Path Forward Committee Meeting
9:30 AM on February 1, 2022
Remote Access Only (see next slides)

Remote Access Options

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Agenda

- Opening comments
- Change in Staff of MRS Project Team
- Transfer of Asset Purchased for UNRBA Monitoring Program
- Status of the UNRBA Stage I Existing Development Interim Alternative Implementation Approach (IAIA)
- Modeling and Regulatory Support Status
- Status of Proposed Chlorophyll-a Site Specific Standards for High Rock Lake
- DWR 2022 Integrated Report and 303(d) Assessments
- News Report - How to Keep Pets Safe from Toxic Algae
- Statistical Model Development and Regulatory Options for the Chlorophyll-a Water Quality Standard
- Communications Support
- Other Status Items
- Closing Comments

Change in Staff of MRS Project Team

Change in Staff of MRS Project Team

- The UNRBA contract with Brown and Caldwell (BC) requires notification of changes to the Modeling and Regulatory Support (MRS) project team.
- Matthew Van de Bogert (BC) resigned in January
- His roles will be covered by other staff at BC, supplemented by the project's subject matter experts.
  - Review of the statistical modeling:
    - Daniel Obenour and Nathan Hall (third-party reviewers funded through the UNC Collaboratory)
    - Jay Sauber (water quality consultant)
    - Clifton Bell (statistics, site-specific criteria development, BC)
    - Doug Durbin (limnologist, BC).

Change in Staff of MRS Project Team

- Options for developing the online portal for sharing WARMF model scenario results are being discussed with the Digital Water group at BC.
- Timing/funding dependent on
  - First calibrating the WARMF Lake water quality model
  - Selecting and evaluating scenarios

Transfer of Asset Purchased for UNRBA Monitoring Program

Transfer of Asset Purchased for UNRBA Monitoring Program

- The UNRBA purchased an inflatable boat during the UNRBA Monitoring Program to assist with collection of bathymetric data along the lake shoreline and lake arms.
- The purchase was made when the contract was with Cardno, Inc. and the boat was transferred to the care of BC when the contract was executed with that firm.
- Since the monitoring program is no longer active, the boat is no longer needed.
- The PFC will discuss options for transferring the property to another organization and develop recommendations to present to the Board in March.

Status of the UNRBA Stage I Existing Development Interim Alternative Implementation Approach (IAIA)

Status of the IAIA Program

- During the January 19, 2022, meeting, the UNRBA Board approved the Town of Stem's request to rejoin the UNRBA.
- The Board decided that further revisions to the Bylaws are needed to allow Stem to join the IAIA during the first year of the program.
- The Board will review the revised Bylaws in March.
- The minimum annual investment levels for other IAIA participants will not be altered with the addition of Stem.
- The CGC approved the reporting tool developed to assist the IAIA participants in tracking eligible projects and compliance with the Program.
- The tool had been previously reviewed by the IAIA Reporting Workgroup and the PFC.

Modeling and Regulatory Support (MRS) Status

Third Party Review of WARMF Watershed Model

Third-party review of the WARMF Watershed Model

- Important to receive input and feedback throughout model development and before the lake models are calibrated
- Third-party reviewers and subject matter experts reviewing the calibrated watershed model and the load allocations
  - Daniel Obenour, NCSU
  - Nathan Hall, UNC
  - Deanna Osmond, NCSU
  - Johnny Boggs, Forest Service
  - Michael O'Driscoll, Guy Iverson, Charles Humphrey, ECU

Review Components

- Discussion of simulated processes in WARMF and the change made to isolate the soils beneath each land use
- Running the model more than three times to get further separation of the soils beneath the land uses and more variation in the areal loading rates (now running 5 times)
- Comparisons to other modeling studies and literature reviews of published areal loading rates
- Comparison to areal loading rates from forested areas in the Falls Lake watershed monitored by the Forest Service
- Review resulted in modifications to the model relative to the version approved by the PFC in September 2021

Evaluations Conducted

- Testing the model under varying precipitation conditions for comparison to other studies that were conducted during drier periods
- Testing the model without accounting for stormwater control measures, stream buffers, and natural routing of runoff from impervious surfaces onto pervious areas
- Details will be provided as an appendix to the watershed modeling report

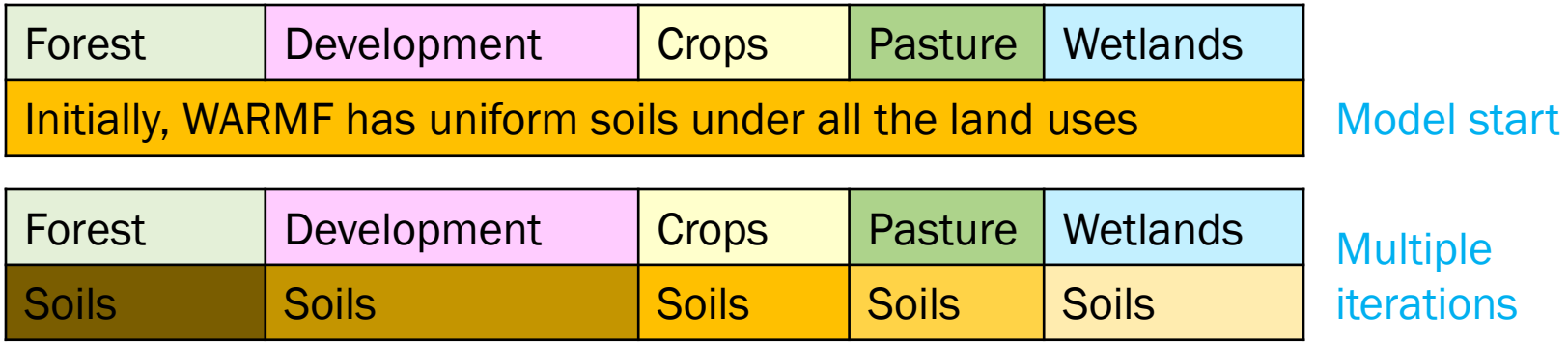
Simulation Processes

Watershed Processes

- The Watershed Analysis Risk Management Framework (WARMF) is a watershed model and decision support system which simulates the processes in a watershed and provides scientific information to stakeholders
  - Physical, chemical, and biological processes
  - Catchments, stream reaches, impoundments
  - Stream flow and water quality concentrations
  - Pollutant loads by source
  - Areal loading rates are calculated from simulated loads and drainage areas for each land use
- WARMF does not “prescribe” any results (e.g., runoff nutrient concentrations are calculated at each timestep, not assigned in a model input file like many other models)

Separate Soil Simulations

- There is an option in WARMF to separate the soils under each land use, but the initial soil concentrations have to be set uniformly for the catchment



- Given the soil chemistry in the watershed, a five-year model period (one model iteration) is not long enough for the initial soil conditions to separate by land use and output distinguishable loads by land use
- The WARMF model has to be run several times to see this separation
- Now running the model five times to see better separation of loading rates among land uses

Importance of Precipitation in Determining Loads

Annual Precipitation at RDU

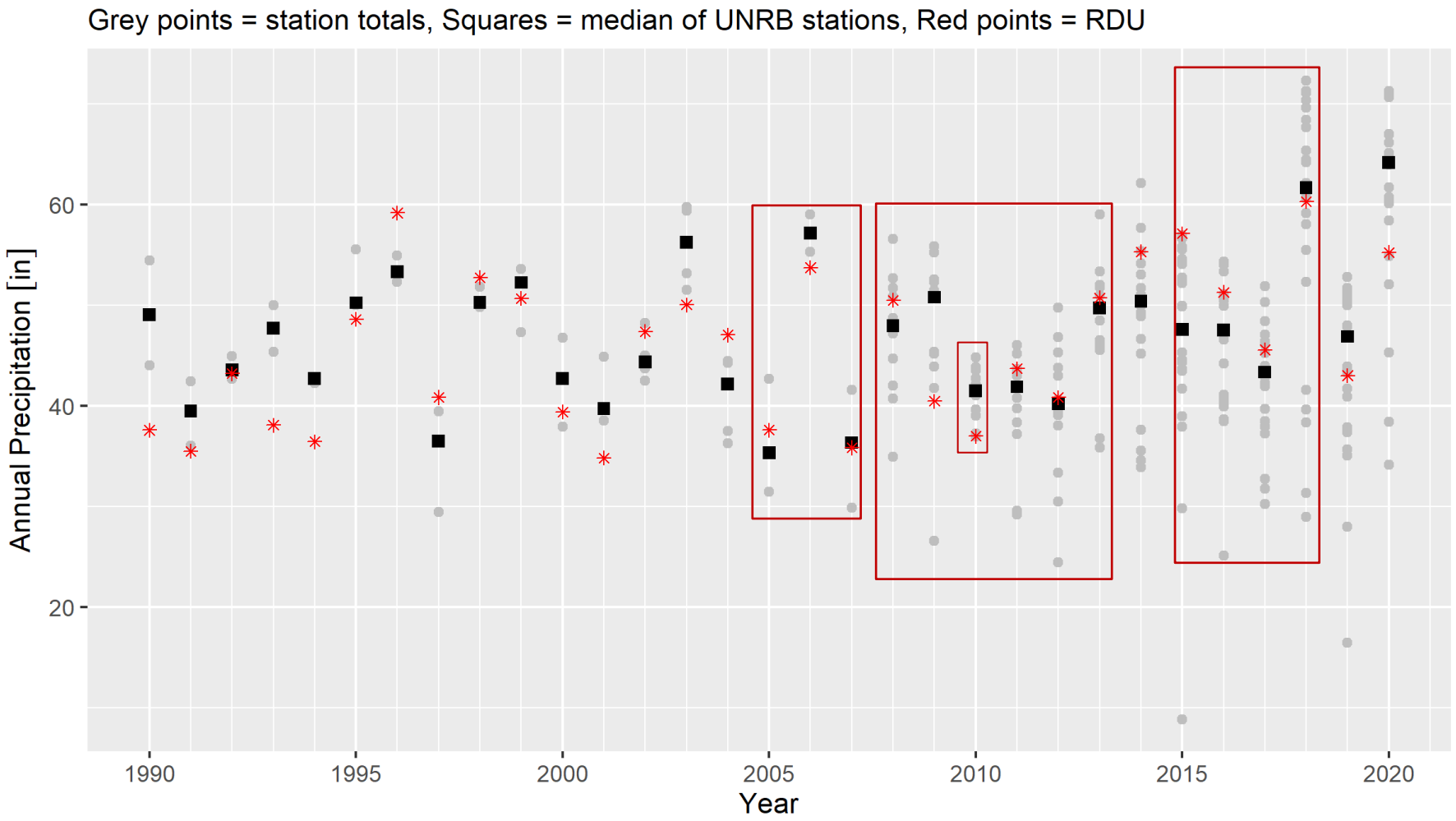
Data Source: NOAA Global Historical Climatology Network Daily Data

Baseline (2005-07)

Forest Service Monitoring (2008-2013)

UNRBA Modeling (2014-18)

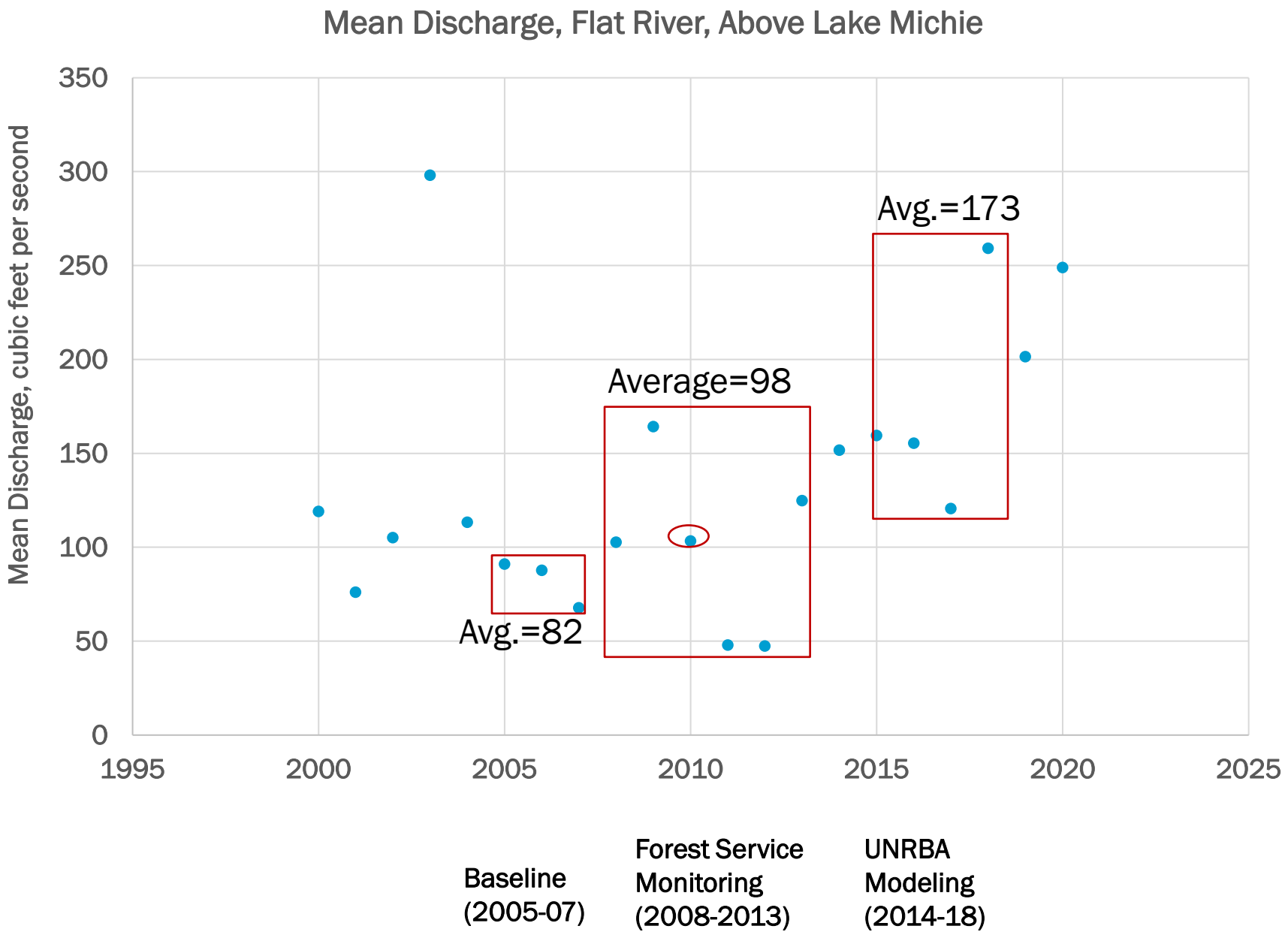
Annual Precipitation Across Watershed



Data Source: NOAA Global Historical Climatology Network Daily Data

Baseline (2005-07)	Forest Service Monitoring (2008-2013)	UNRBA Modeling (2014-18)

Mean Annual Discharge, Example Gage



Importance of Precipitation for Loading

- Load is a function of concentration and flow
- Nutrient loads are highly variable from year to year based on precipitation because flow is a key driver of loading
- Precipitation in 2018 was ~ 15 inches higher than 2017
- TN, TP, TOC loads in 2018 were 2-2.5 times higher than 2017

Loads passing lake loading sites:

Year	Annual Precipitation at RDU (in) [ratio to 2017]	TN (lb/yr) [ratio to 2017]	TP (lb/yr) [ratio to 2017]	TOC (lb/yr) [ratio to 2017]
2015	57.1 [1.25]	1,306,800 [1.6]	128,000 [1.2]	10,031,000 [1.5]
2016	51.3 [1.13]	1,053,800 [1.3]	123,000 [1.1]	8,344,000 [1.3]
2017	**45.6 [1.00]**	**826,800 [1.0]**	**108,800 [1.0]**	**6,671,000 [1.0]**
2018	60.3 [1.32]	1,859,400 [2.2]	224,200 [2.1]	15,738,000 [2.4]

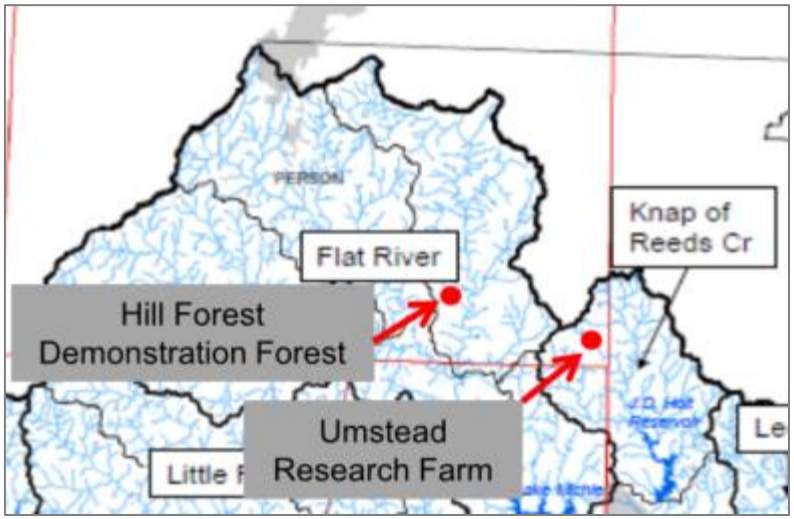
Comparison to Monitoring Studies Conducted by the Forest Service

Areal loading rates are mass per area per time, e.g.,

- *Pounds per acre per year (lb/ac/yr)*
- *Kilograms per hectare per year (kg/ha/yr)*
- *1 lb/ac/yr = 1.12 kg/ha/yr*
- *This monitoring study reported kg/ha/yr*

Comparison to Forest Service Monitoring Studies

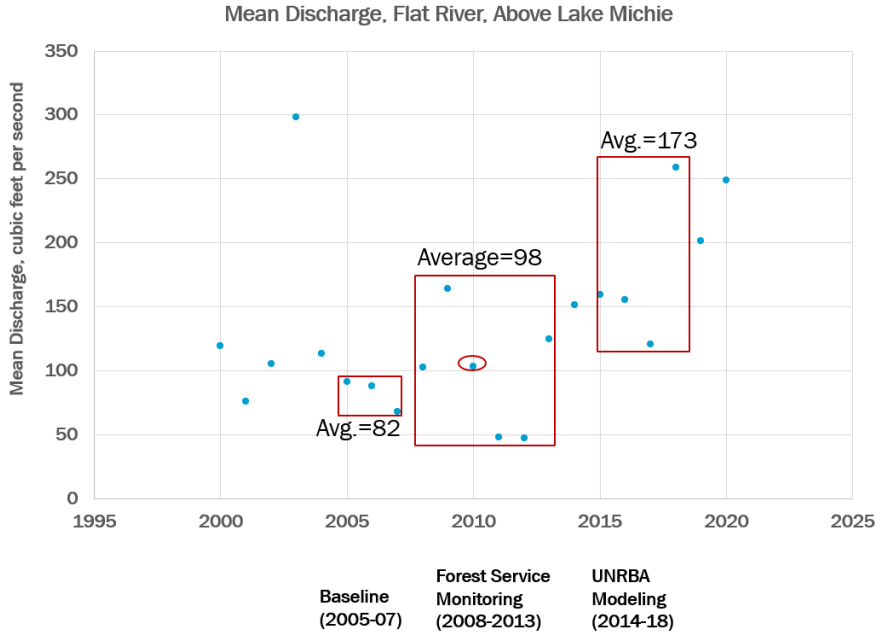
- The Forest Service conducted monitoring studies from 2008 to 2013 on forested headwater catchments in the Falls Lake watershed
  - Average annual precipitation is 42 inches at RDU
  - Annual precipitation ranged from 37 to 51 inches at RDU
- The Forest Service provided areal loading rates of total nitrogen, phosphorus, and carbon
  - Calculated based on storm flow and baseflow sampling
  - Areal loads provided as box plots showing kilograms per hectare per year (kg/ha/yr)
- Hill Forest in Flat River watershed
- Umstead Research Farm in Knap of Reeds Creek watershed



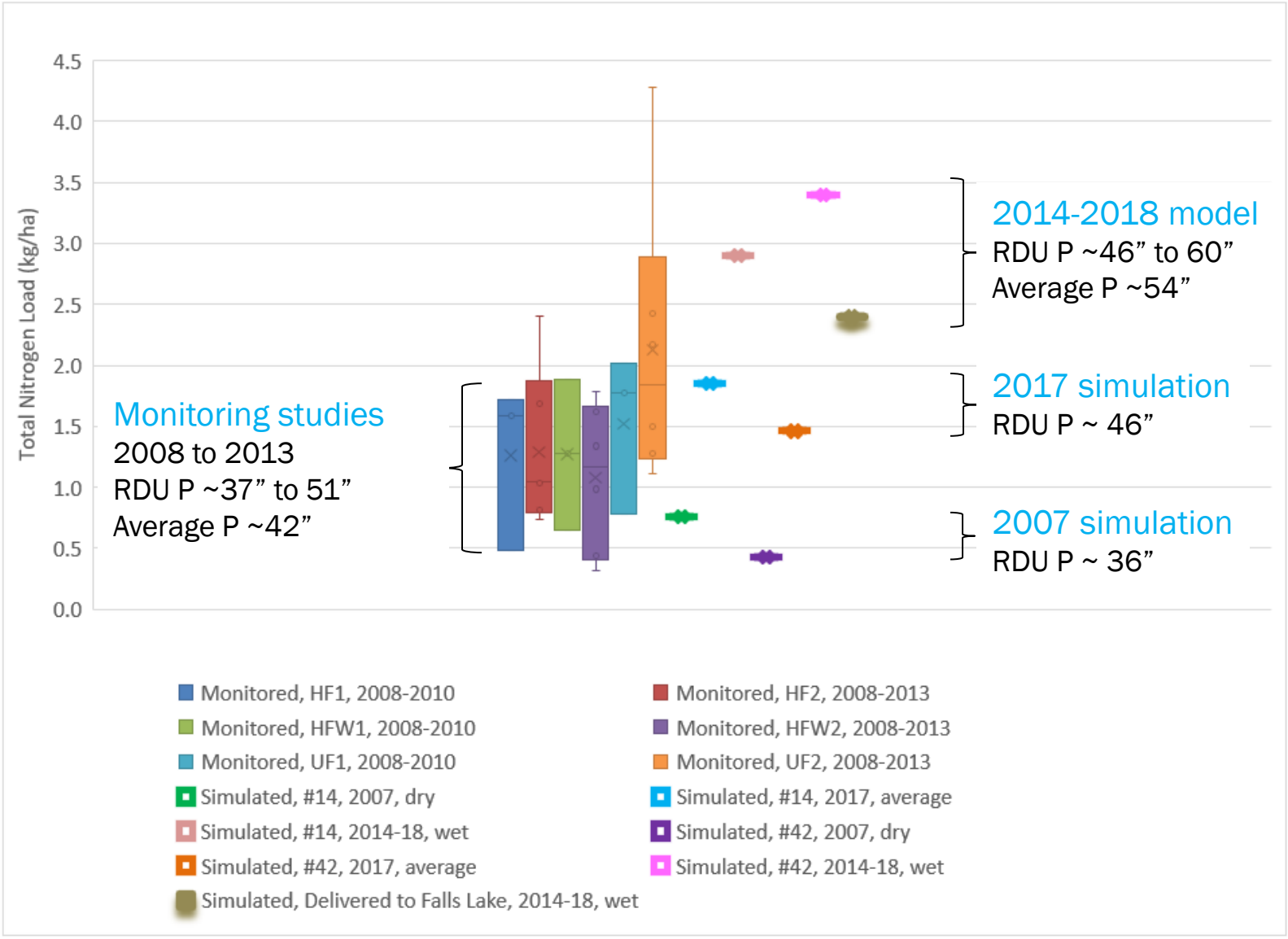
Comparison to Forest Service Monitoring Studies

- When the UNRBA WARMF watershed model is run under similar precipitation conditions as the monitoring studies (dry to average precipitation), the areal loading rates of total nitrogen, phosphorus, and organic carbon simulated by the model are very similar
- For the recent modeling period (average to wet), the UNRBA WARMF watershed model predicts higher loading rates from forested areas
- This is consistent with the hydrologic response recorded by USGS

Mean Annual Discharge, Example Gage

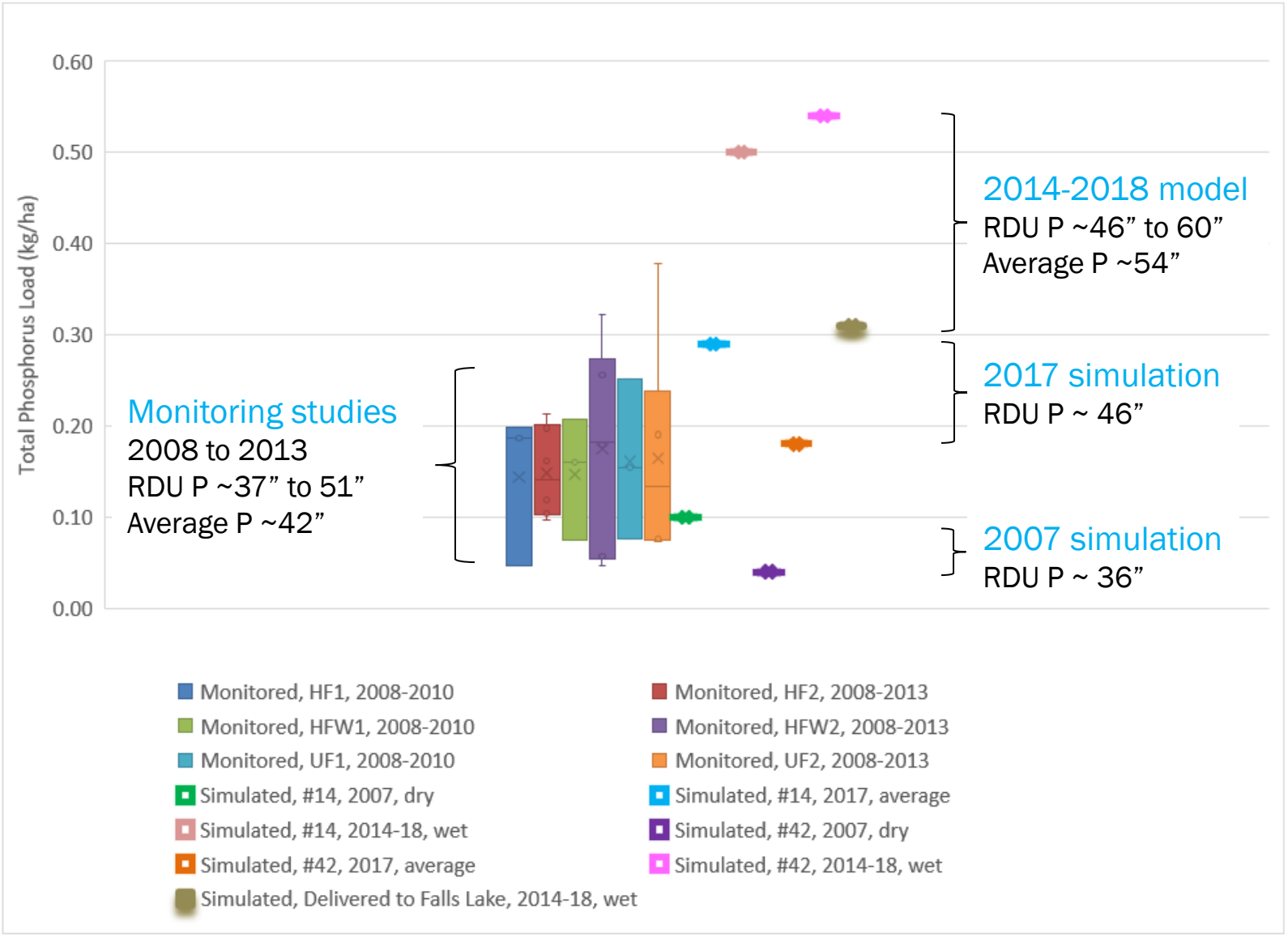


Distribution of TN Loading Rates from the Forest Service Monitoring Study Compared to Simulated Forest Lands for Three Precipitation Conditions



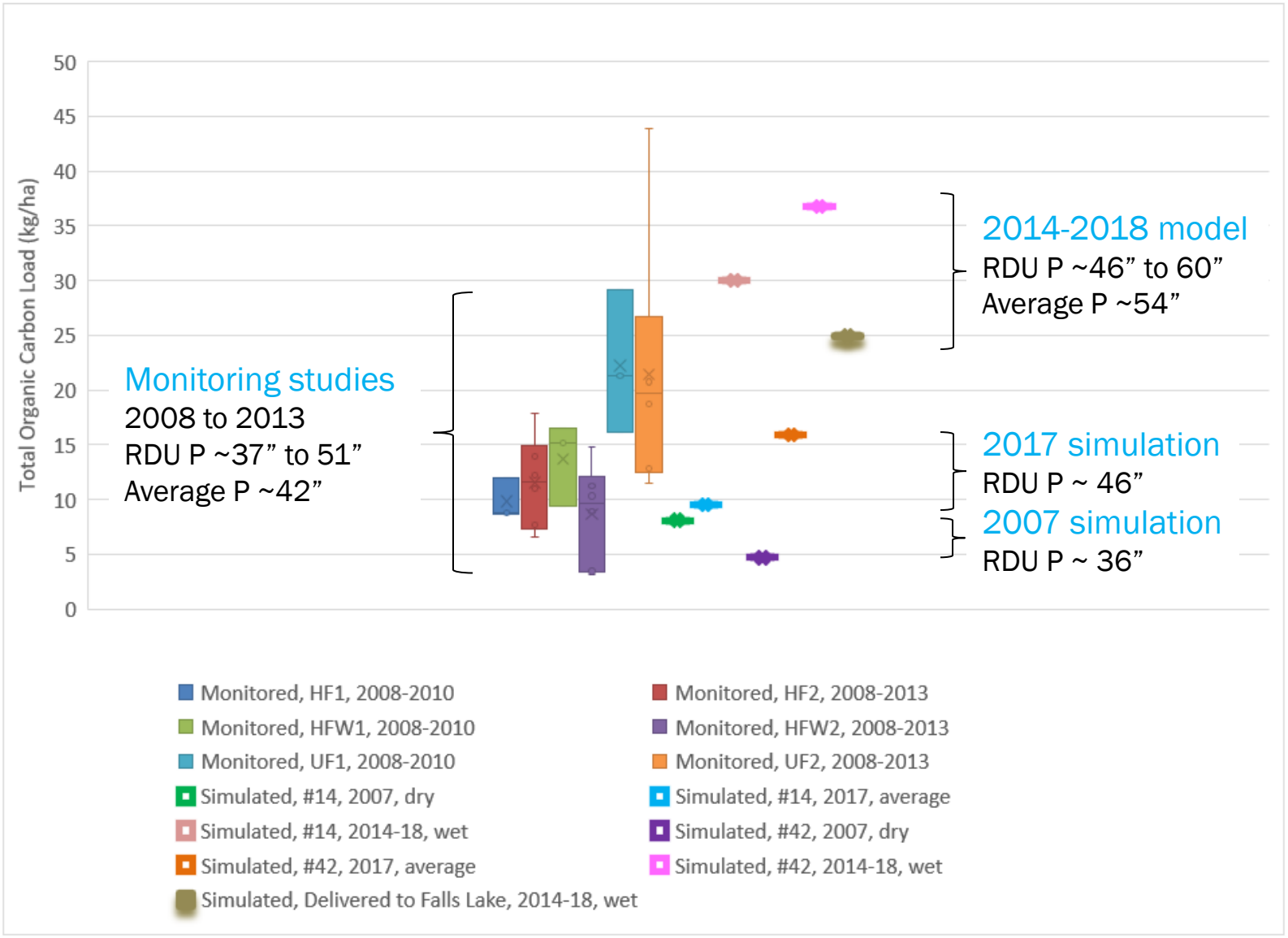
The catchment results do not represent transformations in downstream river segments or impoundments.
The "delivered to Falls Lake" result does include these transformations.

Distribution of TP Loading Rates from the Forest Service Monitoring Study Compared to Simulated Forest Lands for Three Precipitation Conditions



The catchment results do not represent transformations in downstream river segments or impoundments.
The "delivered to Falls Lake" result does include these transformations.

Distribution of TOC Loading Rates from the Forest Service Monitoring Study Compared to Simulated Forest Lands for Three Precipitation Conditions



The catchment results do not represent transformations in downstream river segments or impoundments.
The "delivered to Falls Lake" result does include these transformations.

Simulation of Developed Areas and Streambank Erosion

WARMF Simulation of Developed Areas

- WARMF designates the percentages of pervious and impervious areas for each developed land use class
  - Fertilizer can only be applied to pervious areas
  - Atmospheric deposition affects pervious and impervious areas
- WARMF assumes that runoff from impervious surfaces immediately reaches the stream reach in the catchment, unless it is detained
  - If the precipitation/runoff has a lower concentration of a parameter than the stream, rapid dilutions are simulated
  - Natural topography results in some runoff from impervious surfaces flowing over pervious areas. This water volume can either run off or infiltrate and interact with soil particles as it travels to the stream
  - Features in the watershed also retain water, release it more slowly, allow for evaporation, and allow for chemical reaction (increase or decrease concentrations)
- Some BMPs like street sweeping remove pollutants from impervious areas
- The WARMF model allows the user to account for these processes by:
  - Assigning some of the runoff from impervious surfaces to go to “detention”
  - Turning on BMPs like street sweeping or stream buffers

WARMF Accounting for Stream Bank Erosion

- Stream bank erosion is simulated by WARMF separately from the individual land uses
- Stream bank erosion is an average condition for the reach that accounts for soil erosivity, simulated shear stress, bank and vegetation characteristics, etc.
- The hydrologic impacts of impervious surfaces are not reflected in the nutrient loading rates reported by land use - these are the loading rates from the land surface that account for nutrient application/deposition, soil interactions, etc.
- This approach is very different than empirical models that relate land use characteristics in a watershed to water quality observations in streams or assign export coefficients to land uses (Dodd, 1992; Harden et al. 2013, Lin 2004, Tetra Tech 2014, Miller et al. (2019 and 2021))
  - In these studies, the hydrologic impacts on stream bank erosion and resulting nutrient loading rates are associated with the land uses in the drainage area
- Care will need to be taken when messaging nutrient loading results from WARMF that show higher intensity development having lower nutrient loading rates and do not account for hydrologic impacts

Conditions for Developed Areas

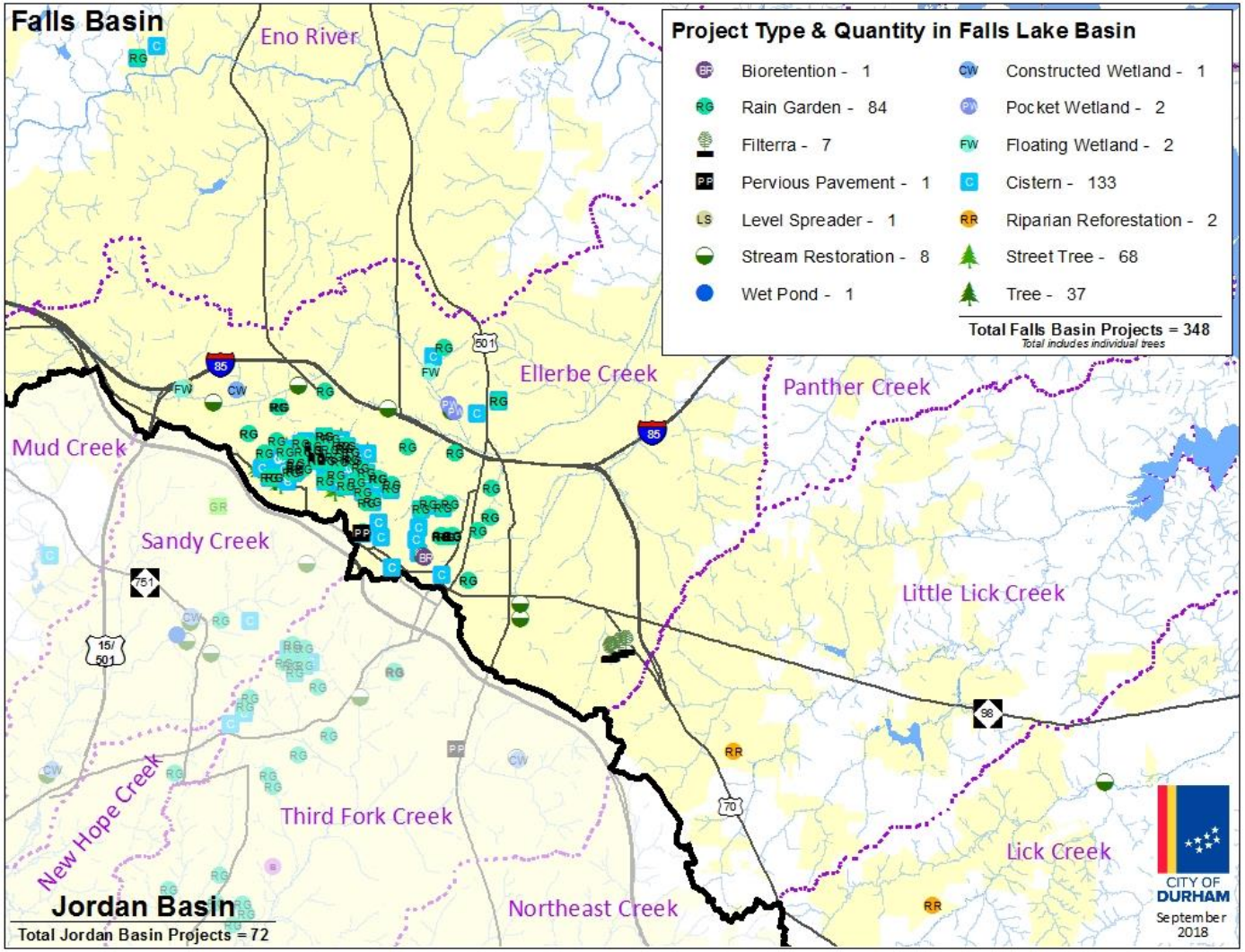
- The Falls Lake Nutrient Management Strategy went into affect in 2011
- The local governments have been implementing best management practices and stormwater control measures to address nutrient loading from development in the watershed (City of Durham example on next slide)
- For the Falls Lake WARMF model, small amounts of detention were assumed in the catchments to calibrate the hydrology and water quality responses in the watershed
- Street sweeping and stream buffers are also present in varying amounts

City of Durham Existing Development Retrofits as of December 2015

Falls Basin:
348 projects
83% of projects

Jordan Basin:
72 projects
17% of projects

Nearly five times the number of projects have been implemented in the Falls Basin than the Jordan Basin.



Comparison of Simulated Areal Loading Rates to Other Modeling Studies

Areal loading rates are mass per area per time, e.g.,

- *Pounds per acre per year (lb/ac/yr)*
- *Kilograms per hectare per year (kg/ha/yr)*
- *1 lb/ac/yr = 1.12 kg/ha/yr*
- *Other modeling studies used kg/ha/yr*

Simulated TN from Existing Development in Ellerbe Creek Compared to Other Models

WARMF Simulated Land Use	2007 Hydrology	2017 Hydrology	Calibrated 2014-18
Existing development, high intensity	6.7	7.9	10.3
Existing development, medium intensity	8.5	9.4	12.7
Existing development, low intensity	8.5	9.8	12.3
Developed open space	4.7	5.2	8.5

Study	TN Loading Rate kg/ha/yr
Miller et al. (2019) low end of range, post 80s	0.7
Hoos and Roland (2019), low end of range, with delivery accounted for	1.3
Lin (2004) low end of range	1.5
Tetra Tech (2014) low end of the literature range for high density dev.	1.8
Tetra Tech (2014) low end of the simulated range, low-medium density dev.	2.4
Hoos and Roland (2019), high end of range, with delivery accounted for	2.5
Tetra Tech (2014) low end of the literature range, low-medium density dev.	2.9
Harden et al (2013) low intensity urban	3.0
Harden et al (2013) high intensity urban	4.1
Dodd (1992) low end of range	5
Tetra Tech (2014) low end of the simulated range for high density dev.	5.7
Tetra Tech (2014) high end of the sim. range, low-medium density dev.	6.5
Miller et al. (2019) high end of range, post 80s	7.3
Miller et al. (2019) low end of range, pre80s	7.4
Tetra Tech (2014) high end of the lit. range, low-medium density dev.	9.0
Tetra Tech (2014) high end of the simulated range for high density dev.	9.2
Dodd (1992) high end of range	9.72
Miller et al. (2019) high end of range, pre 80s	11.4
Tetra Tech (2014) high end of the literatur range, high density dev.	12.3
Chesapeake Bay CASTNET Phase 6 for developed	18.9
Lin (2004) high end of range	38.5

WARMF simulated urban loading rates for N in Ellerbe Creek with BMPs range from 4.7 to 12.7 kg-N/ha/yr depending on the development type and hydrologic condition.

They are within the ranges reported by other modeling studies 0.7 to 38.5 kg-N/ha/yr.

WARMF rates do not account for stream bank erosion (calculated separately).

Simulated TP from Existing Development in Ellerbe Creek Compared to Other Models

Land Use	2007 Hydrology	2017 Hydrology	Calibrated 2014-18
Existing development, high intensity	0.13	0.11	0.37
Existing development, medium intensity	0.27	0.28	0.90
Existing development, low intensity	0.48	0.57	1.78
Developed open space	0.43	0.49	1.39

Study	TP Loading Rate kg/ha/yr
Miller et al. (2019) low, post 80s	0.03
Tetra Tech (2014) low end of the literature range for high density development	0.11
Lin (2004) low end of range	0.19
Hoos and Roland (2019), low, with delivery accounted for	0.21
Tetra Tech (2014) low end of the sim. range, low-medium density dev.	0.26
Hoos and Roland (2019), high, with delivery accounted for	0.34
Harden et al (2013) low intensity urban	0.35
Tetra Tech (2014) low end of the lit. range for low-medium density dev.	0.38
Dodd (1992)	0.45
Harden et al (2013) high intensity urban	0.70
Tetra Tech (2014) high end of the sim. range for low-medium density dev.	0.88
Tetra Tech (2014) low end of the simulated range for high density dev.	0.88
Miller et al. (2019) low, pre80s	1.1
Miller et al. (2019) high, post 80s	1.4
Chesapeake Bay CASTNET Phase 6 for developed	1.4
Dodd (1992)	1.5
Tetra Tech (2014) high end of the simulated range for high density dev.	1.5
Tetra Tech (2014) high end of the lit. range for low-medium density dev.	1.6
Miller et al. (2019) high, pre 80s	1.8
Tetra Tech (2014) high end of the literature range for high density dev.	3.4
Lin (2004) high end of range	6.2

WARMF simulated urban loading rates for P in Ellerbe Creek with BMPs range from 0.13 to 1.78 kg-P/ha/yr depending on the development type and hydrologic condition.

They are within the ranges reported by other modeling studies 0.03 to 6.2 kg-P/ha/yr.

WARMF rates do not account for stream bank erosion (calculated separately).

Simulated TN from Agriculture Compared to Other Modeling Studies

Study	TN Loading Rate kg/ha/yr
Tetra Tech (2014) low end of the literature range for cropland	0.4
Lin (2004) low end of range for pasture	1.5
Tetra Tech (2014) low end of the modeled range for pasture/grassland	2.0
Lin (2004) low end of range for cropland	2.1
Miller et al. (2019) low end of range for pasture and cropland	2.3
Harden et al (2013) low intensity agriculture	2.4
Tetra Tech (2014) low end of the modeled range for cropland	2.5
Tetra Tech (2014) low end of the literature range for pasture/grassland	3.2
Harden et al (2013) high intensity agriculture	3.8
Dodd (1992) low end of range for pasture and cropland	5
Miller et al. (2019) high end of range for pasture and cropland	5.7
Tetra Tech (2014) high end of the modeled range for pasture/grassland	5.7
Tetra Tech (2014) high end of the modeled range for cropland	11.5
Tetra Tech (2014) high end of the literature range for pasture/grassland	14.0
Dodd (1992) high end of range for pasture and cropland	14.3
Chesapeake Bay CASTNET Phase 6 for pasture/hay	16.7
Lin (2004) high end of range for pasture	30.8
Tetra Tech (2014) high end of the literature range for cropland	49.3
Chesapeake Bay CASTNET Phase 6 for cropland	53.4
Lin (2004) high end of range for cropland	79.6

WARMF simulated crop and pasture loading rates for N in Catchment #42 range from 0.1 to 15 kg-N/ha/y r depending on the precipitation condition.

These are within the ranges reported by other modeling studies (0.4 to 79.6 kg-N/ha/yr).

Simulated TP from Agriculture Compared to Other Modeling Studies

Study	TP Loading Rate kg/ha/yr
Tetra Tech (2014) low end of the literature range for cropland	0.10
Tetra Tech (2014) low end of the simulated range for pasture/grassland	0.10
Lin (2004) low end of range for pasture	0.14
Tetra Tech (2014) low end of the simulated range for cropland	0.18
Harden et al (2013) low intensity agriculture	0.24
Lin (2004) low end of range for cropland	0.26
Tetra Tech (2014) high end of the simulated range for pasture/grassland	0.29
Harden et al (2013) high intensity agriculture	0.35
Miller et al. (2019) low end of range for pasture and cropland	0.40
Tetra Tech (2014) low end of the literature range for pasture/grassland	0.50
Dodd 1992 low end of range for pasture and cropland	0.55
Miller et al. (2019) high end of range for pasture and cropland	0.80
Dodd (1992) high end of range for pasture and cropland	0.99
Tetra Tech (2014) high end of the simulated range for cropland	1.4
Chesapeake Bay CASTNET Phase 6 for pasture/hay	1.7
Chesapeake Bay CASTNET Phase 6 for cropland	2.5
Lin (2004) high end of range for pasture	4.9
Tetra Tech (2014) high end of the literature range for pasture/grassland	5.3
Tetra Tech (2014) high end of the literature range for cropland	6.5
Lin (2004) high end of range for cropland	18.6

WARMF simulated crop and pasture loading rates for P in Catchment #42 range from 0.01 to 0.95 kg-P/ha/y r depending on the precipitation.

These are lower than (2007) or within the ranges reported by other modeling studies (0.1 to 18.6 kg-P/ha/yr).

Re-Evaluation of Performance Rankings

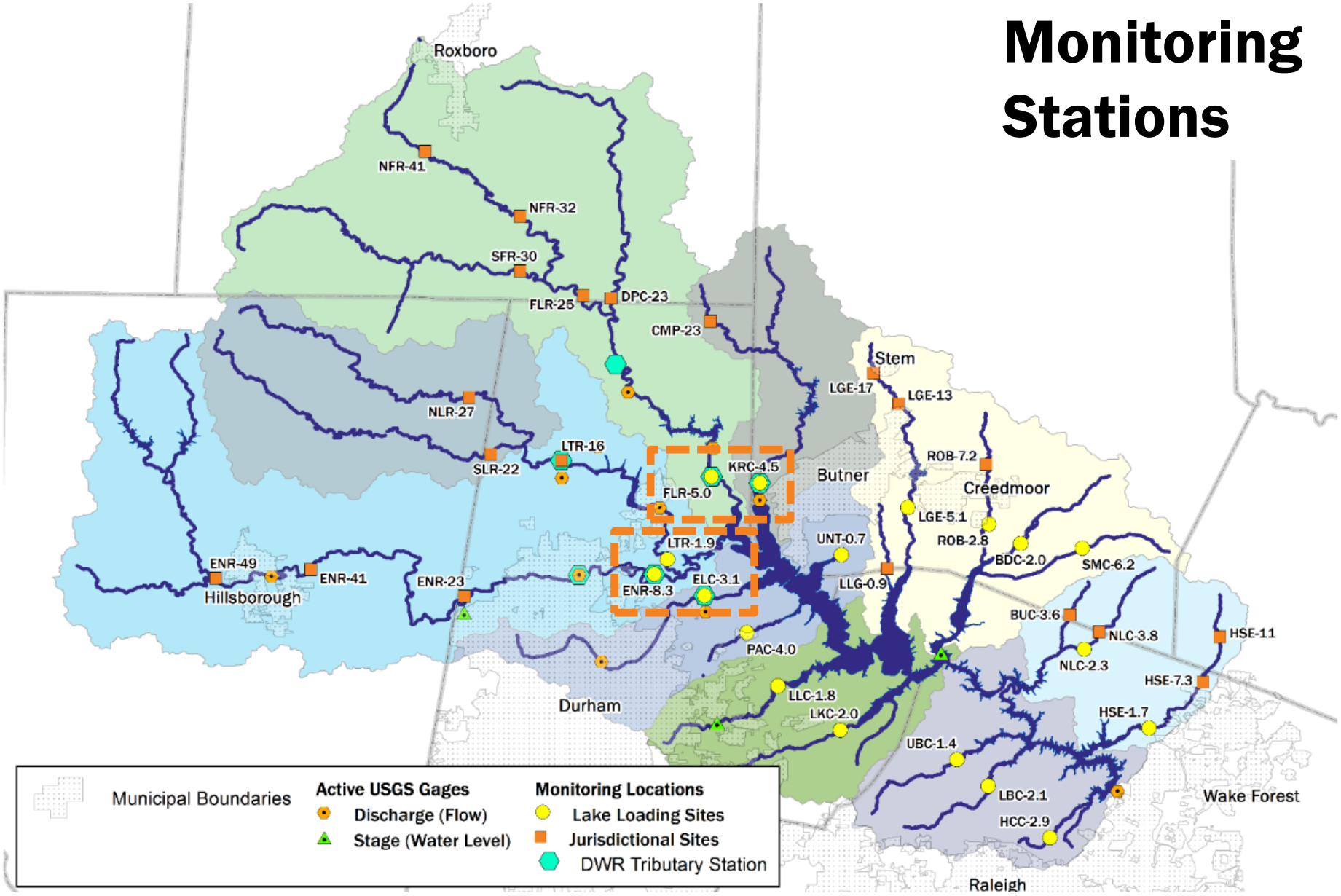
Water Quality Model Performance Criteria

- The UNRBA Modeling QAPP includes the following guidance for water quality calibration (Table A.7-2 from QAPP) for concentrations
- The DWR (2009) watershed modeling report only provided performance criteria for flow, not water quality

Table A.7-2 General Watershed Model Calibration Guidance

Parameter	Percent Bias Criteria		
	Very Good	Good	Fair
Sediment	< ± 20	± 20-30	± 30-45
Water Temperature	< ± 7	± 8-12	± 13-18
Water Quality/Nutrients	< ± 15	± 15-25	± 25-35
Flow (Total Volume)	≤ 5%	5-10%	10-15%

Monitoring Stations



Revised Performance Summary (2015-18)

Parameter	Ellerbe	Eno	Flat	Little	Knap 2015-18	Knap 2017-18
Temperature	Very good	Good	Good	Good	Good	Very good
TSS	Low	Low	Low	Good	Fair	Fair
Ammonia	Very good	Fair	Good	Low	Good	Very good
Nitrate	Very good	Good	Low	Low	Low	Very good
TKN	Fair	Very good	Very good	Very good	Good	Very good
TN	Good	Very good	Very good	Very good	Fair	Very good
TP	Very good	Very good	Good	Very good	Low	Very good
TOC	Very good	Very good	Very good	Very good	Very good	Very good
Chlorophyll-a	Low	Very good	Very good	Very good	Low	Low

Simulated Nutrient Inputs to the Watershed

Simulated Nutrient Inputs and Source Tracking of Delivered Loads

- Nutrient inputs to the watershed associated with model inputs can be quantified
  - Atmospheric deposition (affects all land use)
  - Nutrient application to agriculture or urban land
  - Wastewater treatment facilities
  - Sanitary sewer overflows
  - Onsite wastewater treatment systems
- Internal calculations (contribute loading but we can't assign an "input" value)
  - Streambank erosion
  - Loading associated with soils, dissolution of nutrients, and erosion

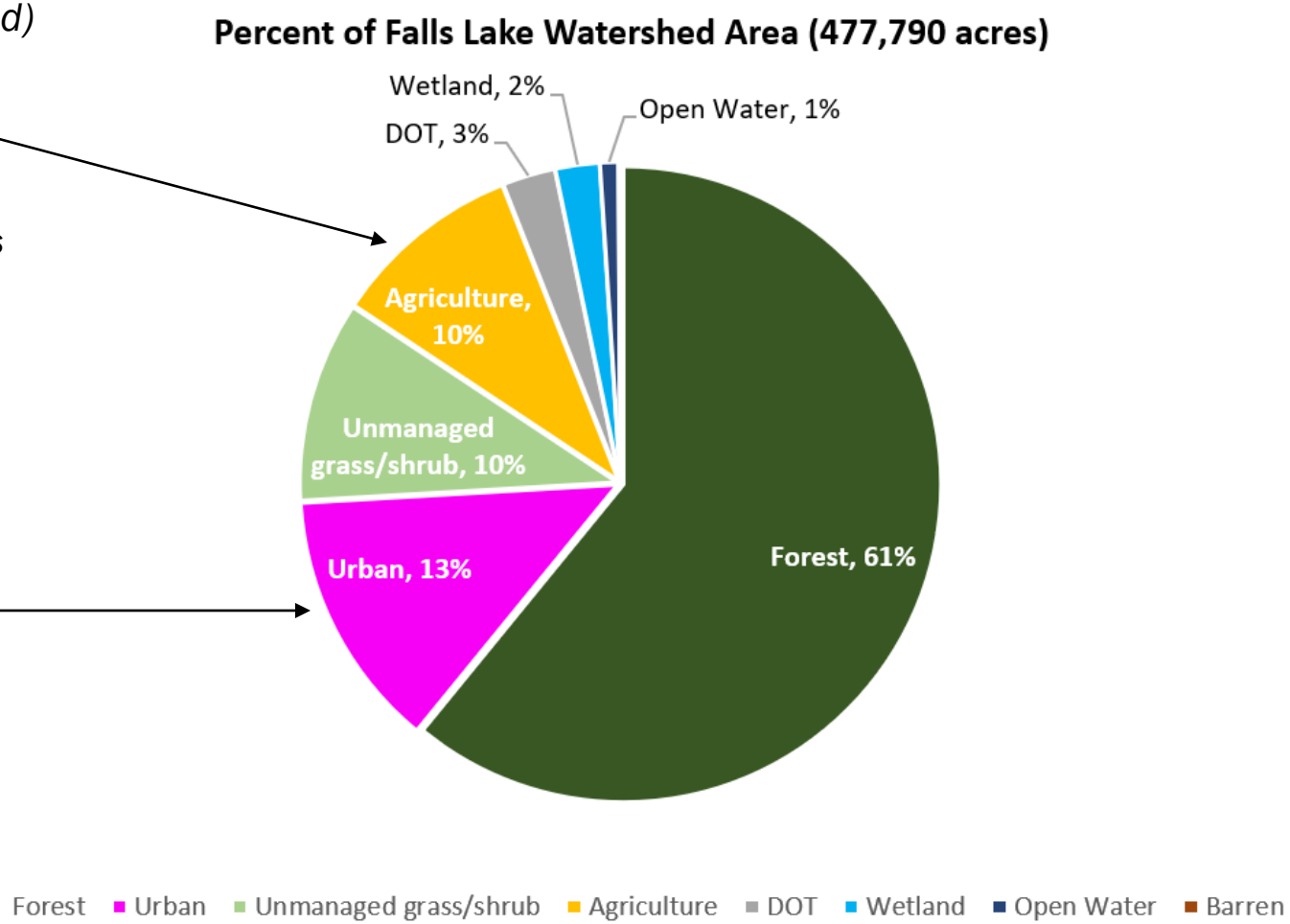
Land Use Composition for the Falls Lake Watershed

Agriculture (10% of watershed) is comprised of

- *57% pasture*
- *12% full season soybeans*
- *10% hay*
- *7% double-cropped soybeans*
- *6% flue-cured tobacco*
- *6% no-till grain corn*
- *2% wheat or other crops*

Urban (13% of the watershed) is comprised of

- *68% "developed open space" (mostly road rights of way (not DOT), parks, etc.)*
- *20% existing development, low intensity.*
- *Both of these types are assumed 20% impervious*

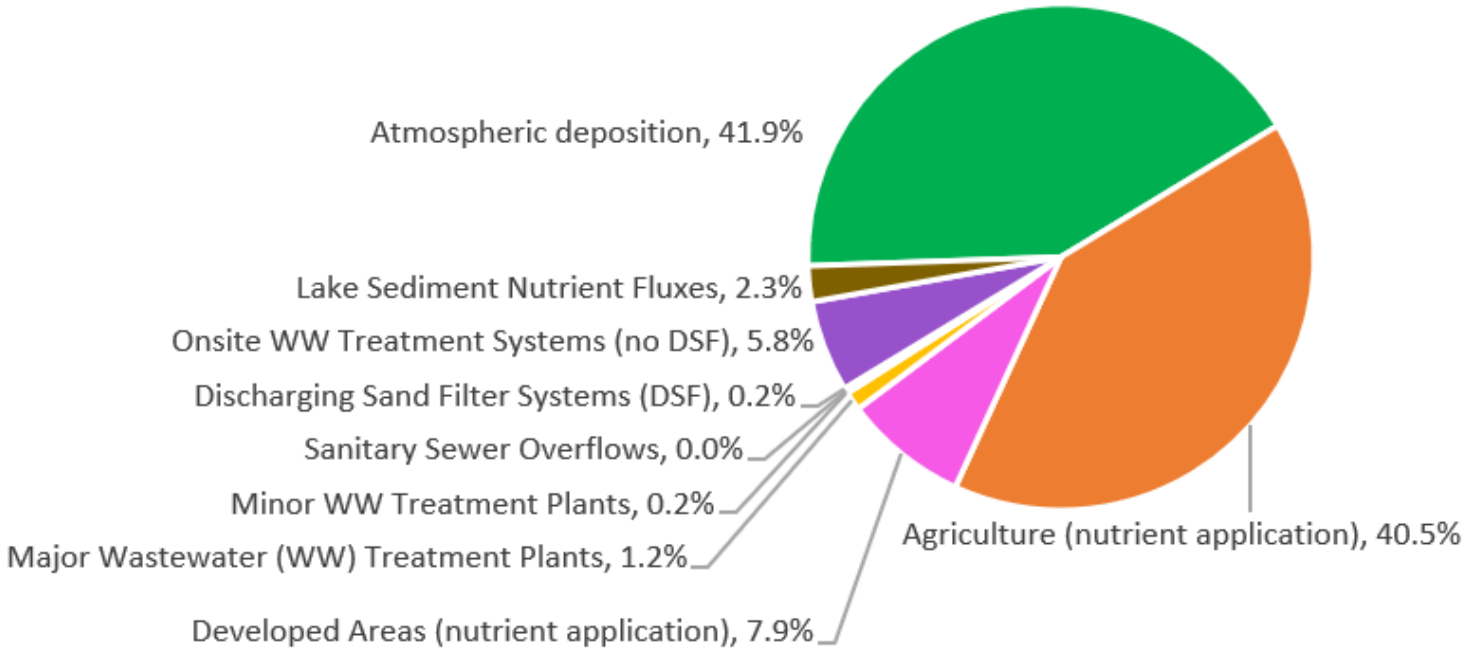


Simulated Nutrient Inputs and Source Tracking of Delivered Loads

- The following pie charts show the percentage of the gross inputs to the watershed from sources that were defined using model inputs
- Internal loading from lake sediments will be simulated soon; for now the pie charts include this using the estimates from the UNRBA 2019 Monitoring Report
- These gross inputs are significantly reduced prior to delivery to Falls Lake

Gross Total Nitrogen Inputs to the Watershed

Percent of the 8,800,000 pounds per year of total nitrogen input the watershed (2015 to 2018)

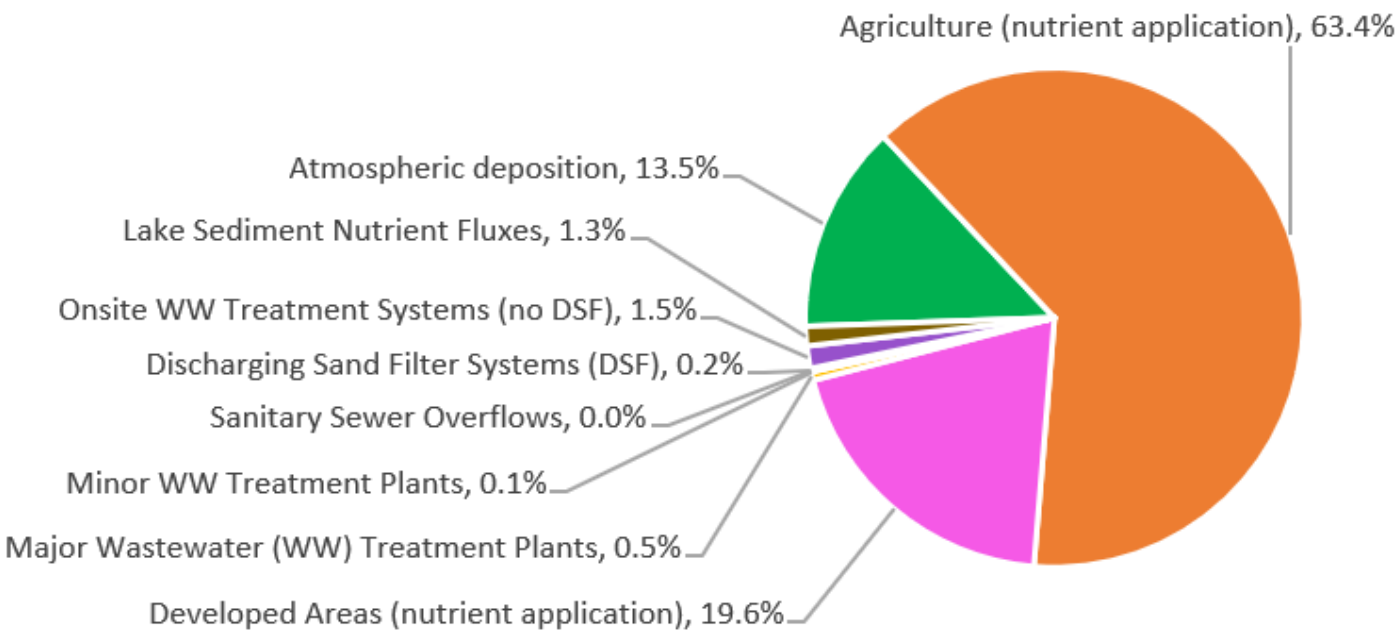


Watershed processes reduce the total nitrogen load by approximately 81 percent prior to delivery to Falls Lake.

Watershed processes including vegetation uptake, crop harvesting, overland and aquatic transformations in streams and impoundments reduce the total nitrogen load by approximately 81 percent prior to delivery to Falls Lake.

Gross Total Phosphorus Inputs to the Watershed

Percent of the 1,115,000 pounds per year of total phosphorus input the watershed (2015 to 2018)



Watershed processes reduce the total phosphorus load by approximately 84 percent prior to delivery to Falls Lake.

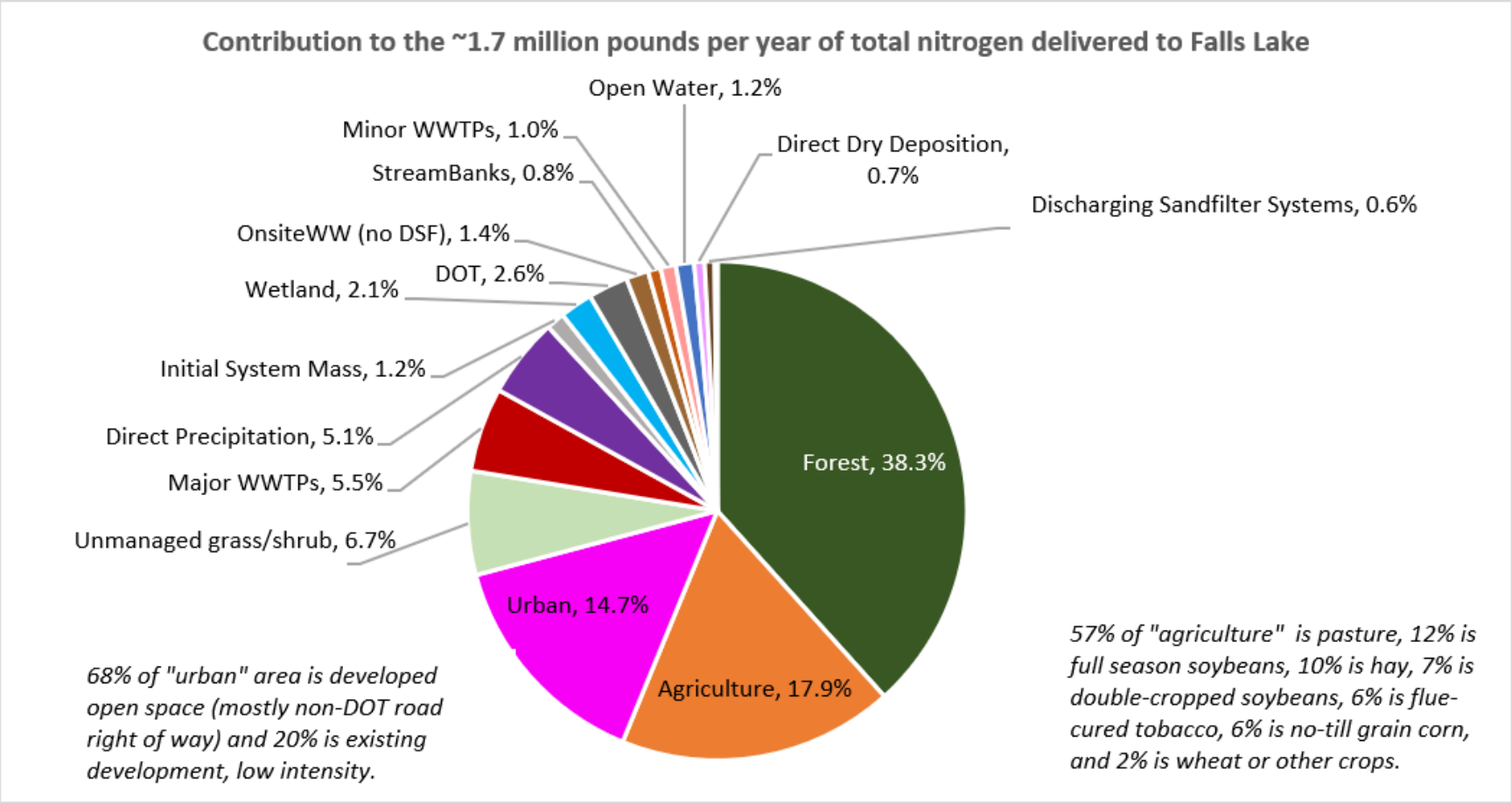
Watershed processes including vegetation uptake, crop harvesting, overland and aquatic transformations in streams and impoundments reduce the total phosphorus load by approximately 84 percent prior to delivery to Falls Lake.

Source Load Allocations for Delivered Loads to Falls Lake

Source Load Allocations

- WARMF tracks loads from each source in the watershed
  - Land uses
  - Onsite wastewater treatment systems
  - Point sources (includes major and minor dischargers, discharging sand filter systems, and sanitary sewer overflows)
  - “General nonpoint sources” (accounts for the initial mass in the streams and impoundments)
  - Stream bank erosion
  - Direct wet and dry deposition to lake surfaces
- The following pie charts show the percent contribution of the delivered load to Falls Lake which accounts for instream and impoundment processes that reduce loading before it is delivered to the lake

Total Nitrogen Delivered to Falls Lake



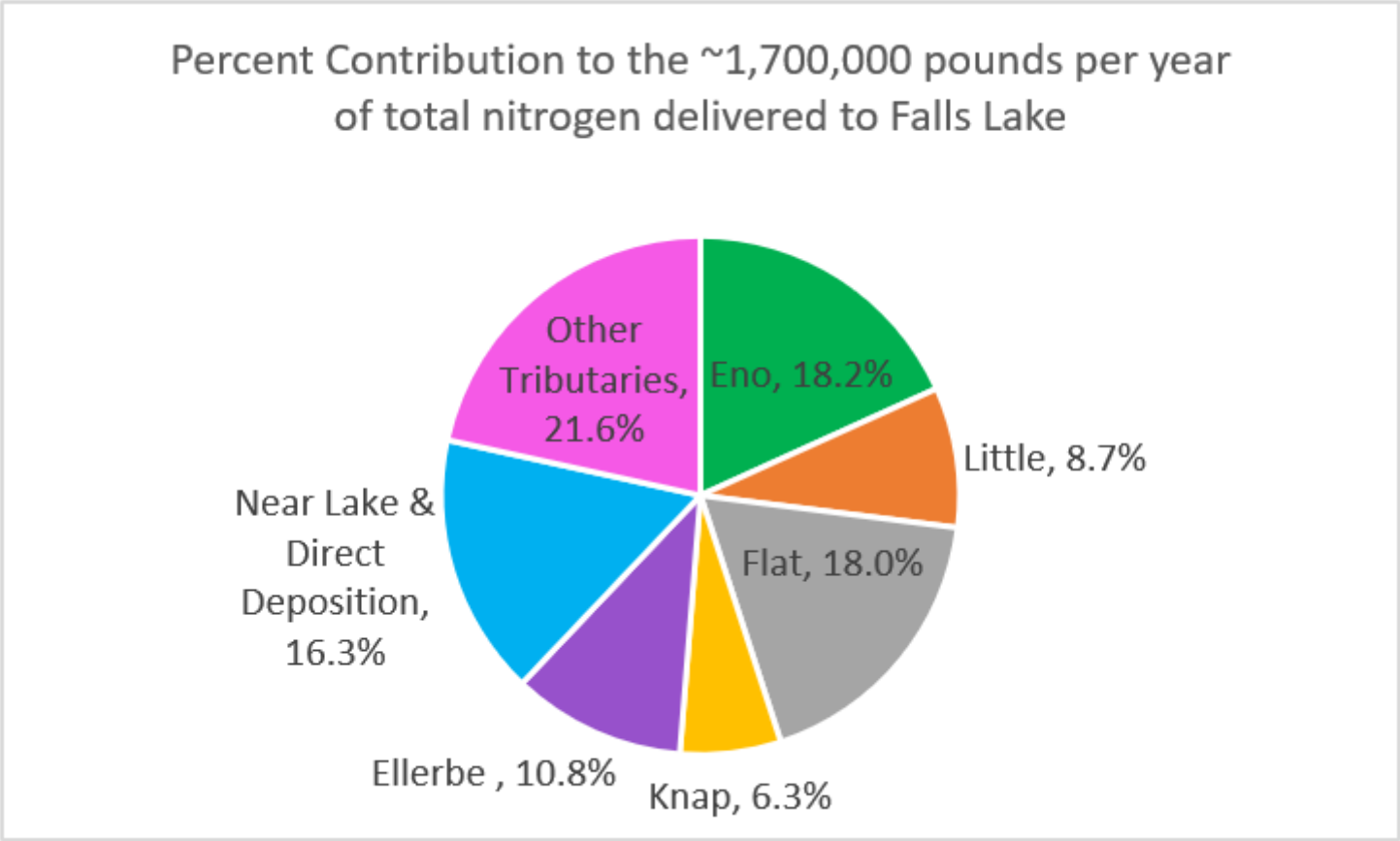
An additional ~200,000 pounds per year of nitrogen is released from the lake sediments into the water column of Falls Lake. This average annual estimate is based on the UNRBA special study of sediment quality and release models developed by Dr. Marc Alperin at UNC described in the 2019 UNRBA Monitoring Report.

Total Nitrogen Load to Falls Lake

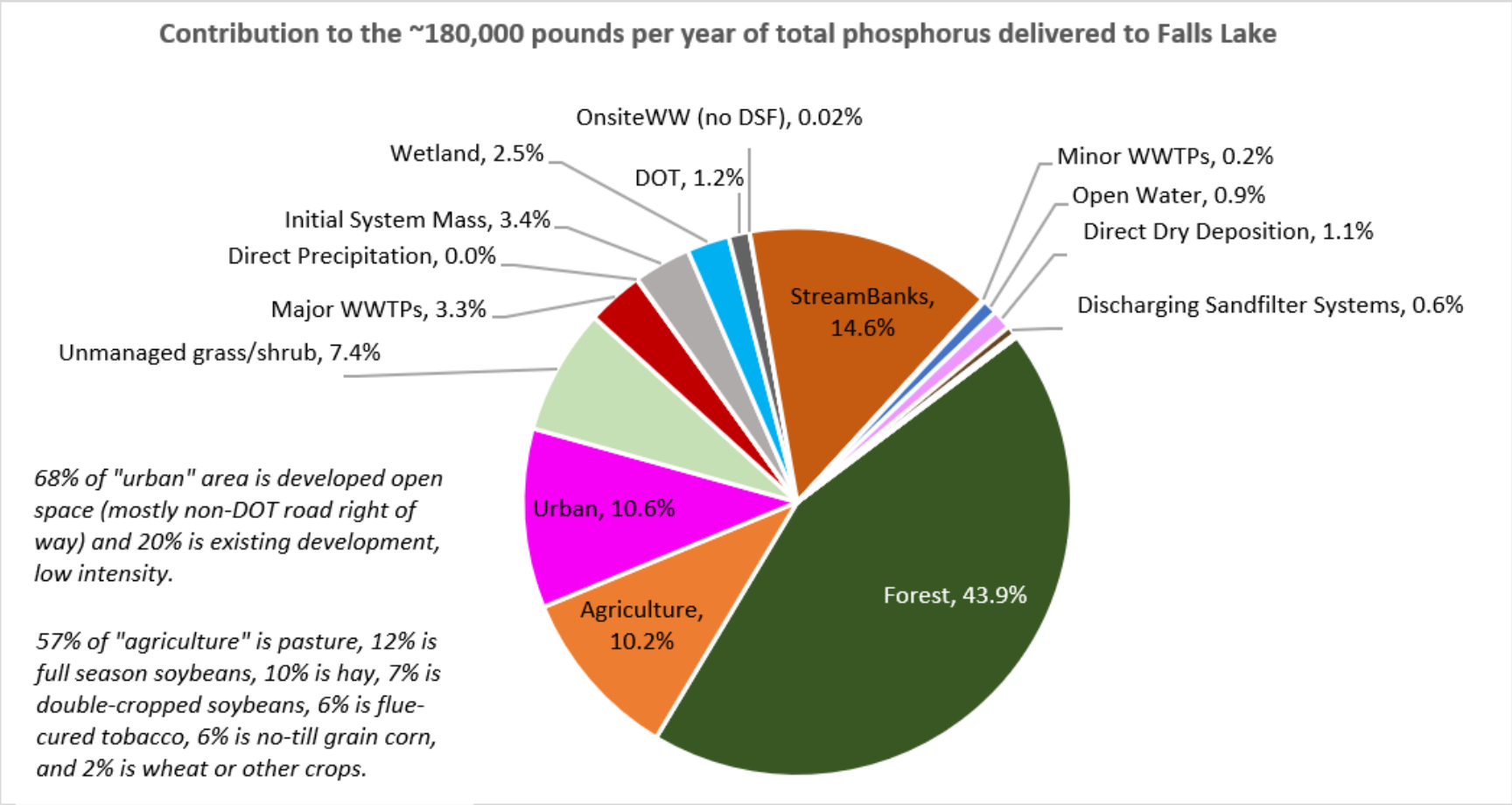
Land use or Source	% Watershed Area	% Total Nitrogen Load
Unmanaged land (forests, grass land shrubland, wetlands, open water)	74	48.3
Managed lands (urban, DOT, agriculture)	26	35.2
WWTPs (major, minor)	Not applicable	6.5
Direct deposition to lake surfaces	Falls Lake surface not included in the land use pie chart (+3%)	5.8
Onsite WW systems including DSF	Not applicable	2.0
Initial system mass	Not applicable	1.2
Stream banks	Not applicable	0.8

Percentages rounded to tenths of a percent sum to 99.8%.

Total Nitrogen Delivered to Falls Lake



Total Phosphorus Delivered to Falls Lake



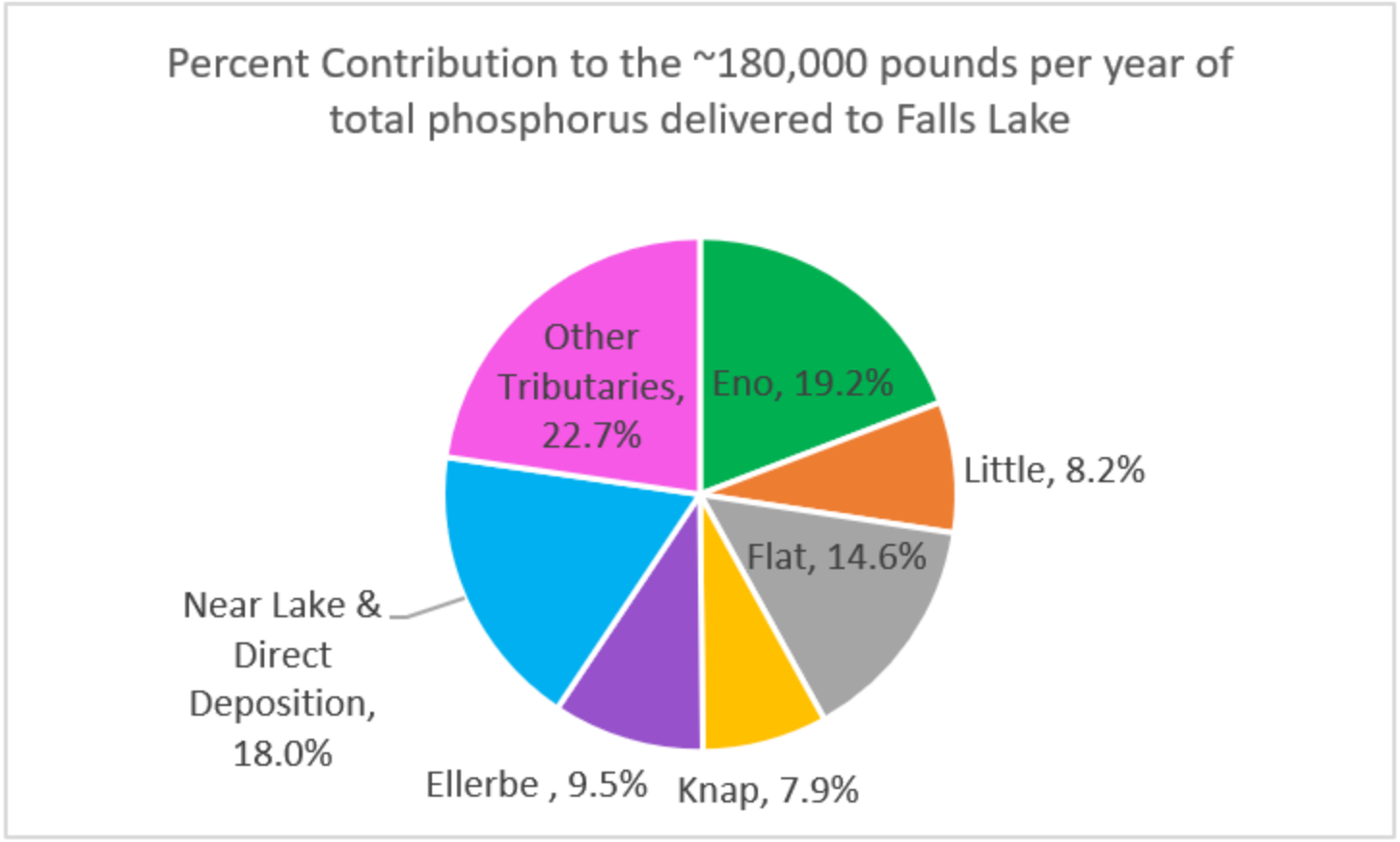
An additional ~14,000 pounds per year of phosphorus is released from the lake sediments into the water column of Falls Lake. This average annual estimate is based on the UNRBA special study of sediment quality and release models developed by Dr. Marc Alperin at UNC described in the 2019 UNRBA Monitoring Report.

Total Phosphorus Load to Falls Lake

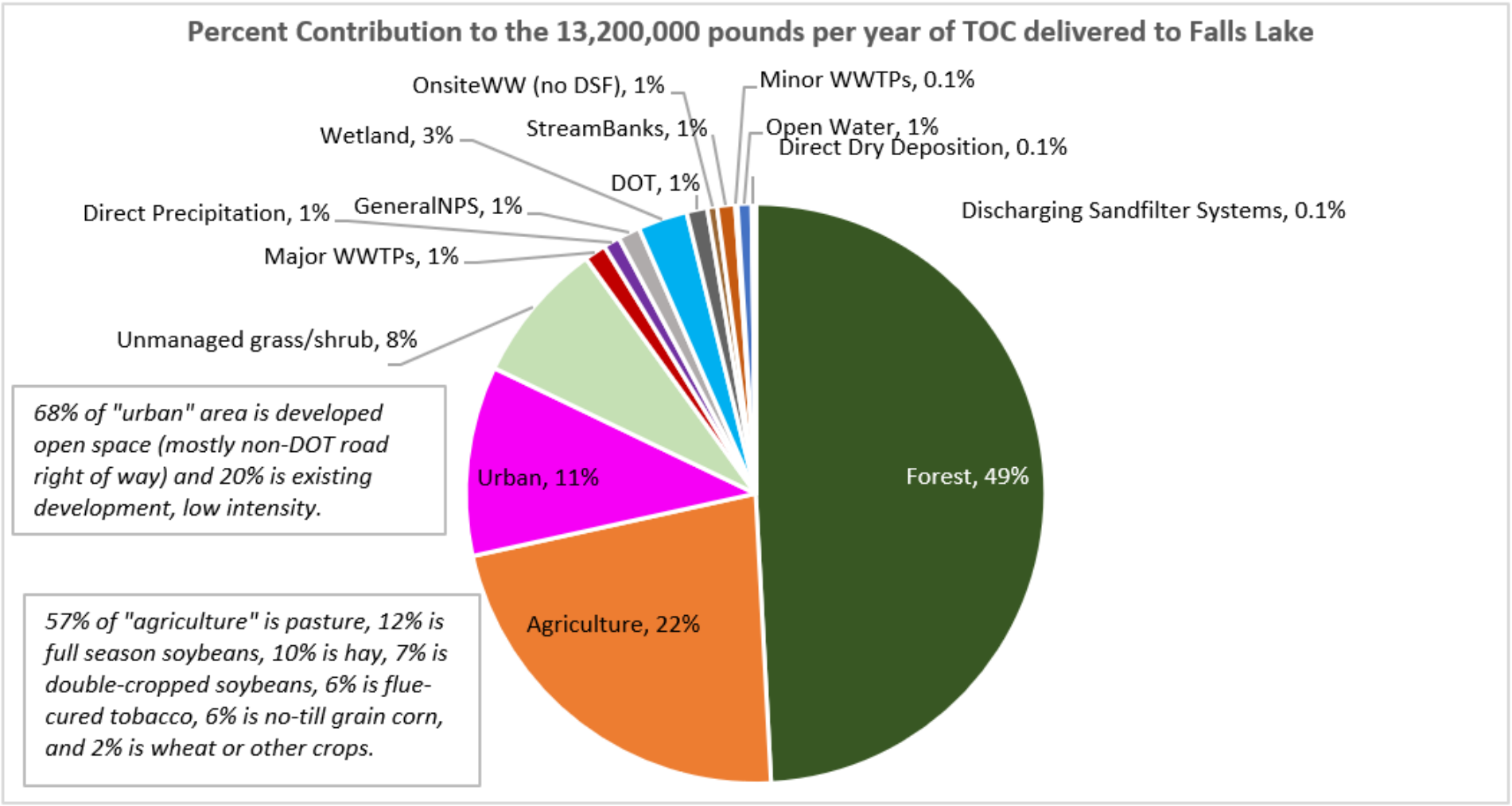
Land use or Source	% Watershed Area	% Total Phosphorus Load
Unmanaged land (forests, grass land shrubland, wetlands, open water)	74	54.7
Managed lands (urban, DOT, agriculture)	26	22.0
Stream banks	Not applicable	14.6
WWTPs (major, minor)	Not applicable	3.5
Initial system mass	Not applicable	3.4
Direct deposition to lake surfaces	Falls Lake surface not included in the land use pie chart (+3%)	1.1
Onsite WW systems including DSF	Not applicable	0.6

Percentages rounded to tenths of a percent sum to 99.9%.

Total Phosphorus Delivered to Falls Lake



Total Organic Carbon Delivered to Falls Lake

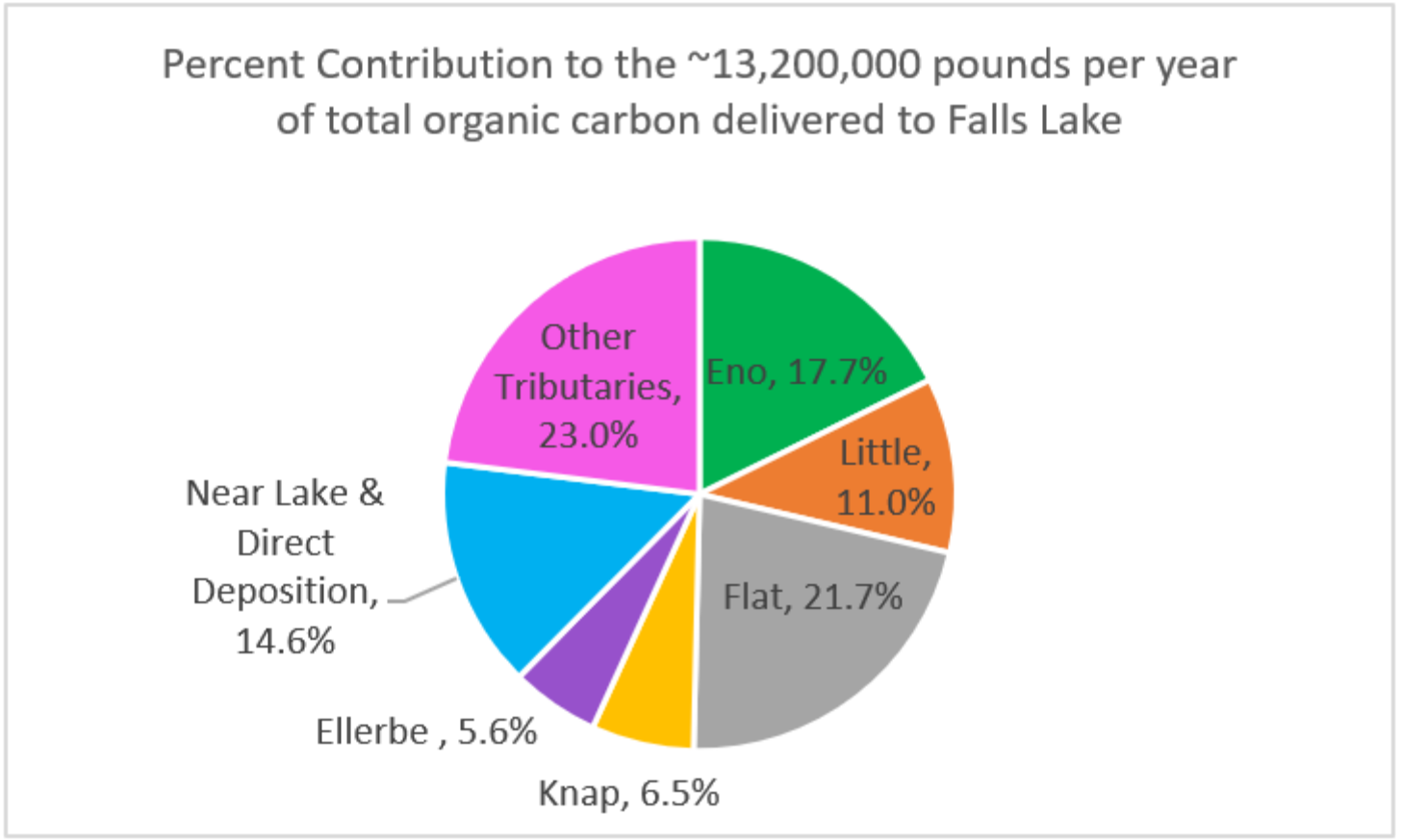


Total Organic Carbon Load to Falls Lake

Land use or Source	% Watershed Area	% Total Organic Carbon Load
Unmanaged land (forests, grass land shrubland, wetlands, open water)	74	61
Managed lands (urban, DOT, agriculture)	26	34
Stream banks	Not applicable	1
WWTPs (major, minor)	Not applicable	1.1
Initial system mass	Not applicable	1
Direct deposition to lake surfaces	Falls Lake surface not included in the land use pie chart (+3%)	1.1
Onsite WW systems including DSF	Not applicable	1.1

Percentages rounded to tenths of a percent sum to 100.3%.

Total Organic Carbon Delivered to Falls Lake



Lake Modeling Status and Scenario Screening Workgroup Status

EFDC and WARMF Lake Modeling

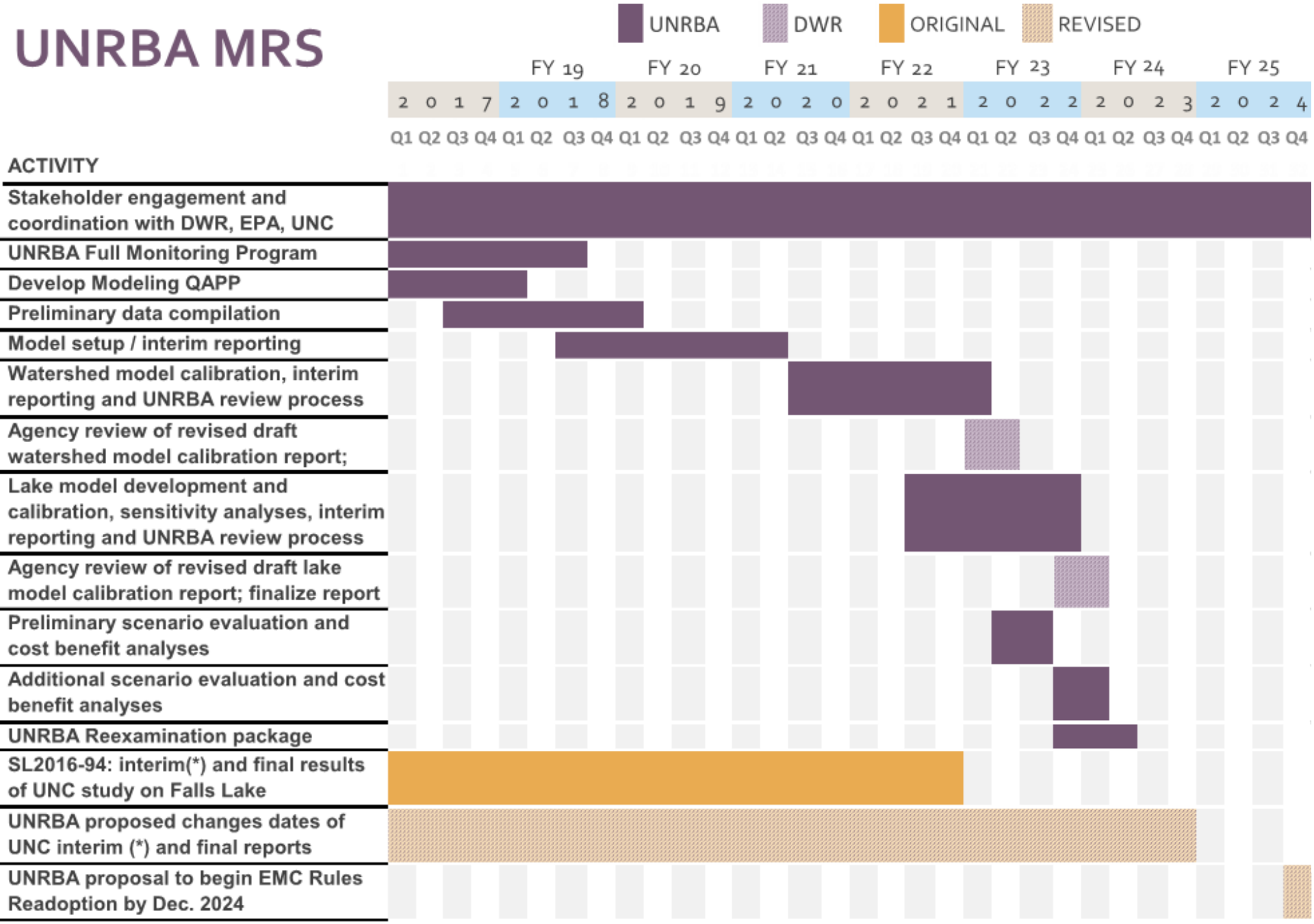
- Both models have transitioned to water quality calibration where the model parameters will be adjusted to provide a good fit to observed data
- Both models use the simulated stream flows and concentrations from WARMF to account for watershed loading to Falls Lake

Scenario Screening Workgroup Status

- Developing a selection process for choosing scenarios and a preliminary list of scenarios to evaluate
- The 9th meeting for workgroup was held January 24, 2022
- Two subgroups of this workgroup are working on scenario forms for scenarios preliminarily assigned a high priority

Re-examination Schedule

UNRBA MRS


UNRBA
DWR
ORIGINAL
REVISED
FY 19
FY 20
FY 21
FY 22
FY 23
FY 24
FY 25
2017 2018 2019 2020 2021 2022 2023 2024 2025
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
ACTIVITY
Stakeholder engagement and coordination with DWR, EPA, UNC
UNRBA Full Monitoring Program
Develop Modeling QAPP
Preliminary data compilation
Model setup / interim reporting
Watershed model calibration, interim reporting and UNRBA review process
Agency review of revised draft watershed model calibration report;
Lake model development and calibration, sensitivity analyses, interim reporting and UNRBA review process
Agency review of revised draft lake model calibration report; finalize report
Preliminary scenario evaluation and cost benefit analyses
Additional scenario evaluation and cost benefit analyses
UNRBA Reexamination package
SL2016-94: interim(*) and final results of UNC study on Falls Lake
UNRBA proposed changes dates of UNC interim (*) and final reports
UNRBA proposal to begin EMC Rules Readoption by Dec. 2024

Status of Proposed Chlorophyll-a Site Specific Standards for High Rock Lake

Status of Proposed Chlorophyll-a Site Specific Standards for High Rock Lake

- During the January 19, 2022, meeting, the UNRBA Board authorized the Executive Director to
  - submit letters on behalf of the Association to encourage consideration of the comments offered to the EMC and,
  - if necessary, develop and send a letter of objection to the Rules Review Commission (RRC) should the EMC adopt a final site-specific standard for High Rock Lake that fails to adequately address the substantial and valid concerns raised in the UNRBA's comments.
- This authorization also includes contact and coordination with the individual UNRBA member jurisdictions for the consideration of formal objection letters from these jurisdictions should a UNRBA letter be needed.

Status 2022 DRAFT NC DWR 303(d) List and Integrated Report

2022 303(d) list and Integrated Report

- 2022 Draft 303d list is located on the DWR Web Site.

https://deq.nc.gov/about/divisions/water-resources/water-planning/modeling-assessment/water-quality-data-assessment/integrated-report-files

- The 2022 Draft Integrated Report (IR) is also posted for public review. The IR includes Falls Lake Assessments.
- Deadline for commenting on the Draft 2022 303(d) list is February 28, 2022
- DWR on track for submittal to EPA by April 1, 2022

Summary DWR Draft 2022 303(d)
New Listings above Falls Lake Dam

- Lick Creek Arm of Falls Lake adds 474.6 Acres
  Turbidity Category 5 Exceeding Criteria
- Beaverdam Creek Reservoir adds 291.7 acres
  from backwaters to 1.5 miles upstream of the dam
  Chlorophyll-a Category 5 Exceeding Criteria
- Little River Reservoir (adds 32.4 acres) from
  0.1 mile ups of SR 1461 to dam
  Chlorophyll-a Category 5 Exceeding Criteria
- East Fork Eno River (Lake Orange) From source to Eno River
  adds 143.6 Acres
  Chlorophyll-a Category 5 Exceeding Criteria

Summary DWR Draft 2022 303(d)
Legacy (older) Listings above Falls Lake Dam

	Year listed
• Falls Lake From source to I-85 bridge	Turbidity 2008
• Falls Lake From I-85 bridge to Panther Creek	Turbidity 2010
• Ledge Creek (Lake Rogers)	Chlorophyll-a 2018
• Lick Creek	Benthos 1998
• Upper Barton Creek	Benthos 2008
• Flat River	Dissolved Oxygen 2008
• Knapp of Reeds Creek	Zinc 2008 Benthos 1998
• Ellerbe Creek	Fish Community 1998 Benthos 2008
• Little Lick Creek	Benthos 1998 Dissolved Oxygen 2008 Turbidity 2008

Summary DWR Draft 2022 Integrated Report (Tier 3 stations) Chlorophyll-a above Falls Lake Dam

	2022 /2020	N	% exceed
• From source to I-85 bridge (1)	4b 4b	53	60%
• From I-85 bridge to Panther Creek (2)	4b 4b	111	46%
• From Panther Cr to Ledge Cr Arm (6)	4b 4b	290	33%
● Ledge Creek Arm (1)	3b 3b	53	9%
• Fr Ledge Cr Arm to Lick Creek Arm (3)	4b 4b	145	28%
• Lick Cr Arm (2)	4b 4b	143	27%
• From Lick Cr Arm to NC 50 (2 tier 2)	4b 4b	246	28%
• From NC 50 to New Light Cr segment (2)	4b 4b	114	19%
• New Light Cr segment (1)	4b 1b”I”	58	17%
• Fr New Light Cr to Lower Brt Cr Arm (4)	4b 4b	255	14%
● From L Barton Cr Arm to Falls Dam (3)	4b 1b	264	11%
• L Barton Cr Arm (1)	4b 3b	58	28%

Summary DWR Draft 2022 Integrated Report
Tier 3 observations Chlorophyll-a Falls Lake

		NCSU	DWR
From source to I-85 bridge (1)	4b	53	0
From I-85 bridge to Panther Creek (2)	4b	56	55
From Panther Cr to Ledge Cr Arm (6)	4b	179	111
Ledge Creek Arm (1)	3b	0	53
Fr Ledge Cr Arm to Lick Creek Arm (3)	4b	59	86
Lick Cr Arm (2)	4b	88	55
From Lick Cr Arm to NC 50 (2 tier 2)	4b	246	0
From NC 50 to New Light Cr segment (2)	4b	58	56
New Light Cr segment (1)	4b	58	0
Fr New Light Cr to Lower Brt Cr Arm (4)	4b	115	110
From L Barton Cr Arm to Falls Dam (3)	4b	208	56
L Barton Cr Arm (1)	4b	58	0
Total Observations	1702	65%	34%

Details Ledge Creek Arm Chlorophyll-a Assessment DWR Draft 2022 Integrated Report

Assessment Number 27-(5.5)b2 Ledge Creek Arm of Falls Lake

- 2022 Draft Assessment Category 3b Data Inconclusive
  One Station DWR LC01
- 53 Observations 2016 – 2020
  5 observations exceeded 40 ug/L or 9% exceeded.
  Confidence that Criteria was Exceeded 38%
  Confidence that criteria was attained 44%
- 22 Observations 2019 - 2020
  2 observations exceeded 40ug/L

>10% Exceed Evaluation Level – NO (9% exceed evaluation level)
> 70% Confidence in meeting criteria – NO (44% confidence in meeting criteria)
Listed on Previous 303d – NO (2020 303d list does not include, 2020 IR category 3b)
<40 % Confidence in meeting criteria – NO (Confidence meeting criteria is 44%)
> 2 Excursions in New Data Years – NO Methodology Review Results: Meets Criteria

Details Chlorophyll-a Assessment Integrated Report

Assessment Number 27-(5.5) b4d2

Falls Lake from Barton Creek Arm to Falls Dam

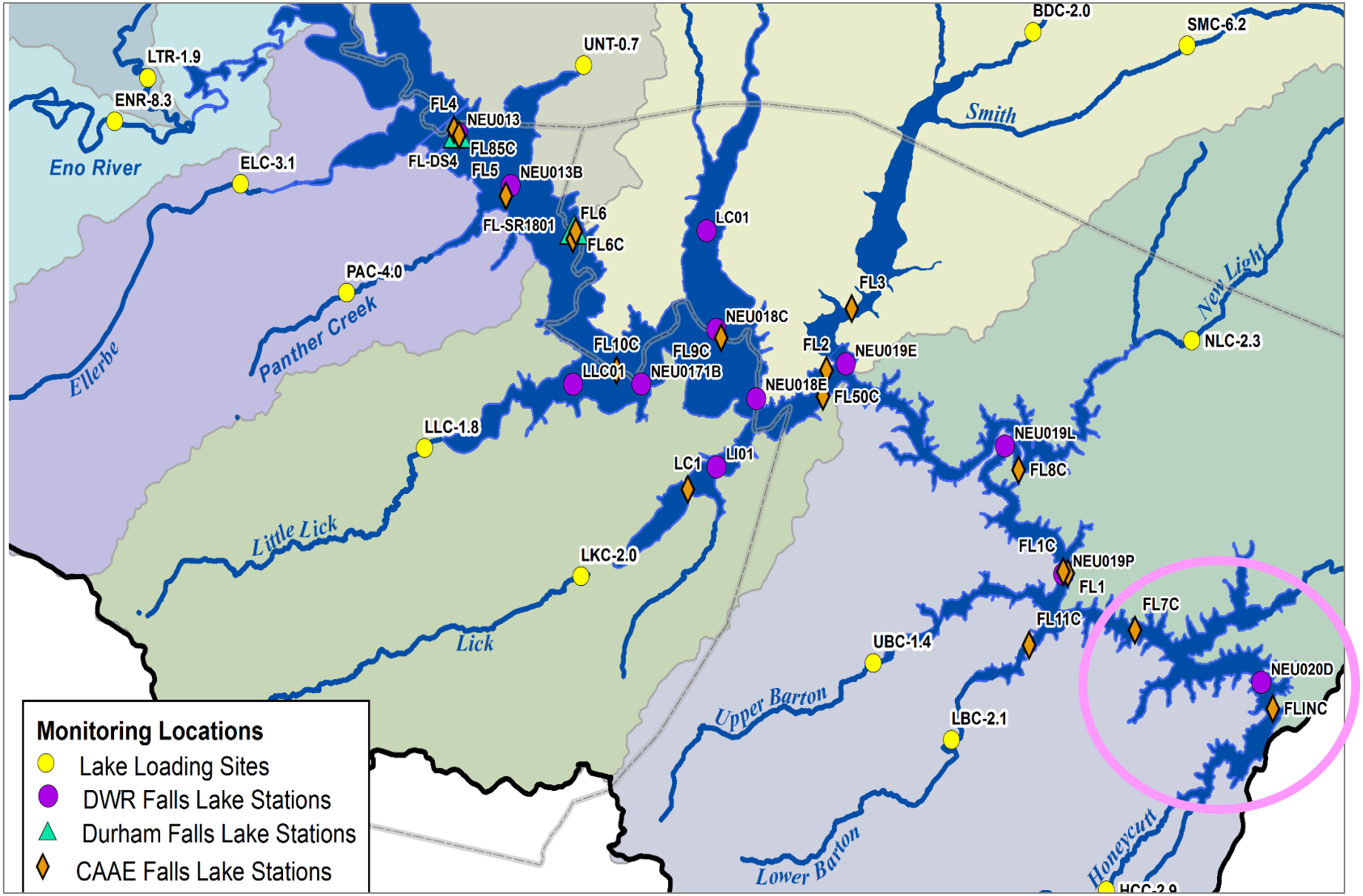
- 2022 Draft Assessment Category 4b "Criteria Status Meeting Criteria"
  Three Stations: DWR NEU020D, NCSU FLINC, NCSU FL7C

- 264 Observations 29 Exceeded 2016 – 2020 or 10.9 % (67% conf Exceed)
  FL7C 58 observations 10 exceeded or 17% exceeded (94%)
  FLINC 150 observations 15 exceeded or 10% exceeded (46%)
  NEU020D 56 observations 4 exceeded or 7% exceeded (18%)

>10% Exceed Evaluation Level – YES (10.9% exceed evaluation level)
> 90% Confidence in exceeding criteria – NO (67% confidence in exceeding criteria)
Listed on Previous 303d – NO (2020 303d list does not include, 2020 IR category 1b)
>3 Excursions in New Data Years with 90% conf exceeded – YES (29) with 93% conf in new data years Methodology Review Results: Exceeds Criteria

Cam McNutt: "The lower most AU in Falls will likely be split due to assessment differences between the intake stations and the CAAE site just up reservoir"

FLINC and NEU020D = 206 obs, 19 exceed, 9.2%, 32% conf exc, 61% conf meets, >2 excursions in 2019 & 2020 results in Data Inconclusive


BDC-2.0
SMC-6.2
LTR-1.9
UNT-0.7
ENR-8.3
FL4
NEU013
FL85C
FL-DS4
FL5
NEU013B
Eno River
ELC-3.1
FL-SR1801
FL6
FL6C
LC01
Smith
PAC-4.0
Panther Creek
Ellerbe
FL3
New Light
NEU018C
FL10C
FL9C
FL2
NEU019E
NLC-2.3
LLC01
NEU0171B
NEU018E
FL50C
LLC-1.8
NEU019L
LC1
LI01
FL8C
Little Lick
FL1C
LKC-2.0
NEU019P
FL1
FL7C
FL11C
Lick
UBC-1.4
NEU020D
FLINC
Upper Barton
LBC-2.1
Lower Barton
Honeycutt
HCC-2.9
Monitoring Locations
Lake Loading Sites
DWR Falls Lake Stations
Durham Falls Lake Stations
CAAE Falls Lake Stations

News Report:

How to Keep Pets Safe from Toxic Algae

News and Observer December 9, 2021

also...
- CBS 17
- newskudo
- WNCN

2A | THE NEWS & OBSERVER | THURSDAY DECEMBER 9 2021

How to keep pets safe from toxic algae

BY KORIE DEAN
kdean@newsobserver.com

A recent report of a dog dying after drinking water from the lake near Blue Jay Point County Park in northern Wake County is circulating on social media, renewing warnings about blue-green algae — a toxic, and sometimes lethal, algae that thrives in warm, slow-moving bodies of water.

Amy Walter reported the incident to the N.C. Department of Environmental Quality on Monday evening, according to the department's Fish Kill & Algal Bloom Dashboard.

In the report, Walter wrote that her dog drank from the lake near the park and died three days later. The report is currently listed as "in progress" on the dashboard, meaning that N.C. DEQ has received the report but has not yet confirmed whether blue-green algae is present at the location.

Blue-green algae poisoning was in the national spotlight in 2019 after four dogs in the Southeast, including three from Wilmington, died within a matter of days after drinking from or playing in lakes.

The algae is naturally occurring, but as global temperatures warm up, it could form more often.

"It's a growing problem not just here in North Carolina, but worldwide," said Dave Dorman, a professor of toxicology at N.C. State's College of Veterinary Medicine. "It's thought that it's due in part to global warming, that the longer summer seasons and increased use of fertilizers creates the growth conditions for the blue-green algae."

The News & Observer talked with Dorman to learn more about blue-green algae and the risk it poses to your pets.

Here's what we learned.

WHAT IS BLUE-GREEN ALGAE?

Though referred to as blue-green algae, it isn't actually algae — it's a naturally occurring bacteria called **cyanobacteria**.

- Cyanobacteria are photosynthetic bacteria that get their energy from light.
- Dorman said cyanobacteria can be found in almost any body of water, including salt and fresh bodies. According to the N.C. Division of Water Resources, cyanobacteria are present in most bodies of freshwater in North Carolina.
- Under certain conditions, such as under bright sunlight and warm temperatures, cyanobacteria can rapidly reproduce to form a **cyanobacterial bloom**.
- Blooms typically form during the **warm summer season**, or when water temperatures are warmer than usual. **Drought** has also been linked to an increase in harmful algal blooms, according to the Environmental Protection Agency.
- Once cyanobacteria bloom, they may be able to produce **toxins**, called cyanotoxins, which can cause illness in humans and animals that come into contact with water affected by a bloom. The toxins can be **lethal to animals**, mostly dogs and livestock.
- According to N.C. DEQ, there are no effective means of treating a cyanobacterial bloom once it appears. Treatment with algacides is not recommended, as they can cause the cyanobacteria to rupture and release toxins contained within the cells.

WHAT DOES BLUE-GREEN ALGAE LOOK LIKE?

Blue-green algae may or may not be visible on the surface of water as microscopic analysis is necessary to confirm the presence of cyanobacteria, but some signs that could indicate the presence of the bacteria in bodies of water are:

- **Discoloration of the water.** As its name suggests, "blue-green algae" can make water appear blue or green, but it can also make water take on other colors, including red and brown.
- **Surface scums.** Dorman said cyanobacteria can have a **"paint-like" appearance** on the surface of the water — as if someone had dumped paint in the water and it's now lingering on the surface.
- Floating or submerged **clumps, flecks or mats** of algae.
- **Decaying** cyanobacteria can produce milky blue and white surface scum.

Dorman noted that it can be easy to mistake **pine pollen** on the surface of water for cyanobacteria or algal blooms. **Remember:** Blue-green algae surface scums will generally have a paint-like appearance.

- If you think a body of water in North Carolina contains blue-green algae, or you're unsure, you can make a report with N.C. DEQ.

CAN BLUE-GREEN ALGAE HARM PETS?

Blue-green algae can cause illness to humans or animals that come into contact with water affected by a cyanobacteria bloom. It can be **lethal** for livestock and dogs.

- Dorman said illness is generally caused by the animals **drinking** water with the toxins, or getting the toxins in their skin by making contact with or submerging in the water — such as by **swimming**.

Dorman said there are generally two types of illness related to blue-green algae that occur in animals:

- **Liver damage to the animal.** This type of illness generally produces symptoms within two to three days of ingesting or making contact with the water.
- **Neurological damage to the animal.** This type of illness is much more rapid, with the animal showing symptoms within minutes or hours of ingesting or making contact with the water.

Illness with symptoms including itching, redness and blistering of the skin may also be possible within hours of contact, according to Veterinary Centers of America (VCA). These signs are not fatal, but may take several days to weeks to resolve, which can be uncomfortable for your animal.

The type of illness that an animal contracts generally depends on the class of toxins each algal bloom contains, Dorman said. Some algal blooms aren't toxic, but there's no way to tell just by looking at them, he said.

WHAT ARE THE SYMPTOMS FOR A DOG WITH BLUE-GREEN ALGAE POISONING?

If your dog has **liver damage** from blue-green algae, symptoms might include:

- Weakness
- Lethargy
- Vomiting
- Diarrhea
- Pale gums
- Jaundice of the gums and skin

Signs of **neurological damage** to your dog caused by blue-green algae include:

- Weakness or inability to walk
- Seizures
- Muscle tremors and rigidity
- Paralysis
- Increased salivation
- Difficulty breathing
- Disorientation

WHAT SHOULD I DO IF I THINK MY DOG HAS BLUE-GREEN ALGAE POISONING?

If your dog gets sick after ingesting or swimming in water, Dorman said it is an **emergency situation** and you should **immediately seek medical care** for your pet by **contacting your local veterinarian.**

- The ASPCA also offers a national hotline for any animal poison-related emergencies. If you think your pet may have ingested a potentially poisonous substance, you can **call 888-426-4435.** A consultation fee may apply.
- The national **Pet Poison Helpline** is also available. The helpline staff provides treatment advice for poisoning cases of all species, including dogs, cats, birds, small mammals, large animals and exotic species. The helpline charges **$65 per incident**, which includes all follow-up consultations. You can call the helpline at **855-764-7661.**

Dorman said some animals can recover from illnesses caused by blue-green algae, but there is not a specific antidote to treat the poisoning. Instead, veterinarians can offer treatment for specific signs or symptoms that the animal is showing, offering **symptomatic and supportive care.**

- VCA says if the possible illness is caught before clinical signs occur, therapy can be directed at ridding the body of the toxin, such as by pumping the animal's stomach.
- Because the toxins can enter the animals body so quickly, though, it is often too late to treat the animal once symptoms emerge.

"Despite aggressive treatment, the prognosis with blue-green algae toxicity is very poor," VCA says. "Some animals actually pass away before reaching a veterinarian."

HOW CAN I PREVENT MY PET FROM GETTING BLUE-GREEN ALGAE POISONING?

The best way to prevent your pet from developing blue-green algae poisoning is by **keeping them away** from waters that may have blue-green algae.

- Dorman recommended regularly checking DEQ's dashboard for any reports of fish kills or algal blooms at locations you frequent with your dogs, such as ponds, lakes and parks.
- Always pay attention to the appearance of bodies of water. If they show any signs of blue-green algae, do not let your pet go near the water.
- If you see a fish kill, also known as a fish die-off, in the water near somewhere you've taken your dog to walk, avoid the water. Fish kills are a sign of algal bloom activity.

The N.C. Department of Health and Human Services offers the following tips to safeguard humans and pets from cyanobacteria:

- Keep children and pets away from waters that appear discolored or scummy.
- Do not handle or touch large accumulations of algae, also called "scums" or "mats".
- Do not water ski or jet ski over algal mats.
- Do not use scummy water for cleaning or irrigation.
- If you accidentally come into contact with an algal bloom, wash thoroughly.
- If your child appears ill after being in waters containing a bloom, seek medical care immediately.
- If your pet appears to stumble, stagger, or collapse after being in a pond, lake or river, seek veterinary care immediately.
- If you are unsure whether or not a bloom is present, it is best to stay out of the water.

HOW TO REPORT ALGAL BLOOMS

If you suspect a blue-green algae bloom in your community, you can report it to N.C. DEQ using the department's **reporting app** or by contacting your **DEQ regional office.**

- Find the reporting app at: survey123.arcgis.com/share/c23ba14c74bb47f3a8aa895f1d976f0d?portalUrl=https://ncdenr.maps.arcgis.com
- Find your regional office at deq.nc.gov/about/contact/regional-offices.
- You can also call the N.C. Division of Water Resources (DWR) emergency hotline at **1-800-858-0368.**

When public health concerns arise from algae blooms, local health departments and NCDHHS determine an appropriate response with technical support from DWR.

- Common actions include swimming closures, contact advisories and the issuance of public notifications.

Korie Dean: 919-335-8507, @koriedean

Report to DWR and DWR Follow-up Testing

- **Amy Walter** reported to DWR 12/6/2021, dog drank from lake around Thanksgiving and three days later dog died.
- **Daniel Wiltsie**, DWR Algal Bloom Response Coordinator. algal and microcystin samples collected 12/7/21 east of Blue Jay Park. Pseudanabaena and Cylindrospermopsis were present but algae below algal bloom levels. Toxin test results for microcystin were below method detection limit. DWR November Falls samples "normal".
- **Kennedy Holt**, DHHS, Occupational and Environmental Epidemiology. Conversation with owner. Dog off leash walking around the lake, dog "had a few laps of water from the lake". Perhaps a mid sized dog. Owner took dog to vet lethargic, limp, no samples analyzed, no lab work. No confirmation tests. Dog euthanized. Owner wanted to make other dog owners aware. Did not want to make "a big production out of it"

Conclusions

- Appears to be a single report as mini survey of area veterinarians by the media yielded only this report.
- Veterinarian samples from the dog were not collected.
- Falls Lake algae were below bloom levels.
- Microcystin sample below detection.
- Location of Blue Jay Point County Park is in lower Falls Lake below Highway 50 and below Highway 98. This area typically has lower concentrations of algae than further upstream.
- <u>Available evidence can not confirm the possibility that this was an episode of algal toxin exposure.</u>
  - Mushroom poisoning has similar effects
  - Anatoxin algal poisoning normally has a rapid response (hours)
  - Delays in reporting and sampling contribute to the unknowns
  - Multiple lines of evidence suggesting algal toxicity are missing

Statistical Model Development and Regulatory Options for the Chlorophyll-a Water Quality Standard

Planning for Development of a Petition for Site Specific Criteria

- A primary task for the legal team is to begin consideration of a petition for site specific criteria for Falls Lake
- The UNRBA Statistical Model of Falls Lake will be used to support this effort
- Evaluation of other State's site-specific standards for chlorophyll-a and nutrient-related standards is ongoing.
- The legal team and the statistical modeling team are coordinating on this effort as well as with Dr. Marty Lebo and the Environmental Finance Center funded by the UNC Collaboratory.
- Evaluation of other State's site-specific standards for chlorophyll-a and nutrient-related standards is ongoing.

Status of Statistical Model Development

- Modelers are continuing to meet virtually with local experts to discuss available information on satisfaction with designated uses
- The contacts and information provided will be reviewed by the Technical Advisors Workgroup at an upcoming meeting, then presented to the PFC
- Modelers are continuing to compile and format data to begin model building
- Reporting is ongoing

Communications Support

Continued Coordination with the UNC Collaboratory

- The UNRBA and UNC Collaboratory met virtually to plan for a joint symposium to be held in Spring 2022; discussions of dates and potential venues are ongoing
- The two organizations are also presenting a full session at the March 2022 Water Resources Research Institute Annual Conference (March 23rd at 3 PM)
- The Falls Lake researchers will continue presenting at upcoming UNRBA MRSW and PFC meetings to ensure the modeling team is integrating these studies into the models
- The UNRBA Modeling Team has been and will continue to reach out to the Falls Lake researchers as the modeling progresses to ensure the best science and available information is incorporated
- The UNRBA Executive Team is coordinating with staff from the Environmental Finance Center to provide information that may be relevant to their Year 3 scope of work

UNRBA Technical Stakeholder Workshop

- The UNRBA Technical Stakeholder Workshop was postponed until FY2022 (this fiscal year) due to COVID-19 and the Collaboratory/UNRBA Symposium.
- Unclear if the workshop can be in person, virtual, or a hybrid
- We have discussed holding this workshop in the Spring and focusing on watershed modeling results; the spring is busy with other communication efforts
- Holding the meeting in the fall would allow calibration of the lake models and evaluation of some scenarios for presentation
- Potential management options for a revised strategy could be discussed during the breakout portion of the meeting

Meetings with DWR, DEQ, and EPA

- The Executive Director and the UNRBA Chair along with members of the legal group met with Secretary Elizabeth Biser on December 13, 2021, to review the work of the UNRBA with the Department of Environmental Quality's leadership
- The UNRBA is planning meetings with DWR to review the technical work and discuss the general approach for the re-examination.
- We continue to engage DWR in the meetings of the MRSW and PFC and to seek the input of the agency on the model development work.
- Fred Andes at Barnes and Thornburg is looking into opportunities (conferences/meetings) to highlight the work of the UNRBA to EPA

External Stakeholder Communication Needs

- Objectives continue to be reviewed relative to communication opportunities with stakeholders.
- To support the re-examination process and achieve broad support for the UNRBA recommendations, additional outreach to external stakeholders including DWR, DEQ, and other interested stakeholders is needed;
- Coordination with local leaders to convey messages and facilitate outreach will be necessary.
- This effort will require the support of the UNRBA membership, staff and Board representatives.
- As a reminder, the Infographic and Fast Facts are available online https://upperneuse.org/resource-library
- An Overview of the Work of the UNRBA provided to the UNC Collaboratory for inclusion in their reporting is available online https://nutrients.web.unc.edu/resources/

Other Status Items

Ongoing Items

- Intensive workgroup activity and management of expectations and resources—A lot to do between now and recommendations in 2023
- Ongoing DEQ/DWR Items
  - MOA
  - Neuse Watershed Model Information Session – Delivery Factors for WWTP

Future Meetings as Currently Scheduled:

Next MRSW or PFC Meeting: March 1, 2022, 9:30 AM to Noon

Next BOD Meeting: March 16, 2022, 9:30 AM to Noon

Closing Comments
Additional Discussion