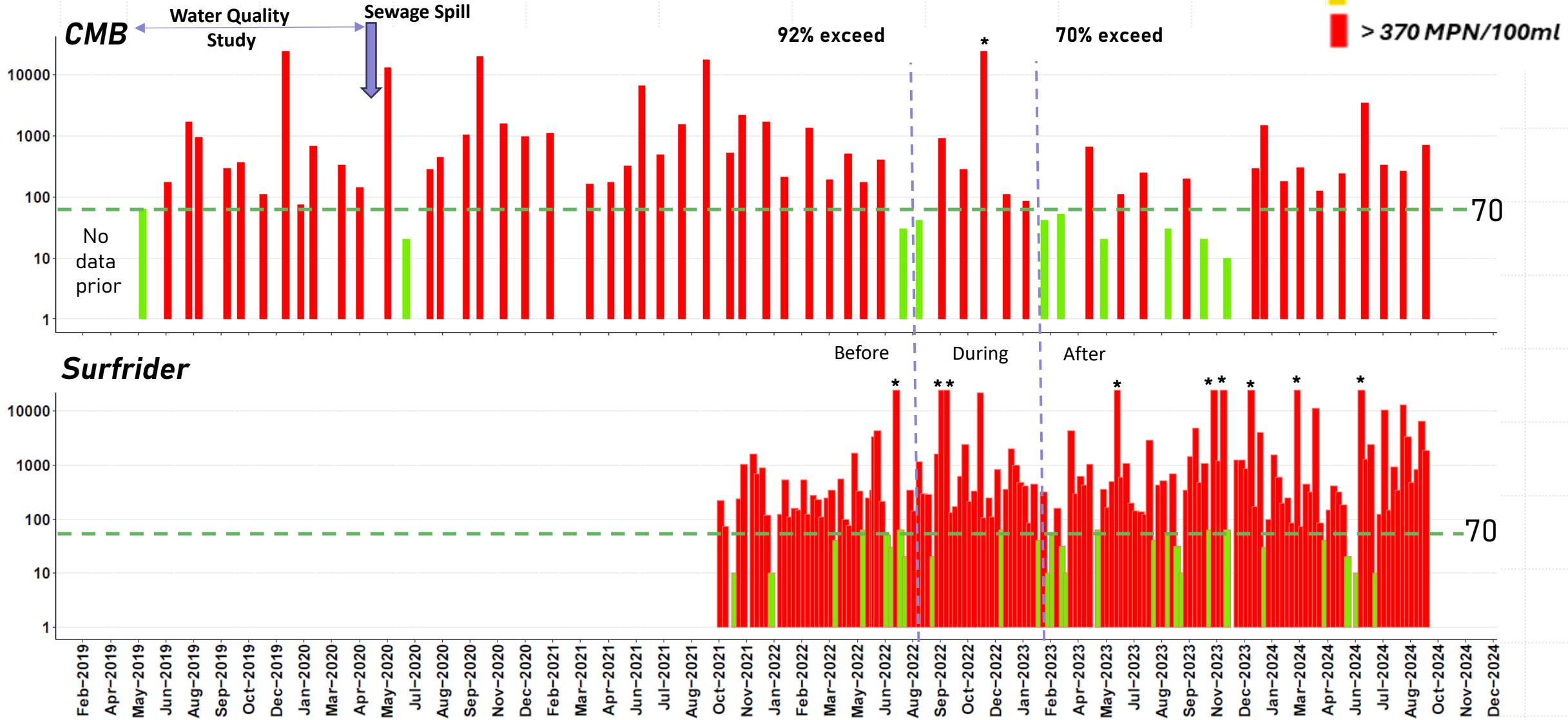
# Enterococci elevated in PVC

 < 70 MPN/100ml  
 > 70 MPN/100ml



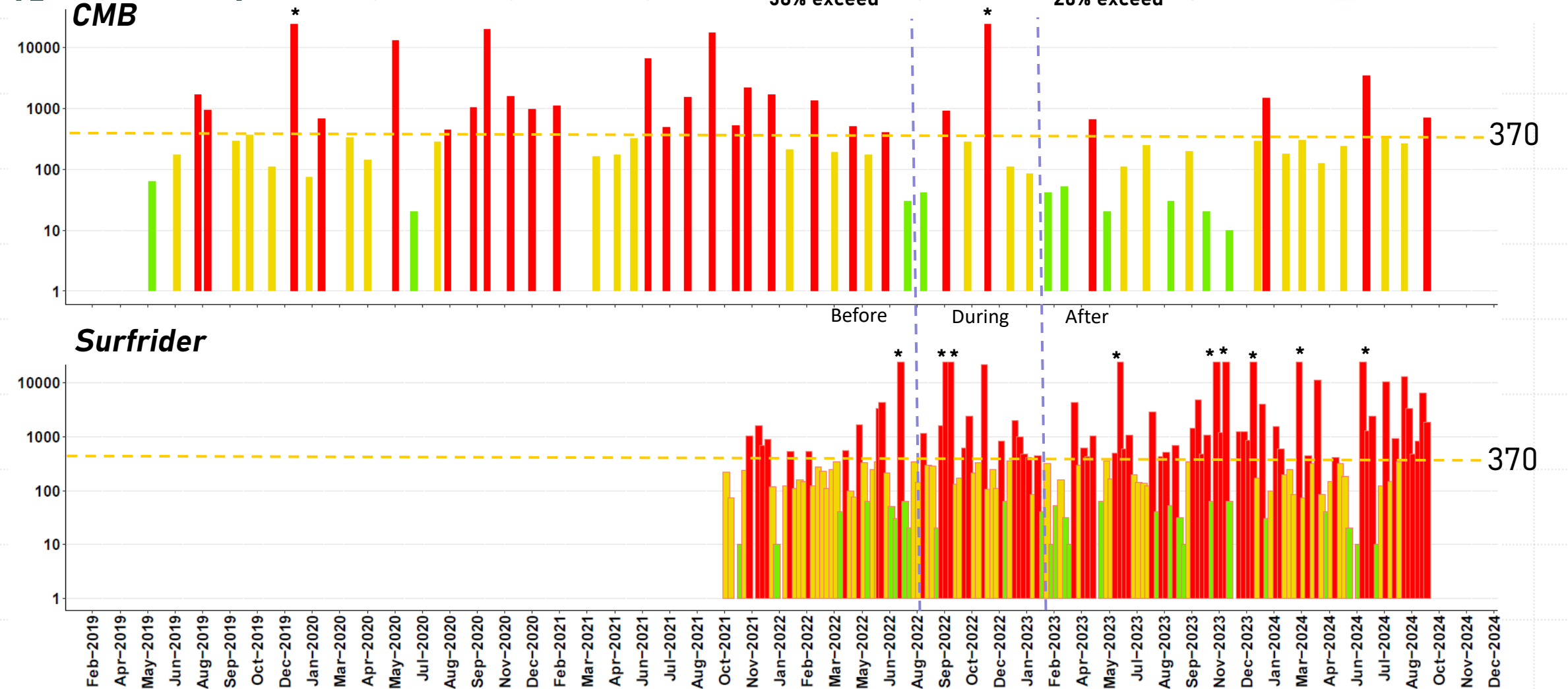
Improved but still elevated

# Enterococci elevated in PVC



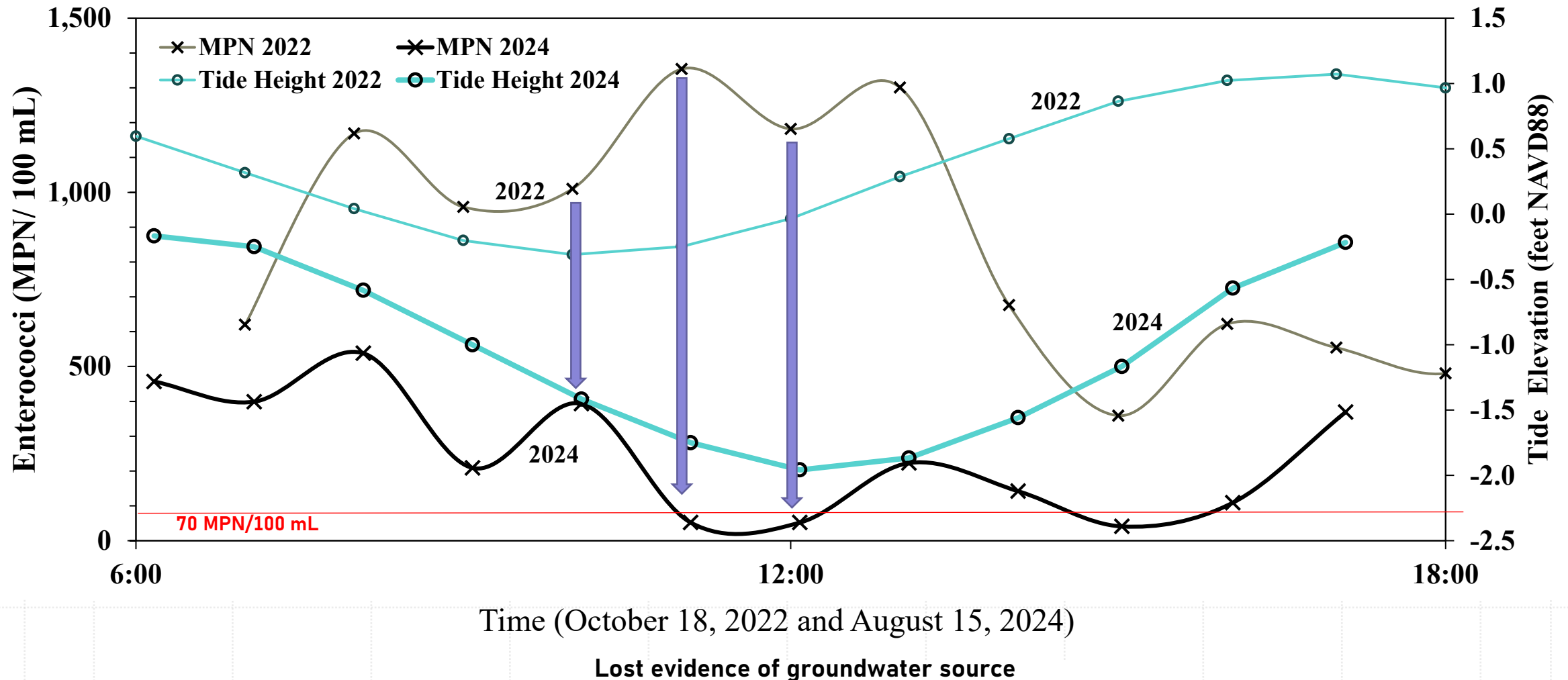
Improved but still elevated

# Considering Kayaking Guidelines



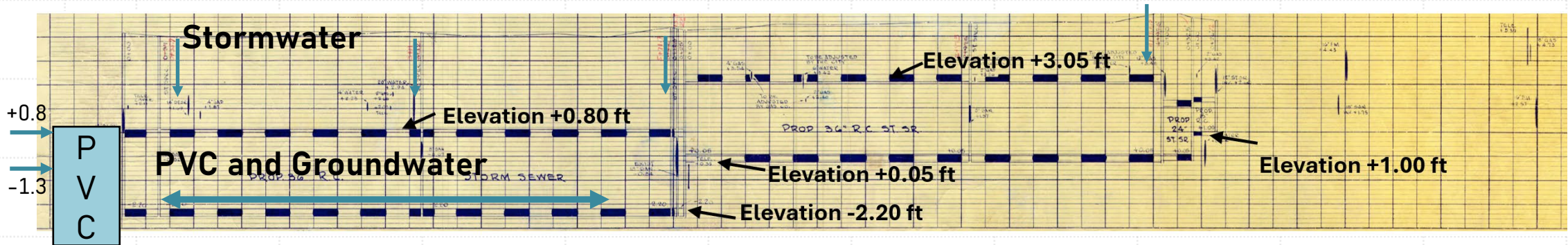
Still elevated above 370, but closer for intended use

# Enterococci values dropped significantly b/w storm events, suggesting ARVs and pipe lining have had a positive impact





# Prior UMiami study in 2022→ Main water type is from stormwater conveyance system



Section Drawings

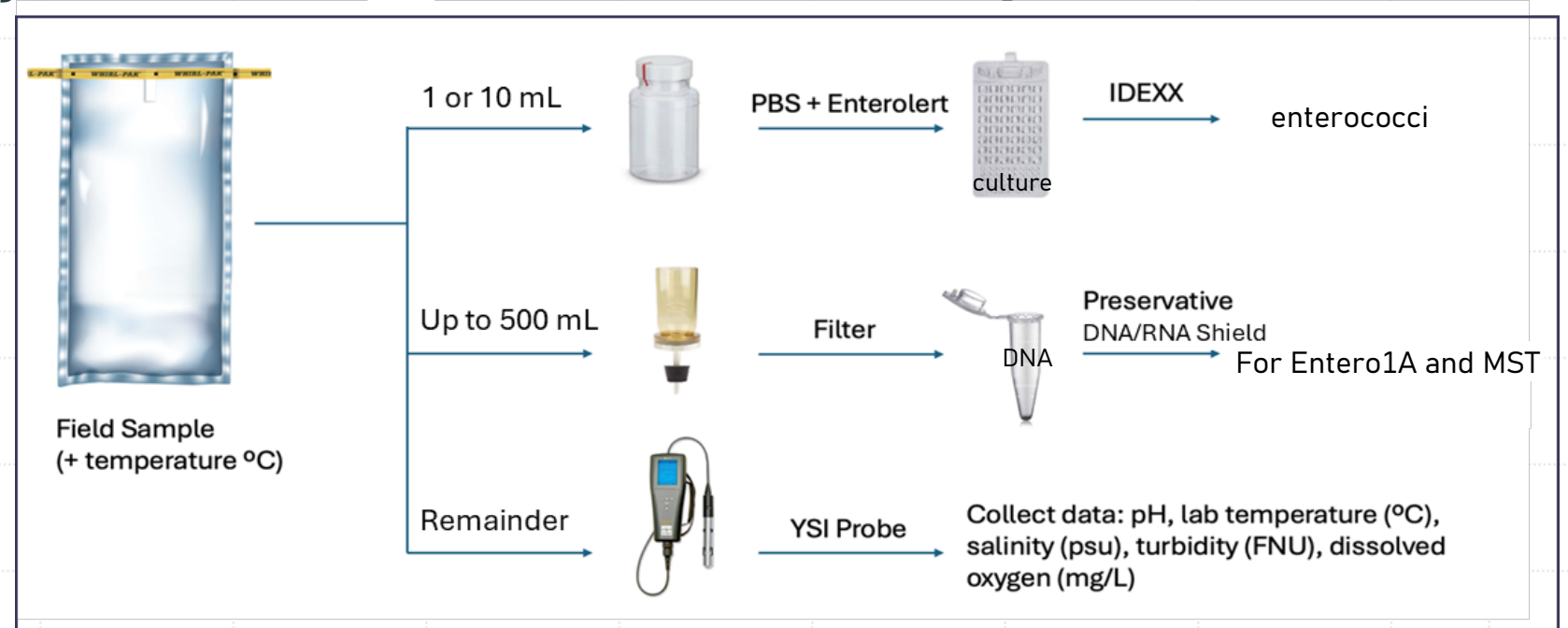
Water in stormwater conveyance system mix of stormwater, groundwater, and PVC water

# Objectives: Set up a sampling system that would:

- Separate ground and storm water to better understand the water type (sewer vs. streets)
- Add measurements of MST to identify sources

## Measurements by Culture and Genomic Analysis

- Groundwater
- Stormwater
- PVC water
  - Surface
  - 1-foot
  - 5-foot

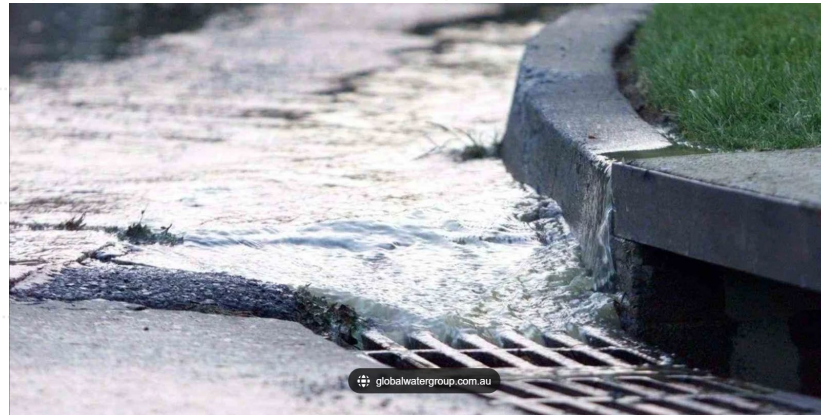




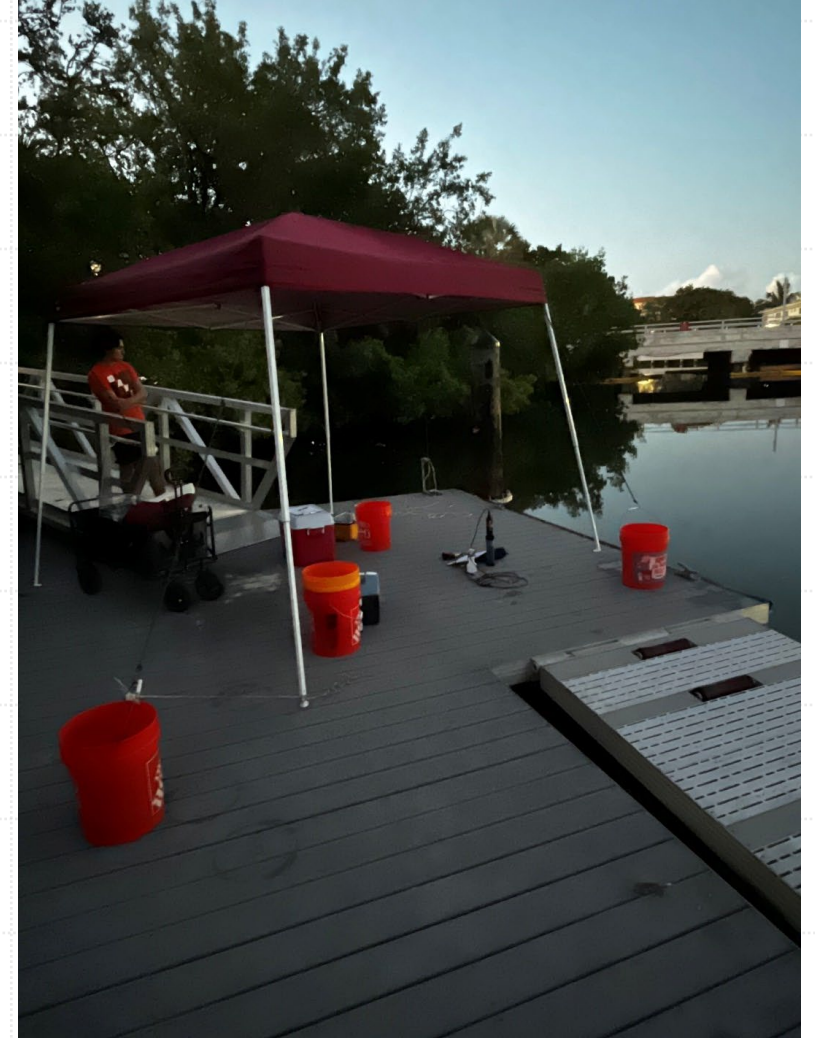
# Groundwater



# Stormwater

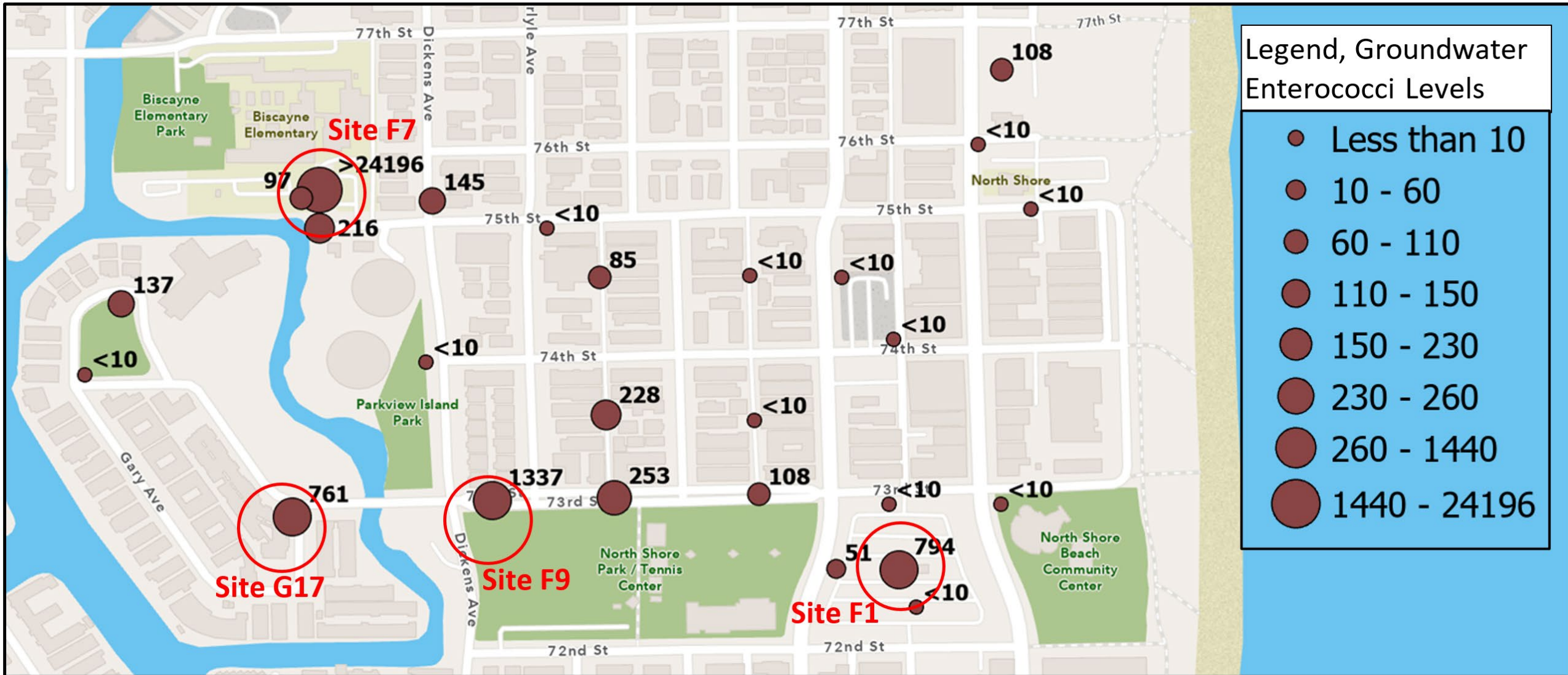


# PVC Water



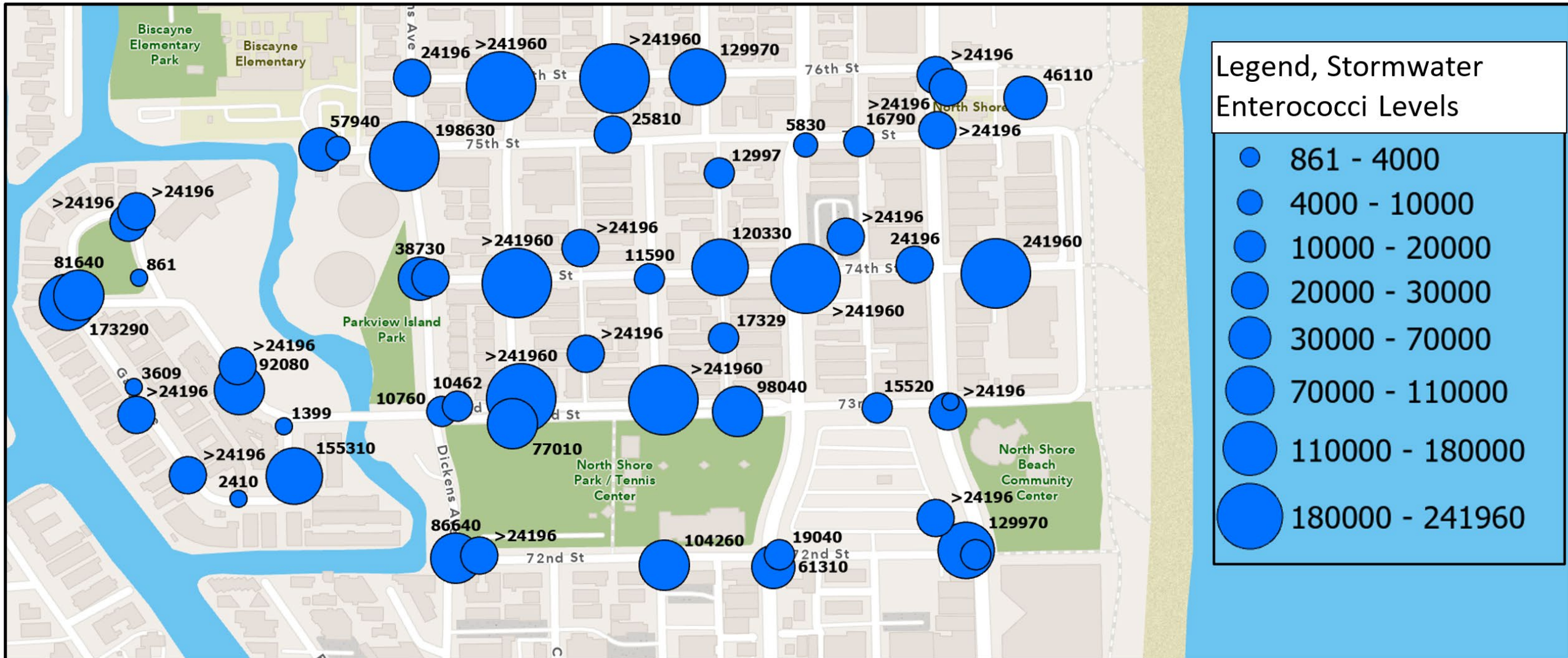


# Results of Enterococci in Groundwater

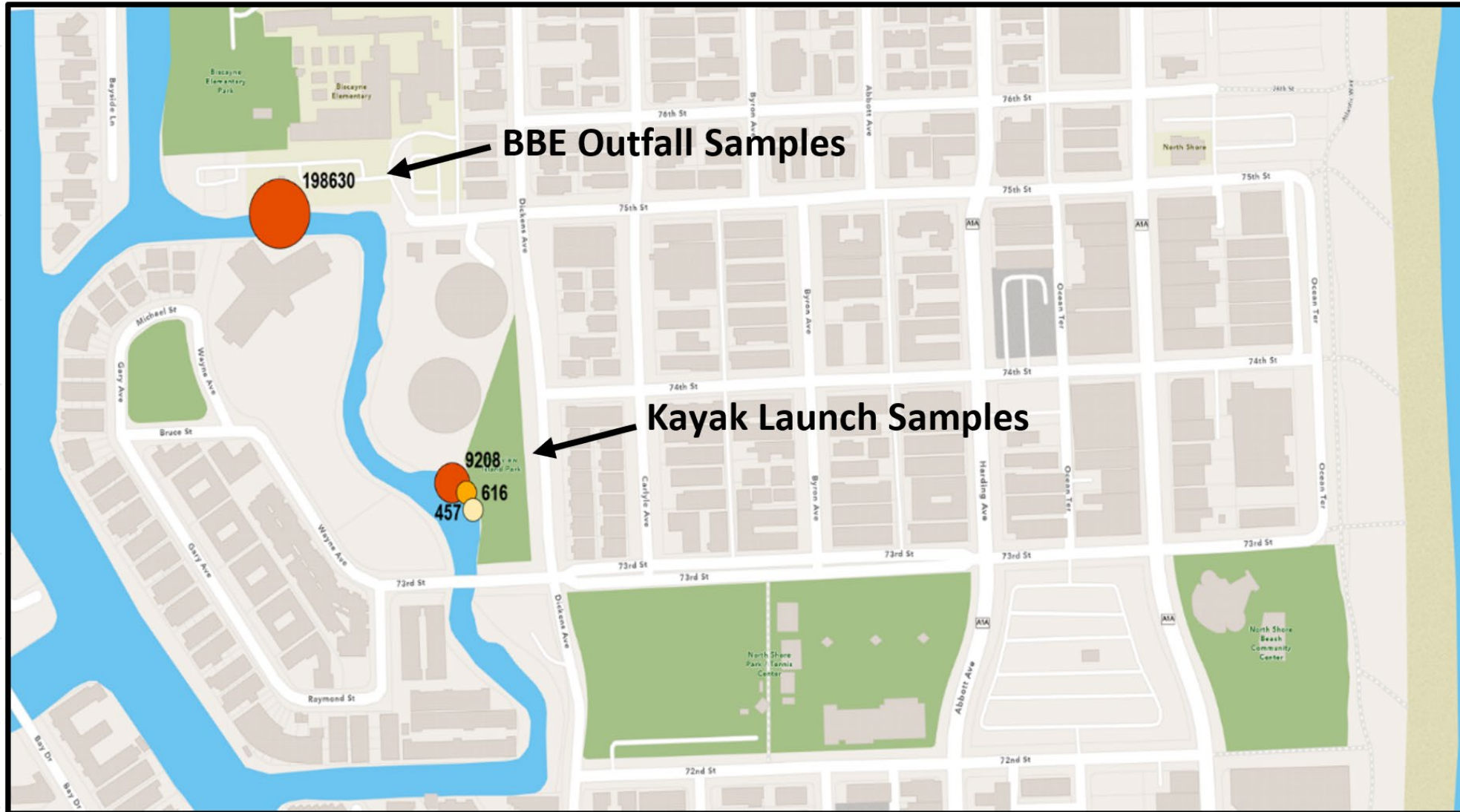




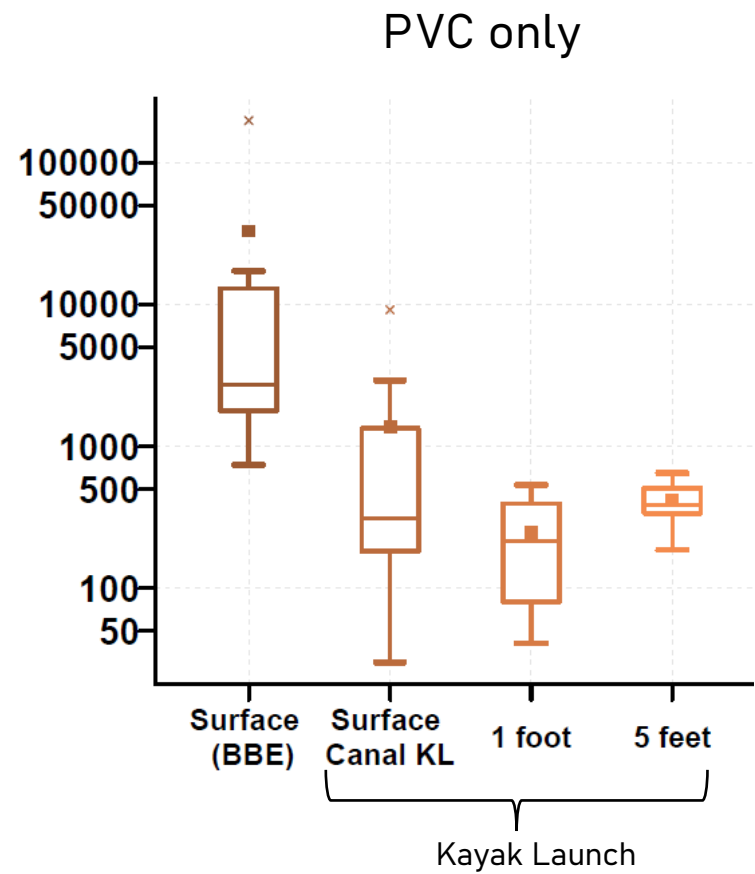
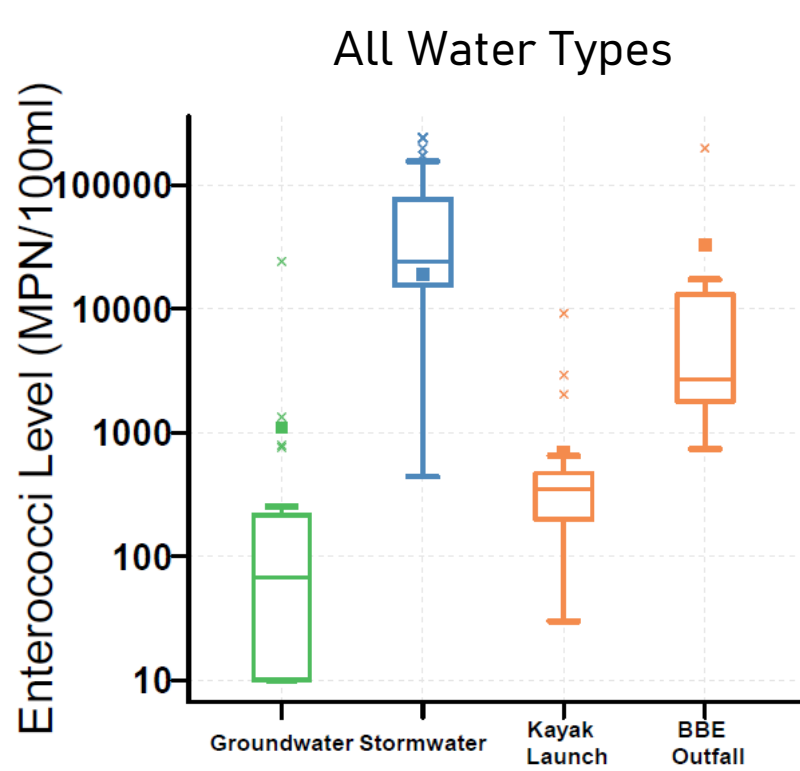
# Enterococci Levels in Street Runoff going into Stormwater System are much higher than Groundwater



# Enterococci in PVC water



# Charts below compare the different samples by water type and depth within PVC



UMiami Samples (Enterococci only)

# Comparison to other urban environments.

## Median is in range/ below available study literature

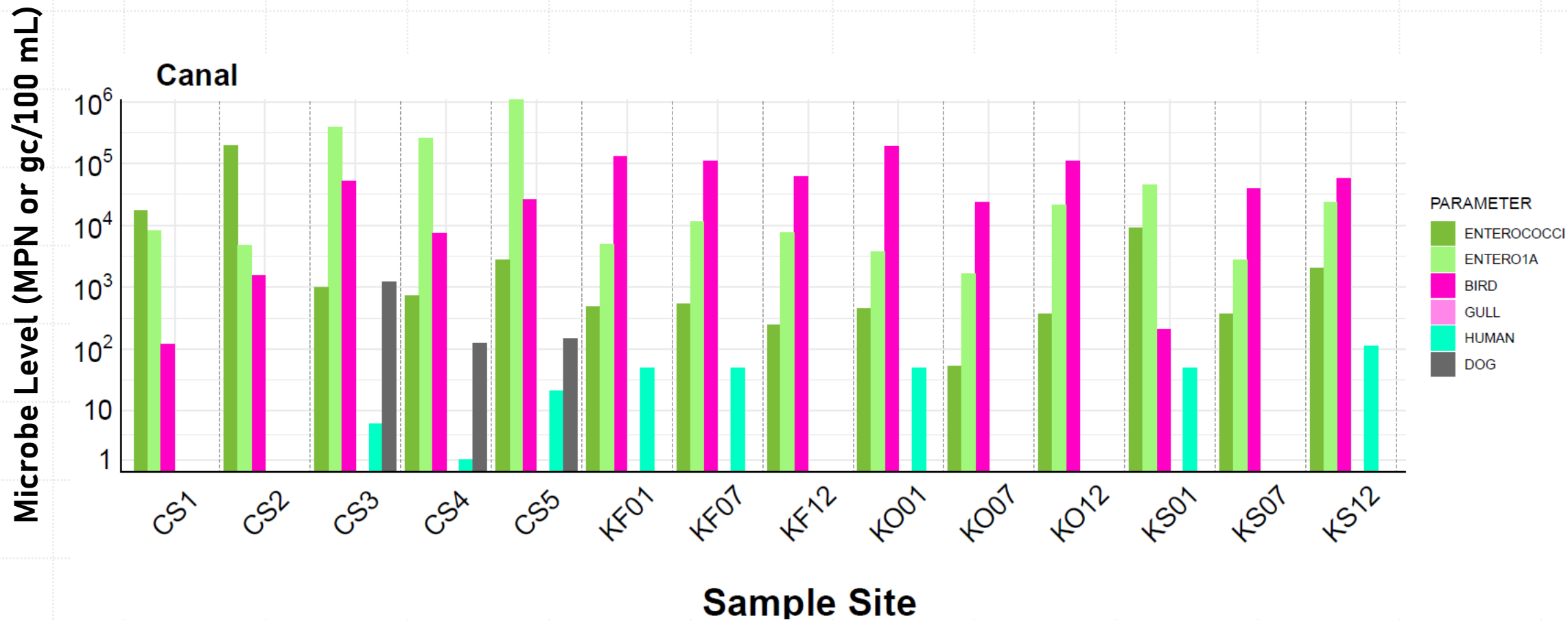
Environment	Location	Enterococci Median (MPN/100 mL)
Roof runoff	Miami, FL	1,200
Canals impacted by stormwater	New Orleans, LA	4,300
	Norfolk, VA	1,200
	PVC	300
Stormwater (from street)	Houston, TX	10,100
	Raleigh, NC	12,300
	PVC	20,000



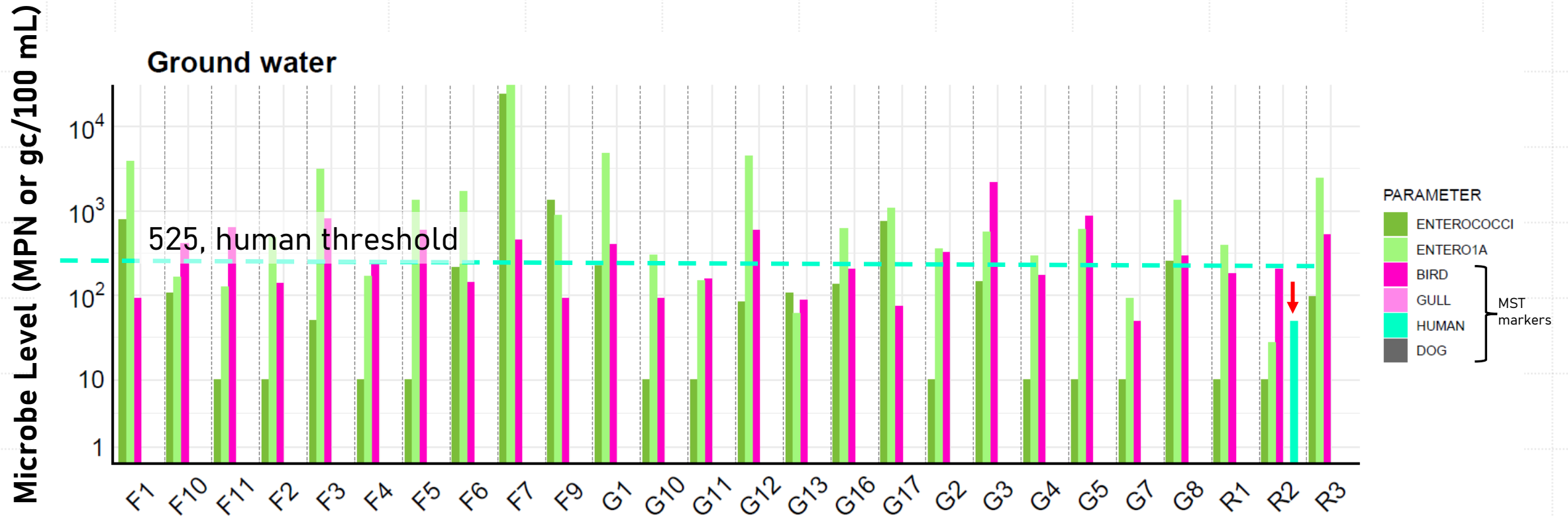


# Microbial Source Tracking MST

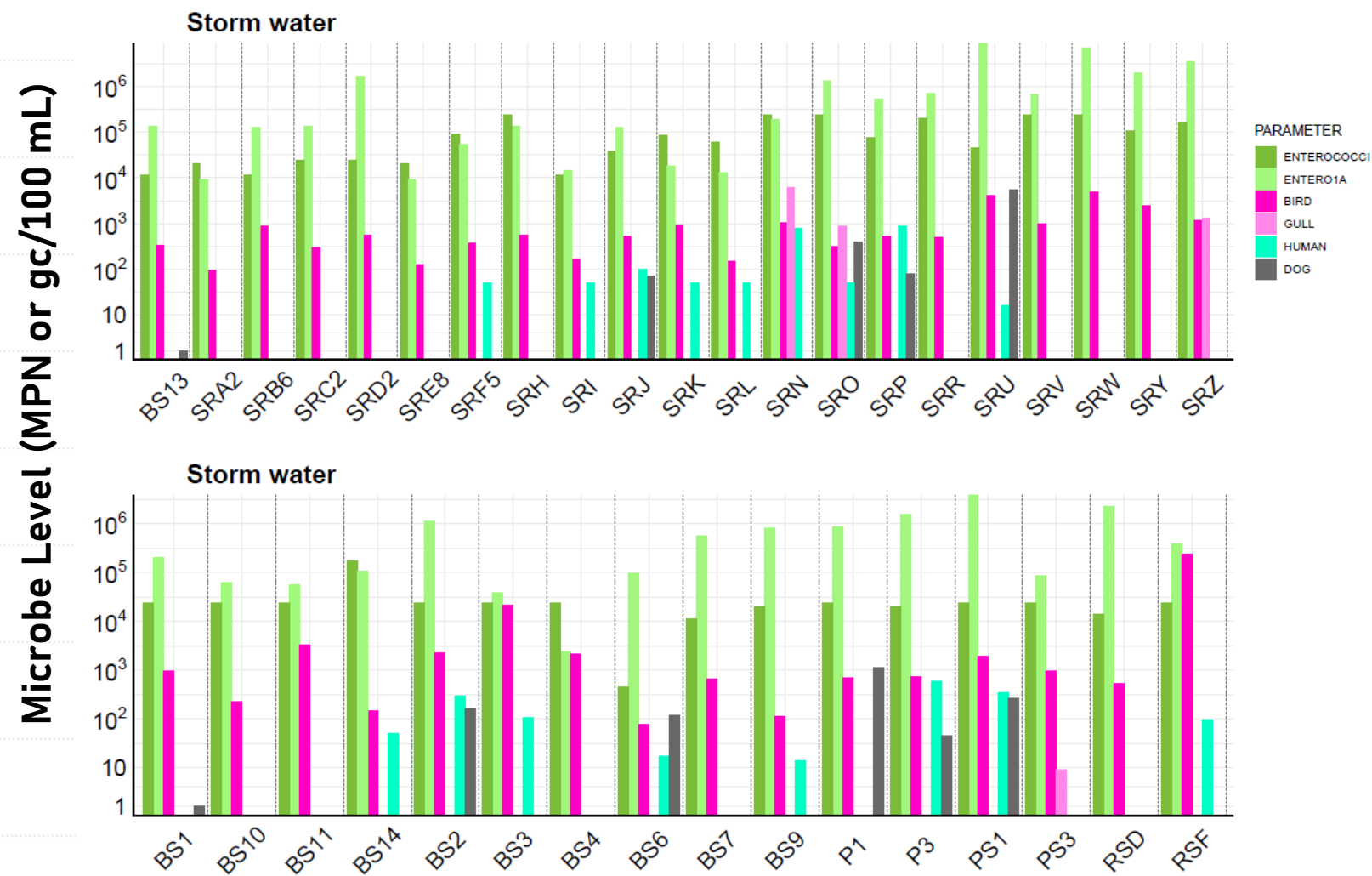
# PVC water shows evidence of bird (a lot), some dog and some human



# Groundwater shows evidence of bird (due to stormwater and PVC mixing) but no dog and one with very low human

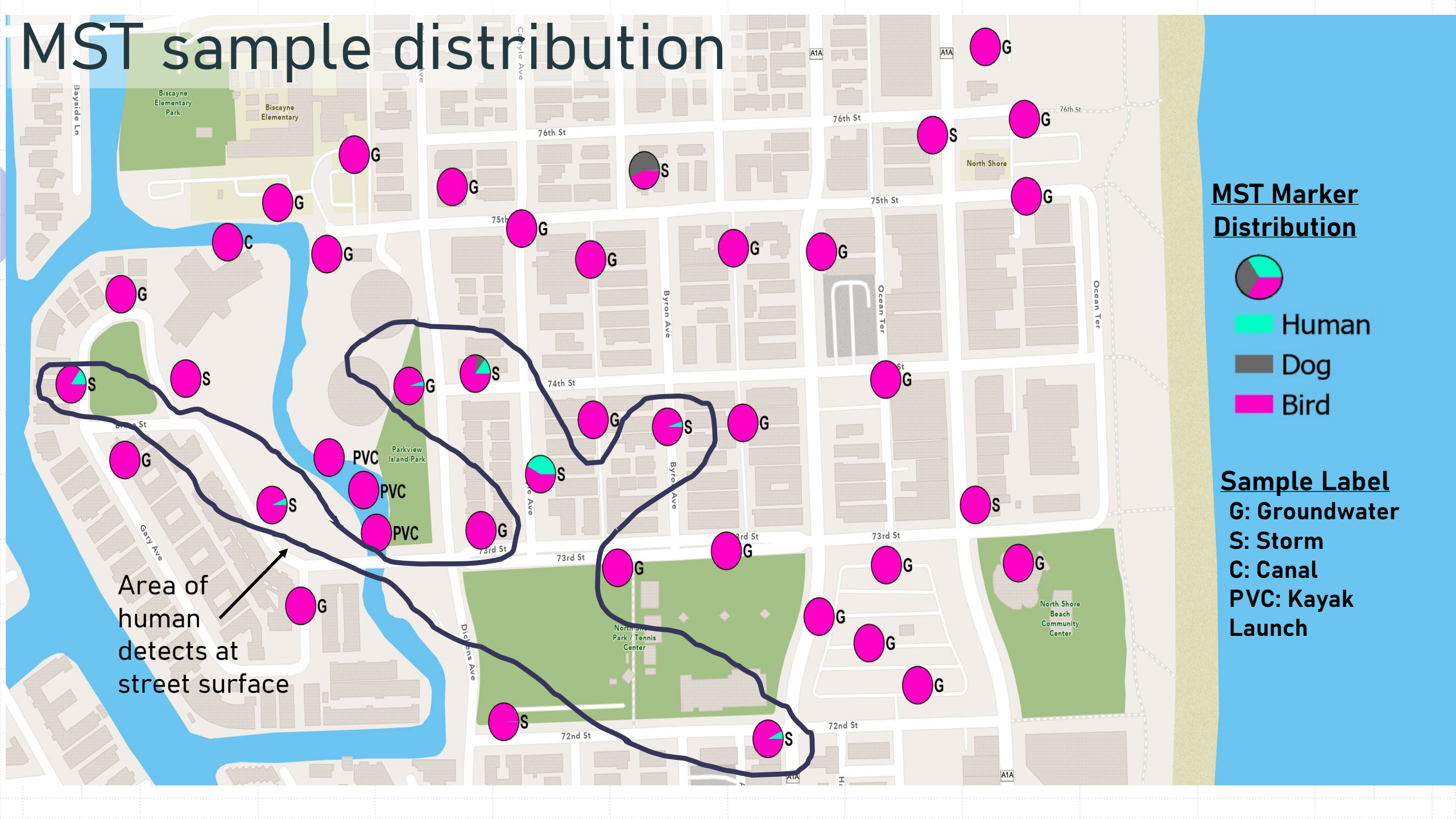


# Stormwater showed highest levels of enterococci, dog, and human markers





# MST sample distribution



# Conclusions

- Enterococci levels lower between storm events (lost earlier signal of possible sewer leaks).
- Sanitary sewer pipe-lining and repair of air release valves appears to have improved water quality between storms
- **Main water type contributing to enterococci in the PVC is stormwater**
- Source to stormwater comes from birds, humans, and dogs from street runoff
- Additional load from birds within the PVC
- BBE outfall contributes enterococci to the PVC

# Recommendations

## Stormwater

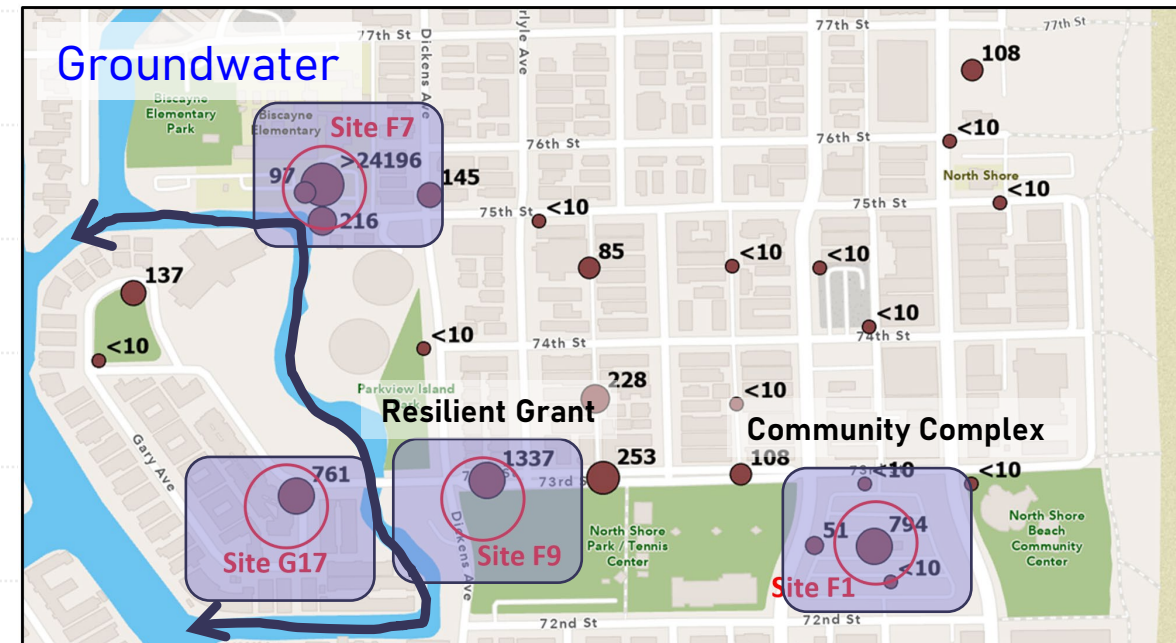
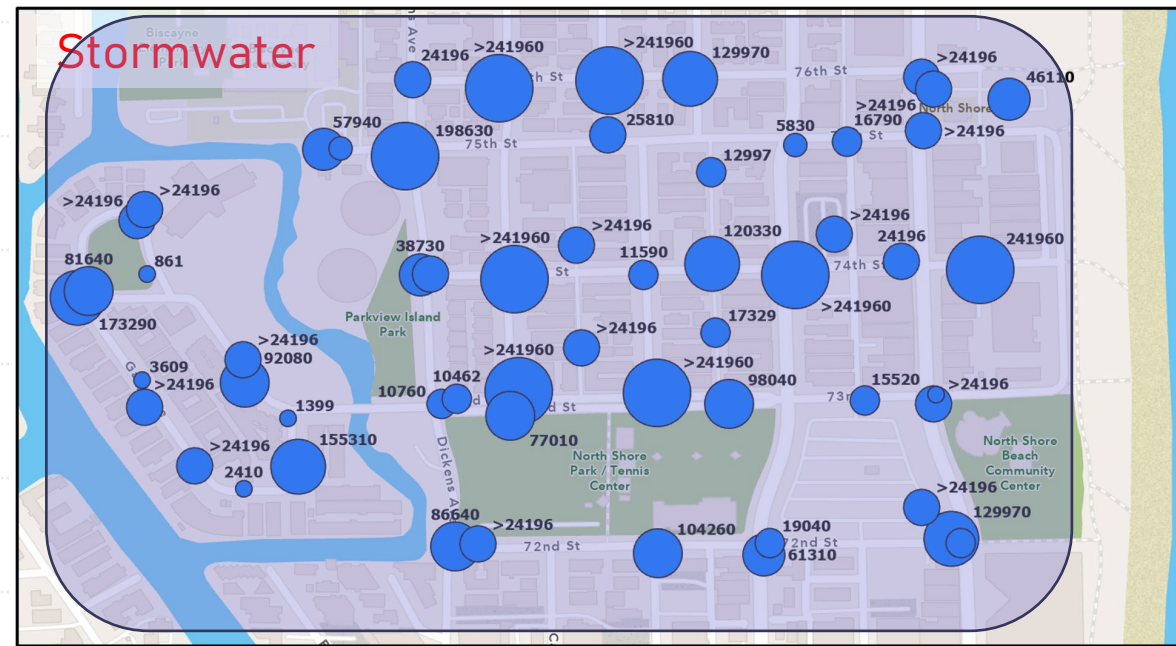
- **Outfalls:** Address outfall at Biscayne Beach Elementary. Miami-Dade should investigate private outfalls contributing to PVC.
- **Street Sweeping:** Increase frequency on east side of catchment. Improve street sweeping access (add smaller units).
- **Cleanliness of Public Spaces:** Deep clean grassy areas and surfaces with visible animal waste. Explore UV disinfection.
- **Pet Waste:** Continue public education campaign. More pet waste stations. Deep clean up of pet waste.
- **Address Homeless Sanitation Practices and Needs:** Explore ways to improve access to sanitation.
- **Birds:** Evaluate what is attracting birds to PVC and throughout catchment

## Groundwater

- Continue with aggressive inspection and maintenance of sanitary sewer

## PVC

- Implement water quality treatment for stormwater outfall improvements
- Improve PVC flushing (in design and permitting phase)
- Improve shoreline to reduce erosion and trash (federally funded living shoreline)
- Consider EPA kayaking guideline (370 MPN/100 mL) coupled with a





# Thank you!

- Next steps
  - Release report to general public in March.
  - Integrate feedback from public into report.