

# Sources of Enterococci to the Park View Canal in Miami Beach



Presentation given by Helena Solo-Gabriele, Ph.D., P.E.  
Professor, University of Miami  
January, 2023



COLLEGE OF  
ENGINEERING

Larissa Montas, Ph.D.  
Afeefa Abdool-Ghany, M.S.  
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Erik Lamm  
Ashley Quijada  
Rivka Reiner  
Hekai Zhang, M.S.  
Helena Solo-Gabriele, Ph.D., P.E.

# January 19, 2022

## Sewage Overflow

## Bruce and Wayne Street Raymond and Gary Ave





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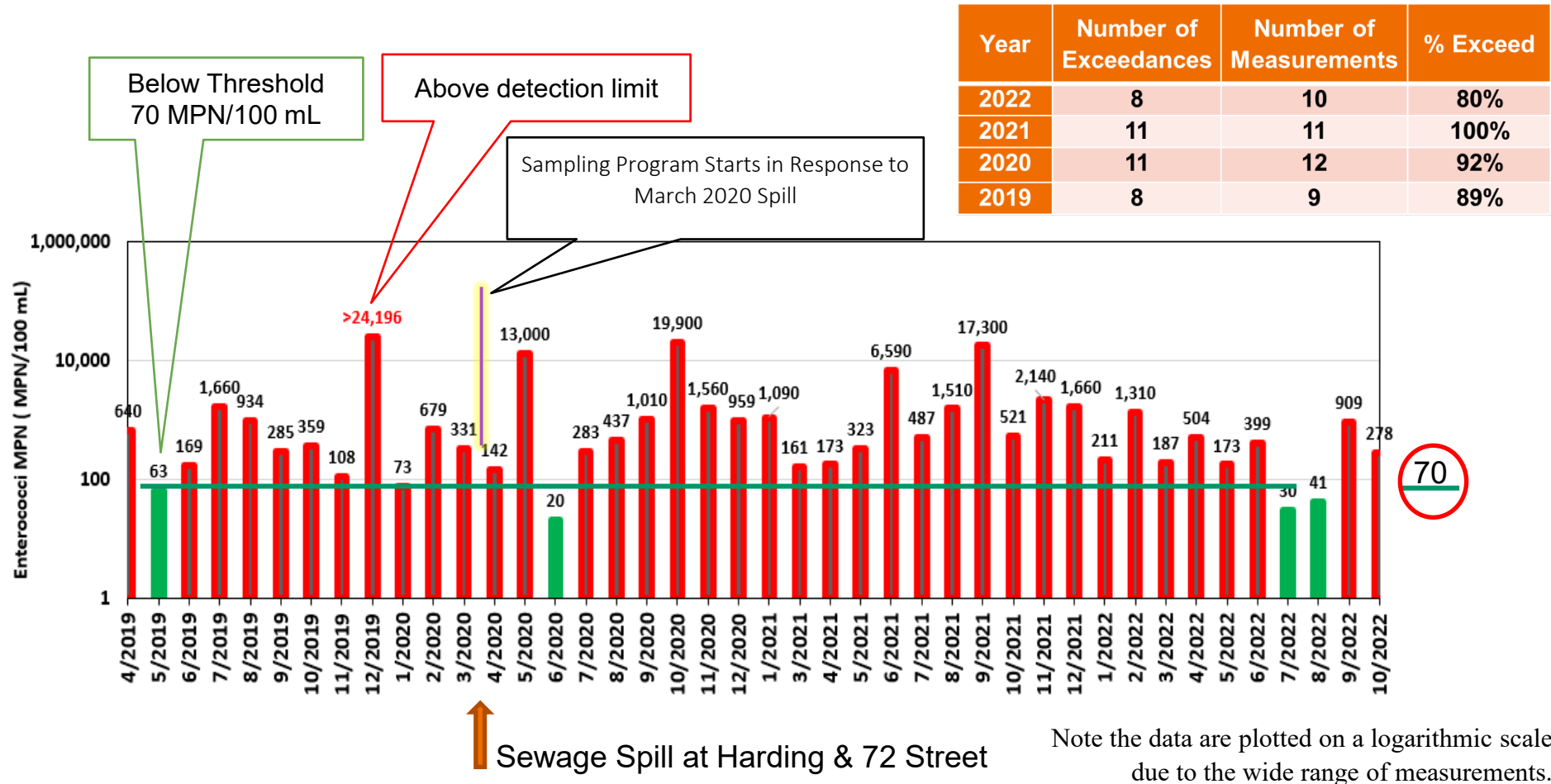


**Park View Canal  
(PVC)  
is a secondary  
canal with limited  
flow  
located within  
Biscayne Bay.**

# Sources

- Prior monitoring → Elevated levels of fecal indicator bacteria (FIB), enterococci and fecal coliform
- Prior studies → FIB comes from dogs, humans and birds
- Enterococci is more commonly used (our focus for sampling)
- Target: 70 MPN/100 mL for primary contact ←

# Historic Enterococci Concentrations in PVC Canal



# Objectives

- From where are the enterococci coming from?
- How enterococci from humans, dogs, and birds enter the waterway?
  - Geographic area
  - Fresh versus marine water
  - Environmental conditions associated with elevated enterococci (rain, tide, sunlight)

# Our Approach

- Evaluate Historical Records  
(Miami Beach has made considerable efforts)
- Initiate Sampling Program

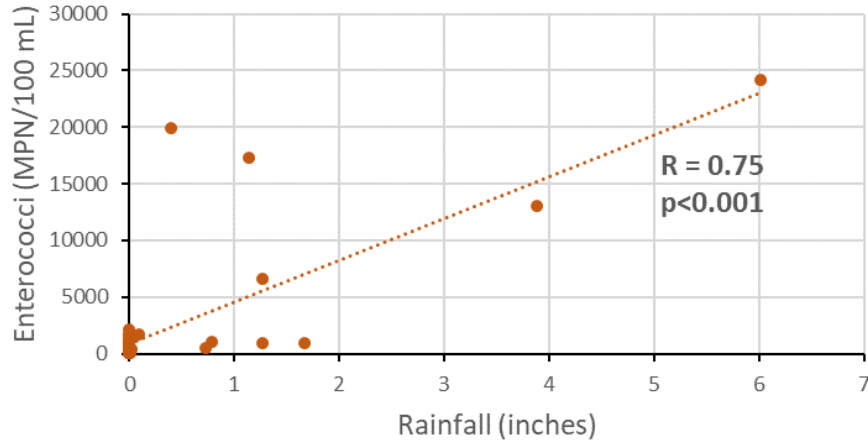
## Sampling Efforts Included:

- Intense Spatial Sampling at the PVC
  - Stormwater System
  - Shoreline Sediments
  - Intense Temporal Sampling
  - Depth Sampling
-



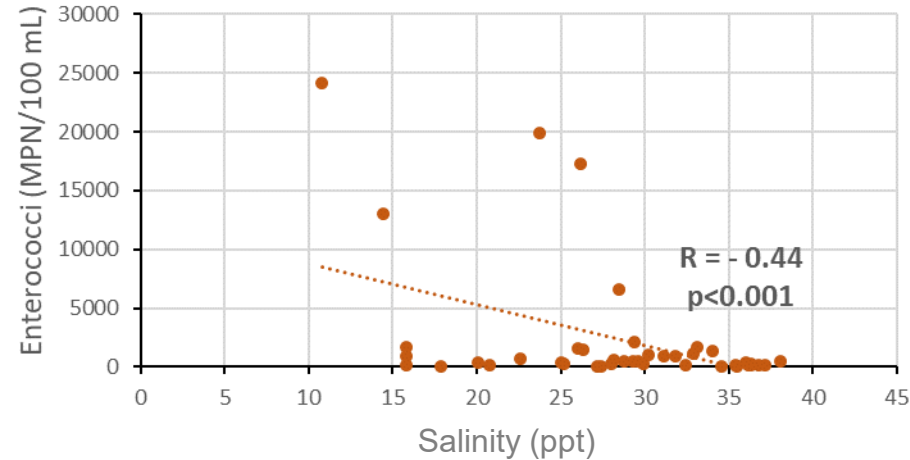
# Historical Records from Prior CMB Studies

24-hour Rainfall



Higher enterococci after rain

Salinity



Higher enterococci in fresher water

# Freshwater sources with differing rain influences

- STORMWATER CONVEYANCE  
INFRASTRUCTURE
- WASTEWATER SANITARY  
SEWER

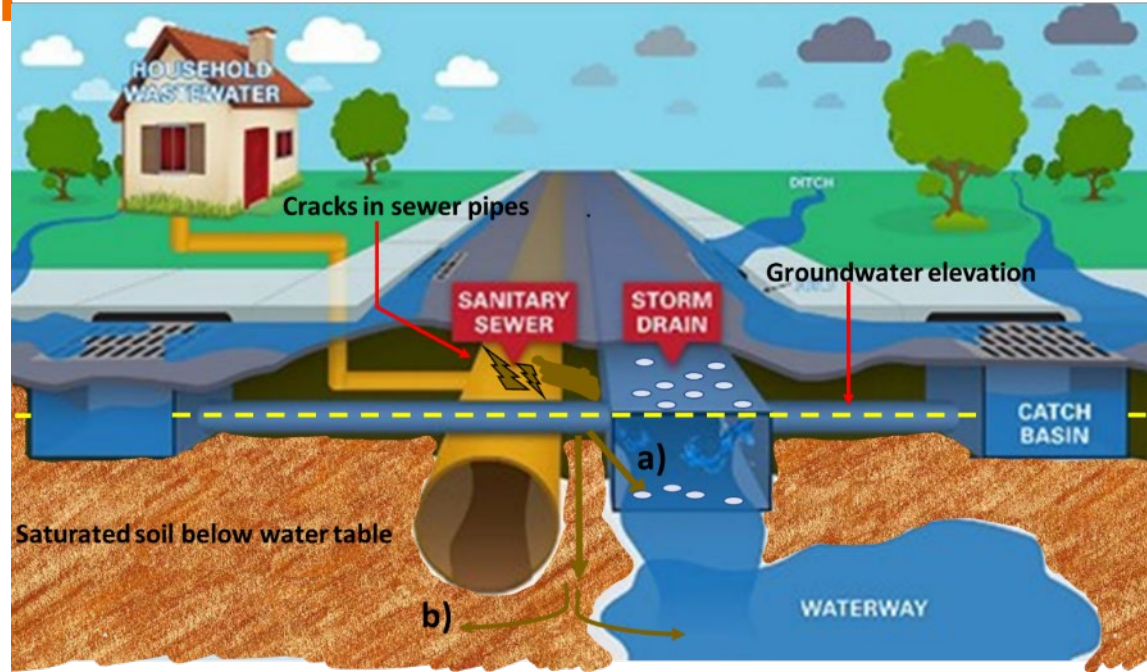
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# Evaluation of Stormwater Conveyance Infrastructure

Total catchment area that discharges storm water to the PVC is about 81 acres.



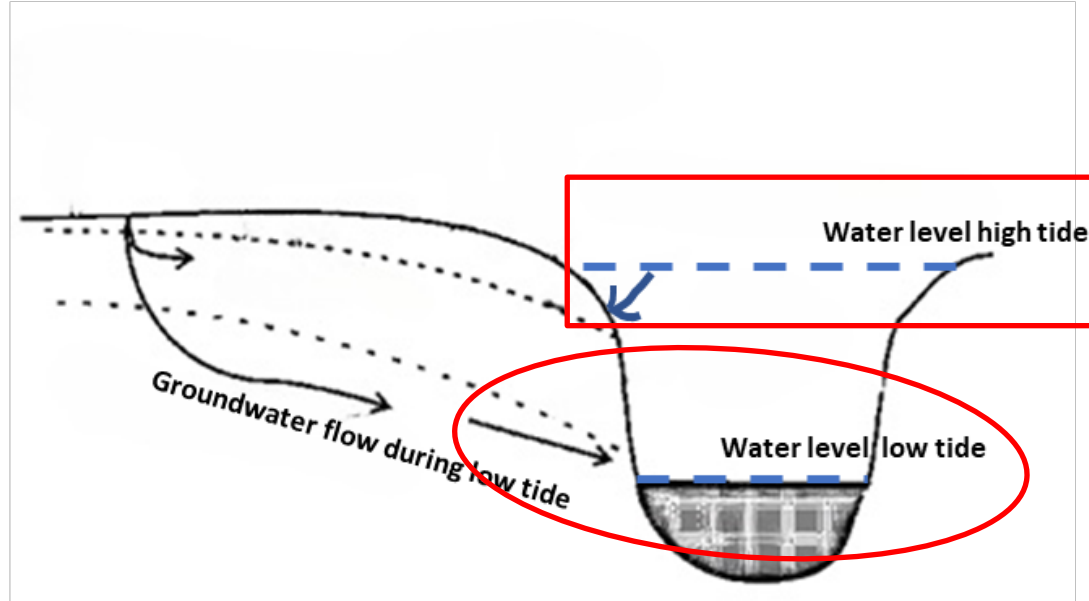
# Close Proximity of Stormwater Conveyance System Sanitary Sewer Makes it Vulnerable to Possible Contamination



Possible but not proven underground connection



# Groundwater and Canal Water Exchange



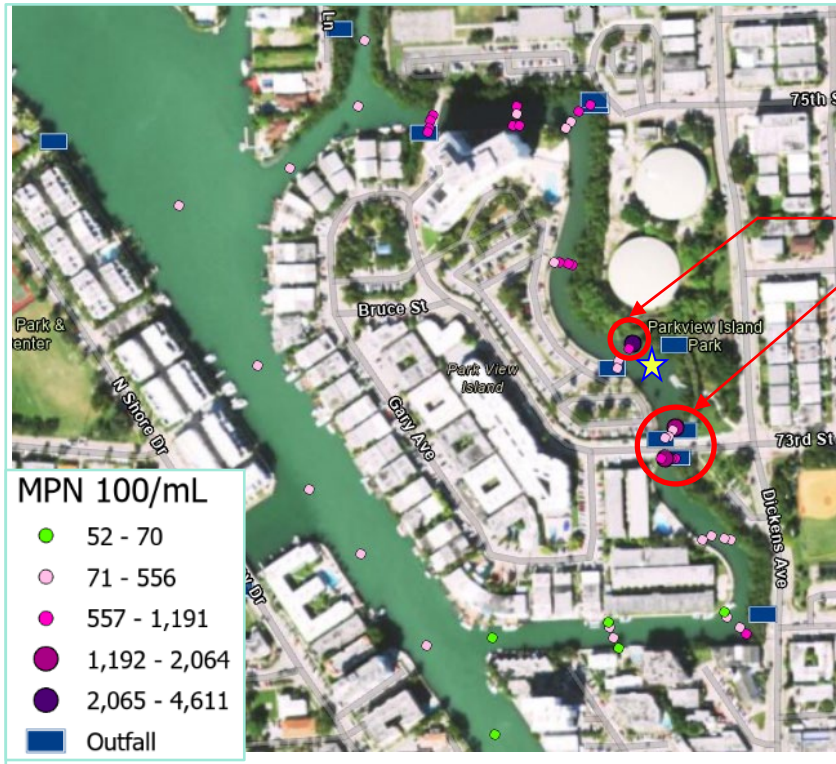
# Sampling Effort



- Intense Spatial Sampling at the PVC
  - Stormwater System
  - Shoreline Sediments
  - Intense Temporal Sampling
  - Depth Sampling
-

# Spatially Intense Sampling

High Tide, August 9 (dry)



Hot Spot  
Storm  
Outfalls



Evaluation of Stormwater  
Conveyance System

# Sampling Effort



- Intense Spatial Sampling at the PVC
- Stormwater System
- Shoreline Sediments
- Intense Temporal Sampling
- Depth Sampling

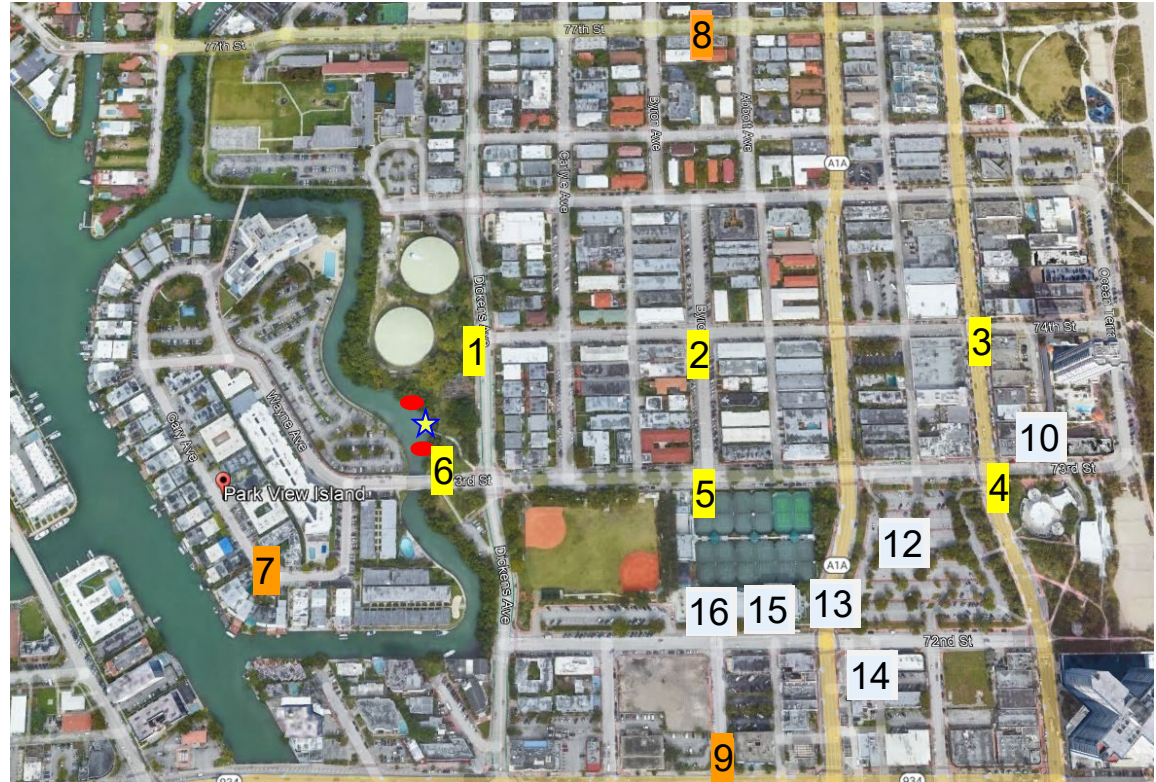


# Intense Storm Water Conveyance and Sanitary Infrastructure

- 1 Initial Sites
- 7 Background Sites
- 10 Exploratory Sites

● Storm Water Outfall (Hot Spot)

★ Kayak Launch



Enterococci Levels in Water (MPN /100 mL)

1,000,000  
100,000  
10,000  
1,000  
100  
10  
1

In Storm Water Conveyance Hot Spots

Water in Storm Water Inlets

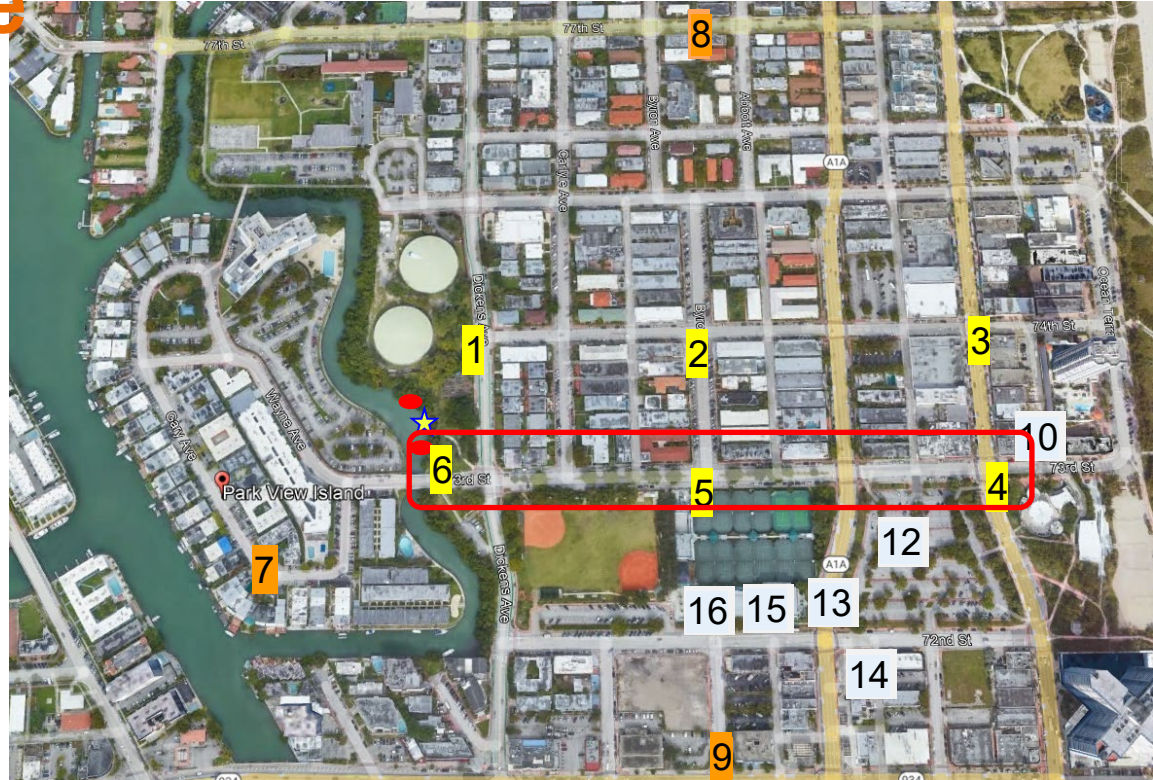
Sites Farthest from  
Sanitary Force Mains

Site 8

—○— 8/19 Catch Basin Water  
...×... 9/2 Catch Basin Water

S1	S2	S3	1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	4R
			12,873	13,053	17,968	241,960	1,327	512										
			2,718	13,393	18,868	14,923	12,248	241,960	173	19,648	463	13,753	16,768	11,730	14,978	6,240	12,528	

# Intense Storm Water Conveyance and Sanitary Infrastructure



- 1 Initial Sites
- 7 Background Sites
- 10 Exploratory Sites

● Storm Water Outfall (Hot Spot)

★ Kayak Launch

Storm  
Water  
Conveyance  
Hot Spot



# Sediments

T1,T2... Top sediments  
B1,B2... Bottom sediments  
S1,S2,S3 Waterway bank

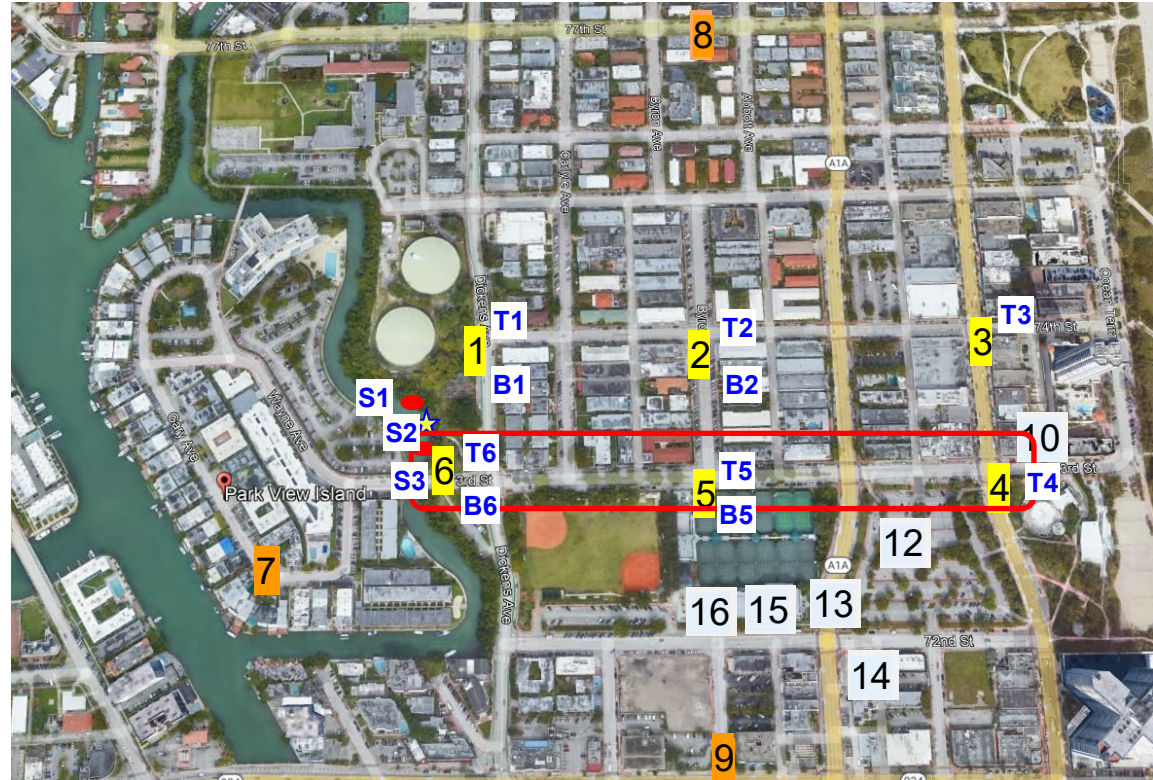
1 Initial Sites

7 Background Sites

10 Exploratory Sites

● Storm Water Outfall (Hot Spot)

★ Kayak Launch



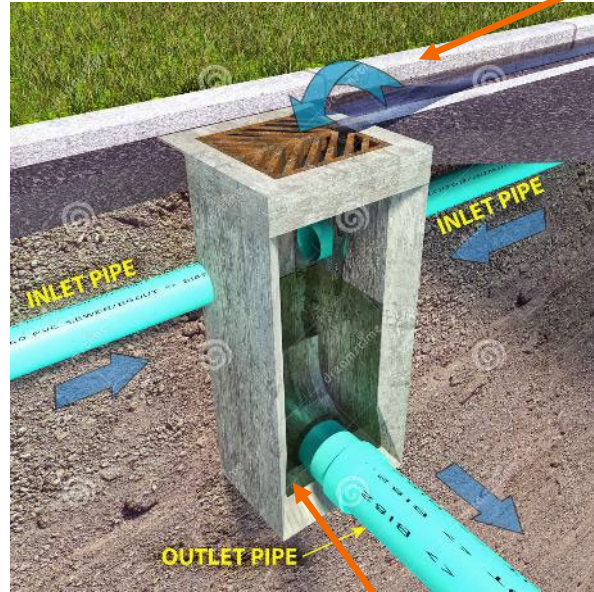


# What Are Possible Contribution From Sediment

Shoreline  
Sediments



Storm Water Inlet



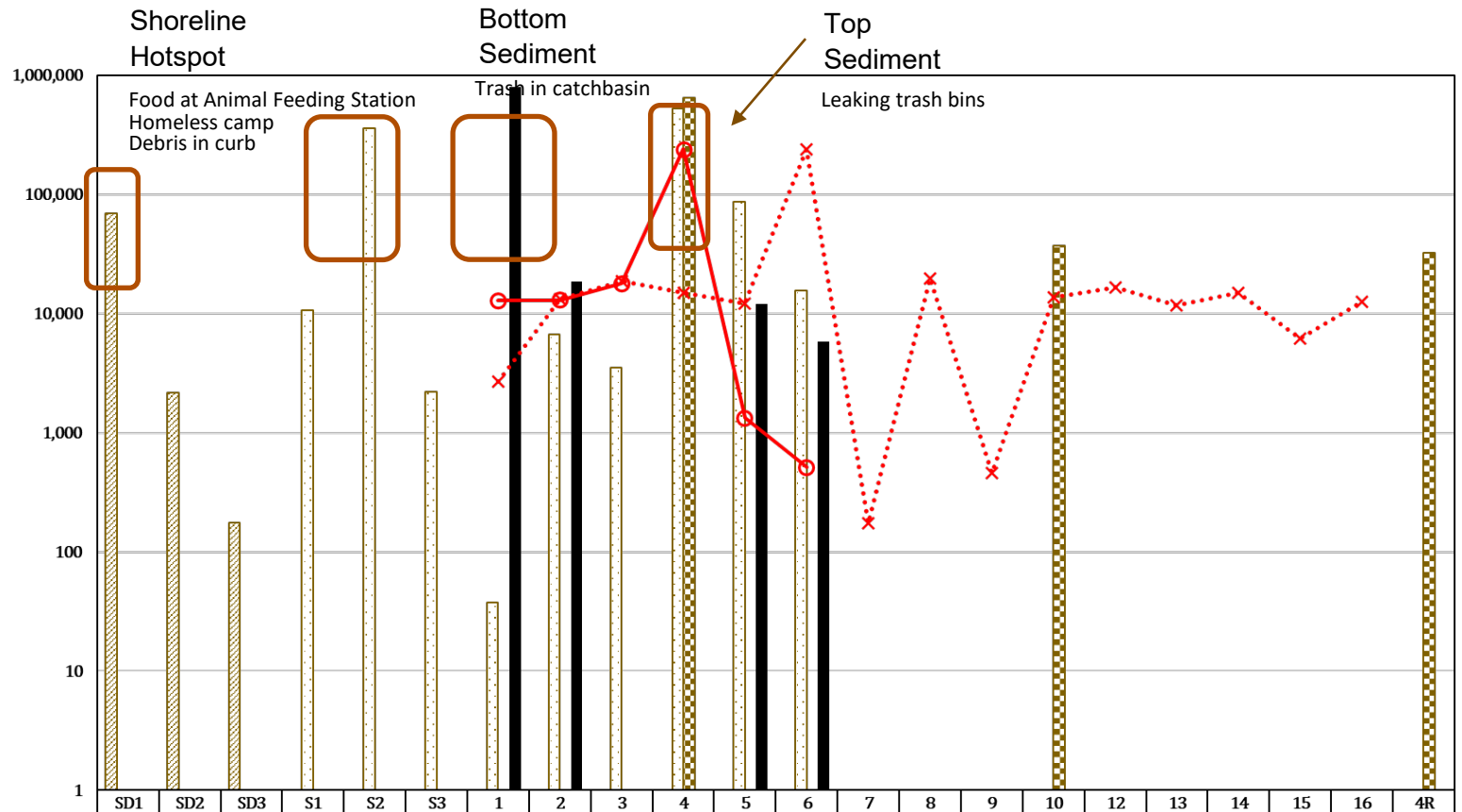
Top Sediments



Bottom  
Sediments



Enterococci Levels in Water (MPN /100 mL)  
Enterococci Levels in Sediments (MPN/g dry sediment)



	SD1	SD2	SD3	S1	S2	S3	1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	4R
8/9 Top Sediments	69,355	2,158	174.5																			
8/17 Top Sediments				10,704	359,886	2,212	38	6,709	3,526	526,092	87,023	15,743										
9/2 Top Sediments										654,063						37,135						32,467
8/17 Bottom Sediments							798,013	18,751			12,042	5,787										
8/17 Catch Basin Water							12,873	13,053	17,968	241,960	1,327	512										
9/2 Catch Basin Water							2,718	13,393	18,868	14,923	12,248	241,960	173	19,648	463	13,753	16,768	11,730	14,978	6,240	12,528	

# Sampling Effort



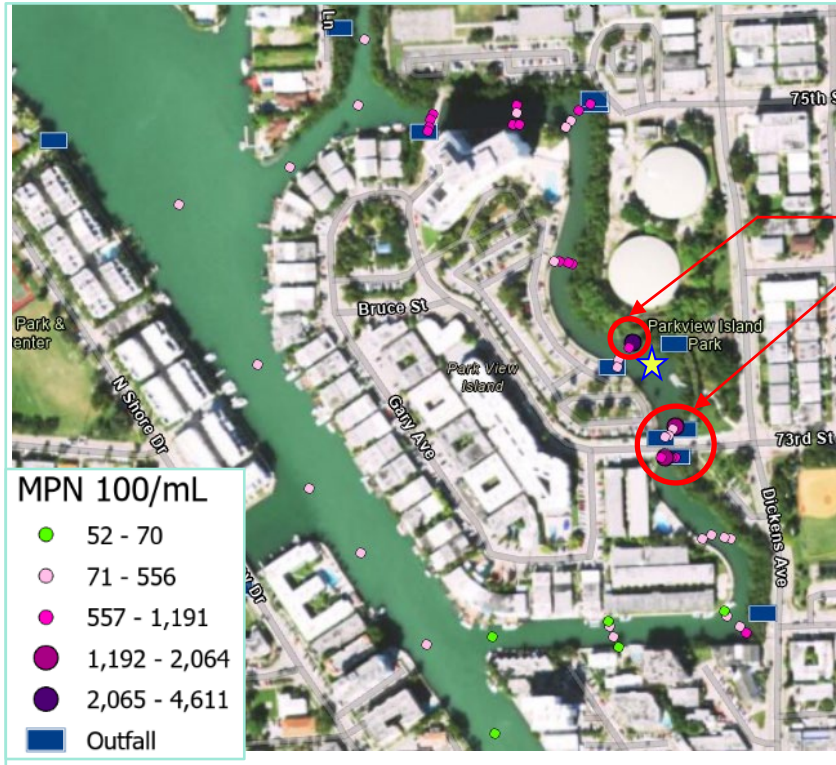
Low tide?

- Intense Spatial Sampling at the PVC
  - Stormwater System
  - Shoreline Sediments
  - Intense Temporal Sampling
  - Depth Sampling
-



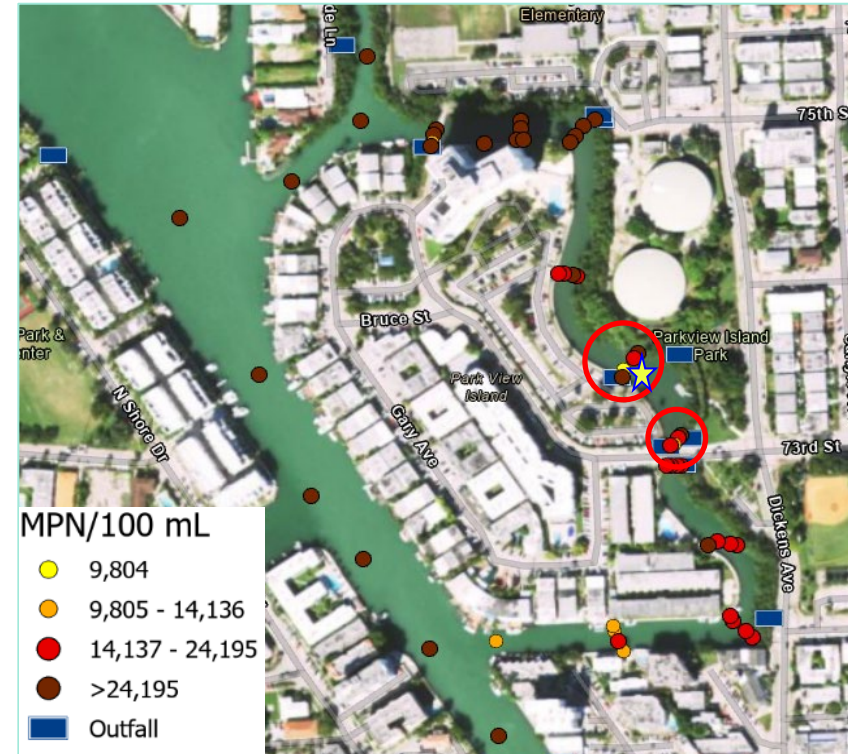
# Spatially Intense Sampling

High Tide, August 9 (dry)  
(Saltier Water)



Hot Spot  
Storm  
Outfalls

Low Tide, September 16 (wet)  
(Fresher Water)



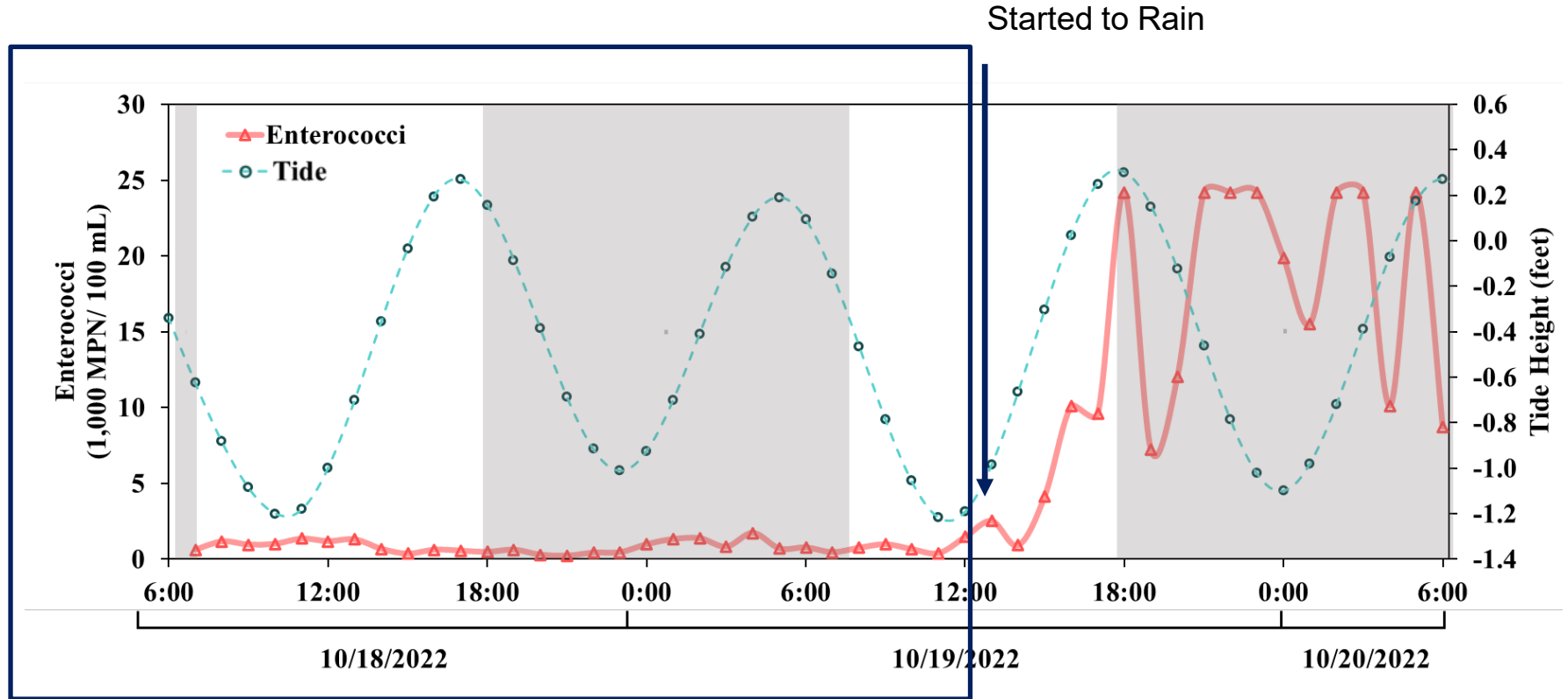


# Sampling Efforts



- Intense Spatial Sampling at the PVC
- Shoreline Sediments
- Stormwater System
- Intense Temporal Sampling
- Depth Sampling

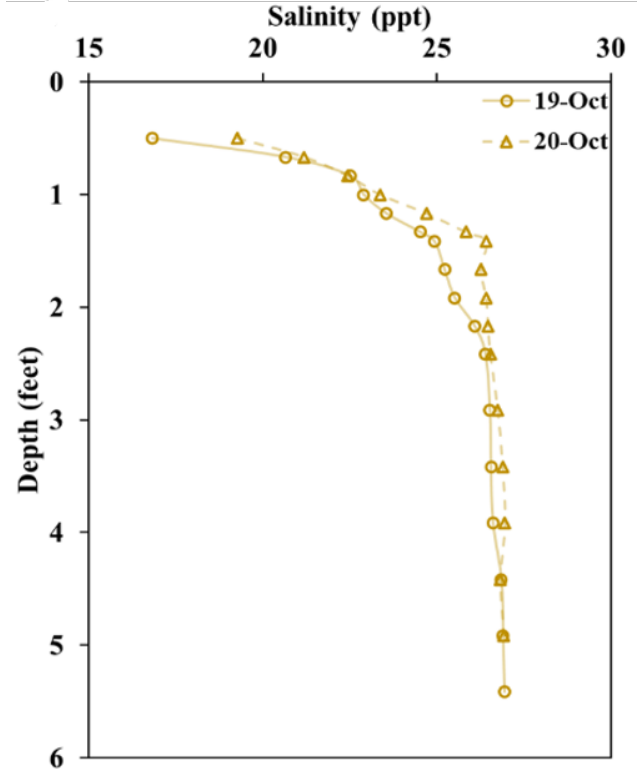
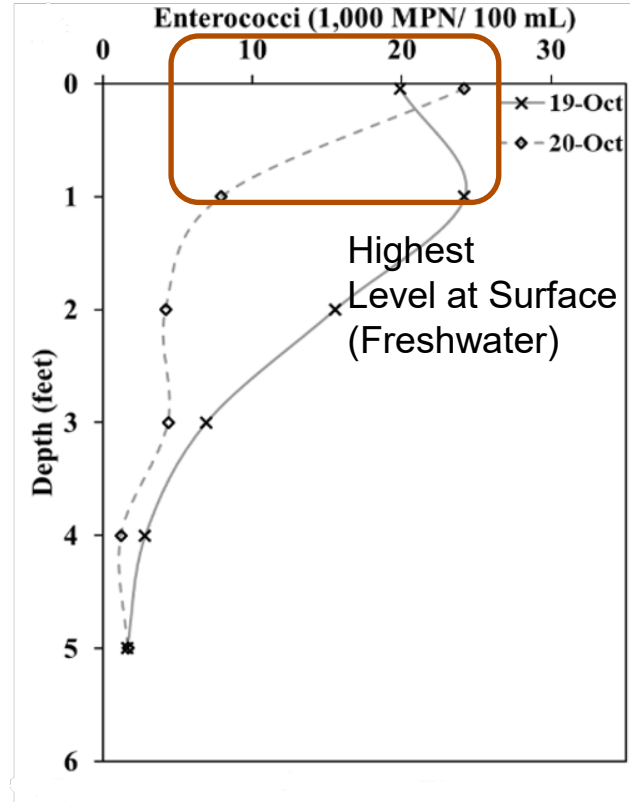
# Time Intense Sampling

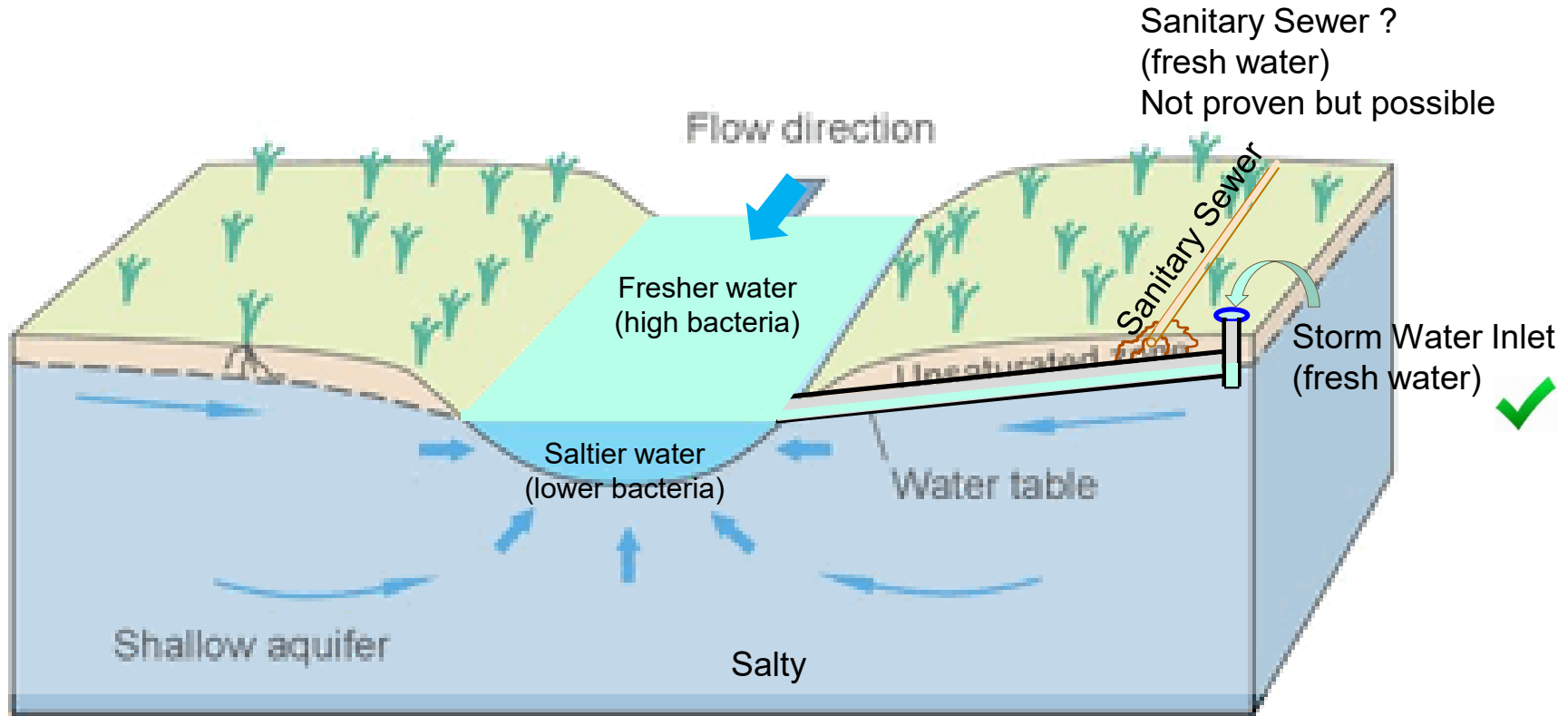


# Depth Intense Sampling

Measurements in the vertical direction within the water column at:

0, 1, 2, 3, 4, and 5 feet.





**Main Source is Fresh Water That Enters Through Storm Water Conveyance System**



# Visible Feces





# Animal Feeding Station





Homeless



Storm Water Conveyance System



Garbage Bins



# Sewer Overflow (from Jan. 19, 2023)



Bruce and Wayne  
Courtesy of PVI Resident



Raymond and Gary Ave.  
Courtesy of PVI Resident





# Conclusions/Summary

Enterococci is:

- Associated with freshwater and this freshwater floats on canal surface
- Enters during storm events through stormwater conveyance system
- Source to stormwater includes:
  - Dog feces
  - Feces from feral animals
  - Homeless without access to sanitation
  - Leaking garbage bins
  - Trash
- Cannot discount sanitary sewage. When sewage backs up and overflows it enters the stormwater conveyance system and contaminates the streets including all sediments
- Need to further investigate underground sewage leaks. Such leaks can possibly impact the stormwater conveyance system.

# Visible Items

## Potential Responses (currently being address

Animal feeding stations that attract feral animals such as roosters, iguanas, racoons, rats. Dog feces visible.	Remove animal feeding station. Remove feral animals humanely. Continue dog waste removal education program. Designate clean up schedule to address visible feces.
Homeless (4 encampments)	Remove access to areas under bridges. Provide facilities for homeless. Lazarus project may help.
Trash in waterway	Remove trash caught in mangroves. Increase trash removal from streets. Install trash catch systems in storm sewers.
Trash and debris in curbs	More frequent street sweeping.
Trash bins from commercial establishments leaking liquids	Frequent inspections and enforcement of covered trash bins.
Shaded embankments with natural soils.	Minimize inputs from animals along shore. Improvements to water quality.

# Infrastructure

# Potential Responses (long term plan)

Many storm water outfalls	Confirm that storm water is being treated for first flush contaminant removal
Some outfalls are grandfathered	Private outfalls prior to regulations to be addressed by DERM upon recertification of building
Very little green space in upper areas of storm water conveyance system with possible minimal treatment of first flush	Evaluate storm water system's ability to handle the first flush. May require some initial treatment of storm water or use of sediment separators and additional disinfection
Upgrade stormwater conveyance system	Modern stormwater systems treat the first flush of contaminants. Need to integrate systems for trash capture (bar racks) coupled with sediment removal systems (e.g., vortexers)
Reduce back up of sewage	Frequently inspect manholes for potential back ups. Install "smart" manholes that issue alerts when back ups occur.
Upgrade sanitary infrastructure	Sanitary sewer infrastructure is aging and in need of upgrades. Major investments needed to upgrade system to minimize leaks and breaks. City has completed camera inspection of all public sewers on Park View Island
Lack of flushing of PVC	Trash removal and consider improving circulation through dredging

# Key Takeaways

- From where are the enterococci coming from? Comes from surfaces washed by rain and carried by runoff through stormwater conveyance system.
- Cross connections with sanitary sewage is possible but not proven in the current study. (Exception is when sewer is blocked and overflows)
- More housekeeping on streets (initiated by City during course of study)
- Longterm investments needed in upgrading the stormwater conveyance system and the sanitary sewer system.

Thank you. [hmsolo@miami.edu](mailto:hmsolo@miami.edu)