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October 27, 2015

INTEGRATED PLANNING: USING INNOVATIVE TECHNOLOGIES TO IDENTIFY AND MITIGATE PRIORITY SOURCES OF POLLUTION

NEWEA CSO/WET WEATHER ISSUES SPECIALTY CONFERENCE

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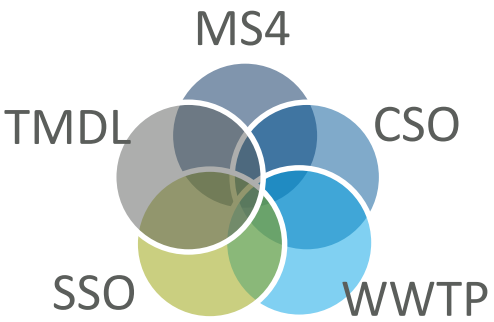
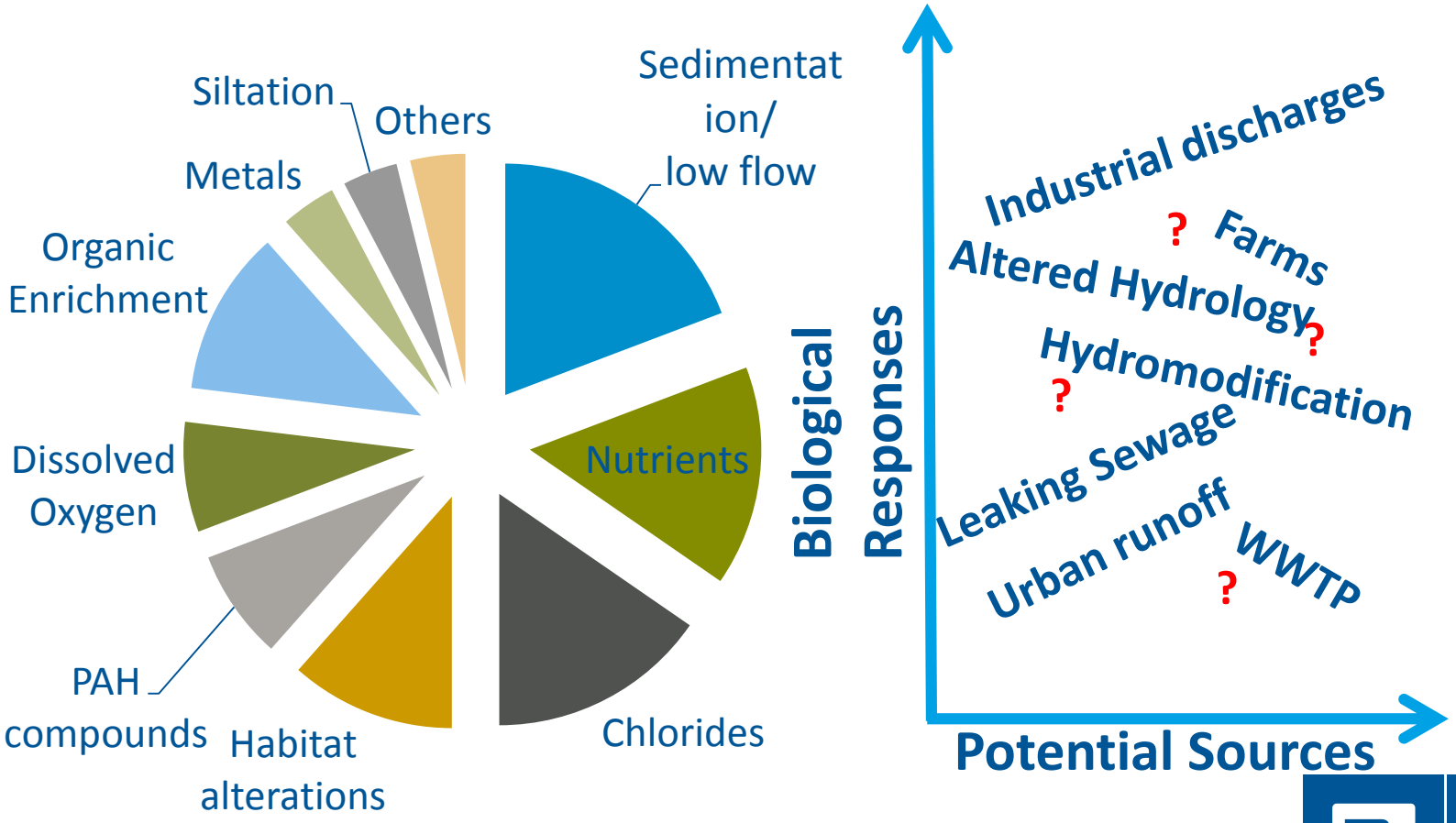
INTRODUCTION

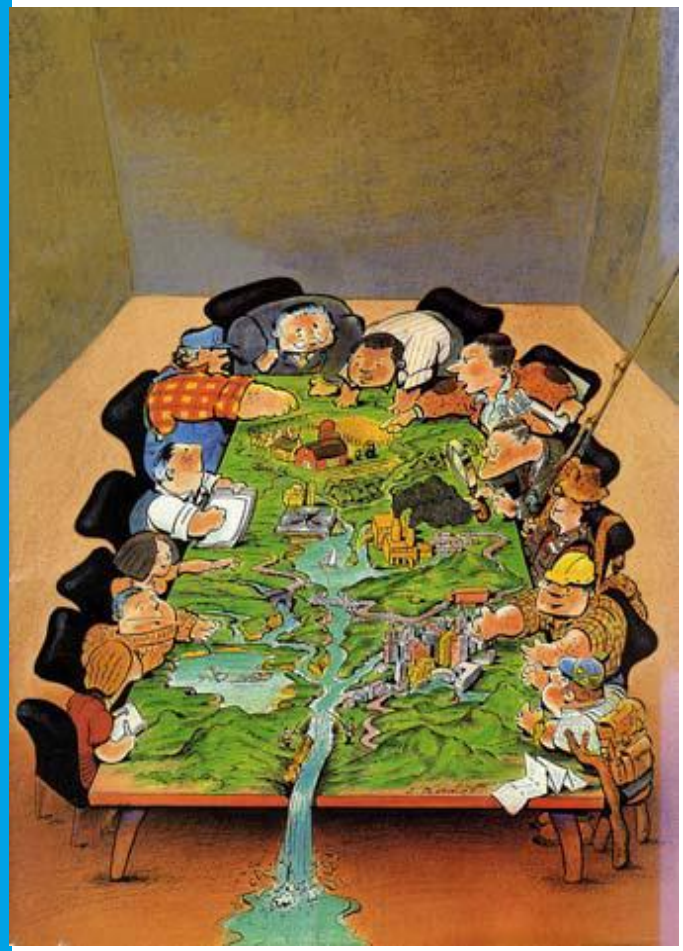
- Municipalities and utilities charged with meeting Clean Water Act requirements
- Multiple sources contribute to surface water quality degradation
- Generalized watershed-wide reduction of wet weather discharges may not address priority sources
- It is critical to identify the priority sources of pollutants prior to developing mitigation
- Integrated Water Quality Studies form the foundation of a holistic wet weather management plan



WATER QUALITY STRESSORS ARE WATERSHED BASED AND NOT JUST A WET WEATHER PROBLEM



INTEGRATED STUDIES WILL HELP ANSWER THE FOLLOWING QUESTIONS



- Is Wet Weather the only source of water pollution?
- What are the other pollution contributions?
- What is impact of water quantity vs. water quality?
- How do we prioritize mitigation projects?
- How do we measure project /program effectiveness?
- How do we assess human health risk when exposed to the impairment of water body?

INNOVATIVE TOOLS AND TECHNOLOGIES TO UNDERSTAND SOURCES AND REDUCE IMPLEMENTATION COSTS

- Microbial source tracking
- Remote sensing
- Water Quality Modeling

MICROBIAL SOURCE TRACKING: LINKING THE POLLUTANTS WITH THE SOURCE

Identifies the source of target bacterial pollutants, not just the concentration

- Identify non-wet weather related , non-human sources

Enhances prioritization of improvement projects

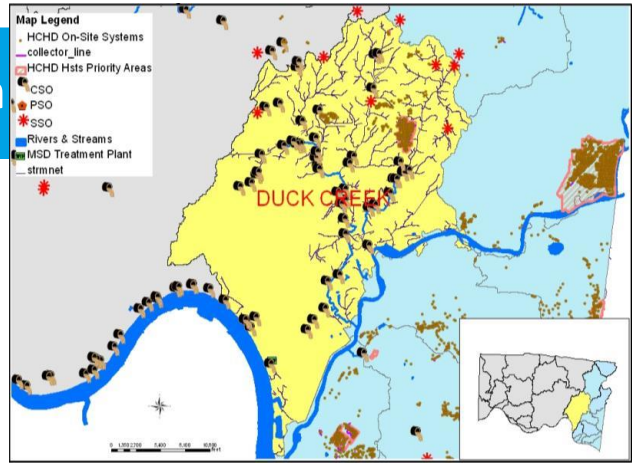
- Target priority sources of contamination

Helps focus investments and saves money

- Reduce less effective projects

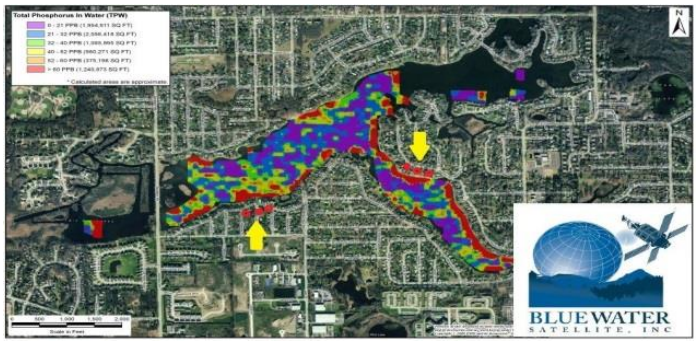
Facilitates communication and regulatory buy-in

- Data and justification for your approach



REMOTE SENSING: COST-EFFECTIVE IDENTIFICATION OF WATERSHED POLLUTION

- Remote detection of non-microbial contaminants
- Identifies sources and hotspots on watershed scale
- Documents water quality trends
- Helps guide field investigations
- Focus and target solutions



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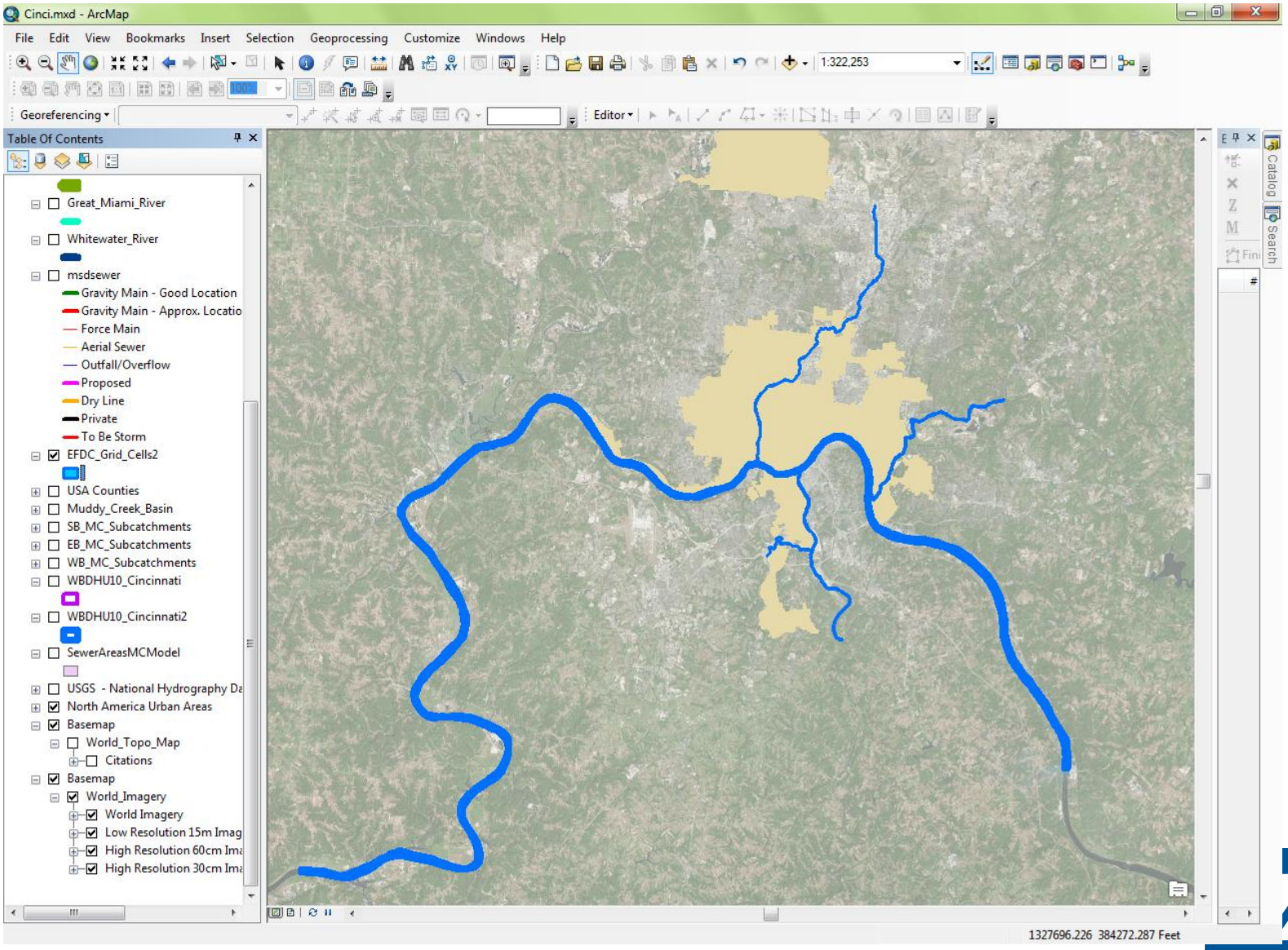
INTEGRATED WATER QUALITY MODELS: HELP PRIORITIZE WET WEATHER PROJECTS

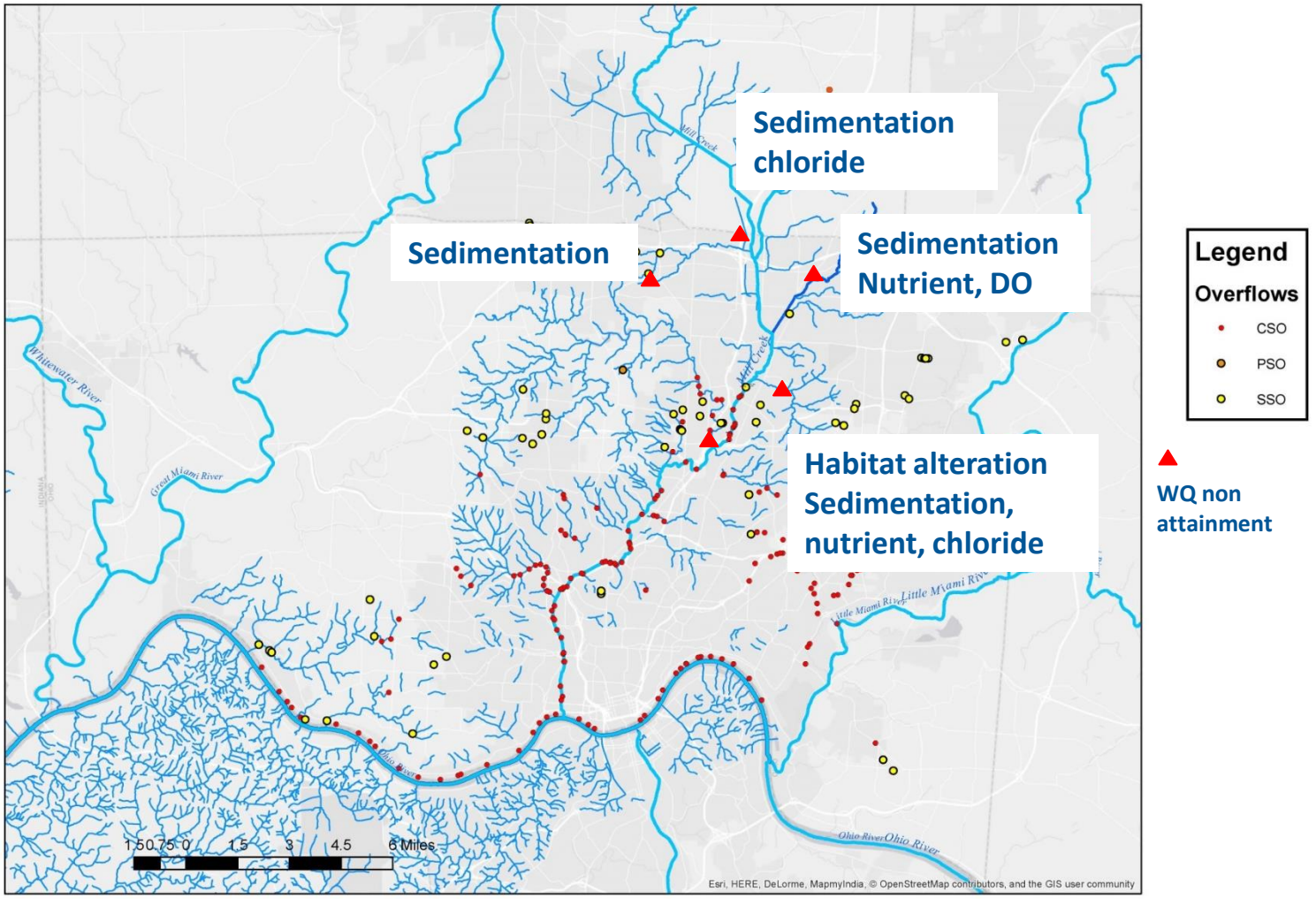


CINCINNATI INTEGRATED PLANNING EXAMPLE

WET WEATHER DISCHARGES ARE NOT THE ONLY SOURCE OF IMPAIRMENT

DO CSOs/SSOs DRIVE WATER QUALITY?

HOW DO PROJECTS GET PRIORITIZED?



CINCINNATI INTEGRATED PLANNING ROADMAP

2014
- Summarize and review existing information

2014
- Develop sampling and modeling plans

2014 - 2015
- Perform water quality sampling

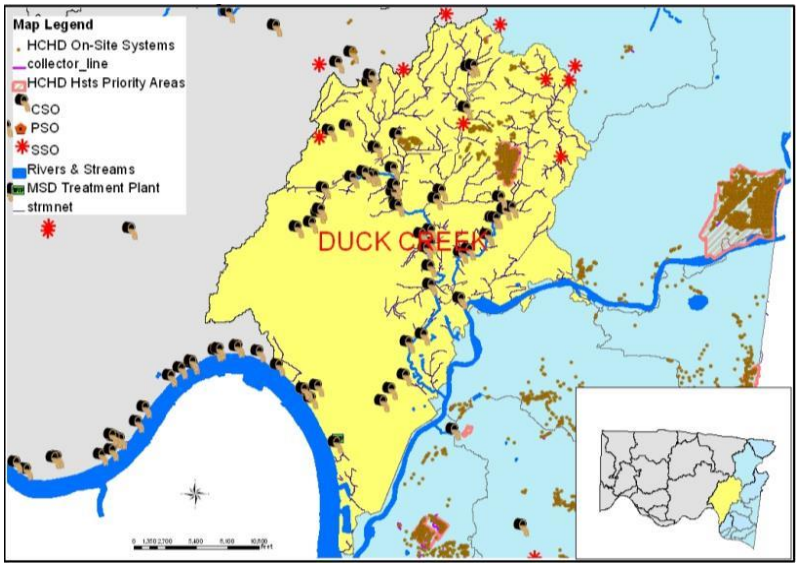
2015
- Develop water quality models

2015-2016
- Calibrate and verify models

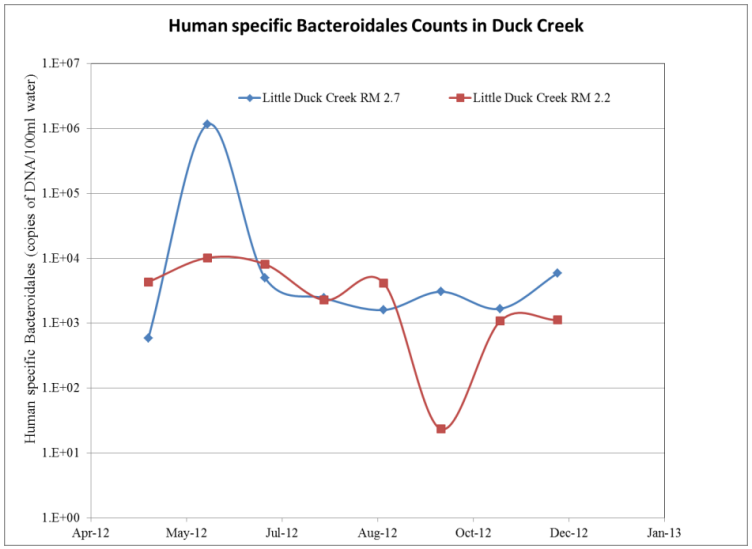
2016
- Scenario planning and simulations

LINKING THE POLLUTANTS TO THE SOURCES

GIS Mapping



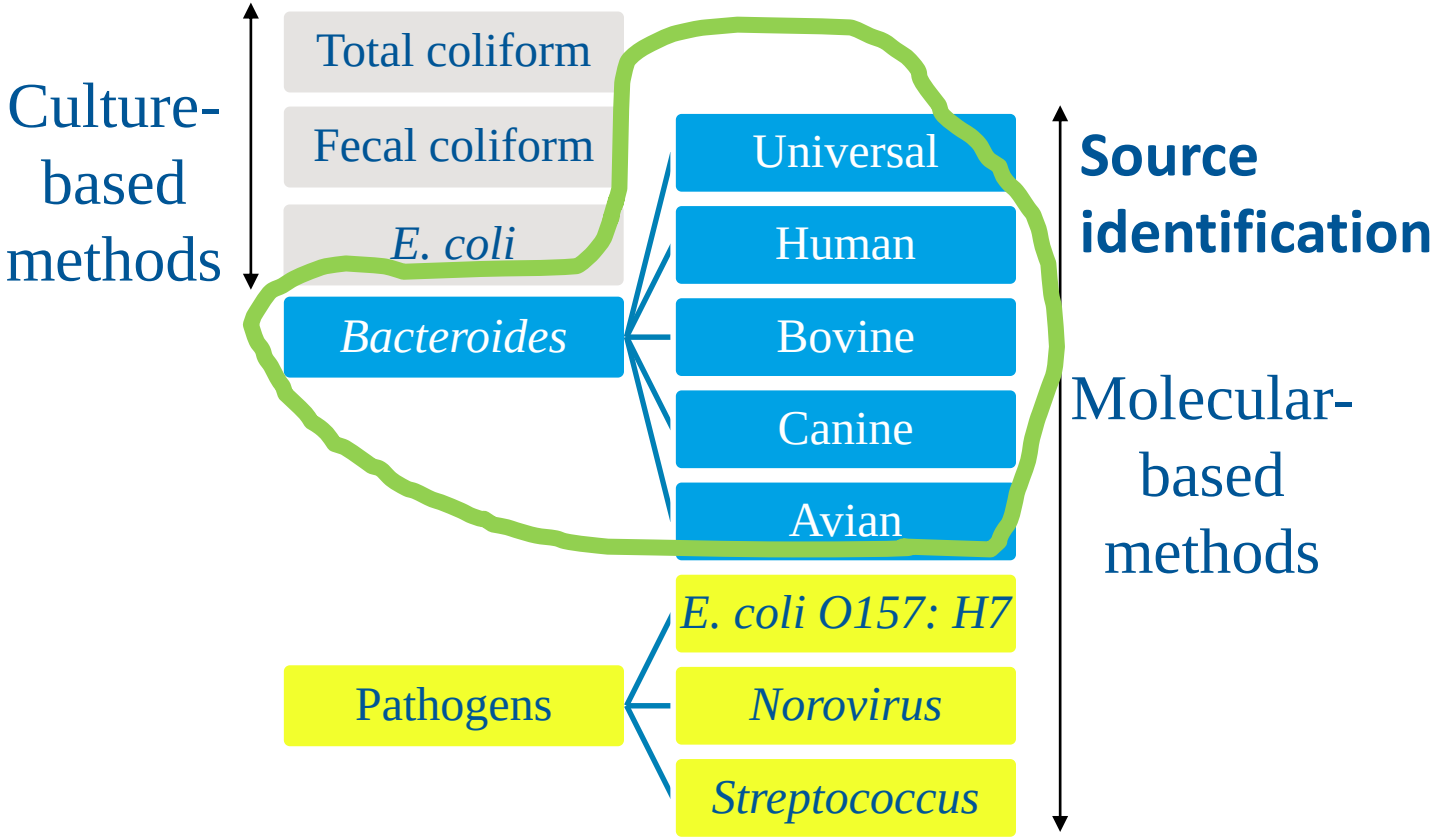
Source Quantification



Source Identification

Pollution origin	Pollution detection and causes/reasons
Human	Yes, CSO, SSO, and septic tanks
Bovine	No, no cattle in the watershed
Canine	Yes, pet facility nearby or parks
Avian	Yes, wild waterfowl

INTEGRATED BIOMARKER DEVELOPMENT



MICROBIAL SOURCE TRACKING FINDINGS

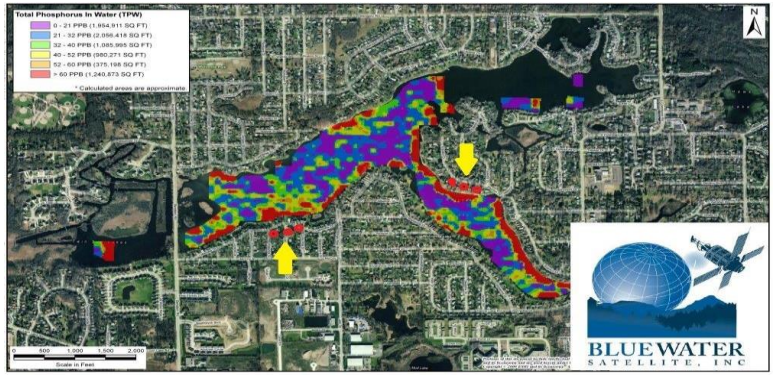
- **Human fecal pollution is the dominant pollution source in the watershed**
  - Identify and address key CSO/SSO areas for water quality improvement
- **In addition to sewer overflows, septic tanks contribute significantly to this problem**
  - Work with other agencies to more effectively address these pollution problems
- **Fecal pollution loadings were lower where green vegetation is present**
  - This tool can be used for green infrastructure effectiveness measurement

REMOTE SENSING: SEEING IS BELIEVING

How: using satellite images, through patented algorism

Outcome:

1. **view constitutes concentrations over large geographic areas at ppb level.**
2. **use in model development or to target field studies for more detailed information**



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REMOTE SENSING : OHIO RIVER TOTAL PHOSPHORUS IN WATER

OHIO RIVER TPW 2012 NORMAL FLOW: LOW TPW

OHIO RIVER TPW 2013 HIGH FLOW: HIGH TPW

REMOTE SENSING : OHIO RIVER TOTAL PHOSPHORUS IN WATER

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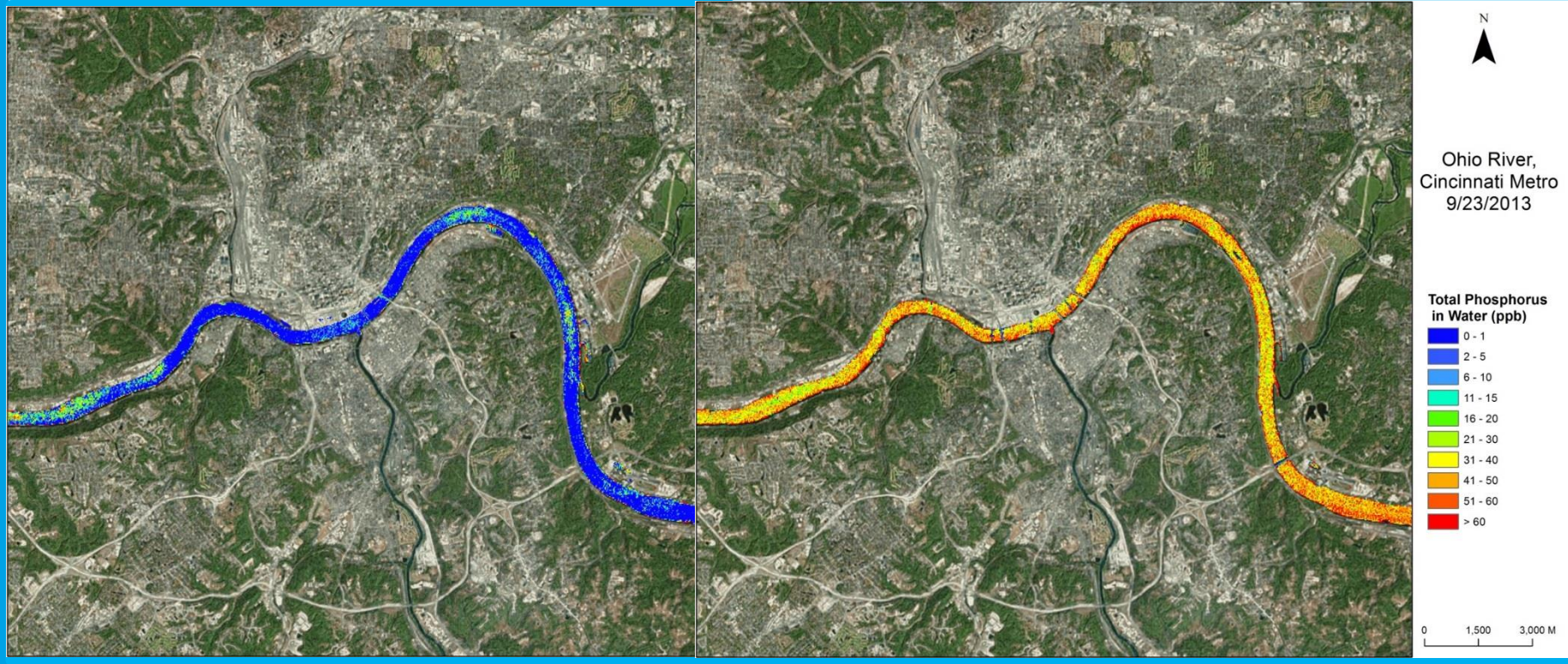


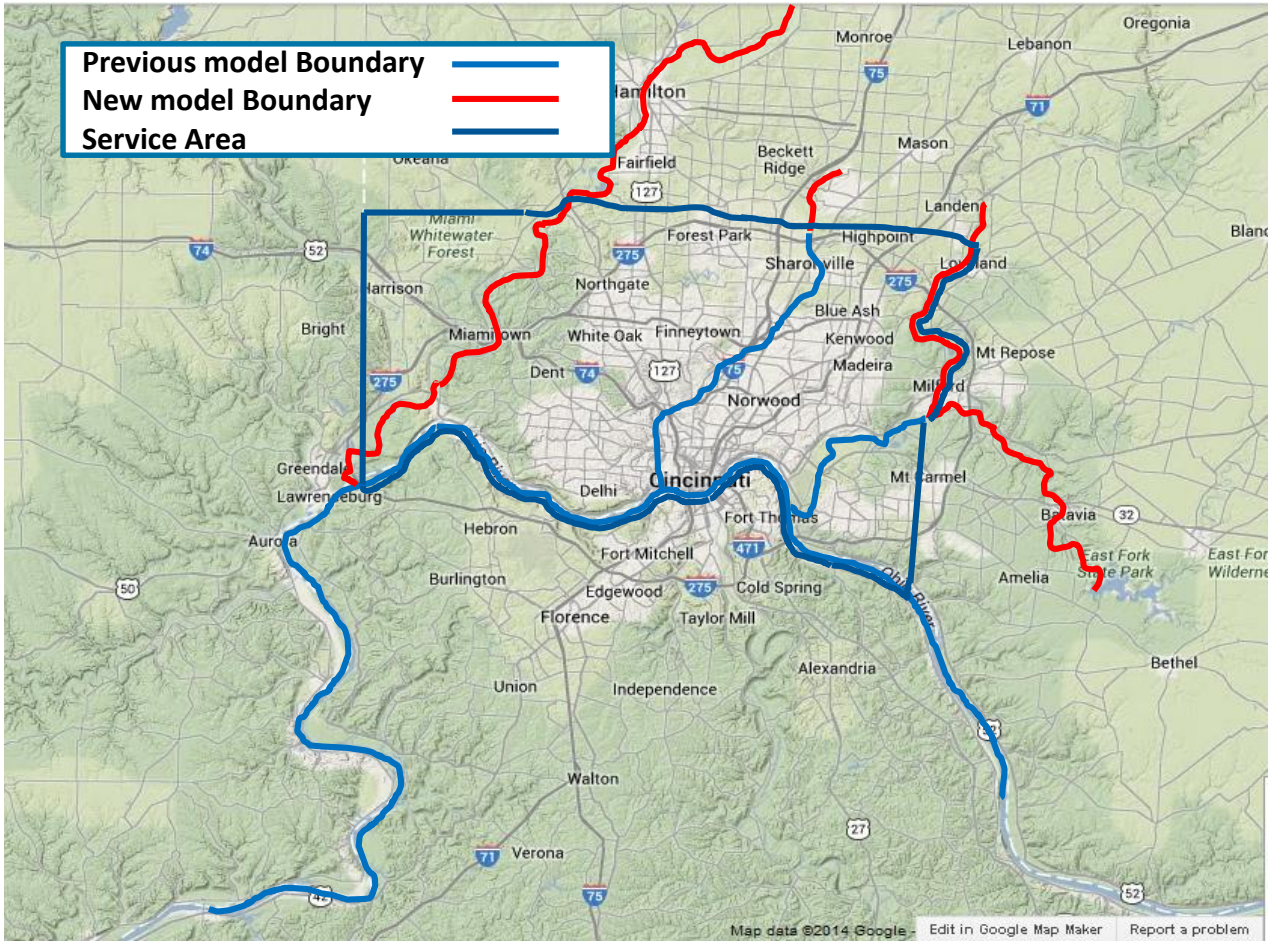
High level clusters of TP downstream of tributary confluences.

REMOTE SENSING OUTCOME

- **Gain understanding of what's really happening across the entire watershed**
  - Low flow (normal conditions) shows low total phosphorus
  - High level clusters of total phosphorus are visible
  - High total phosphorus after a major rain event
- **Reduced sampling and monitoring costs**
- **Targeting mitigation investment**

HOW DO YOU BRING IT ALL TOGETHER & JUSTIFY WATER QUALITY BENEFITS FROM PROJECTS?

WATER QUALITY MODEL UPDATED TO PROVIDE DECISION SUPPORT SYSTEM – PROJECT PRIORITIZATION

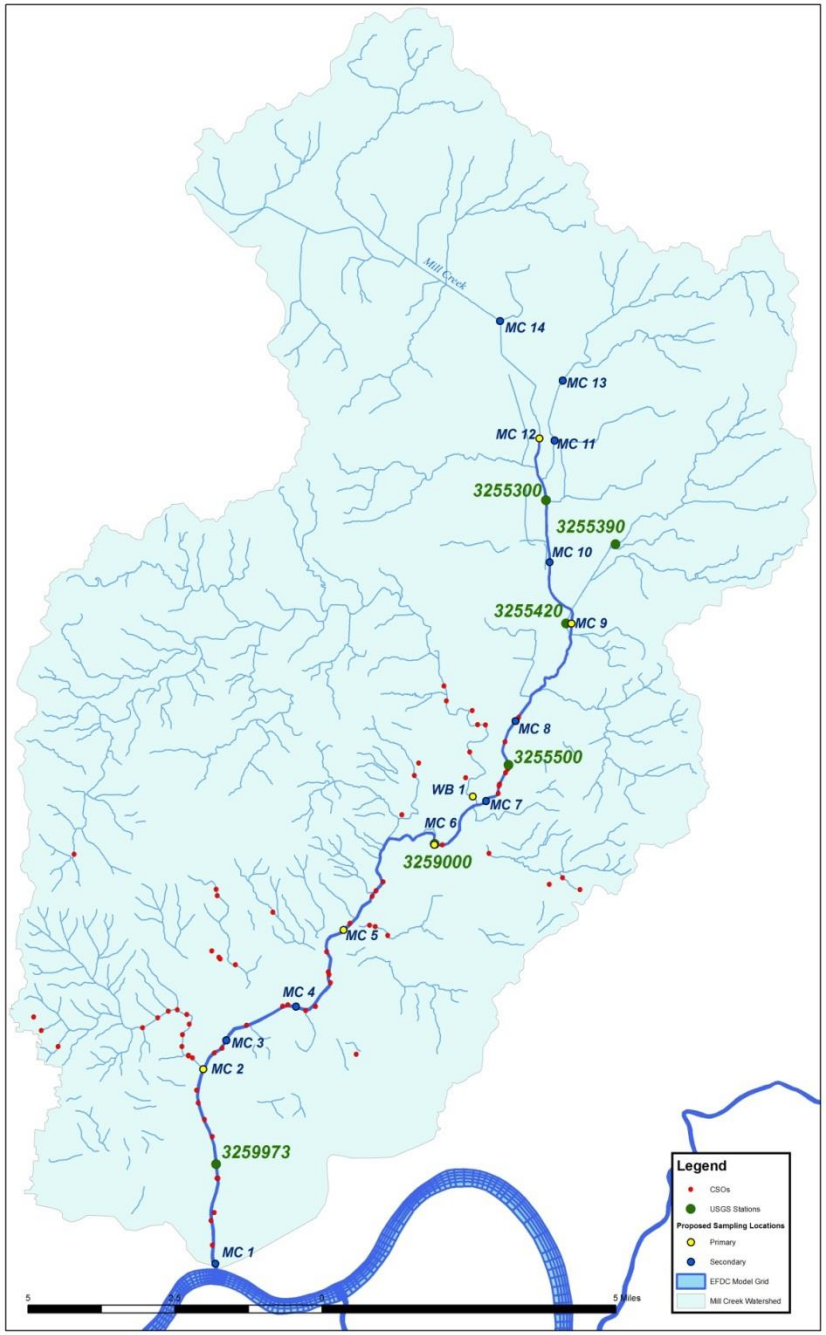


ROBUST MONITORING IS KEY TO A SUCCESSFUL INTEGRATED WATER QUALITY BASED STUDY

THREE PRIMARY ELEMENTS

- Routine Sampling: modify existing MSDGC sampling programs. Primarily base flow conditions
- Storm Event Sampling: quantify loads from upstream sources, tributaries, CSOs/SSOs. Measure water quality changes that occur in Mill Creek
- Special Studies: bacterial source tracking, Quantitative Microbial Risk Assessment, remote sensing, continuous in-situ measurements

Parameters
Ammonia, Nitrate +Nitrite, Total Kjeldahl Nitrogen, Total Kjeldahl Phosphorus Total Phosphorus *
Carbonaceous Biochemical Oxygen Demand, Total Suspended Solids, Total Dissolved Solids Total Organic Carbon
E. coli
Conductivity, Dissolved Oxygen, pH, Temperature



STATION LOCATIONS – PRIORITIZING WET WEATHER SAMPLING TO DETERMINE CSO IMPACTS

- Primary – target 5 Mill Creek and 1 tributary stations
- Secondary – target 9 Mill Creek stations
- CSO/SSO – target 5 stations, locations to be determined
- Existing USGS gaging stations

WATER QUALITY MODELING:

BRINGS IT ALL TOGETHER

WWTP

Sewered area

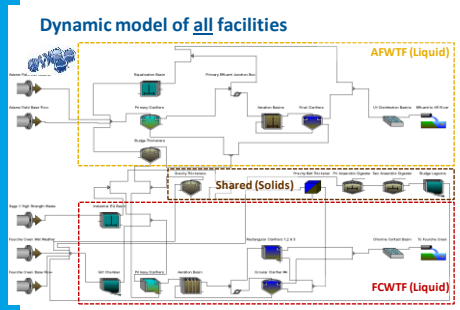
Non-sewered area

Process model

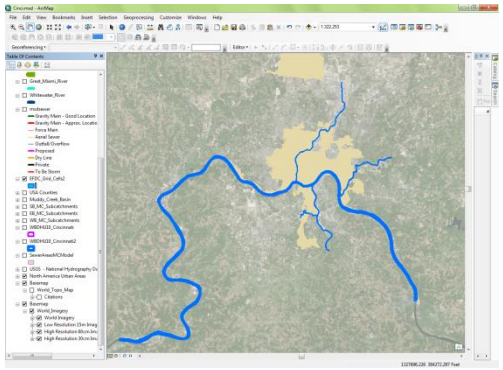
SWMM

Watershed model

1. Green solution locator
2. H&H



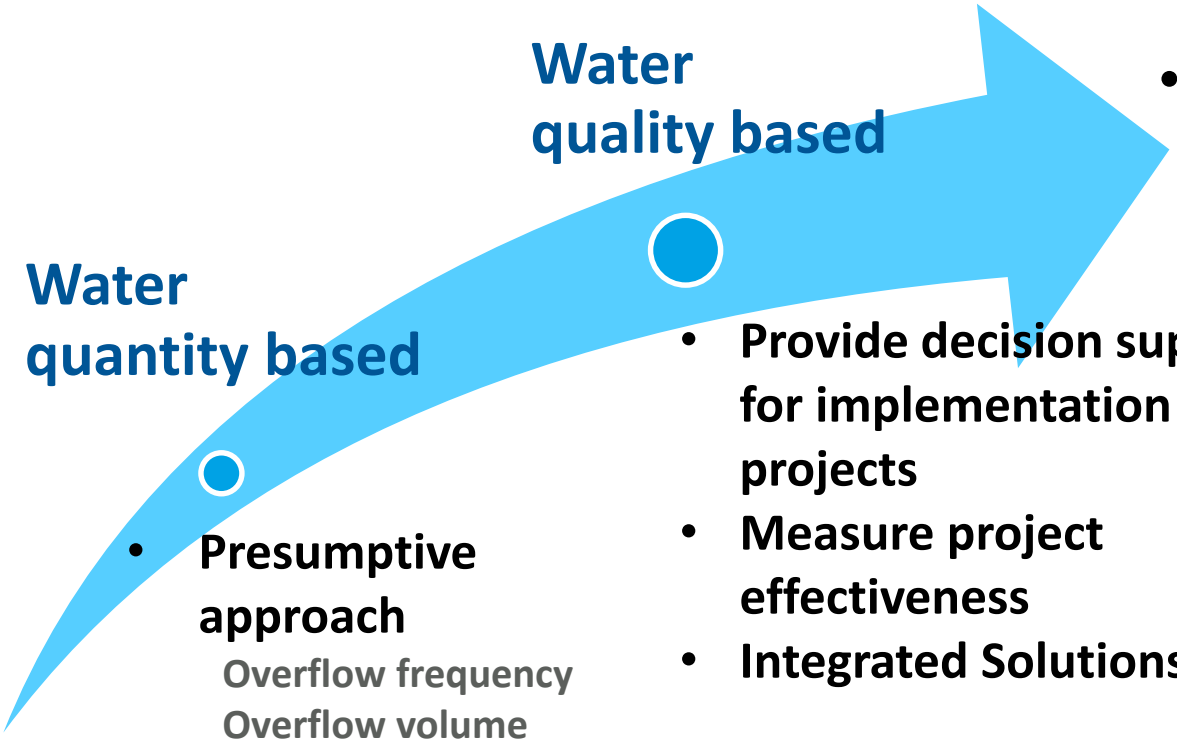
CUSTOMIZED Receiving Stream Model



River Hydrographs

River Pollutographs

INTEGRATED WATER QUALITY PLANNING PROMOTES COORDINATED REGIONAL DECISION MAKING



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