

FSA

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Approach to the Prioritization and Implementation of Bacteria TMDLs

Cheryl M. Wapnick

Tom Singleton

PBS&J



Issue in Florida

~340 WBIDs
verified as
impaired for
fecal coliform
contamination
in Florida

WBIDs Impaired for Fecal Coliform



**Where is the pollution
coming from?**

**What can we do with the
information we have today?**



Developed Two Approaches / Tools



**Decision-Support Tool
developed to guide
potential additional
sampling and help
prioritize basins for
management action**

**Identification of
sources of fecal
coliform
contamination using
weight-of-evidence**

Designed for state-wide application

Tested in the Hillsborough River watershed

**Dr. Valerie (Jody) Harwood
Dr. Gerold Morrison**



Decision-Support Tool for Guiding Additional Sampling and Prioritizing Management Actions

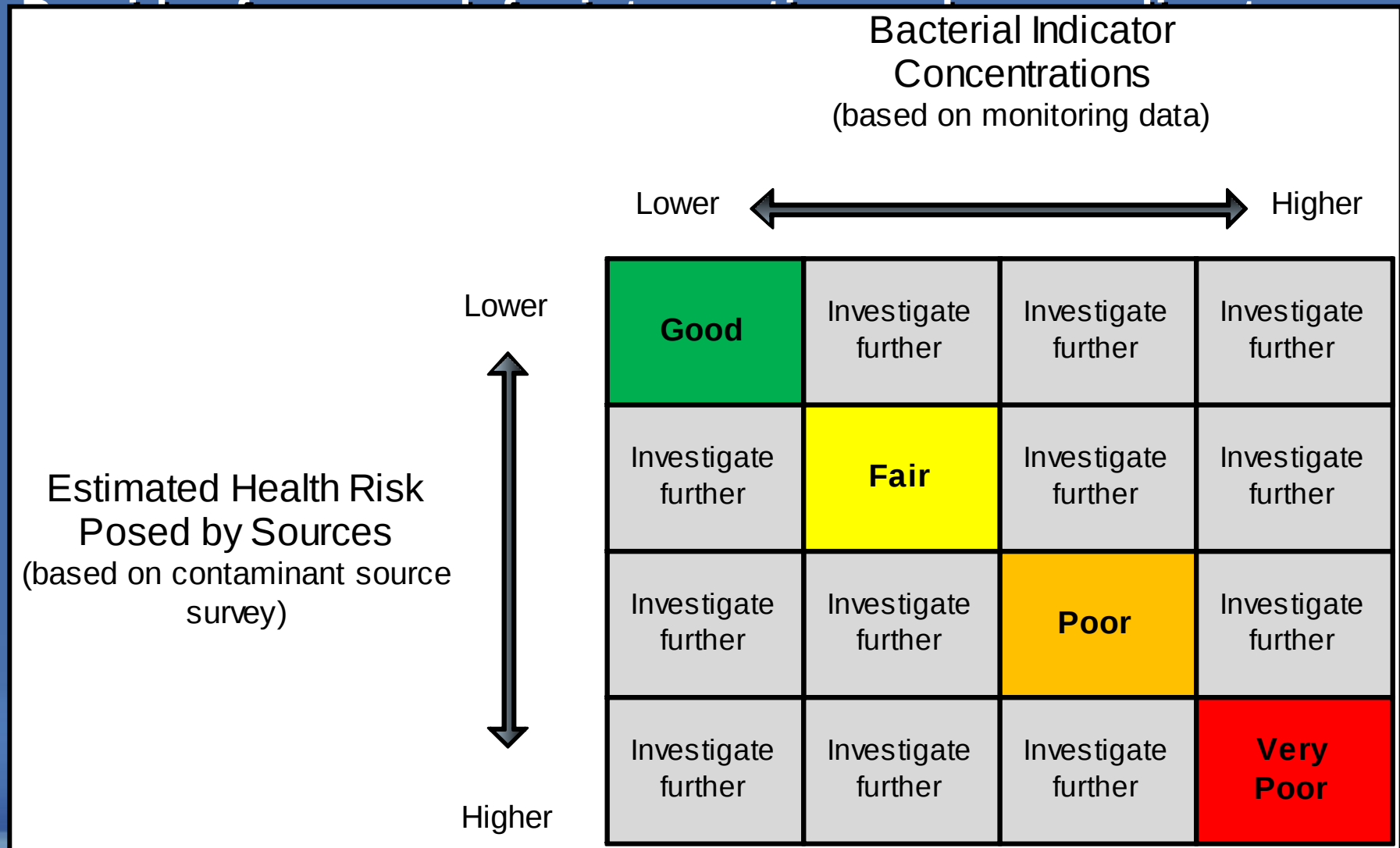


Why is a decision-support tool needed to help with fecal coliform BMAPs?

- Florida is currently developing TMDLs and BMAPs for WBIDs that are not meeting water quality criteria
- Historical use of coliform bacteria as indicators of potential fecal contamination
 - Potential for “false-positive” exceedances that are not correlated with human health risk
 - Potential for “false-negative” results [e.g., pathogenic viruses and protozoa (*Giardia* or *Cryptosporidium*)] can survive longer than fecal coliforms in surface waters



How does this tool help ?



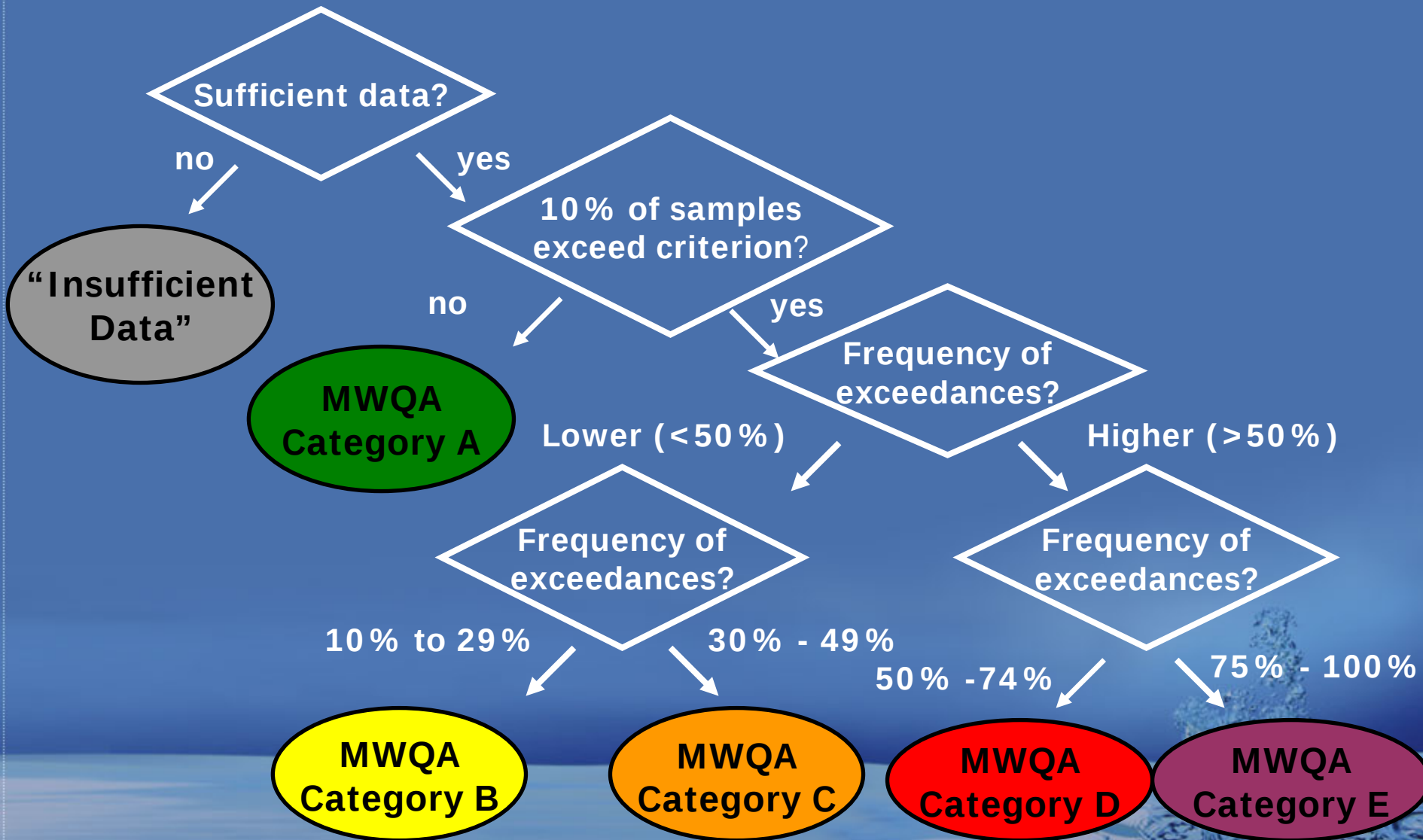
quality conditions and attainment of water quality goals

Step 1

Characterize microbial water quality conditions within each WBID, based on fecal coliform concentrations observed in the available monitoring data



Decision Tree



Step 2

Classify sites based on potential for human health risks, using CSS assessment categories and MST data, when available



CSS assessment categories (likelihood for human health risk)

- **Very Low:** No visual evidence of potential sources of human pathogens; natural environment; no or minimal anthropogenic land uses; wildlife present (any density)
- **Low:** Low density agricultural and residential sources, including pets, livestock (without direct access to surface waters), or poultry operations; residences on septic systems
- **Moderate:** Urban stormwater sources (including pet waste) present; well-functioning wastewater infrastructure (both sewer and septic); episodic/low volume sanitary sewer overflows (SSOs) reaching surface waters; moderate-density livestock with little direct access to surface waters; Class A residual and/or septage spreading areas may be present
- **High:** Major stormwater outfalls present; history of failing wastewater infrastructure (central sewer or onsite systems); episodic or chronic/high volume SSOs reaching surface waters; concentrated livestock without direct access to surface waters; residual/septage spreading (Class B)
- **Very High:** Current failing wastewater infrastructure; chronic/high volume SSOs reaching surface waters; concentrated livestock with direct access to surface waters; evidence of direct sewage inputs (e.g., confirmed illicit discharges)

Classification matrix ("Annapolis protocol") approach

		MWQA group (based on binomial assessment of frequency of 400 CFU/100 mL fecal coliform exceedances)					Exceptional Circumstances (e.g., sewer line break) ^c
		A (≤ 10%)	B (>10% - 30%)	C (>30% - 50%)	D (>50% - 75%)	E (>75%)	
Contaminant source survey (CSS) assessment category (likelihood of fecal contamination posing human health risks)	1. Very Low	A1	B1	C1 ^a	D1 ^a	E1 ^a	Immediate Action
	2. Low	A2 ^b	B2	C2	D2 ^a	E2 ^a	
	3. Moderate	A3 ^b	B3	C3	D3	E3	
	4. High	A4 ^b	B4 ^b	C4	D4	E4	
	5. Very High	A5 ^b	B5 ^b	C5 ^b	D5	E5	
Exceptional Circumstances (e.g., sewer line break) ^c		Immediate Action					

Notes:

- These outcomes imply that the CSS may be providing an overly optimistic rating of water quality, or the fecal coliform sources in the area may be relatively low-risk or primarily environmental (e.g., wildlife, sediments, soils, vegetation), and the cause(s) of the discrepancy should be verified.
- These outcomes imply that the fecal coliform indicator may be providing an overly optimistic MWQA rating, or the CSS may be providing an overly negative assessment, and the cause(s) of the discrepancy should be verified.
- As explained by WHO (2003), exceptional circumstances involve acute situations known to be associated with higher public health risks, such as sewer line breaks and other SSOs that contaminate surface waters, which require immediate remedial action.

Tracking and Reporting of Results

	Monitoring Location			
Year	1	2	3	4
2004	D4	A1	B1	C3
2005	C4	B1	B1	C3
2006	D4	B1	C1	B3
2007	C3	A1	B1	B2
2008	C3	A1	A1	B2

Use results to suggest more intense monitoring or to track management actions

Initial Hillsborough county-wide site prioritization

using MWQA scores based on fecal coliform data from EPCHC monitoring stations (2001-2007)

Location	Sta. No.	No. Samples	% >400 CFU/100 mL ($\hat{P}$)	MWQA category	Geometric mean fecal coli. (CFU/100 mL)	Geometric mean enterococci (CFU/100 mL)
Turkey Creek at SR 60	111	77	84%	E	1,212.0	1,426.0
Bullfrog Creek at Symmes Rd	132	78	83%	E	1,134.8	2,658.9
Sweetwater Creek at Hillsborough Ave	104	84	69%	D	786.4	849.9
Delaney Creek at 36th Ave	138	84	54%	C	443.3	642.2
Delaney Creek at US 41	133	84	42%	C	376.7	596.8
Little Manatee River at CR 579	140	84	31%	B	283.6	664.9
English Creek at SR 60	154	83	30%	B	266.6	487.7
Mill Creek at I-4	149	81	37%	B	258.0	578.7
Little Manatee River at US 301	113	84	20%	B	250.8	664.0
Rocky Creek at Hillsborough Ave	103	84	26%	B	242.6	285.2
Hillsborough River at Sligh Ave	152	84	27%	B	239.8	182.8
Bullfrog Creek at US 41	144	84	37%	B	233.7	254.7
Little Manatee River at CR 674	129	84	24%	B	218.5	704.0
Baker Creek at Thonotosassa Rd	107	84	35%	B	216.5	508.7
Hillsborough River at Rowlett Pk	105	84	26%	B	208.7	127.7
Rocky Creek at Waters Ave	141	84	26%	B	205.8	343.4
Hillsborough River at Columbus Ave	137	84	33%	B	195.5	153.7
Flint Creek at US 301	148	84	25%	B	191.2	359.8
Double Branch Creek at Hillsborough Ave	101	84	27%	B	185.1	222.6
Blackwater Creek at SR 39	143	82	21%	B	156.9	284.2
Trout Creek at CR 581	145	65	18%	B	152.9	281.8
Sweetwater Creek at Anderson Rd	142	84	20%	B	152.2	764.8
Turkey Creek at Durant Rd	151	82	26%	B	142.0	322.6
Alafia River South Prong at Bethlehem Rd	139	83	16%	B	138.8	215.7
Alafia River at Bell Shoals Rd	114	84	18%	B	136.4	240.7
Cypress Creek at CR 581	120	72	19%	B	132.9	261.9
Alafia River at US 301	153	83	14%	A	152.7	209.7
Hillsborough River at US 301	108	83	11%	A	101.7	159.4
Alafia River North Prong ab confluence	115	84	11%	A	100.4	267.3
Alafia River South Prong ab confluence	116	84	10%	A	80.6	207.3
Channel A at Hillsborough Ave	102	84	14%	A	63.2	63.1
L. Thonotosassa at Flint Creek	118	82	2%	A	46.8	68.5
Hillsborough River at Fowler Ave	106	84	5%	A	46.6	96.4
TBC at Fowler Ave	146	82	7%	A	40.5	51.0
Palm River at US 41	109	84	7%	A	39.1	36.4
Little Manatee River at US 41	112	84	5%	A	34.6	55.1
L. Thonotosassa middle	135	82	2%	A	32.9	41.7
TBC at MLK Blvd	147	84	6%	A	31.9	31.0
Palm River at SR 60	110	84	7%	A	25.4	21.8

Benefits of the approach

- **Screening tool to prioritize bacterial impairments at the station and WBID levels**
 - **Enables targeting of efforts, resulting in a significant saving of time and money**
- **Uses the level of impairment and estimated likelihood of human health risk to prioritize identification of sources**
 - **Increases efficiency and effectiveness, resulting in a significant saving of time and money**
- **Encourages active stakeholder involvement**
 - **Helps to coordinate and leverage available resources and assists in building consensus for addressing sources**
- **Can be used to evaluate the “sufficiency of effort” of the projects identified in the BMAP to restore water quality**
 - **Helps ensure that projects identified in BMAP can be expected to address the impairment and in the most effective way**
 - **Helps reduce the possibility of 3rd party challenges to the BMAP**

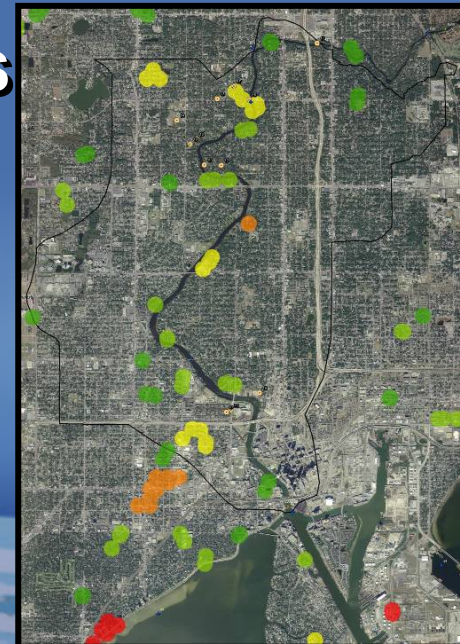
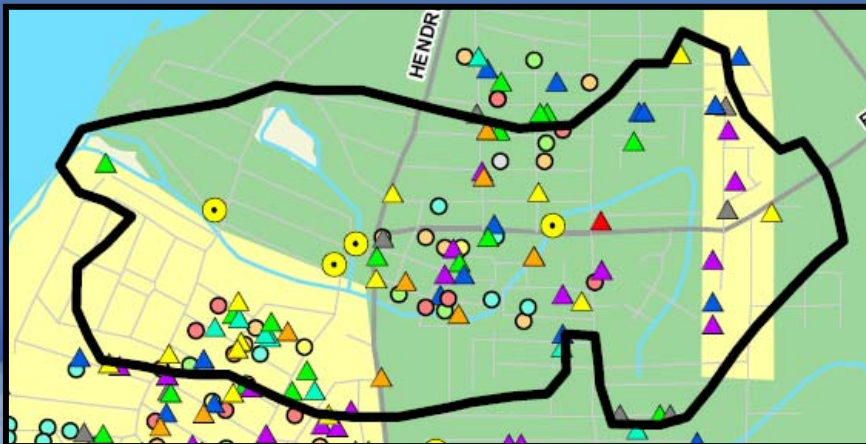
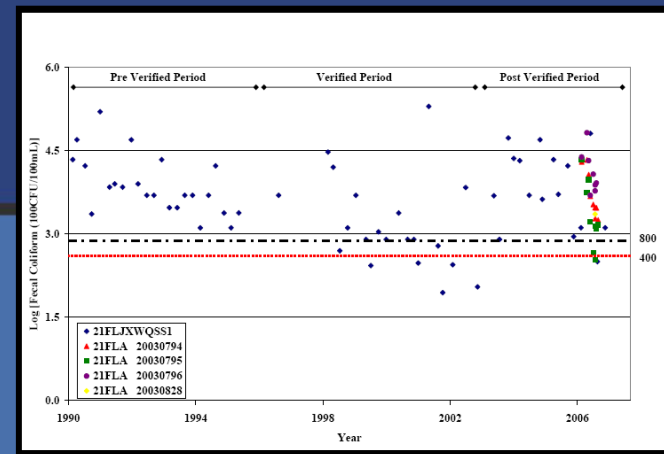
Identification of Sources using Weight-of-Evidence Approach



Approach

1. Initial Screening

- Compile and evaluate GIS data
- Perform detailed review of existing data
- Conduct preliminary field review
- Conduct one-on-one interviews



1. Project Workshop

- Evaluate and review results from initial screening process
 - Capture additional information using “Maps-on-the-Table” approach
 - Review proposed strategy for field reconnaissance, sampling and analysis
 - Identify role and logistics of local stakeholders
 - Develop Draft Sampling Implementation Plan
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- A graphic of a water splash or fountain, rendered in a light blue color, located in the bottom right corner of the slide.

Approach

3. “Walk the WBIDs”

- Assess probable sources and migration pathways
- Identify potential monitoring stations
- Key participants include representatives from each local entity with most field knowledge of basins
- Develop Final Sampling Implementation Plan
- Recommend WBIDs for Thermal Imaging Analysis



4. Sampling and MST Analysis

- Use of decision-tree approach based on “toolbox” of MST methods
 - Indicator Organisms
 - Advanced MST Techniques
 - PCR, qPCR
- Sampling and analysis performed in conjunction with local agencies, USF and Source Molecular
 - 8 months of sampling
- Collaboration with local stakeholders
 - Bi-monthly meetings with local stakeholders
 - Continuous communication and field visits



Application of MST Methods

- **Month 1**
 - Use of indicator suite and advanced MST techniques simultaneously at all stations
- **Months 2-8**
 - ~50 % of sites were re-tested using advanced MST techniques each month
 - Increased testing in some WBIDs and decreased testing in others
 - Sediments tested at identified stations each month



5. Thermal Imaging

- International Imaging Technologies
- Water samples will be collected for fecal coliform analysis before and after fly-over
- To extent possible, results will be used to direct remaining sampling events
- Generate map and report of results



Take Home Messages

- This process results in the compilation and synthesis of information and consensus as to the most probable sources
- Identification of sources, using the weight-of-evidence approach, is the first step in BMAP implementation
- Continual stakeholder involvement increases accountability, facilitates decision making, and results in action



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PROJECT CONTACT

Cheryl Wapnick
cmwapnick@pbsj.com
(904) 363-8443

