

Modeling and Regulatory Support Workgroup Meeting Remote Access, May 3, 2022



Remote Access Options

Equipment Type	Access Information	Notes
Computers with microphones and speakers	Join Microsoft Teams Meeting Please mute your microphone unless you want to provide input.	Press control and click on this link to bring up Microsoft Teams through the internet. You can view the screen share and communicate through your computer's speakers and microphone
Computers without audio capabilities, or audio that is not working	Join Microsoft Teams Meeting (888) 404-2493 Passcode: 371 817 961# Please mute your phone unless you want to provide input.	Follow instructions above Turn down your computer speakers, mute your computer microphone, and dial the toll-free number through your phone and enter the passcode
Phone only	(888) 404-2493 Passcode: 371 817 961# Please mute your phone unless you want to provide input.	Dial the toll-free number and enter the passcode

Remote Access Guidelines

- This meeting will open 30 minutes prior to the official meeting start time to allow users to **test equipment** and ensure communication methods are working
- If you dial in through your phone, mute your microphone and turn down your speakers to **avoid feedback**
- Unless you are speaking, please mute your computer or device microphone and phone microphone to **minimize background noise**

Agenda

- Opening Comments, Agenda Review/Revisions
- Discussion of the Joint Symposium with the NC Collaboratory
- Draft Scope of Work for FY2023
- Modeling and Regulatory Support Status
- Estimating Loads by County
- Watershed Model Report Status
- Lake Modeling Status
- Summary of CDC OHHABS data
- MRSW Workgroup Reports
- Plan for Statistical Model Development and Regulatory Options for the Site-Specific Chlorophyll-a Water Quality Standard Proposal
- Communications Outreach and Preparation
- Future Meeting Protocols

Discussion of the Joint Symposium with the NC Collaboratory

Discussion of the Joint Symposium with the NC Collaboratory

- The second joint symposium with the NC Policy Collaboratory was held on April 7, 2022.
- This in person meeting was very successful with substantive discussions about the challenges facing Falls Lake.
- A summary of the discussions and questions posed will be provided on the following slides for a few key topics.
- The UNRBA would like to thank the NC Policy Collaboratory and the UNC Institute for the Environment for coordinating and hosting this important event.

Nutrient Loading and Lake Processes

- Complex relationships in the lake and watershed
- No “smoking gun” as cause for the impairment
- Falls Lake is like a big stormwater control measure protecting downstream estuary
- Organic nitrogen loads are likely to increase due to climate change
- Hydrologic conditions drive loading, and some land uses store up nutrients during dry periods
- Internal lake releases will be more important during dry years
- Potential to use bioreactors downstream of septics and discussions about how significant loading from septics is relative to other sources
- Denitrification is an important part of the nitrogen balance and should be encouraged

Algal Toxins, Chlorophyll-a, and Zooplankton

- Nutrients don't always correlate to chlorophyll-a
- Chlorophyll-a doesn't correlate to toxin levels in Falls Lake
- Upper lake has higher chl-a but lower lake has higher toxin levels
- Though toxin levels in Falls Lake are low, some participants expressed concerns about their presence
- Comment that high frequency periods of data collection to better understand day to day variability would be helpful.
- Understanding what conditions favor different algal groups.

Nutrient Management

- Management options
 - Lake operations, discussions with USACE
 - Lake sediment removal to reduce internal loading
- Maintenance issues with SCMs
 - Convert existing and new infrastructure into utilities rather than HOA's or other groups responsible
 - Improving existing infrastructure
 - Incentivizing and crediting O&M
 - Better information transfer from developers to owners

Financing and Implementation

- Funding sources
 - Federal money under the infrastructure bill could be used to build large practices and regional SMCs
 - Revenueshed is a good idea
 - Everyone should pay
 - Environmental and social justice should be factored in
 - Some portion of water bills should go to watershed protection, not just water treatment (e.g., UNCWI)
 - IAIA is a good idea
 - Flexible approach with multi-benefit projects that should be an acceptable compliance tool
 - Should be considered as part of the new rule

Designated Uses

- Recreation is an important use for Falls Lake
- The upper area is quieter and lends itself well to kayakers
- Water clarity is important
- There is more water quality data for this lake than there is recreational data (not unusual)
- Potential toxin levels and water clarity may change people's perception of when to do certain recreational activities.
- It may be helpful to know the impact of stories on toxin levels on recreation use
- Just because the fishable use is met, doesn't mean other uses are met

Draft MRS and Communications Scope of Work for FY2023

Review Process for the Draft Scope of Work

- The Executive Director's review comments are being incorporated into the draft scope of work
- Followed by a review by the MRSW and PFC
- Board will review and act during the June 15, 2022, meeting
- The total budget is proposed at \$815,000
 - BC (labor and miscellaneous expenses): ~\$332,300
 - Systech Water Resources (WARMF): ~\$148,500
 - Dynamic Solutions (EFDC): ~\$223,400
 - KDV (Statistical, Bayesian, Decision Support): ~\$65,000
 - Brindle Creek (economist): ~\$45,700

Task 350 (~\$136,800)

- Finalize calibration of WARMF Lake and EFDC lake models to address subject matter expert and DWR input
- Unspent money to be shifted to subsequent tasks

Task 351 (~\$133,300)

- Sensitivity analyses and scenario evaluation

Task 352 (~\$117,800)

- Statistical/Bayesian/Decision Support tool development
- Re-examination data analysis support

Task 353 (~\$141,800)

- Iterative reporting and production of draft lake model report
- Generation of meeting slides for status meetings, technical workshops, etc.

Task 354 (~\$6,100)

- Update the multi-year work plan and develop scope for FY2024

Task 355 (~\$65,000)

- Regulatory support for the re-examination (meetings, workshops, assistance with framework development, etc.)
- IAIA Program Support

Task 356 (~\$60,000)

- Continued management and coordination of UNRBA's communications team
- Implementation and revision (as needed) of the UNRBA Communications Plan
- Preparation of materials to support meetings with regulatory agencies, commissions, and NGOs; technical stakeholder workshop; and symposia or forums
- Coordination with communications staff at local governments to leverage existing resources, platforms, and distribution lists and better reach the general public concerning the re-examination goals and recommendations
- Coordination with UNRBA members regarding the hosting of an online portal for sharing scenario results using existing ESRI or ArcMap licenses

Task 410 (~\$63,700)

- Cost benefit analyses to support the re-examination
- Integration with work of the UNC Environmental Finance Center

Task 500 (~\$20,000)

- Compile data inputs, model files, executables, and final reports for submittal to DWR
- Provide these materials, as required, to other regulatory agencies, such as EPA
- Respond to comments and inquiries from the agencies to clarify any questions

Task 610 (~\$70,500)

- Project management
- Meeting attendance: working calls, workshops, status meetings, symposium

Proposed Revisions to the Meeting Plan

- Target no more than two meetings or workshops per month to achieve schedule
- Transition back to PFC meetings with MRSW members included
- Utilize reserved monthly meetings times for alternative purposes to achieve schedule
 - Technical Stakeholders Workshop
 - Workshop with UNRBA members' communication staff
 - Workshop with DWR/NC Policy Collaboratory/NGOs regarding stakeholder feedback on a revised strategy
 - Spring Symposium
- Note: July 5th is the first Tuesday of the month and follows the July 4th Holiday

Modeling and Regulatory Support Status

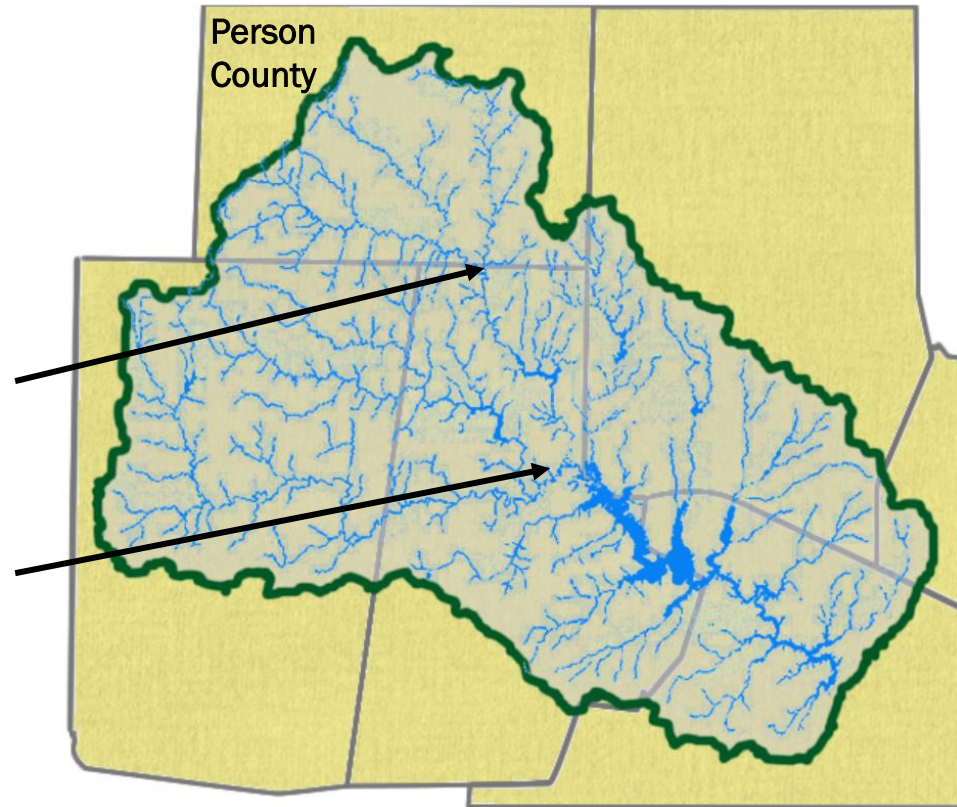
Estimating Delivered Loads by County

Model Limitations

- UNRBA requested catchments be delineated to county boundaries (where feasible) to allow for estimation of delivered loads by county
- Systech Water Resources has been evaluating different options for extracting the county-level delivered loads to Falls Lake from the calibrated WARMF watershed model.
- While the model simulator keeps track of this information, the number of data points we have generated (5 years, 6-hr time steps, 20 or so land uses, and the separating the soils beneath the land use) has exceeded the data limitations of the GUI to pull this information out of the results.
- A new GUI is currently under development that will address this limitation, but results would not be available until Fall
- An alternative approach has been recommended using the “All Forest” scenario approved by the UNRBA

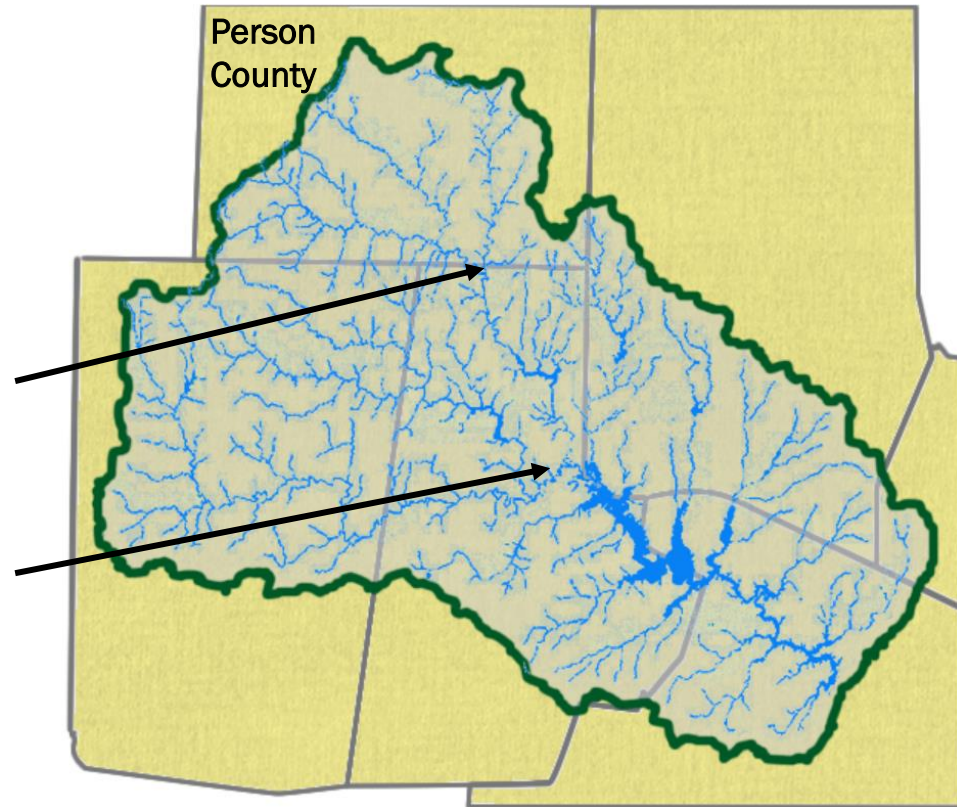
Option for Estimating County-Level Loads

- The “All Forest” scenario would convert all land uses in the watershed to Mixed Forest (except for other forest classes, wetlands, and open water).
- The Mixed Forest in each catchment include an abbreviation for county name (e.g., MixedForestPeCo)
- Loads from mixed forests in would be tracked
 - The loading crossing the county line and
 - The load delivered to the lake



Option for Estimating County-Level Loads

- We would compare the delivered load (e.g., MixedForestPeCo) to the load that crossed the county line.
- The ratio of delivered load to county-line load would be used to scale the loads from all land uses in the calibrated model that cross the county line for the study period.



Draft County-Level Loads

County	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)	Total Organic Carbon (lb/yr)	Area (ac)
Durham	544,144	69,890	4,182,708	127,304
Franklin	8,246	793	57,631	4,504
Granville	301,465	36,037	2,695,500	80,430
Orange	292,677	23,817	2,403,911	118,877
Person	242,356	24,588	2,255,669	83,066
Wake	179,791	26,577	1,492,459	63,564
Falls Lake Surface	87,682	2,015	117,724	11,255
Total	1,656,361	183,717	13,205,602	489,000

County	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)	Total Organic Carbon (lb/yr)	Area (ac)
Durham	33%	38%	32%	26%
Franklin	0.5%	0.4%	0.4%	1%
Granville	18%	20%	20%	16%
Orange	18%	13%	18%	24%
Person	15%	13%	17%	17%
Wake	11%	14%	11%	13%
Falls Lake Surface	5%	1%	1%	2%
Total	100%	100%	100%	100%

Watershed Model Report Status

WARMF Watershed Model Report Status

- Draft report is being reviewed by the Executive Director and Chair of the MRSW
- The Executive Summary for the report has been reviewed by both and revised in response to comments (summarized on the following slides)
- Agricultural representatives have reviewed sections of the report describing agricultural inputs and outputs
- County loads will be processed following today's meeting and added to an appendix with loading summaries by tributary
- The full modeling report will be distributed to the MRSW after the Executive Director and Chair have reviewed and comments have been addressed by the modeling team

WARMF and EFDC Lake Calibration Status

WARMF Lake and EFDC Modeling - Algae

- Preliminary model results were discussed with the subject matter experts
- Each model includes three algal groups which can be set up as individual algal groups or multiple groups
- There are five dominant groups in Falls Lake (greens, diatoms, blue greens, Prymnesiophytes, and Euglenoids)
- WARMF Lake will simulate greens, Prymnesiophytes, and Euglenoids in a group called “other algae”
- EFDC modelers are researching if information is available to simulate Prymnesiophytes and Euglenoids in two additional groups
- Modeling team is also working with Linda Ehrlich at Spirogyra to her include her data (including these groups) collected in Falls Lake, Lake Michie, and Little River Reservoir

WARMF Lake and EFDC Modeling – Sediment Nutrient Fluxes

- Both models simulate releases of nutrients from lake sediments (EFDC is more complex than WARMF)
- Multiple studies by DWR, EPA, and UNRBA (Dr. Marc Alperin) have been summarized previously
- Additional studies by the NC Policy Collaboratory are being summarized (Dr. Mike Piehler)
- Each of these studies is limited in terms of spatial coverage and are much smaller in coverage than the EFDC model grid or WARMF Lake segment
- Direct comparison is not possible but these studies provide bounds on nutrient cycling in the lake for comparison to the models
- Water quality in the water column also places bounds on what can be released from the sediments

WARMF Lake and EFDC Status

- Model calibration continues and the additional information from Dr. Piehler will be added when available
- Coordination with Dr. Nathan Hall and Dr. Linda Ehrlich will continue regarding simulation of algal groups
- Additional meetings with the subject matter experts will be scheduled in May and June
- Plan to finalize the models in July/August to begin scenario evaluation

Summary of the CDC One Health Harmful Algal Blooms (OHHABS) Data

Characterizing Algal Bloom Events with Known Health Outcomes



<https://www.cdc.gov/habs/ohhabs.html>

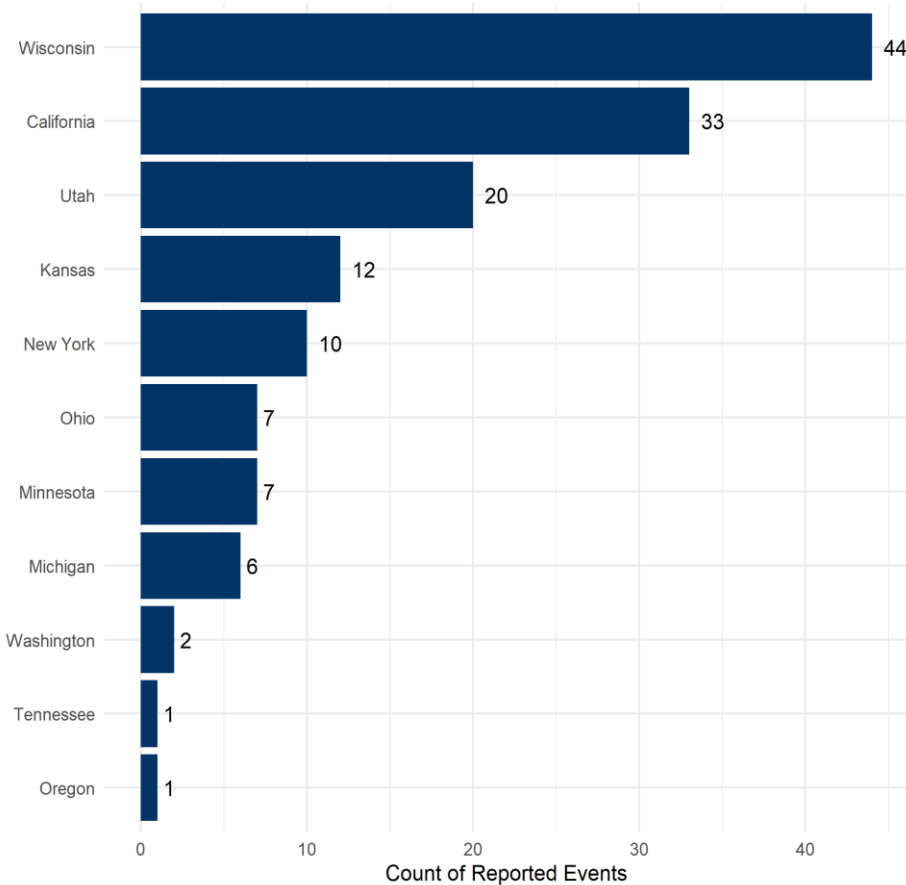
Why OHHABS data?



- Falls Lake
 - Few documented hazardous algal bloom (HAB) events
 - No recreational closures due to HABs
- We need data from other databases to fill gaps
- OHHABS provides data to describe:
 - Algal species present and toxin levels associated with human and animal health outcomes
 - Algal species present and toxin levels associated with warnings and closures
 - Environmental conditions documented at time of HAB events
 - Human use complaints documented in relation to HAB events
- OHHABS does NOT provide data to define cause-effect relationships or set thresholds

OHHABS Events by State Reporting

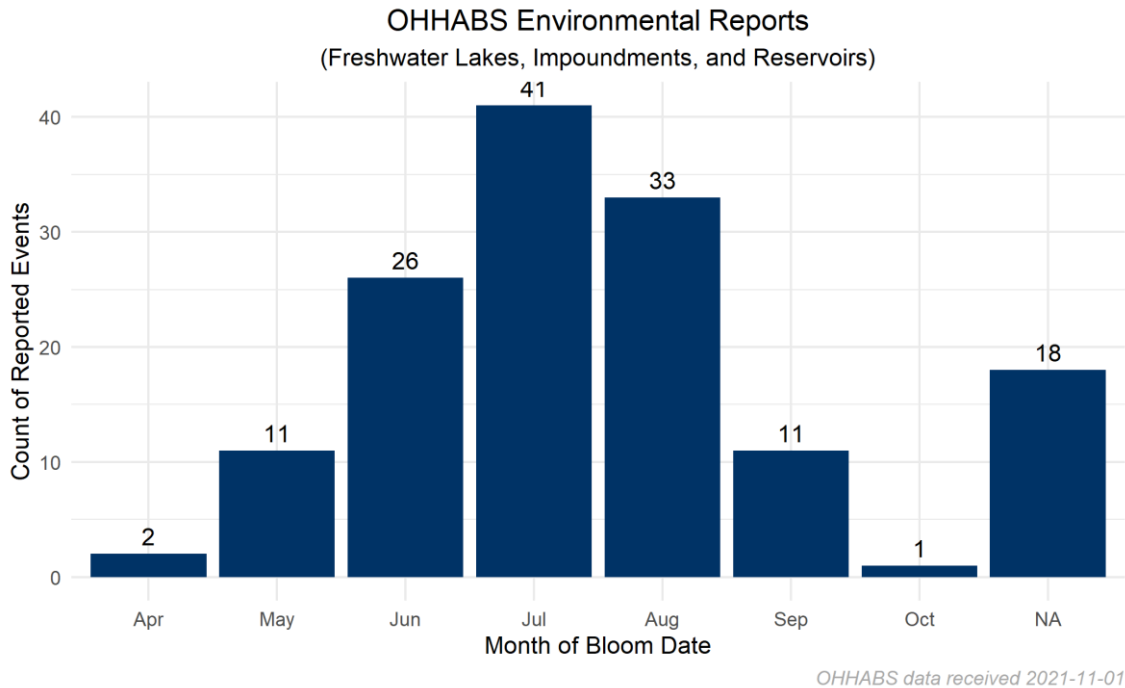
OHHABS Environmental Reports
(Freshwater Lakes, Impoundments, and Reservoirs)



OHHABS data received 2021-11-01

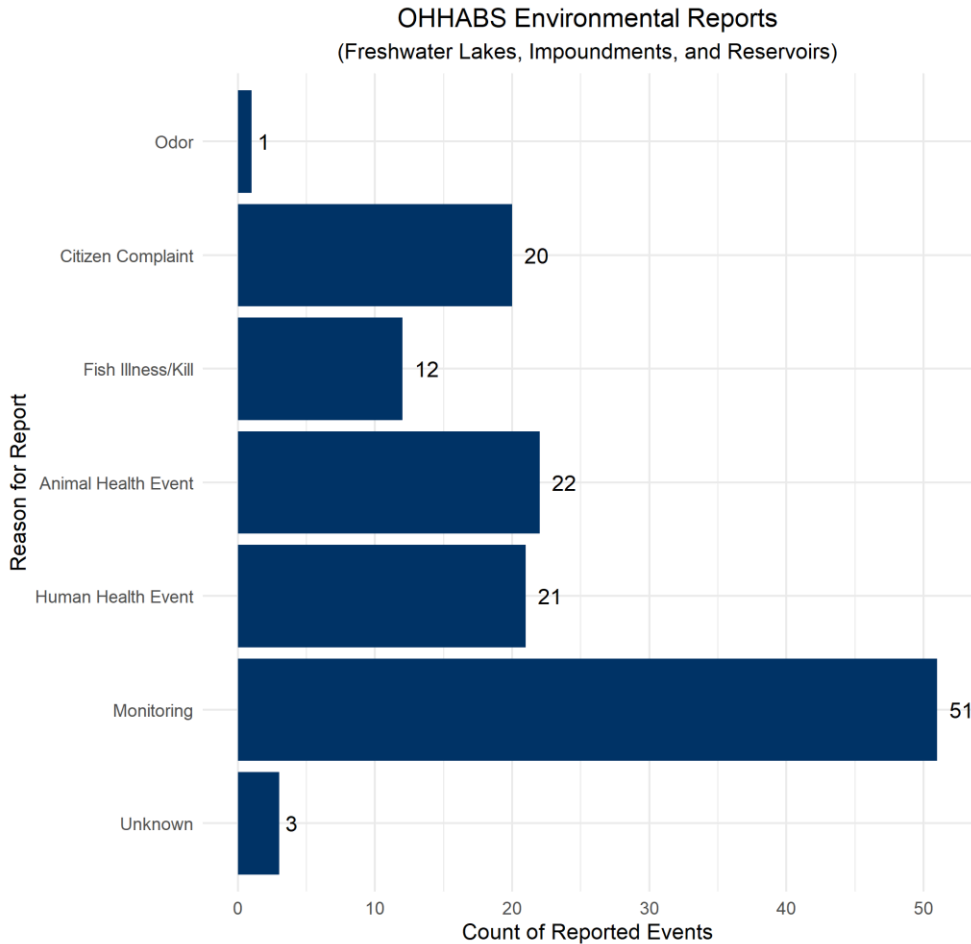
- Geographic distribution of records
 - 1 reported bloom in OHHABS – at least one bloom occurred
- Among states, reporting differs
 - Some include monitoring data, some do not
 - Reporting period not constant
 - Reporting has not necessarily been continuous once state joined project
 - Not all blooms are reported (these are a characterization of what has been reported)
 - There are no requirements to report (voluntary)
- ***Figure shows state contribution to database, NOT frequency of events by state***

OHHABS Events by Month



- Temporal distribution of records
 - Many NA for date of event because of choices in how they report (cause of reporting or when they reported)
 - No documented events in Dec-Mar, but cannot say events do not occur in this period

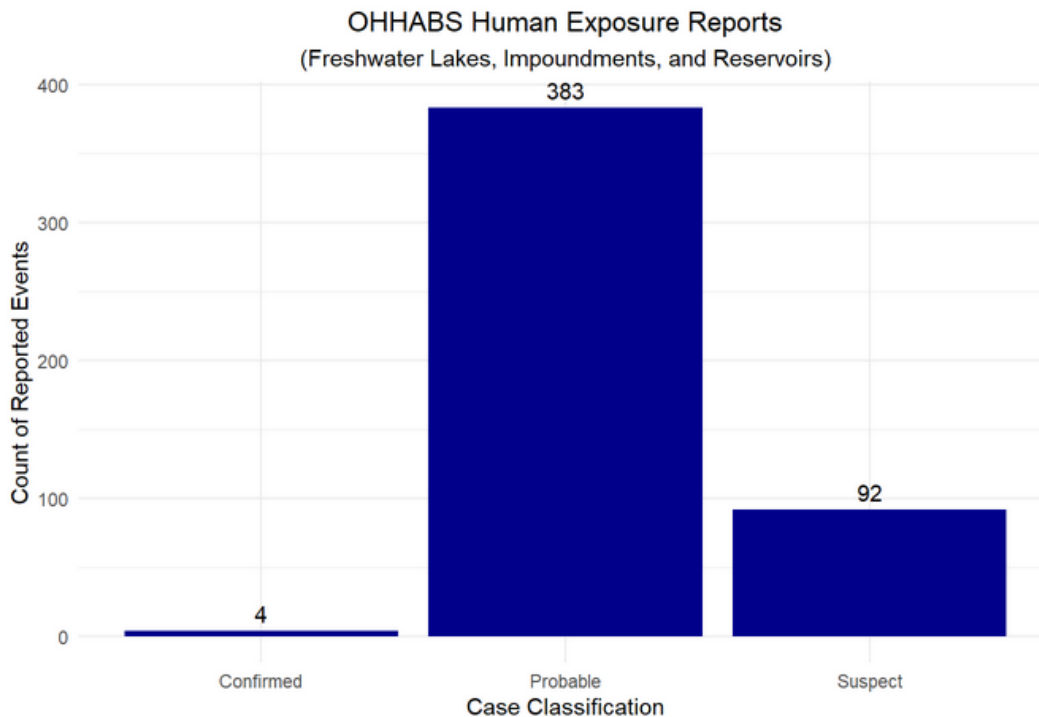
OHHABS Events by Reason



OHHABS data received 2021-11-01

- Reason for reporting to the state or to CDC
 - Not all data are associated with a health event.
 - Some states report monitoring data if toxins/algae above certain levels (e.g., EPA)
- Some events included monitoring data but another reason was listed for the report
- Some events had monitoring data but no adverse event was reported (e.g., monitoring may have exceeded a threshold)

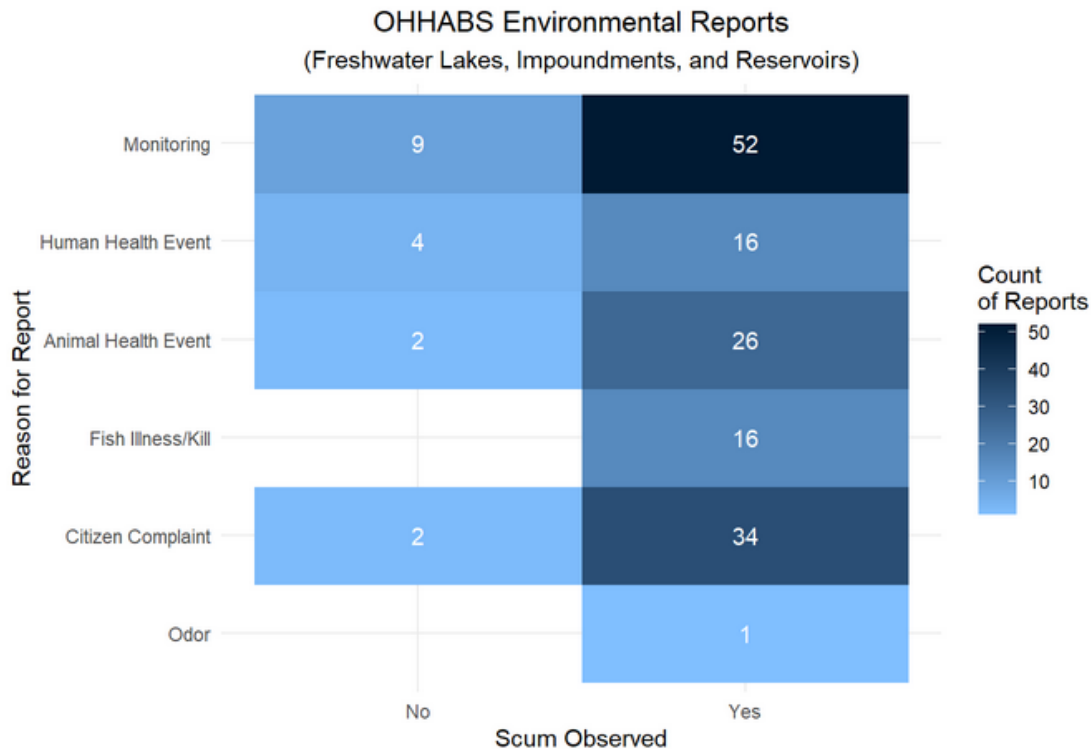
OHHABS Event Classification



OHHABS data received 2021-11-01

- Very difficult to directly, positively tie a specific health event to a specific harmful algal bloom
 - Delays in reporting
 - Multiple exposure pathways
 - Lack of testing
- Majority of cases are considered “probably” – and were the justification to issue health advisories

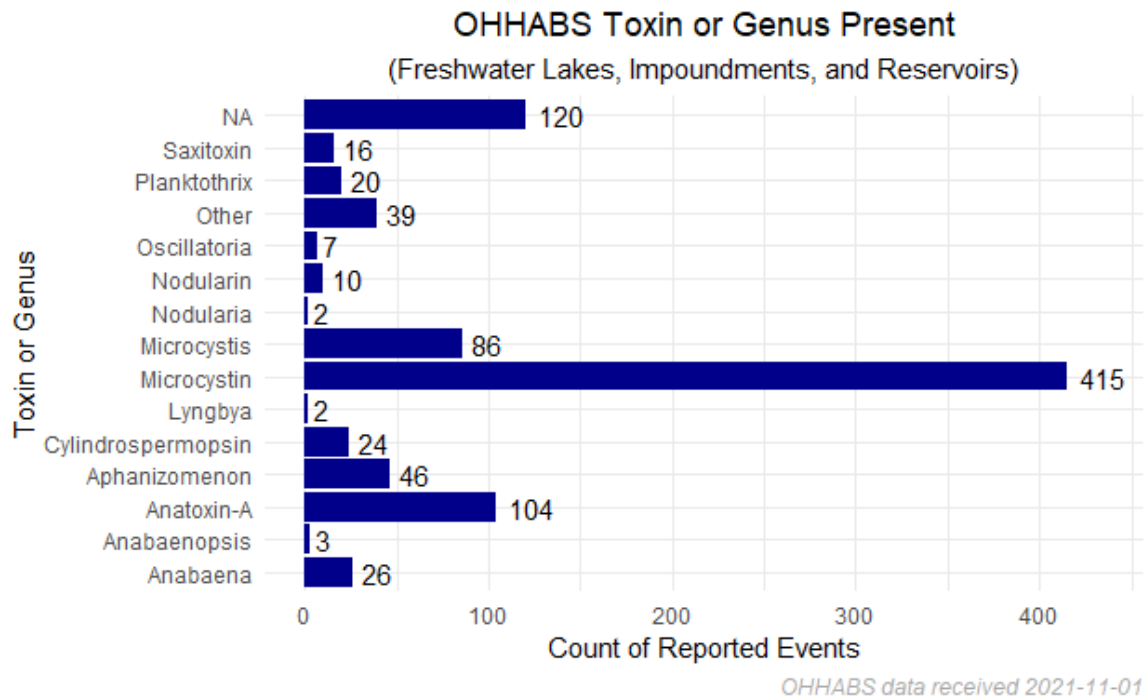
Environmental Conditions Reported



OHHABS data received 2021-11-01

- Conditions reported:
 - Scum present/absent
 - Water color
 - Water clarity
 - Odor present/absent
 - Flowing or Stagnant

Toxins and/or Genus Present



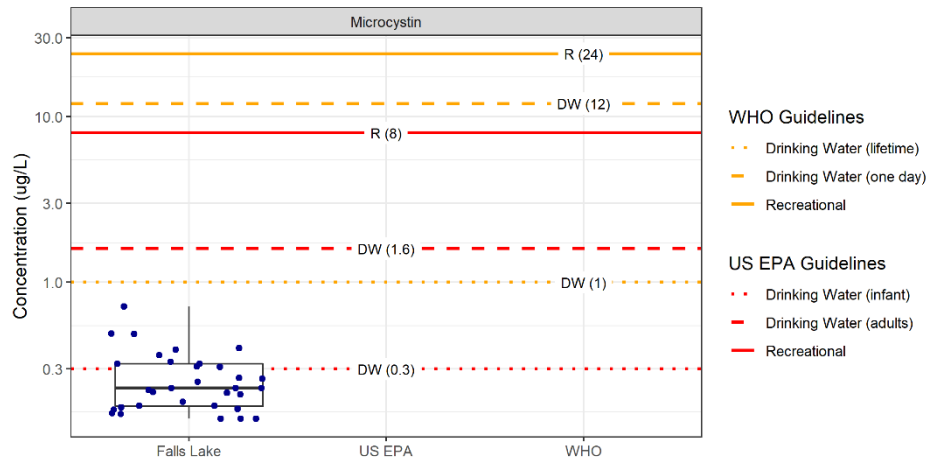
- Toxins reported as “Present”, ppb, or ug/L
- Genera reported as “Present” or cells/mL
- Note: Our NC DWR data report biovolume (mm^3/m^3) and cells/mL

Microcystin

- Never above WHO or US EPA limits (2016-2018)
- No advisories or closures due to microcystin
- Values observed in Falls have been present during OHHABS health events
- Levels observed in OHHABS event have been observed in Falls without reported events

Falls Lake Data

Falls Lake Toxins (2016 - 2018)
with World Health Organization and
US Environmental Protection Agency Guidelines

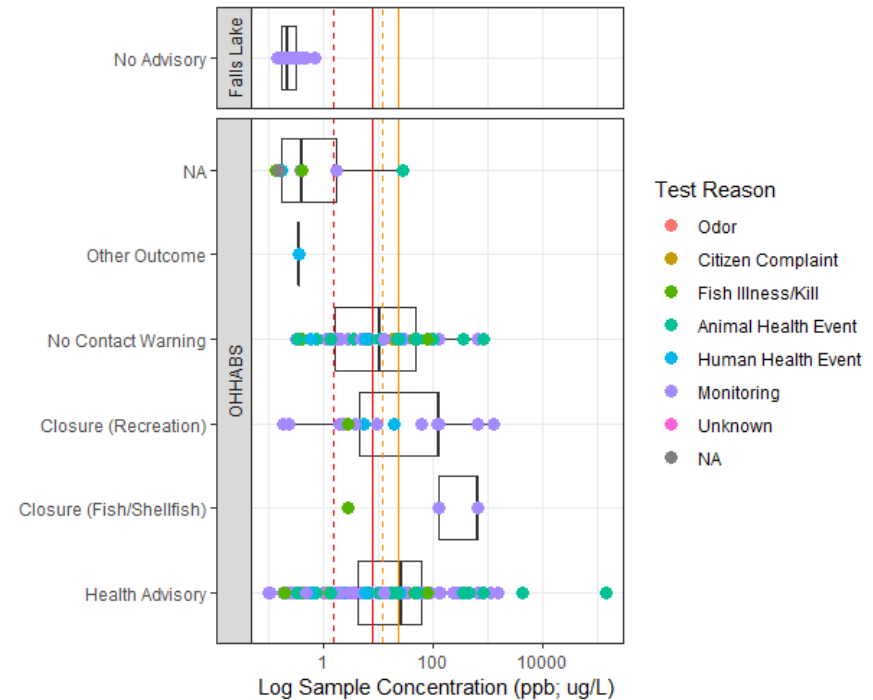


City of Raleigh toxin data

Falls Lake Data Compared to OHHABS Reports

Microcystin: Levels and Advisory Outcomes

Limits: red solid (EPA recreation); orange solid (WHO recreation); red dash (EPA drinking); orange dash (WHO drinking)



OHHABS data received 2021-11-01

Adverse events may be caused by something other than this toxin.

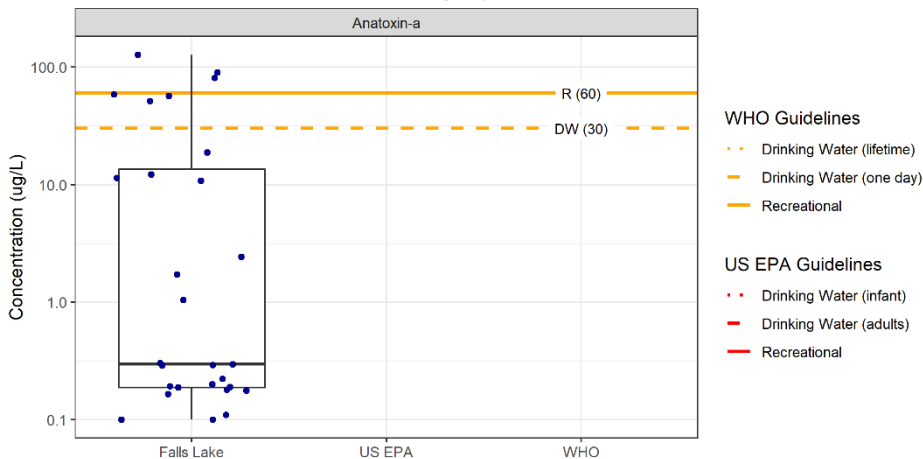
Concentrations are shown in log scale.

Anatoxin-a

- Occasionally above WHO limits (no US EPA limits)
- No advisories or closures due to anatoxin-a
- Values observed in Falls have been present during OHHABS health events
- Levels observed in OHHABS event have been observed in Falls without reported events

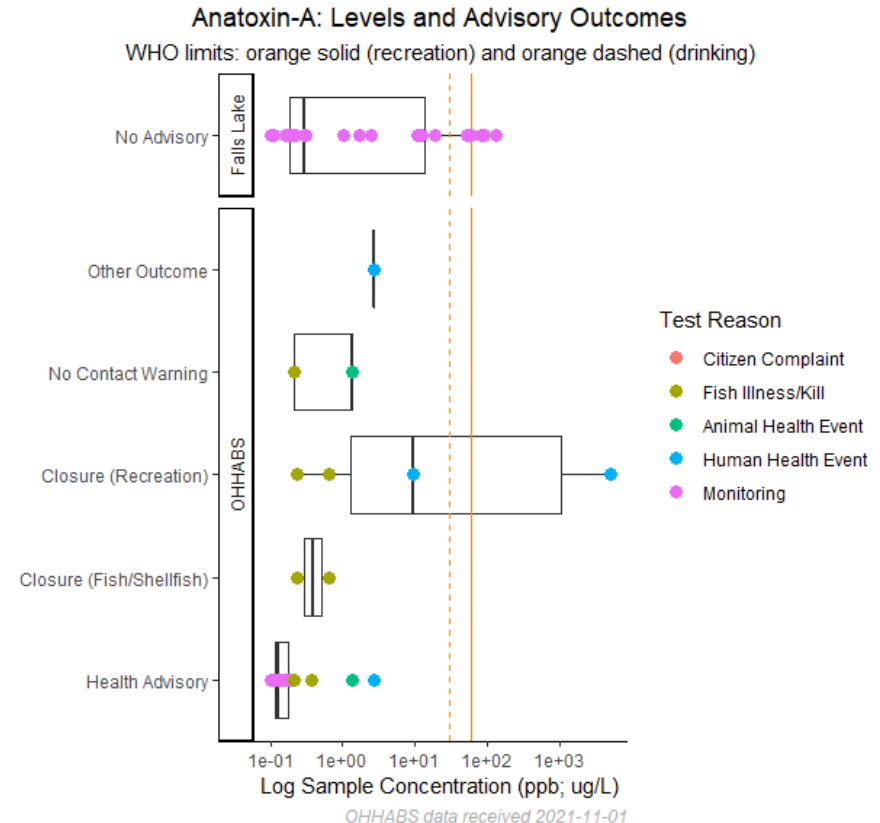
Falls Lake Data

Falls Lake Toxins (2016 - 2018)
with World Health Organization and
US Environmental Protection Agency Guidelines



City of Raleigh toxin data

Falls Lake Data Compared to OHHABS Reports



OHHABS data received 2021-11-01

Adverse events likely caused by something other than this toxin.

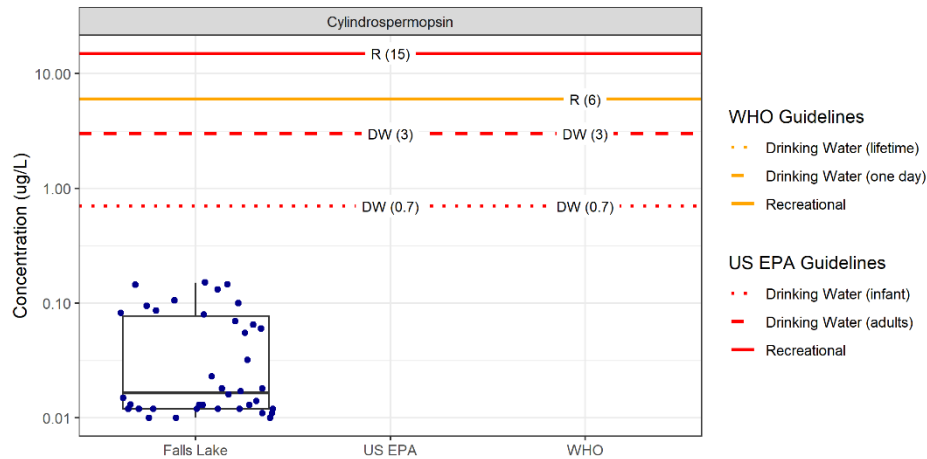
Concentrations are shown in log scale.

Cylindrospermopsin

- Never above WHO or US EPA limits (2016-2018)
- No advisories or closures due to cylindrospermopsin
- Values observed in Falls have been present during OHHABS health events
- Levels observed in OHHABS event have been observed in Falls without reported events

Falls Lake Data

Falls Lake Toxins (2016 - 2018)
with World Health Organization and
US Environmental Protection Agency Guidelines

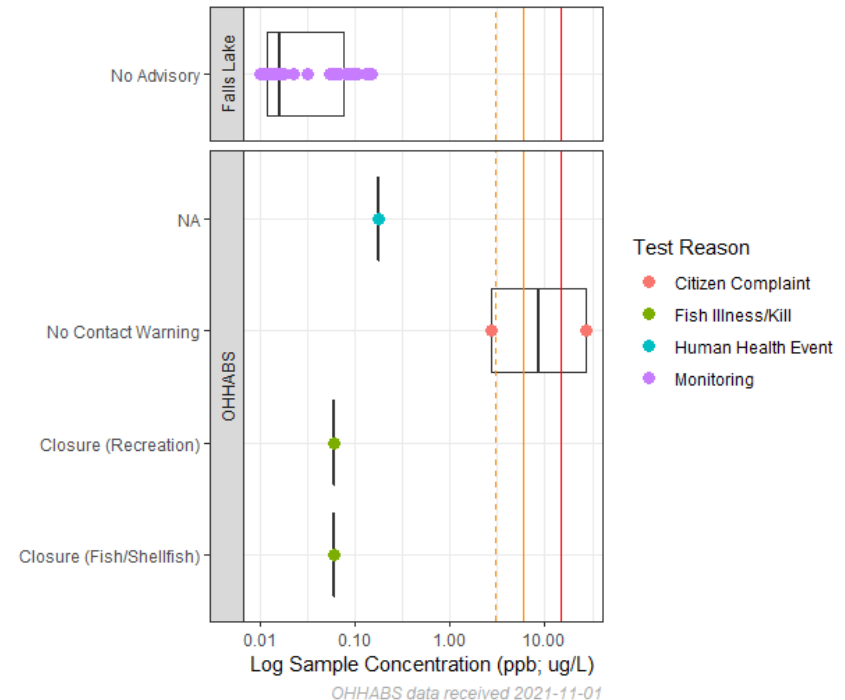


City of Raleigh toxin data

Falls Lake Data Compared to OHHABS Reports

Cylindrospermopsin: Levels and Advisory Outcomes

Limits: red solid (EPA recreation); orange solid (WHO recreation); orange dashed (WHO and EPA drinking)



Adverse events likely caused by something other than this toxin.

Concentrations are shown in log scale.

Data Insights and Gaps

- Extremely important to remember:
 - All reported data are opportunistic, voluntary, and presence-only
 - Methods vary and it is impossible to know the completeness of any given report
- These data help define what is **plausible** and what is **possible**, but not to define what is **probable**
 - We can say A and B have co-occurred (but cannot calculate frequency, probability, or causality of this co-occurrence)
 - We can report the observed range of values during reported blooms (but cannot state these are characteristic of broader patterns)

Example statements:

- In reported data, when (HUMAN USE IMPACT) has been documented, (TOXIN or GENUS) has been present at values ranging (MIN) to (MAX), but unverified as cause.
- In reported data, when (TOXIN or GENUS) presence has been documented, (ENVIRONMENTAL CONDITIONS) have been reported, but a causal relationship is unverified.

MRSW Workgroup Reports

Status of Scenario Screening Workgroup

- Developing a selection process for choosing scenarios and a preliminary list of scenarios to evaluate
- Two subgroups of this workgroup are working on scenario forms for scenarios preliminarily assigned a high priority
- During the January 2022 meeting, the workgroup
 - Recommended that model scenarios be developed to simulate nutrient management on urban and agricultural lands
 - Requested that the modeling team describe potential model changes to evaluate nutrient management on these land uses
- The 10th and final meeting for workgroup was held February 21st
 - Discussed potential forest management, algal flo-way, and onsite wastewater treatment system scenarios
- Modeling team met with representatives from agriculture on April 27th to discuss management options to simulate for agriculture

**Plan for Statistical Model
Development and Regulatory
Options for the Site-Specific
Chlorophyll-a Water Quality
Standard Proposal**

Status

- Consideration of a petition for rulemaking for Falls Lake (e.g., site specific criteria).
- The Statistical Model has important flexibility in the posing of questions related to the appropriateness of a site-specific standard.
- All the models supporting the Re-examination of the Falls Nutrient Management Strategy will be used to support the effort
- The statistical modeling team has been reaching out to contacts provided by the Technical Advisors Workgroup and DWR to collect data and information
- National and local datasets are being formatted to build the model (e.g., CDC's OHHABS data discussed above).
- Also coordinating with Dr. Marty Lebo and evaluating other State's site-specific standards for chlorophyll-a and nutrient-related standards

Communications Outreach and Preparation

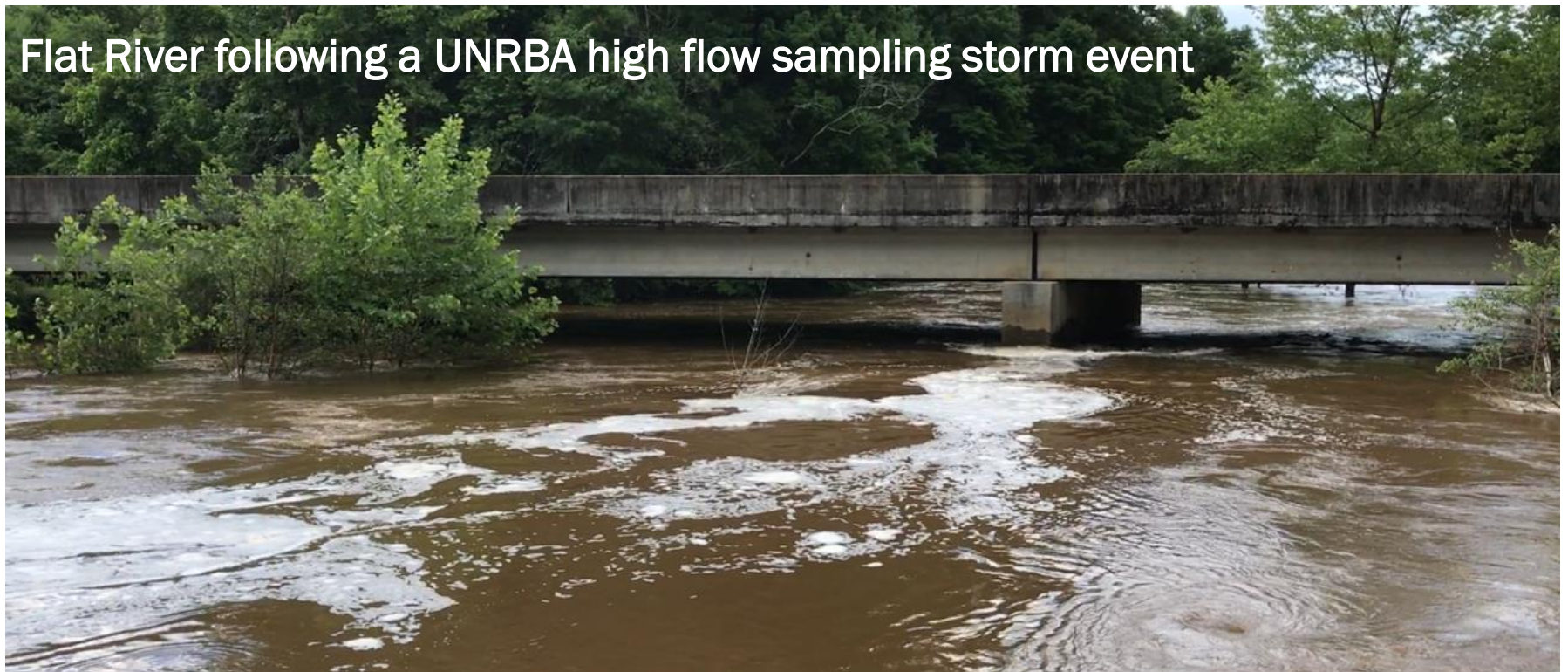
Communications Outreach and Preparation

- Reaching out to DWR and the new director on several topics
 - Work of the UNRBA
 - Preliminary results on the Re-examination
 - Process for site-specific water quality standard petition
 - High Rock Lake site-specific rulemaking process
- Identified several data presentation tools and data visualization figures to illustrate some of the important findings of our work to policy makers, UNRBA representatives, DWR, stakeholders, and the general public.
- General data presentation, base statistical relationships, and key findings from the data report and the watershed model are extremely important and need to be presented in ways that everyone can appreciate and understand.
- These “conversations” are important and represent the basis of discussing potential regulatory options for the UNRBA’s proposed recommendations on rule readoption.
- Examples of information presented at the Symposium are included on the following slides

Impacts of Hydrology on Nutrient Loading

- At the last MRSW meeting we discussed how nutrient loading can be hundreds of times higher than baseflow conditions on days with high precipitation amounts
- We showed that data at the Symposium along with this picture showing the Flat River flow through the treetops and rising toward the bridge deck

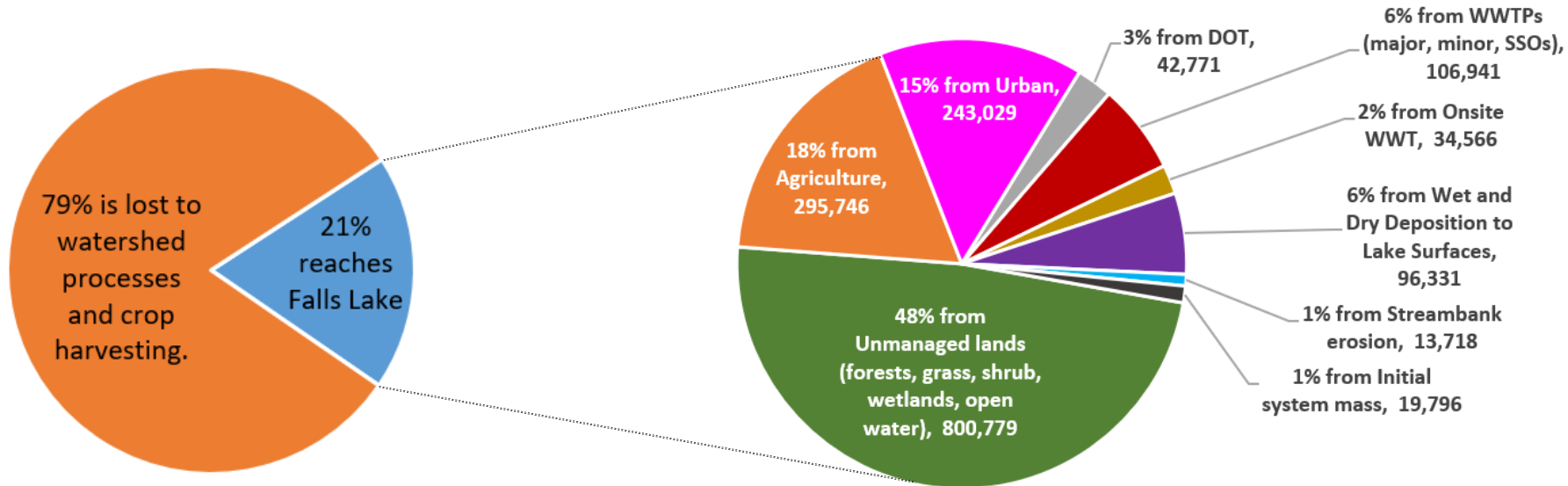
Flat River following a UNRBA high flow sampling storm event



Annual Average Applied and Delivered Total Nitrogen Loads

Gross inputs:
8.8 million pounds per year

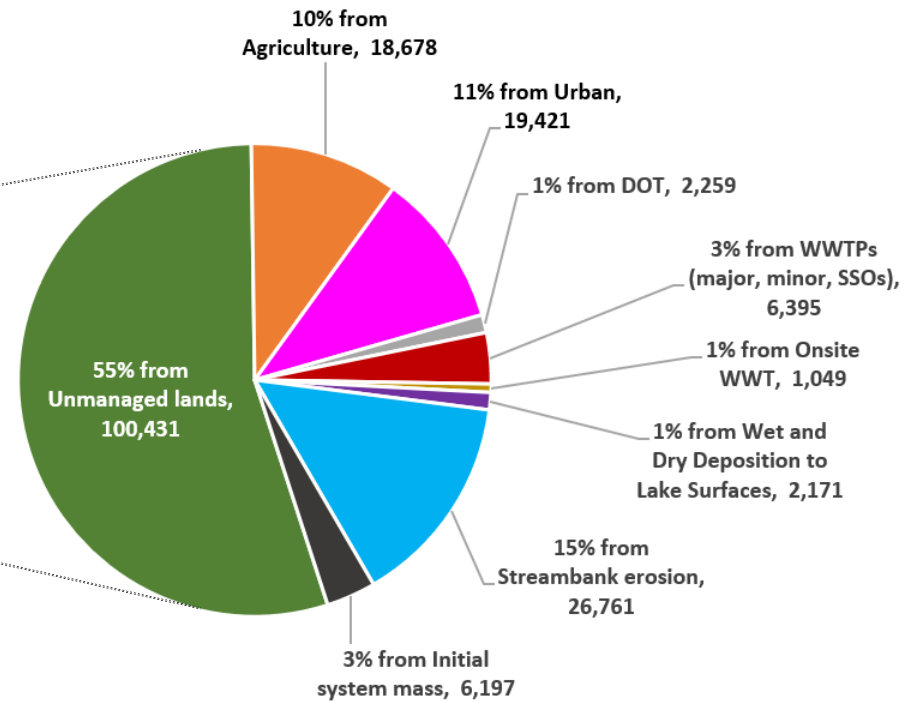
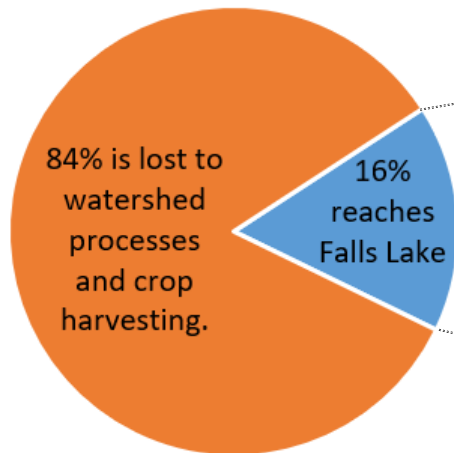
Delivered load:
1.65 million pounds per year



Annual Average Applied and Delivered Total Phosphorus Loads

Gross inputs:
1.1 million pounds per year

Delivered load:
180,000 pounds per year



Future Meeting Protocols

Future Meeting Protocols

- With COVID-related meeting and person-to-person contact protocols changing, the UNRBA needs to consider transition toward “in-person” meetings
- The Executive Director has polled the Board Officers, Directors, and Alternates about the status of local government meeting protocols and individual preferences about a timeline for returning to in-person meetings.
- The initial response has been for in-person meetings to begin soon, but with recommended protocols and a virtual option.
- The Executive Director has contacted the Co-Chairs of the PFC (Michelle Woolfolk and Terry Hackett) about the “ifs, how and when” to move the PFC and its workgroups back to in-person.
 - Both indicate that is generally acceptable and that
 - Participants need to have comfort with the format
 - We need to provide a remote option
 - Recommended that I reach out to the PFC for input
- Input received will be summarized during the meeting

Closing Comments

Additional Discussion