Modeling and Regulatory Support Workgroup Meeting
Remote Access, March 1, 2022

Unrba

Brown AND Caldwell

SYSTECH WATER RESOURCES

Dynamic Solutions LLC

Remote Access Options

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Remote Access Guidelines

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Agenda

- Opening Comments, Agenda Review/Revisions
- Modeling and Regulatory Support Status
- MRSW Workgroup Reports
- Plan for Statistical Model Development and Regulatory Options for the Chlorophyll-a Water Quality Standard
- Communications Outreach and Preparation
- Upcoming WRRI Annual Conference Presentation with the NC Collaboratory (March 23, 2022)
- Upcoming Joint Symposium with the NC Collaboratory (April 7, 2022)
- Transfer of Asset Purchased for UNRBA Monitoring Program
- Discussion of Potential IAIA Reporting Dates

Modeling and Regulatory Support Status

WARMF 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)
- 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.
- Additional loading summaries by tributary and county are under development and will be provided as an appendix to the watershed modeling report.
- A summary of the Executive Summary follows

Executive Summary – Report Purpose

- The UNRBA's Watershed Analysis Risk Management Framework (WARMF) watershed modeling effort followed
  - DWR-approved UNRBA Description of the Water Quality Modeling Framework
  - UNRBA Modeling Quality Assurance Project Plan (QAPP)
- Approval of the watershed model is requested under rule 15A NCAC 02B.0275(5)(f), which states in summary that any model submitted must be develop "in accordance with the quality assurance requirements of the Division."
- The report documents the extensive work performed to develop the UNRBA's Falls Lake Watershed model and will accompany submittal of the model for approval under Falls Lake Rule 15A NCAC .0275.
- Computer files developed for this watershed model will also be made available to DWR for review and evaluation

Executive Summary – Background

- Summarizes previous UNRBA efforts to support the re-examination:
  - UNRBA Description of the Modeling Framework,
  - UNRBA Monitoring Plan and UNRBA Monitoring QAPP
  - UNRBA Modeling QAPP
  - Evaluation and Selection of Model Packages for the UNRBA Modeling and Regulatory Support Project
  - Conceptual Modeling Plan
  - Data Management Plan
  - Four-year monitoring program
  - 2019 UNRBA Monitoring Report
  - Status updates and special meetings (UNRBA Meeting Page)
  - UNRBA Decision Framework

Executive Summary – Stakeholder Input

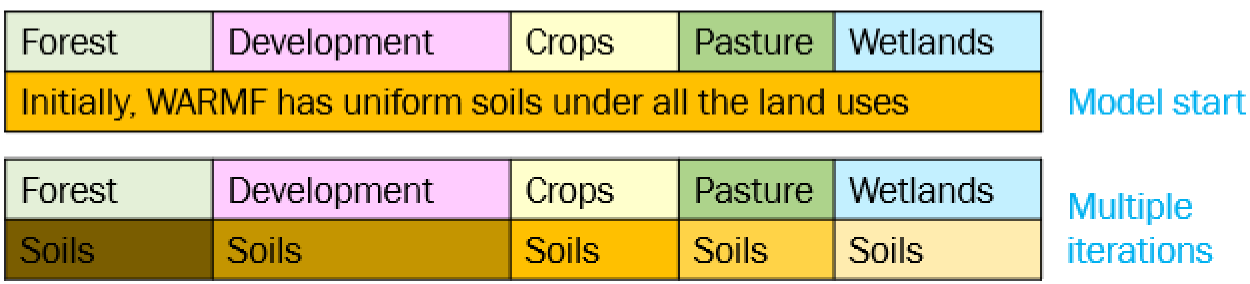
- The UNRBA is committed to an open and well vetted model development process.
- Data collection for critical components of the model preparation effort would not have been possible without the cooperation, support, and work of the
  - UNRBA member jurisdictions, MRSW, and PFC
  - NC Department of Agriculture's Division of Soil and Water, local Soil and Water Conservation Districts, the NC Farm Bureau, and the Falls Lake Watershed Oversight Committee (WOC)
  - NC State's Climate Office (SCO)
  - NC's Department of Transportation (DOT)
  - NC Division of Water Resources (DWR)
  - NC Wildlife Resources Commission (WRC)
  - Representatives from non-governmental organizations (NGOs).
- The UNRBA extends many thanks to these organizations and the dedicated staff that develop and maintain these critical data sources.

Executive Summary – Workshops/Forums

- Three Technical Stakeholders Workshops
- MRSW meetings began in 2019
- February 12, 2020, UNRBA Regulatory Forum
- May 19, 2021, joint symposium with the NC Collaboratory
- A fourth technical stakeholder workshop and second joint symposium are planned for 2022
- The executive summary briefly describes what was presented at each special meeting and what types of input was provided by stakeholders
- UNRBA has worked closely with researchers funded by the NC Collaboratory to conduct research in Falls Lake and its watershed
- UNRBA has also coordinated closely with DWR modeling staff, third-party reviewers funded by the NC Policy Collaboratory, and technical subject matter experts to
    - Evaluate the model and provide input on concerns, questions, or issues identified as the model was being developed
    - Participate in routine and special meetings to address questions

Executive Summary – Model Characteristics and Development

- Description of the WARMF model
  - How WARMF simulates nutrient loading
  - How WARMF differs from other models
- Modeling option to separate soils under land use classes
- Model code revisions to simulate more than three (default) types of onsite wastewater treatment systems



Executive Summary – Nutrient Inputs to the System

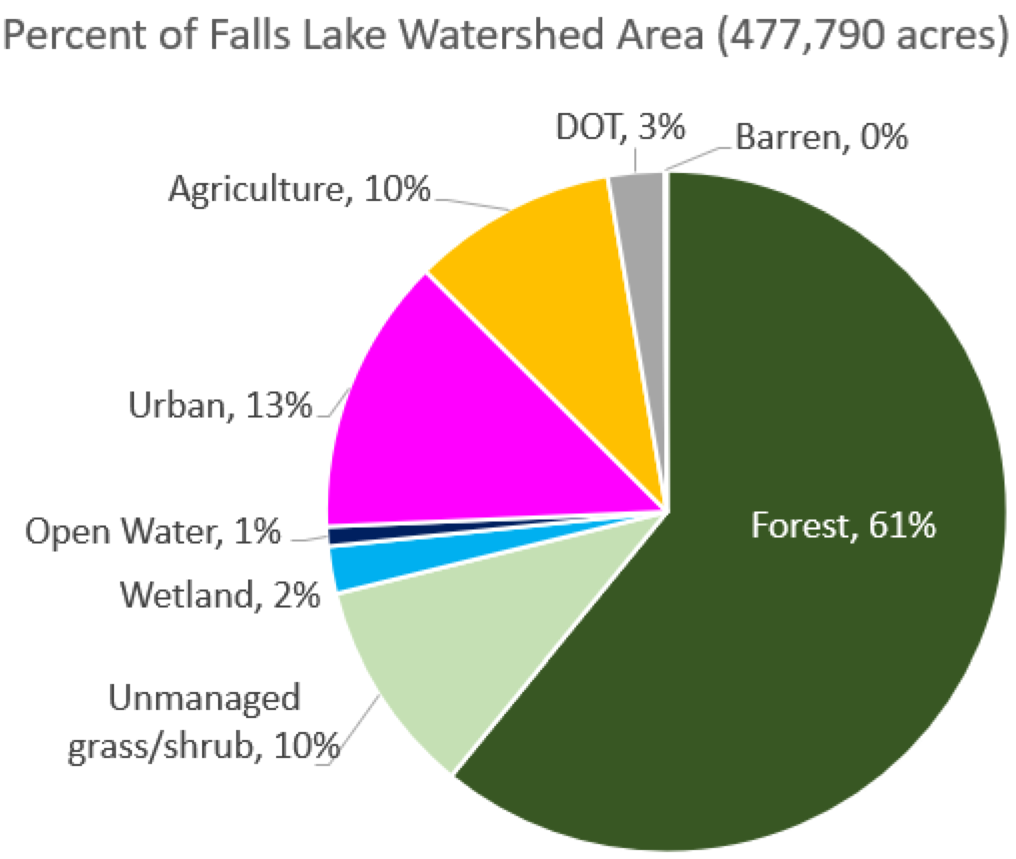
- External sources of nitrogen and phosphorus enter the Falls Lake watershed system on the vegetation or land surface, subsurface, or as discharges to streams and rivers.
- Nutrients are stored in the watershed soils and lake sediments based on past inputs, vegetative removal or recycling, and physical, chemical, and biological transformations that occur in the groundwater and the soils.

Executive Summary – Land Use Summary

Agriculture (10% of watershed):
- 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):
- 68% “developed open space” (mostly road rights of way (not DOT), parks, etc.)
- 20% existing development, low intensity.

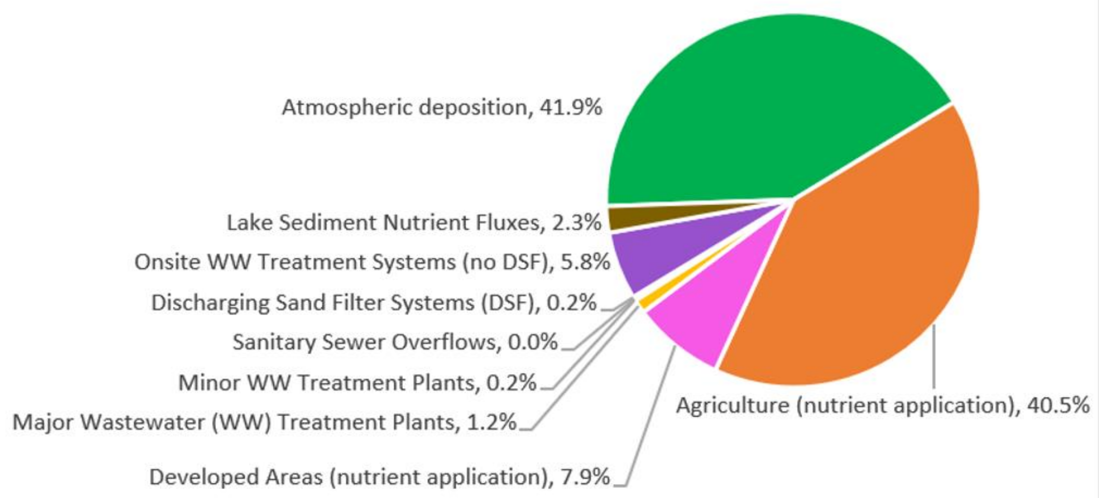
Unmanaged land uses (74% of the watershed):
- 61% forests
- 10% unmanaged grass/shrubland
- 2% wetlands
- 1% open water



Executive Summary – Total Nitrogen Inputs to the System

- For the recent modeling period ~8.8 million pounds of total nitrogen are input the watershed
- Watershed processes reduce this load by 81 percent before it reaches Falls Lake
- In the baseline period, the total nitrogen inputs were 13.9 million pounds per year
- Inputs for the recent period are ~37 percent lower than baseline

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

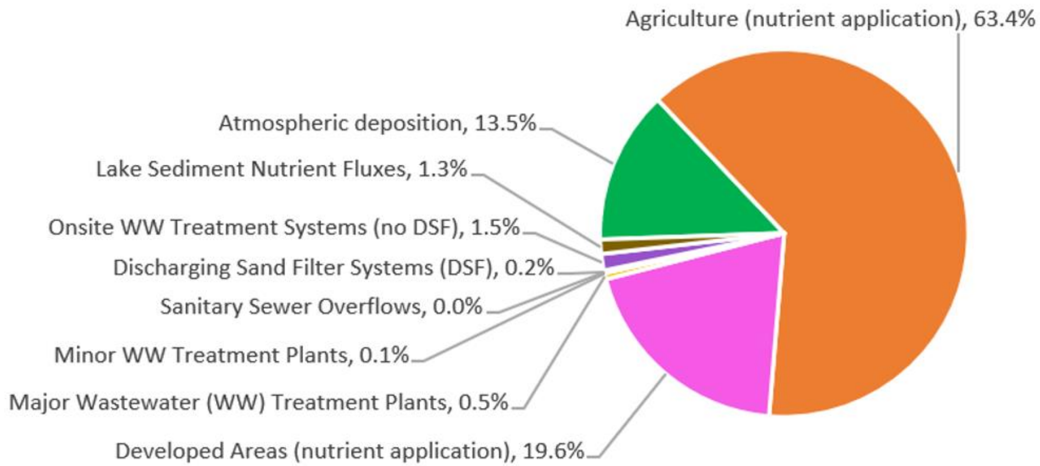


Watershed processes reduce the total nitrogen load by approximately 81 percent prior to delivery to Falls Lake.

Executive Summary – **Total Phosphorus Inputs to the System**

- For the recent modeling period ~1.1 million pounds of total nitrogen are input the watershed
- Watershed processes reduce this load by 84 percent before it reaches Falls Lake
- In the baseline period, the total nitrogen inputs were 1.6 million pounds per year
- Inputs for the recent period are ~29 percent lower than baseline

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.

Executive Summary – Hydrologic Calibration

Table ES-1. Hydrologic Performance Rankings for the Recent Period (2015-2018)

Volume	Ellerbe - Club Boulevard (0208675010)	*Ellerbe - Gorman (02086849)	Eno - Hills-borough (02085000)	*Eno - Durham (02085070)	Flat - Bahama (02085500)	*Flat - Dam Near Ba-hama (02086500)	*Knap Of Reeds - Butner (02086624)	Little River - Orange Factory (0208521324)
Total	Good	Good	Very Good	Good	Good	Good	Very Good	Good
Annual	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
50% lowest flows	Low	Very Good	Very Good	Fair	Very Good	Good	Low	Very Good
10% highest flows	Very Good	Good	Very Good	Very Good	Good	Good	Fair	Very Good
Summer	Good	Very Good	Very Good	Very Good	Good	Good	Very Good	Very Good
Fall	Very Good	Very Good	Very Good	Good	Very Good	Very Good	Fair	Very Good
Winter	Good	Very Good	Very Good	Good	Very Good	Very Good	Very Good	Very Good
Spring	Good	Very Good	Good	Very Good	Good	Fair	Good	Good

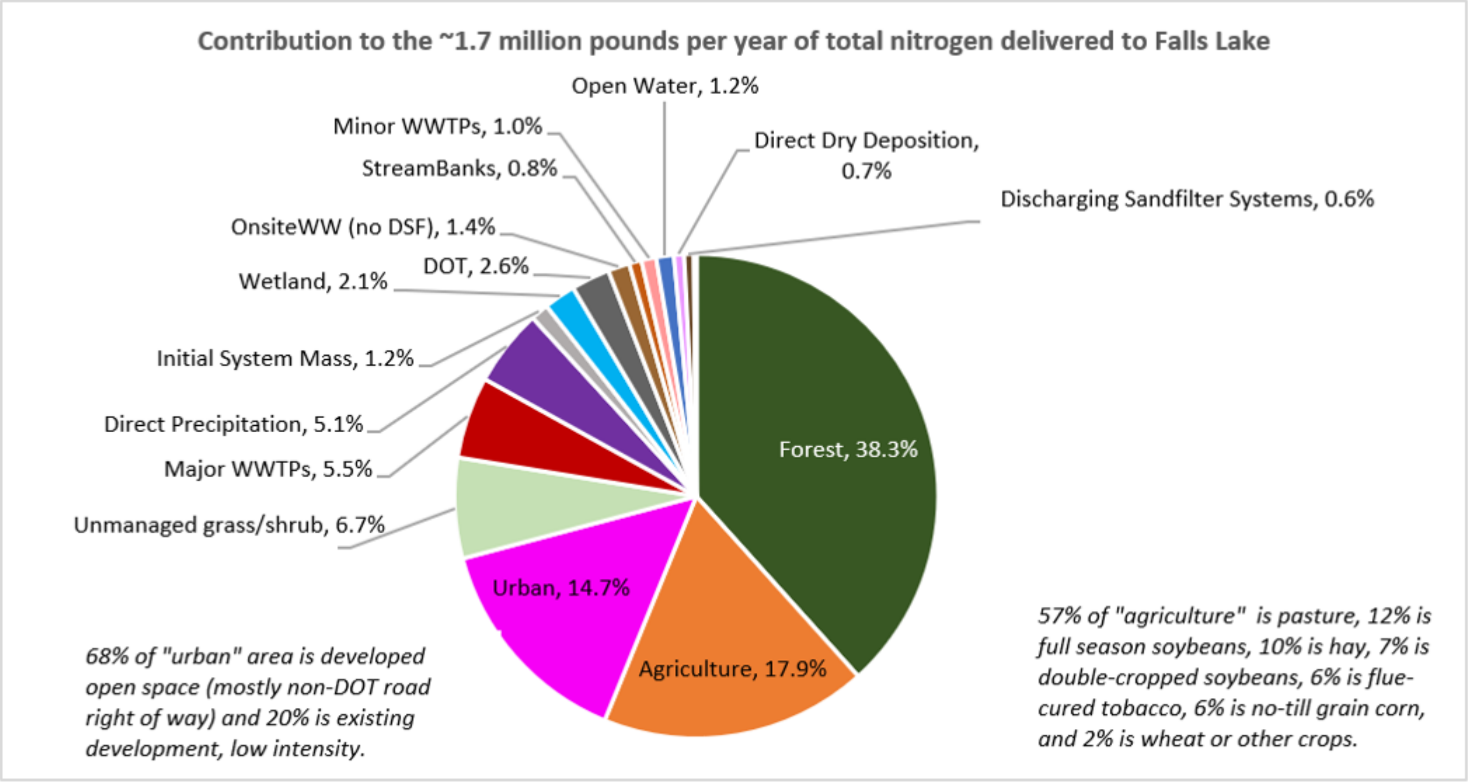
Performance criteria are described in the UNRBA Modeling QAPP.

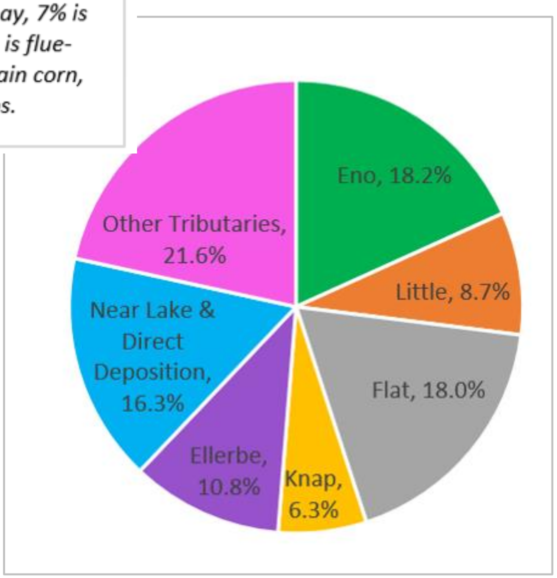
Executive Summary – Water Quality Calibration

Table ES-2. Water Quality Performance Rankings for the Recent Period (2015-2018) for the Five Largest Tributaries					
Parameter	Ellerbe	Eno	Flat	Little	Knap
Temperature[1]	Very good	Good	Good	Good	Good
TSS[2]	Low	Low	Low	Good	Fair
Ammonia[3]	Very good	Fair	Good	Low	Good
Nitrate[4]	Very good	Good	Low	Low	Low
TKN[5]	Fair	Very good	Very good	Very good	Good
TN[6]	Good	Very good	Very good	Very good	Fair
TP[7]	Very good	Very good	Good	Very good	Low
TOC[8]	Very good	Very good	Very good	Very good	Very good
Chlorophyll-a[9]	Low	Very good	Very good	Very good	Good

Knap of Reeds Creek ranks "very good" for all parameters except TSS and chlorophyll-a for the validation period; an event that occurred during the calibration period is not reflected in the available input data.

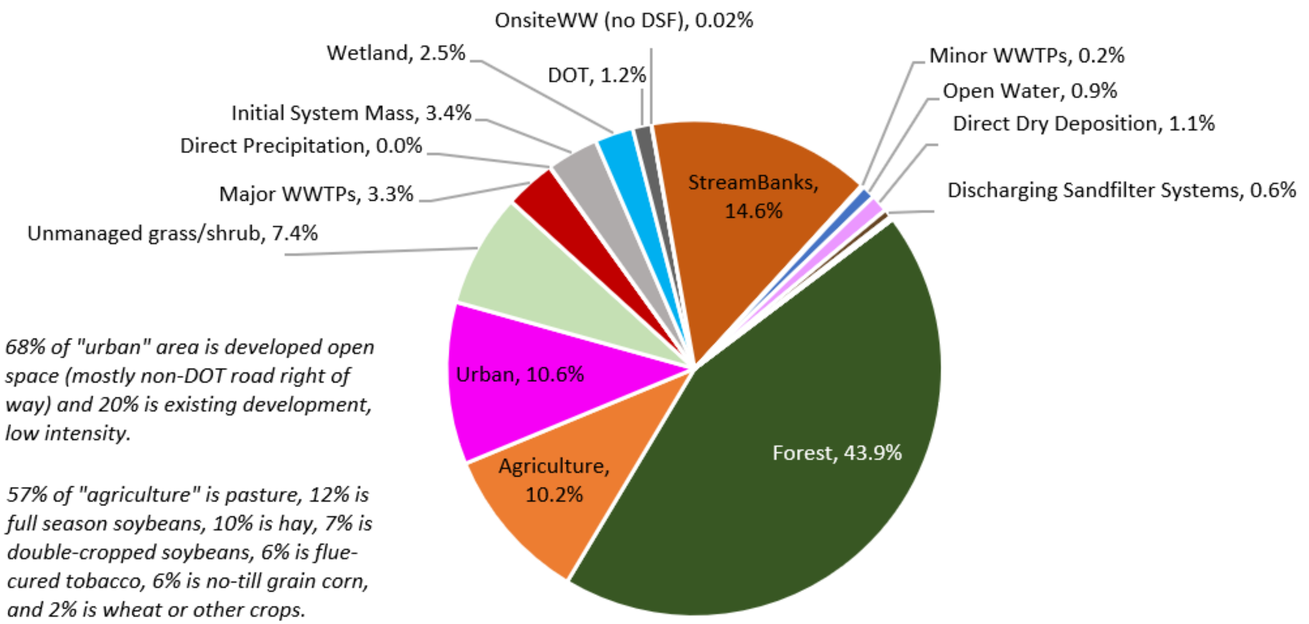
Executive Summary – Delivered Total Nitrogen Loads





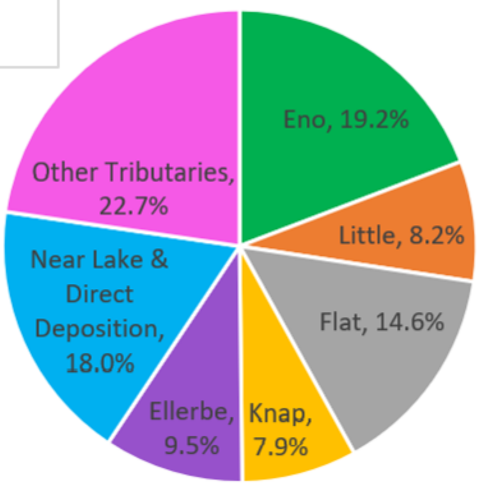
Executive Summary – Delivered Total Phosphorus Loads

Contribution to the ~180,000 pounds per year of total phosphorus delivered to Falls Lake



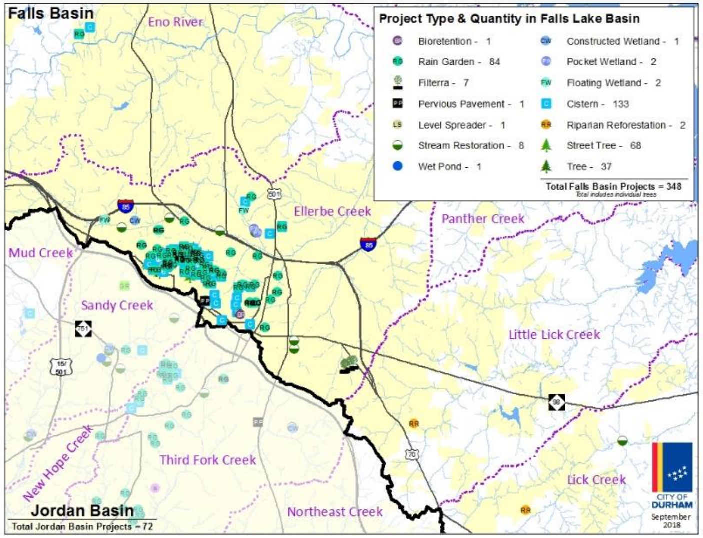
68% of "urban" area is developed open space (mostly non-DOT road right of way) and 20% is existing development, low intensity.

57% of "agriculture" is pasture, 12% is full season soybeans, 10% is hay, 7% is double-cropped soybeans, 6% is flue-cured tobacco, 6% is no-till grain corn, and 2% is wheat or other crops.



Executive Summary – Summary and Key Findings

- Inputs of nutrient loading have declined since the baseline period
  - Lower fertilizer application rates and acres planted
  - Lower rates of atmospheric deposition
  - Improvements at major wastewater treatment plants
- Hundreds of existing development retrofits stream restoration projects have been implemented
- The UNRBA has invested significant resources into the monitoring program and development of modeling tools to support the re-examination
- Many stakeholders contributed input data critical for model development and calibration



Executive Summary – Summary and Key Findings

- The chemistry of the soils in the watershed results in the retention and slow release of nutrients over time
- 74 percent of the watershed area is unmanaged and contribute
    - Over one-half of the total nitrogen load delivered to Falls Lake
    - Nearly 60 percent of the total phosphorus load delivered
- The other half of the total nitrogen load is due to agriculture, urban areas, and wastewater treatment
- Streambank erosion contributes approximately 15 of the total phosphorus loading and the remaining 25 percent is due to urban areas, agriculture, and wastewater treatment
- Total nitrogen inputs to the watershed have decreased by 37% since baseline; approximately 19% of the inputs reach the lake
- Total phosphorus inputs have decreased by 29% since baseline; approximately 16% of the inputs reach the lake
- Hydrologic condition is the primary driver of variability in nutrient loads for land uses in the Falls Lake watershed
- Pervious areas have the ability to store nutrients during dry periods

Executive Summary – Summary and Key Findings

- When the model is tested under dry to average hydrologic conditions, simulated loading rates for land uses compare well to other modeling studies and monitoring of forests in the watershed
- Denitrification is an important process in the watershed for removing nitrogen from the system
- Conventional, advanced treatment systems that discharge to the subsurface for onsite wastewater treatment contribute a minor fraction of the load to Falls Lake
- Discharging sand filter systems and sanitary sewer overflows also contribute a minor fraction of the load
- Major WWTPs contribute less than six percent of the delivered total nitrogen load and less than four percent of the delivered total phosphorus load
- Major facilities have reduced total nitrogen loads by ~33 percent and total phosphorus loads by 77 percent relative to the baseline period when 2015 is excluded
- Large storms can contribute tens to hundreds of times more load in a 24-hour period than baseflow conditions

WARMF Lake Calibration Status

WARMF Lake Modeling

- Output from the watershed model is directly linked to the lake model
- The lake model is comprised of the lake itself and the watershed modeling catchments that are adjacent to the lake without a stream reach (overland flow)
- Model takes ~ 8 hours to run
- Scripts are under development to take the lake model output by segment and layer and conduct the appropriate averaging for comparison to photic zone composite lake water quality data
- Primary statistic for performance evaluation is the percent bias (same as for the watershed model)
- Today, Scott will show visual comparisons for the segment above Interstate 85

EFDC Lake Calibration Status

EFDC Lake Modeling

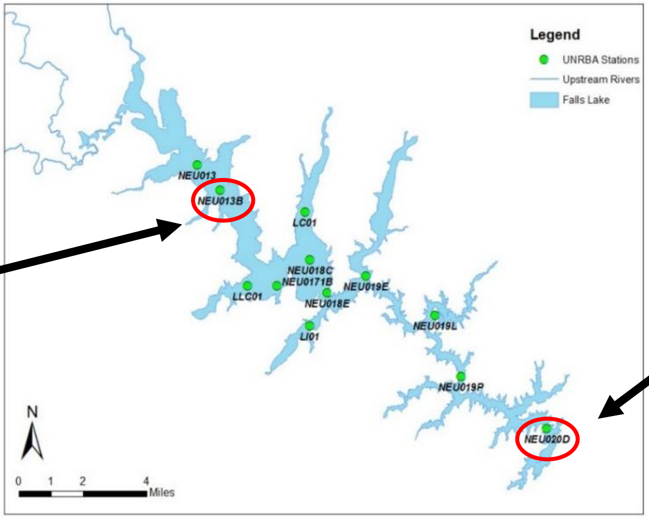
- Output from the watershed model provides stream flow and nutrient concentrations to the EFDC lake model
- The EFDC lake model is comprised of the ~862 horizontal grid cells and 10 Sigma-Zed vertical layers*.
- Model takes ~ 12 hrs to run 2014 to 2018 (1 initialization and 4 calibration/validation years)
- Templates developed to conduct the layer-averaging for comparing to photic zone composite lake water quality data
- Primary performance criteria is the normalized root mean square error (RMSE)
    - Expressed as a percentage
    - Ratio of the RMSE to the standard deviation in the observed data for each hydrodynamic or water quality constituent
    - Abbreviated RSR (**R**MSE to **S**tandard deviation **R**atio)

** Sigma-Zed allows for the number of layers to vary over the model domain. Each cell can use a different number of layers, though the number of layers for each cell is constant in time. The thickness of each layer varies in time to accommodate the time varying depths.*

Water Quality Stations

- The model is being calibrated to the 12 DWR lake monitoring stations (UNRBA Modeling QAPP)
- Data from other organizations is used to inform model development
- Today we will review preliminary calibration results for two stations

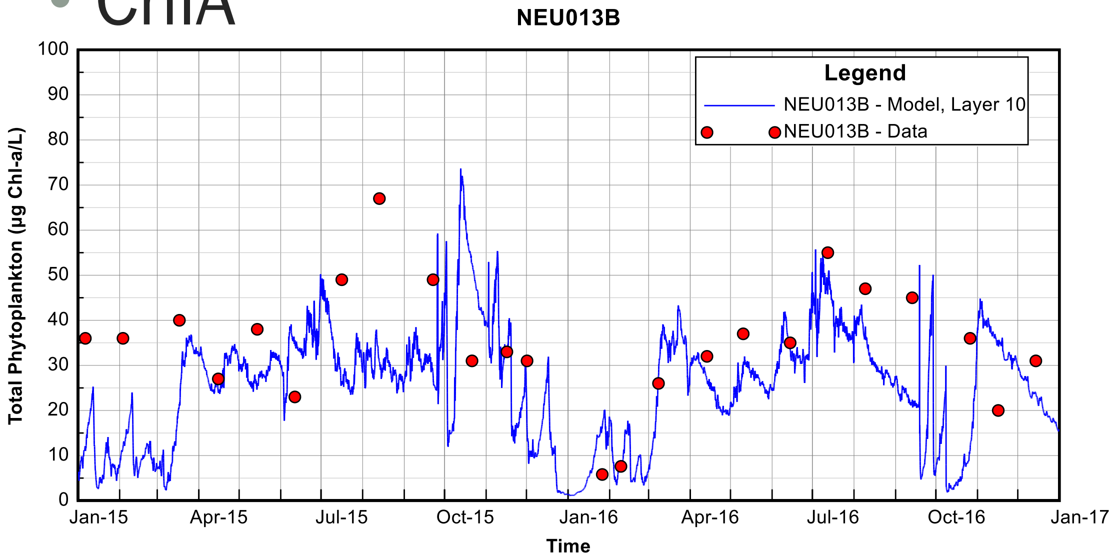
Station NEU013B in the upper lake (photic layer is the top layer (10))

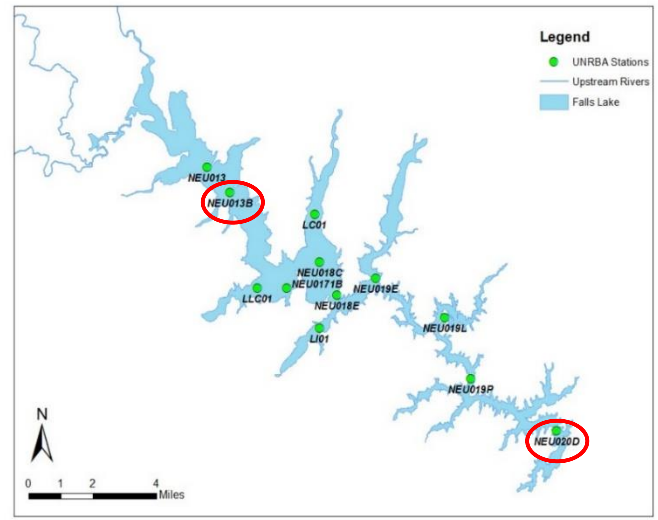


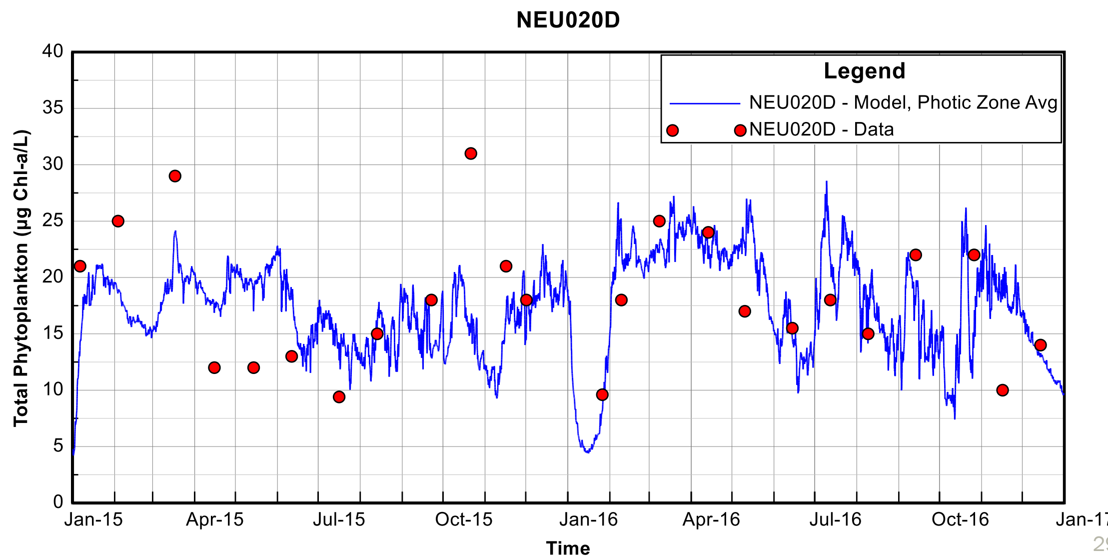
Station NEU020D in the lower lake photic layers include 10, 9, and 8 depending on the water level.

Preliminary Calibration Results

- ChlA

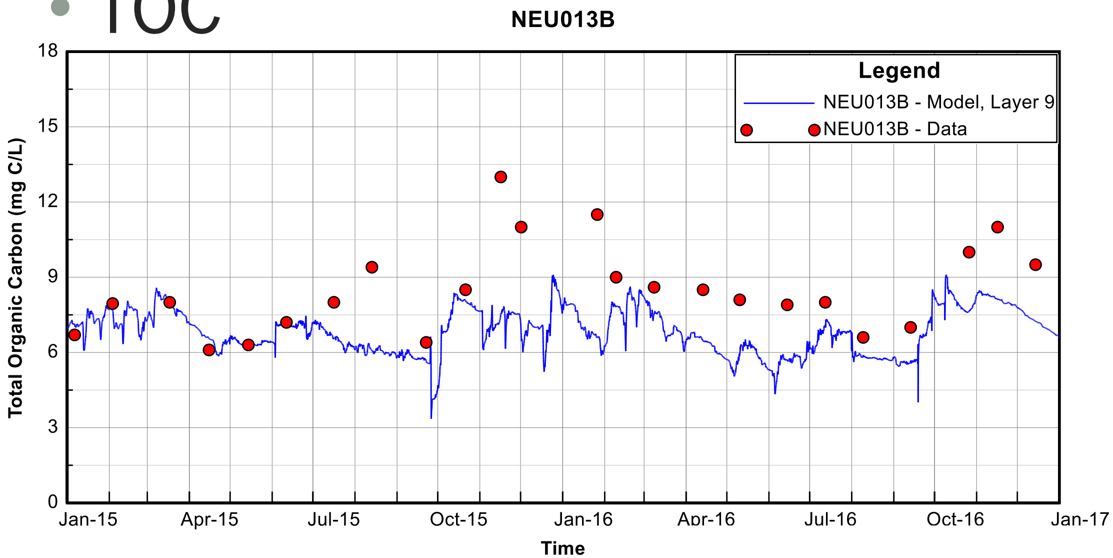


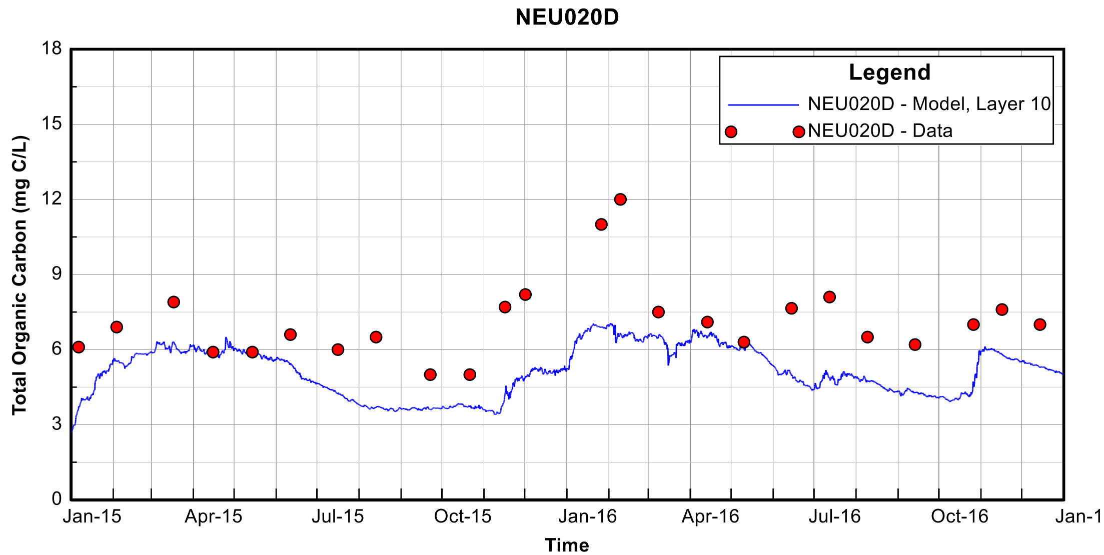




Preliminary Calibration Results

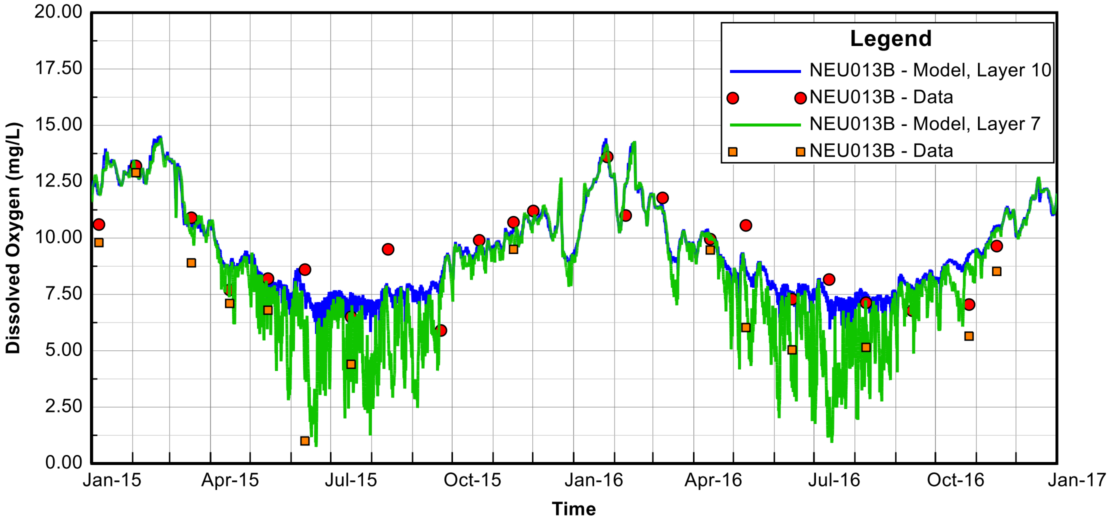
- TOC

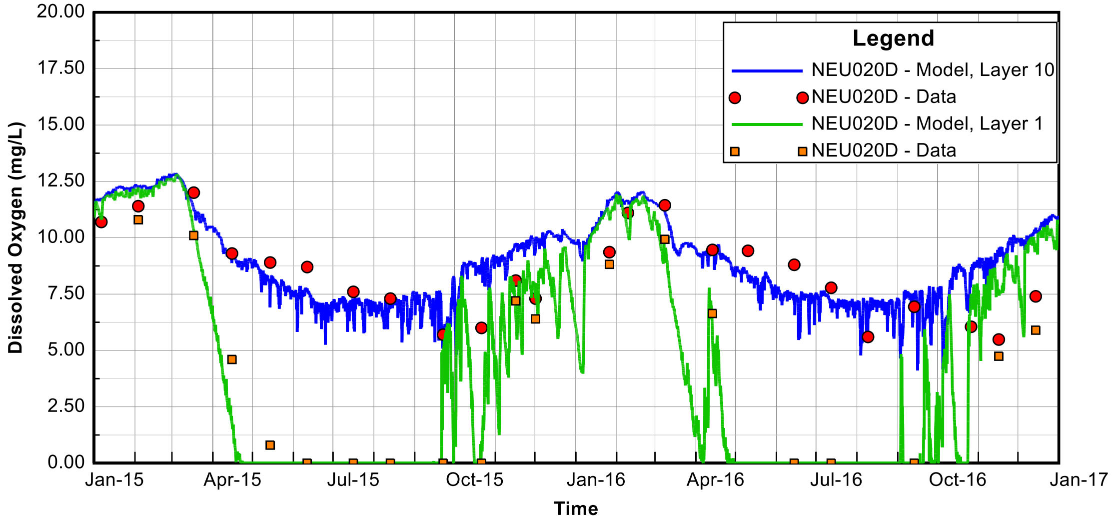




Preliminary Calibration Results

- DO





Summary of Preliminary Calibration

- EFDC simulated sediment bed nutrient fluxes are reasonably simulated compared to data collected in Falls Lake:
  - A weight of evidence approach is needed because measured/calculated nutrient fluxes are at a finer scale than the model grid
  - Nutrient flux from the sediment bed impacts nutrients in the water column and therefore algal growth (chl-a).
  - The simulated vs. the observed water column nutrients and chl-a are reasonably simulated with appropriate ranges of water quality parameters and sediment nutrient fluxes.
- More calibration runs are needed to improve the model performance to meet the calibration targets for various parameters at each station.
- The model team will schedule meetings to review the lake model calibration with subject matter experts and third-party model reviewers

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 (next slides)
- The 10th and final meeting for workgroup was held February 21st
  - Discussed potential forest management, algal flo-way, and onsite wastewater treatment system scenarios

Examples of Model Changes in Urban Areas to Represent Nutrient Management

- Increasing the amount of detention basins which store runoff from impervious surfaces
- Lowering the assumed nutrient application rates to urban areas
- Changing some percent of existing development to new development (which has lower nutrient application rates)
- Increasing bank stability factors to represent urban stream restoration

Examples of Model Changes in Agricultural Areas to Represent Potential Nutrient Reducing BMPs

- Modeling team met with representatives from NC Department of Agriculture and the Farm Bureau on February 2nd to discuss
- Representatives have scheduled follow up meetings to gather information from
  - Local districts regarding the types of projects they have sought funding for in the watershed or that farmers may be interested in
  - The agricultural representatives will be meeting to compile and provide recommendations to the modelers
- Current actions already implemented and included in the model include
  - Stream buffers
  - Keeping animals out of streams
  - Reduced nutrient application rates from baseline (2007) to recent modeling period (using 2016 data for crops and 2017 data for pasture)
  - Conservation tillage (simulated as a land use)

Summary of Scenario Screening Workgroup Recommendations – High Priority Scenarios

- All forests scenario*
  - Provides information on constraints for lake water quality
- Improvements at two minor WWTPs*
  - Minor WWTPs are an insignificant source of loading to Falls Lake (1% of TN, 0.2% of TP)
  - Likely add to a multi-source management scenario
- Determine the load reduction curves needed to comply with the chlorophyll-a standard as currently written
- Reduce controllable sources (urban, agriculture, two minor WWTPs, etc.)*

* These three scenarios likely require simulation in the watershed model.

Summary of Scenario Screening Workgroup Recommendations – Medium Priority Scenarios

- Algal flo-way/turf scrubber*
  - Pump water from tributaries or lakes, reduce nutrients, discharge back to water
  - Depending on where these are simulated, may require simulation in the watershed model
- Modification to Falls Lake operations
  - Operation of the lake as a flood control basin impacts residence time and the growth of algae
  - A change in operational guide curve may not be feasible and would require extensive negotiation with the USACE

Summary of Scenario Screening Workgroup Recommendations – Options for Nutrient Management

- The workgroup recommends that the revised nutrient management strategy consider the following options for management, but they do not recommend evaluating these with the UNRBA watershed or lake models
  - Forest management such as controlled burns and stream restoration
  - Inspections, repairs, and education programs to address proper maintenance of onsite wastewater treatment systems

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

Status

- The Technical Advisors Workgroup and DWR have provided contacts to the statistical modeling team to obtain data and information regarding satisfaction of designated uses in Falls Lake
- The statistical modelers continue to reach out to these contacts for data and information
- Modelers are processing and formatting the local, regional, and national datasets that have been obtained
- The statistical modelers have begun to evaluate the chlorophyll-a trends in Falls Lake to support the WARMF and EFDC Lake models (later in presentation)

Communications Outreach and Preparation

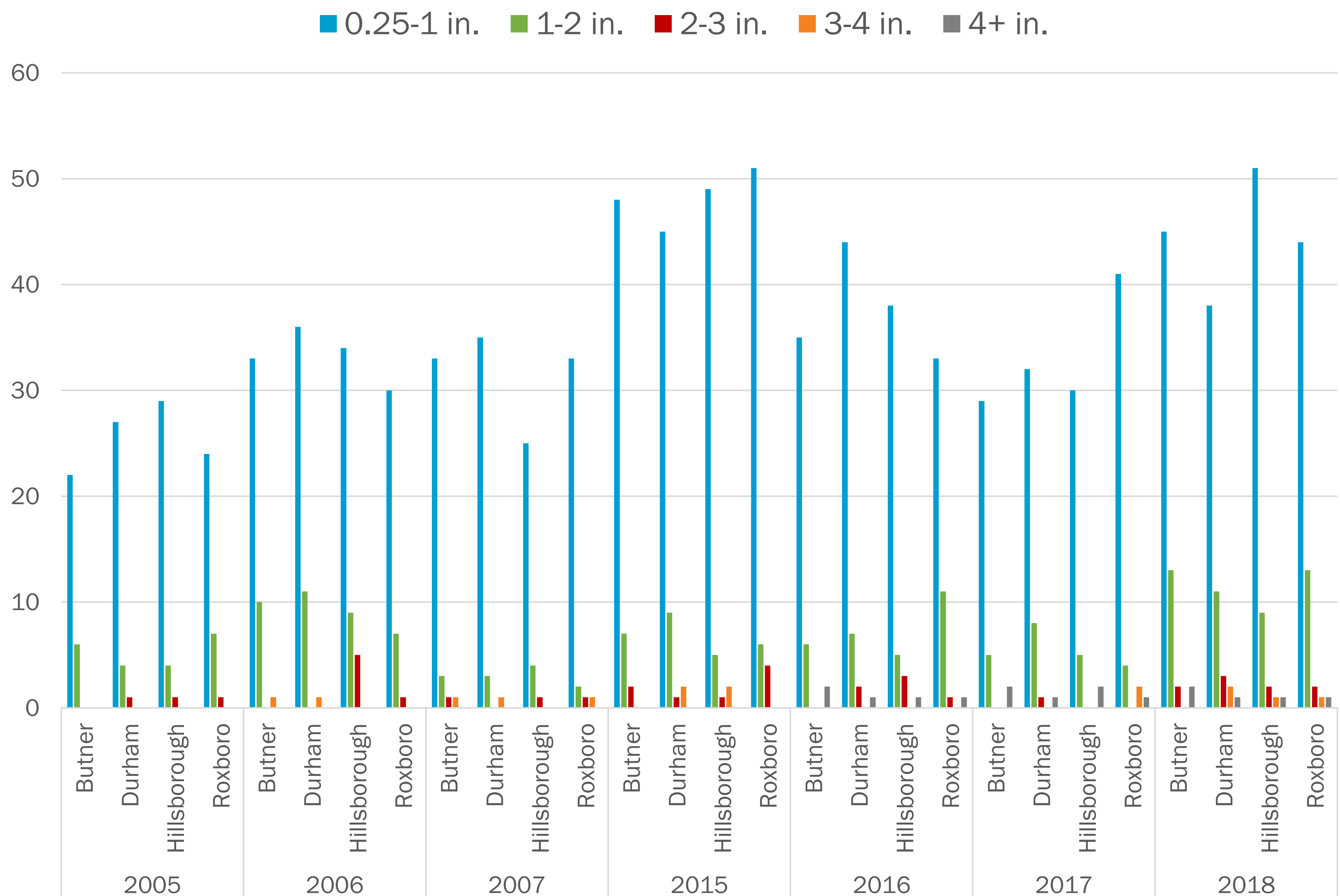
Communications Outreach and Preparation

- Reached out to Danny Smith, the DWR Director, to set up a workshop session with DWR to discuss
  - 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 the 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 even, hopefully, 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.

Example Data Presentations and Tools

- Explore relationships among
  - Precipitation
  - Nutrient loading
  - Lake residence time
  - Season
  - Lake water quality
- Preliminary evaluations using information already generated
- Statistical/Bayesian model under development
- Example questions:
  - How much loading reaches Falls Lake when precipitation amounts are above the design storm size (1 inch)
  - Do different parts of the lake experience increased concentrations of chlorophyll-a at different times of the year?
  - What is the likely range of chlorophyll-a concentrations when the preceding loading was high and the lake residence time is currently "average"?
  - What happens if I change the residence time to be relatively "long"?

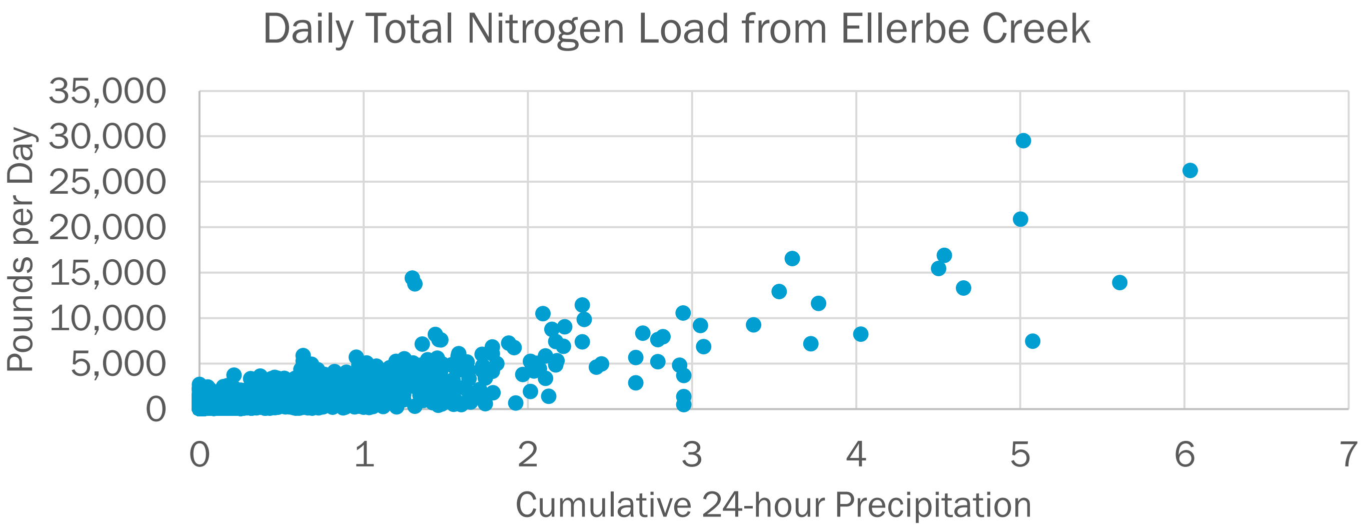
Number of Storms (Continuous Rainfall) by Size



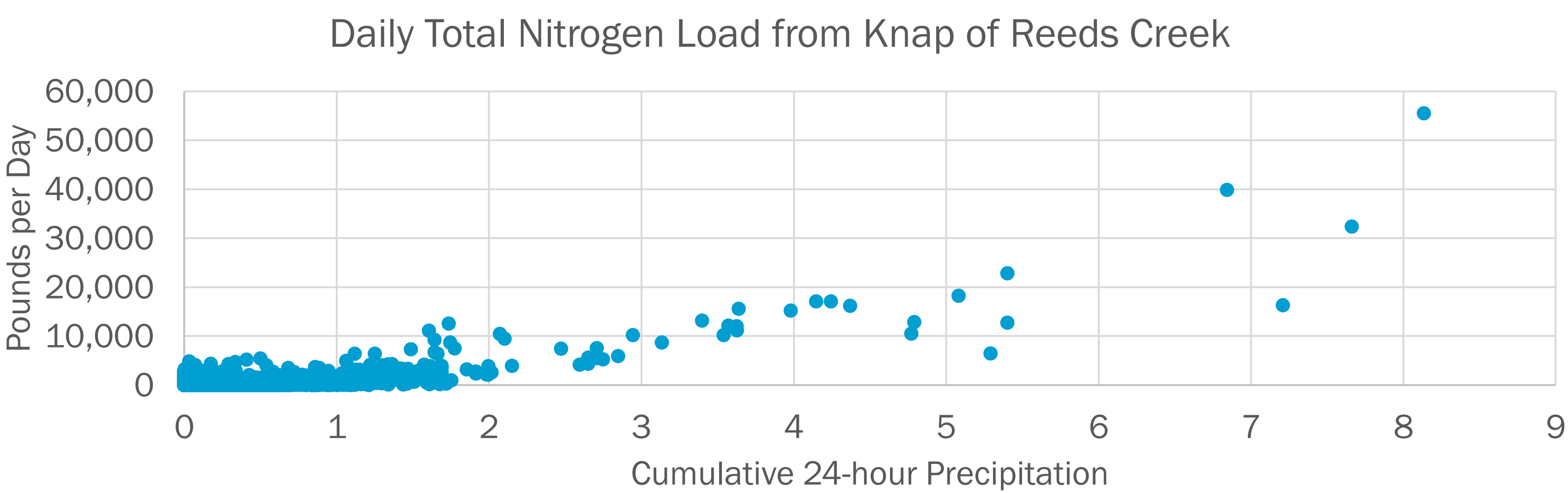
Precipitation versus Loading Evaluations

- Two example subwatersheds selected with relatively small drainage areas
  - Ellerbe Creek
  - Knap of Reeds Creek
- One of 78 NEXRAD precipitation locations used for each drainage (this may not work well for large drainages)
- WARMF 6-hr precipitation used to calculate preceding 24-hour precipitation
- WARMF 6-hr simulated load used for comparison to precipitation
- Slides focus on total nitrogen but information for total phosphorus and total organic carbon are being compiled as well

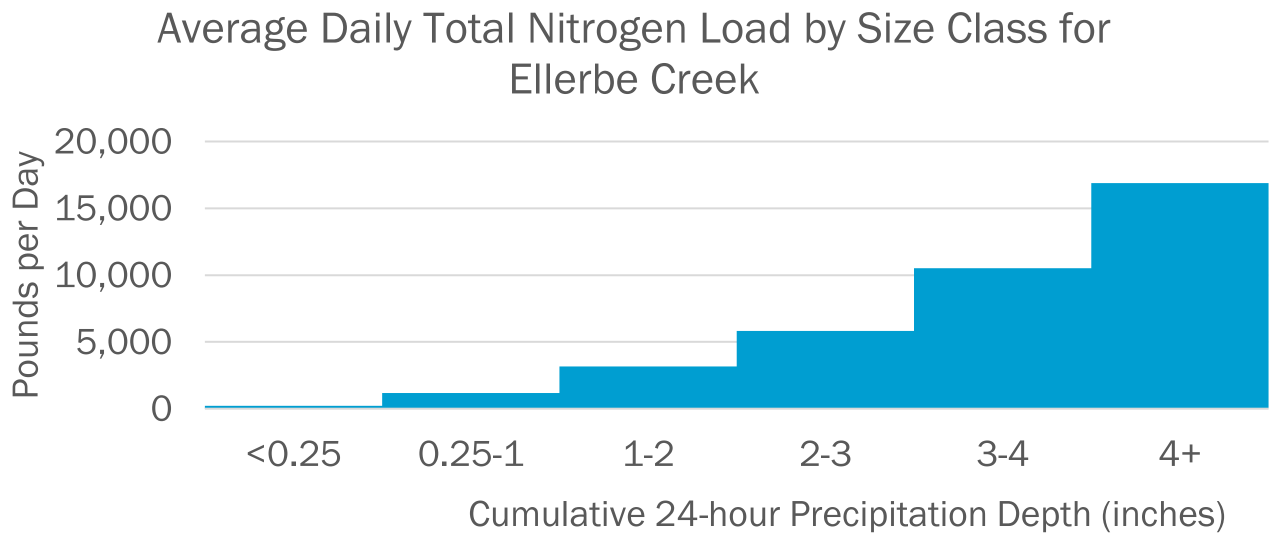
24-hr Precipitation and WARMF Simulated Total Nitrogen Load

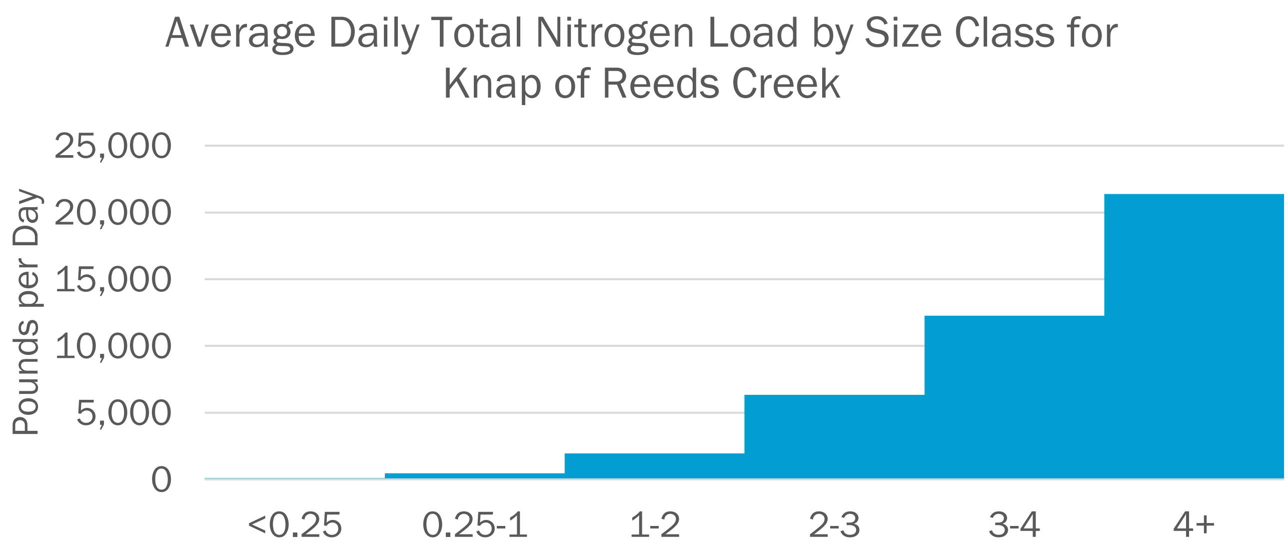


Each point represents simulated load for a 6-hr time step.



24-hr Precipitation and Average Simulated Total Nitrogen Load





Each bar represents the average of the simulated loads for a precipitation depth.

Number of Periods by Hydrologic Condition at Ellerbe Creek

Number of 24-hour periods				
24-hr Cumulative Precipitation (inche	2015	2016	2017	2018
<0.25	307	310.5	317.5	298.5
0.25-1	42	42.5	37.75	48
1-2	13.75	10.25	7.75	13.25
2-3	1.75	2	1	3.25
3-4	0.5	0	0.5	0.75
4+	0	0.75	0.5	1
Total	365	366	365	365

- Approximately 84% of 24-hr periods have less than ¼ inch rainfall.
- Approximately 12% of 24-hr periods have 0.25 to 1 inch of rainfall.
- Approximately 3% of 24-hr periods have 1 to 2 inches of rainfall.
- Approximately 0.5% of 24-hr periods have 2 to 3 inches of rainfall.
- Approximately 0.1% of 24-hr periods have 3 to 4 inches of rainfall.
- Approximately 0.1% of 24-hr periods have 4 or more inches of rainfall.

24-hr Precipitation and Annual Simulated Total Nitrogen Load at Ellerbe Creek

Total Load Delivered to Falls Lake from the Lake Loading Station				
24-hr Cumulative Precipitation (inches)	**2015**	**2016**	**2017**	**2018**
<0.25	69,747	63,587	53,291	69,897
0.25-1	60,867	38,997	33,025	68,923
1-2	44,035	30,975	17,811	49,175
2-3	13,430	11,144	4,989	16,961
3-4	4,014	N/A	6,456	7,941
4+	N/A	9,625	9,088	19,287
Total	192,093	154,329	124,660	232,184
Load from major WWTP	*82,210*	*75,839*	*61,457*	*83,337*

24-hr Precipitation and Average Daily Simulated Total Nitrogen Load at Ellerbe Creek

Average Loading Per 24-hour Period				
24-hr Cumulative Precipitation (inche	2015	2016	2017	2018
<0.25	227	205	168	234
0.25-1	1,449	918	875	1,436
1-2	3,203	3,022	2,298	3,711
2-3	7,674	5,572	4,989	5,219
3-4	8,028	N/A	12,911	10,588
4+	N/A	12,833	18,176	19,287
Load from major WWTP	*225*	*208*	*168*	*228*

- Load discharged from the major WWTP is partially attenuated prior to reaching Falls Lake; for Ellerbe Creek this load represents the majority of total nitrogen load under zero to low precipitation conditions.
- As storm size increases, daily total nitrogen load can increase by 100 times relative to baseflow conditions (0 to 0.25 inches of rain)

Number of Periods by Hydrologic Condition at Knap of Reeds Creek

Number of 24-hour periods				
24-hr Cumulative Precipitation (inches)	2015	2016	2017	2018
<0.25	306	316	320.5	296
0.25-1	48	40	36	50
1-2	10.75	7.75	7	15
2-3	0.5	0.25	0.25	2
3-4	0	0.75	0.5	0.75
4+	0	1	1.25	1
Total	365	366	365	365

- Approximately 85% of 24-hr periods have less than ¼ inch rainfall.
- Approximately 12% of 24-hr periods have 0.25 to 1 inch of rainfall.
- Approximately 3% of 24-hr periods have 1 to 2 inches of rainfall.
- Approximately 0.2% of 24-hr periods have 2 to 3 inches of rainfall.
- Approximately 0.1% of 24-hr periods have 3 to 4 inches of rainfall.
- Approximately 0.2% of 24-hr periods have 4 or more inches of rainfall.

24-hr Precipitation and Annual Simulated Total Nitrogen Load at Knap of Reeds Creek

Total Load Delivered to Falls Lake from the Lake Loading Station				
24-hr Cumulative Precipitation (inches)	**2015**	**2016**	**2017**	**2018**
<0.25	42,254	22,886	14,228	41,555
0.25-1	27,904	10,704	11,673	28,421
1-2	38,223	10,901	5,200	24,689
2-3	4,989	1,475	2,549	11,611
3-4	N/A	8,601	5,970	9,982
4+	N/A	14,377	19,113	36,002
Total All Flows	113,370	68,944	58,734	152,260
Load from major WWTP	*53,395*	*14,573*	*14,387*	*11,747*

24-hr Precipitation and Average Daily Simulated Total Nitrogen Load at Knap of Reeds Creek

Average Loading Per 24-hour Period				
24-hr Cumulative Precipitation (inches)	2015	2016	2017	2018
<0.25	138	72	44	140
0.25-1	581	266	329	568
1-2	3,556	1,407	743	1,646
2-3	9,978	5,900	10,197	5,160
3-4	N/A	11,468	11,940	13,309
4+	N/A	14,377	15,290	36,002
Load from major WWTP	*146*	*40*	*39*	*32*

- Load discharged from the major WWTP is partially attenuated prior to reaching Falls Lake; for Knap of Reeds Creek this load represents a large portion of the total nitrogen load under zero to low precipitation conditions.
- As storm size increases, daily total nitrogen load can increase by 250 times relative to baseflow conditions (0 to 0.25 inches of rain)

Upcoming WRRI Annual Conference Presentation with the NC Collaboratory (March 23, 2022)

WRRI Annual Conference Presentation

- The UNRBA and NC Collaboratory are jointly presenting a full conference session on Falls Lake at the 2022 Annual Conference of the Water Resources Research Institute (WRRI).
- This 80-minute session (four presenters) will address
  - Falls Lake Nutrient Management Strategy and the need for a re-examination
  - Integration of the work of the UNRBA and UNC Policy Collaboratory in the re-examination process
  - Summary of past and current research on Falls Lake and its watershed
  - Incorporation of research into watershed and lake model development and calibration
  - Status of the Collaboratory research and UNRBA model development
  - Timeline for review, stakeholder input, and deadline for recommendations from the Collaboratory and the UNRBA

Upcoming Joint Symposium with the NC Collaboratory (April 7, 2022)

Joint Symposium with the NC Collaboratory

- The UNRBA is collaborating with the UNC Institute for the Environment to provide the 2022 Falls Lake Nutrient Management Study Research Symposium.
- Purpose: inform stakeholders of recent research that has been funded by the NC Collaboratory and UNRBA's efforts to re-examine the Falls Lake Nutrient Management Strategy.
- The symposium will feature updates from researchers from UNC, NC State, and East Carolina University, as well as the UNRBA.
- Location and time:

  Thursday, April 7, 2022, from 10:00 am to 4:00 pm

  North Carolina Botanical Garden, Reeves Auditorium

  100 Old Mason Farm Rd, Chapel Hill, NC

- Lunch and morning coffee will be provided.
- The symposium is free, but registration is required: https://unc.az1.qualtrics.com/jfe/form/SV_bgy9wmjpv4qIKXk

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.
  - Boat: 2015 Zodiac 310AL (aluminum), purchased for $1500, weighs 88 pounds, handled by two people and will carry up to 5 adults, or 1300 pounds, additional specifications: https://www.pacificinflatableboats.com/product/zodiac-cadet-310-aluminum/
  - Motor:

- 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 MRSW will discuss options for transferring the property to another organization and develop recommendations to present to the Board in March.

Discussion of Potential IAIA Reporting Dates

Discussion of Potential IAIA Reporting Dates

- Local governments participating in the IAIA are required to submit annual reports to DWR and copy the UNRBA
- The UNRBA will compile these reports and create a summary report for DWR
- The IAIA Program Document does not specify a deadline for submitting annual reports
- The Executive Director submitted three options for consideration by the MRSW and PFC
  - Please provide input by responding to Executive Director's email
  - Recommendations will be provided to the Board at the March meeting and incorporated in the Program Document

Option	Individual Report to DWR/UNRBA	UNRBA Summary Report Following Compliance Group Committee Meeting
1	September 30	November 30
2	October 31	November 30
3	November 20 (before T-giving)	January 31

Closing Comments

Additional

Discussion