Modeling and Regulatory Support Workgroup Meeting
Remote Access, November 3, 2020

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
- Changes to MRSW Meeting Plans
- Modeling and Regulatory Support Status
- Discuss Revised Recommendations for Watershed Analysis Risk Management Framework Lake Modeling
- Discuss Potential Training Topics for MRSW

Changes to MRSW Meeting Plans

Change in Meeting Times

- The PFC decided during the October 6, 2020 meeting to extend the duration of the MRSW meetings to two hours for the months that they meet.
  - MRSW meetings 9:00 AM to 11:00 AM
  - 30-minute break
  - PFC meetings from 11:30 to 1:15.
- This extension will allow more time for discussion of the models.
- During months where an MRSW meeting is not scheduled
  - PFC meetings from 9:30 AM to noon.

Change in Meeting Months and Topics

- There are no MRSW meetings scheduled in December or January.
- The following months and topics are anticipated
  - November
    - Finalize WARMF Lake decisions (segmentation and calibration points)
    - Summarize water quality inputs for watershed model (SSOs, nutrient application rates, etc.)
    - Form Model Scenario Output Group
    - Form Scenario Screening Group
  - February
    - Review watershed model water quality calibration and validation results
    - Review preliminary loading summaries

Change in Meeting Months and Topics

- The following months and topics are anticipated
  - May
    - Model Scenario Output Group and Scenario Screening Group will discuss their recommendations with the MRSW
    - MRSW to provide input on preliminary draft scope of work and budget for MRS and Communications contract
  - June
    - Review EFDC Lake model preliminary water quality calibration and validation results

Formation of MRSW Subgroups

- The UNRBA Technical Stakeholder Workshop has been postponed to FY2021 due to COVID-19
- Two MRSW subgroups to form (next slides)
  - Recommend scenarios for evaluation (**Scenario Screening Group**)
  - Recommend output summaries for comparing scenarios (**Model Scenario Output Group**).
- A third workgroup will be formed during the January PFC meeting to provide technical input to the legal team and statistical modeling team in terms (**Technical Liaisons to the Legal Group**).
- These three groups will provide recommendations to the MRSW and/or PFC for consideration.

Formation of Model Scenario Output Group

- The MRSW has discussed output and reporting formats for model calibration (comparison of simulated to observed values)
- The Model Scenario Output Group will develop recommendations for summarizing model output and comparing scenarios to ensure information is useful to members
- Recommendations will be provided to the MRSW and PFC
- MRSW Chair to lead this group and provide examples of scenario output for consideration
- Seeking 2 to 3 MRSW local government members to join this subgroup

Formation of Scenario Screening Group

- Prior plan was to generate list of potential scenarios to evaluate during the small group session of the UNRBA Technical Workshop
- Due to COVID-19 and cancellation of this workshop, we need an alternate means to receive this input
- Scenario Screening Group will generate list of scenarios for review by MRSW and PFC
- Include external participants from prior Technical Workshops representing NGOs and other regulated entities
- Also plan to discuss with a broader audience at the joint symposium with the UNC Collaboratory
- Group to be led by the PFC co-chairs
- Seeking 3 MRSW local government members to join this subgroup
- Seeking representatives from agriculture, NC Department of Transportation, and NGOs to join as well

Modeling and Regulatory Support Status

Watershed Modeling Status and Water Quality Inputs

Watershed Modeling Status

- Continue work on the Watershed Analysis Risk Management Framework (WARMF) watershed model for water quality simulations (next slides)
  - Onsite wastewater treatment systems
  - Sanitary sewer overflows
  - Wastewater treatment plants
  - Air chemistry and deposition
  - Soil chemistry
  - Nutrient application rates
  - Wildlife impoundments
- Completed the model code revisions to simulate different types of onsite wastewater systems and drafting report for DWR to satisfy the grant requirements
- Coordinating with researchers at UNC Collaboratory on the model inputs for onsite systems

# Onsite Wastewater Treatment Systems: Locations and Types
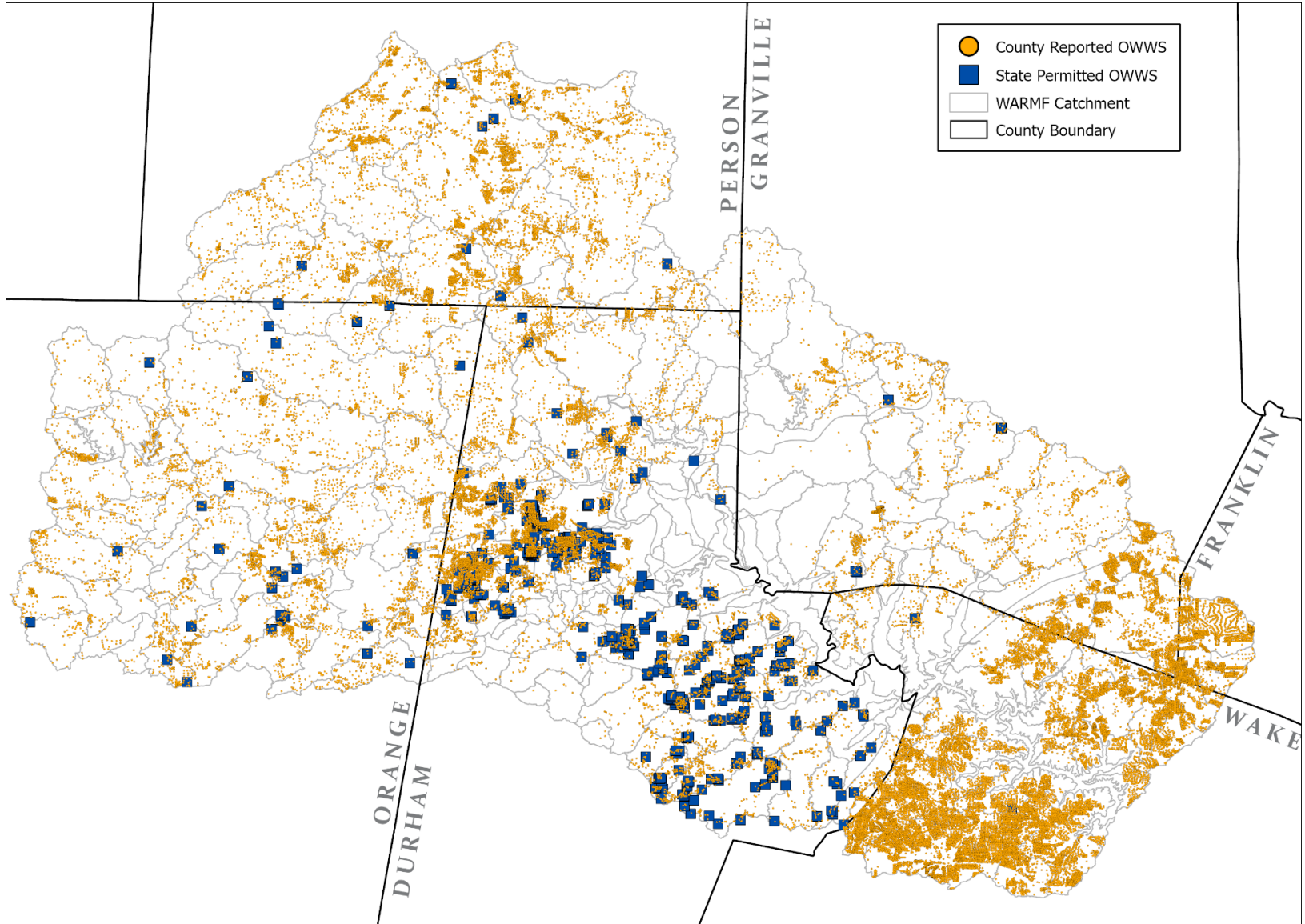
Onsite Wastewater Treatment Systems: Locations and Types

- Parcel level data were used where available
  - Durham, Orange, Wake, and Person
- Estimates from Guy Iverson at UNC Collaboratory were used for counties without spatial databases
  - Granville and Franklin
- State database of permitted and nonpermitted systems was used to account for discharging sand filters (without double counting)
- Some counties included system type in the data
  - Durham, Orange, Wake
- If system type wasn't provided, ratios of system types observed in the 2013 county inventories was assumed

Onsite Wastewater Treatment Systems: Failure Rates and Data Reviews

- Failures rates are set by system type based on 2013 inventories
  - Except Wake County which is providing updated numbers
- Estimates of counts by system type and failure rates were provided to each county for review prior to developing model inputs (requests for review were sent on October 26th and 27th)

# Sanitary Sewer Overflows (Locations, Owners)
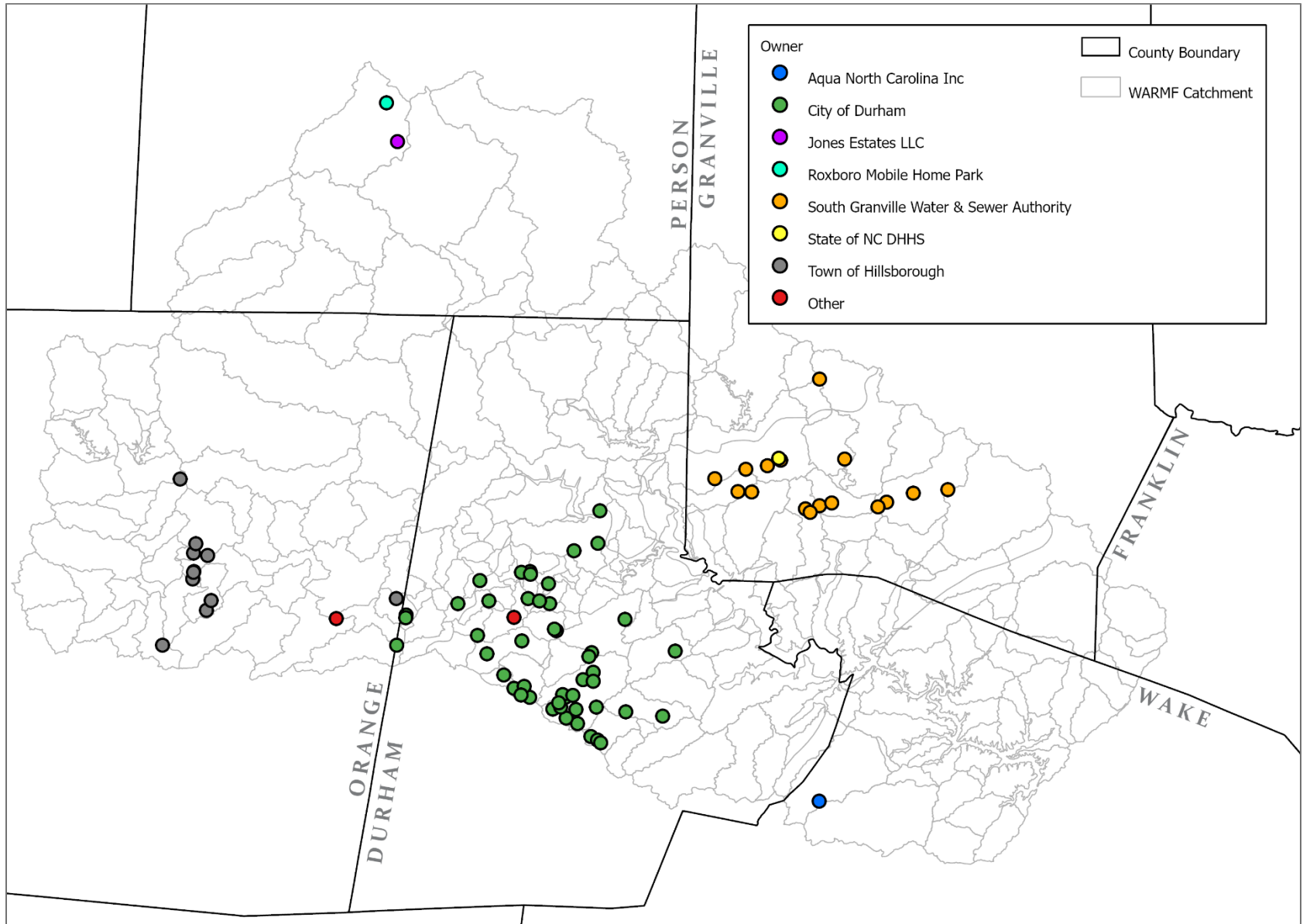
Sanitary Sewer Overflow (SSO) Data

- For the baseline period, model files from the previously developed DWR WARMF model were used as inputs
- For the 2015-2018 modeling period, datasets from the City of Durham, the Town of Hillsborough, and SGWASA were compiled
- These data sets were compared to State SSO data
  - Duplicate events were removed
- It was noted whether each SSO occurred during a precipitation event based on the report date to assign different nutrient concentrations for wet and dry weather SSOs (based on IDDE Crediting Document):

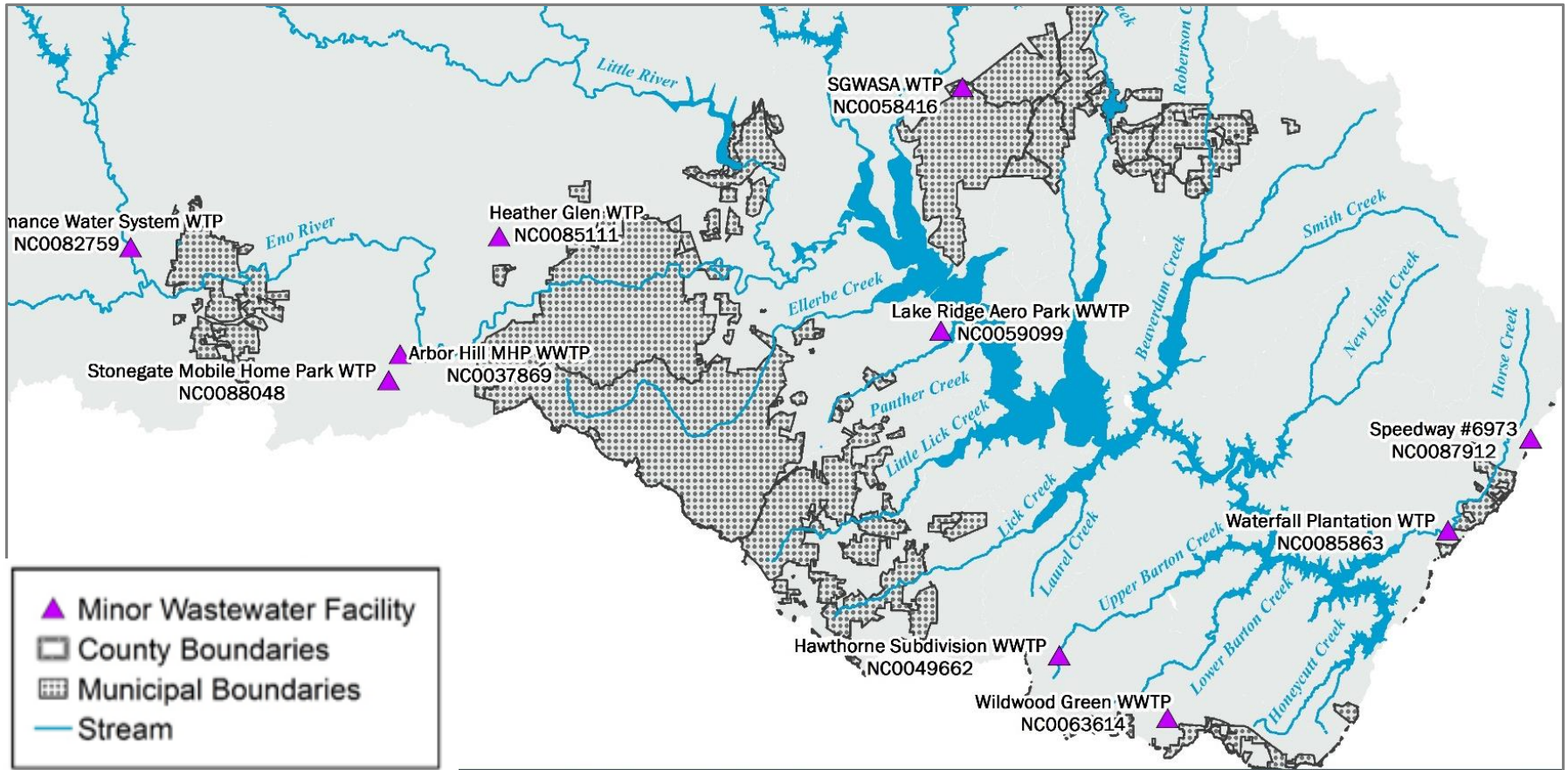| Type	TN (mg-N/L)	TP (mg-P/L)
Dry	33	6
Wet	11.9	2.18

Major Wastewater Treatment Plants
## (> 1 MGD)
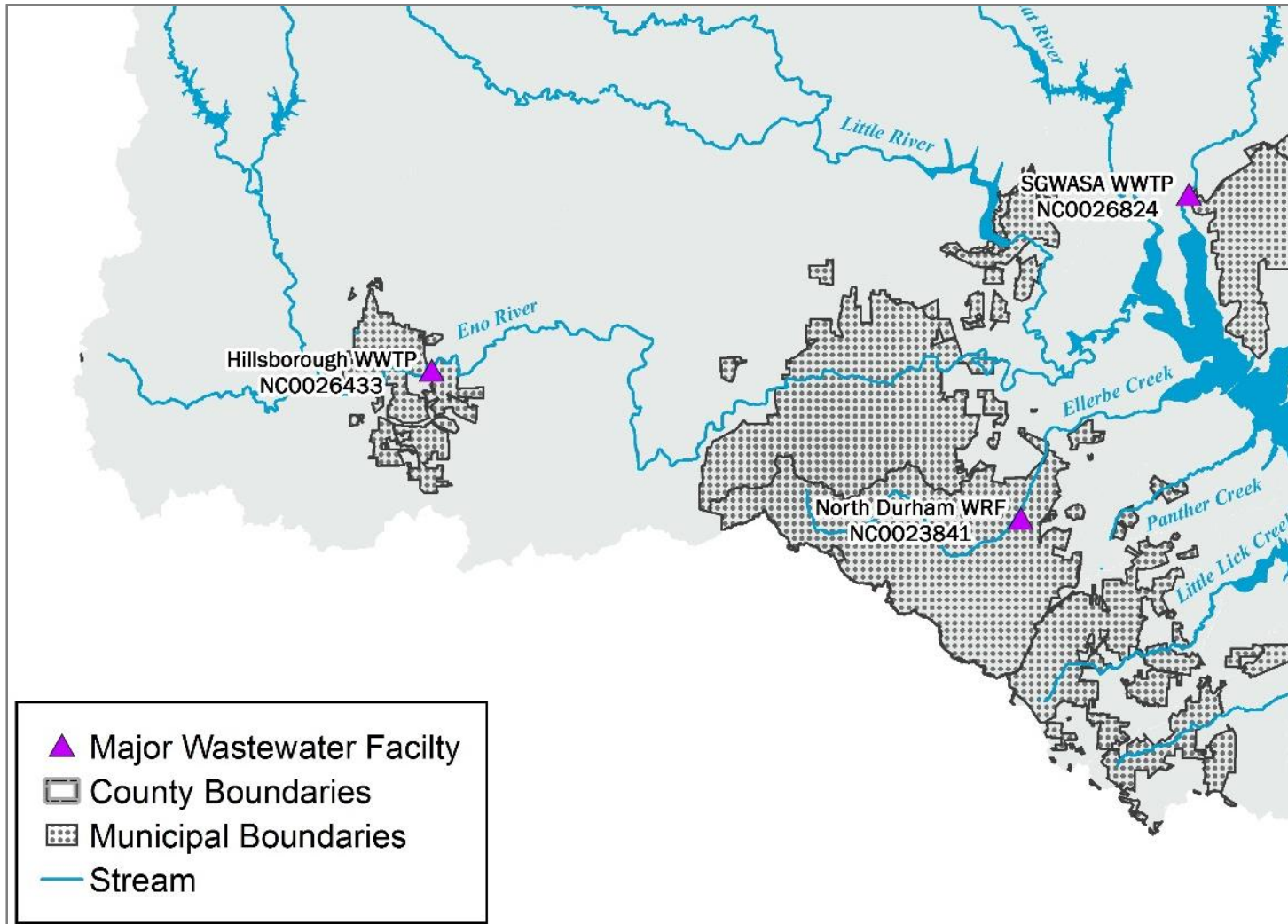
Minor Wastewater Treatment Plants
(< 1 MGD)

Wastewater Treatment Plant (WWTP) Data

- For both the baseline period and modeling period, wastewater treatment plant effluent flows and parameter concentrations were provided
    - Operators provided data for major facilities ($\geq$ 1.0 MGD flows)
    - State provided data for minor facilities (< 1.0 MGD flows)
- Interpolation was used to estimate flows and concentrations occurring between reported measurements
- In some instances, monthly flow and concentration averages were used in place of daily observations (baseline only)
- For observations recorded as "<" the reporting limit (RL), concentrations were calculated as 1/2 the RL.
- Prior to finalizing WARMF input files, total yearly loading values for Nitrogen and Phosphorus were calculated for each major facility and provided to operators for review

Atmospheric Deposition
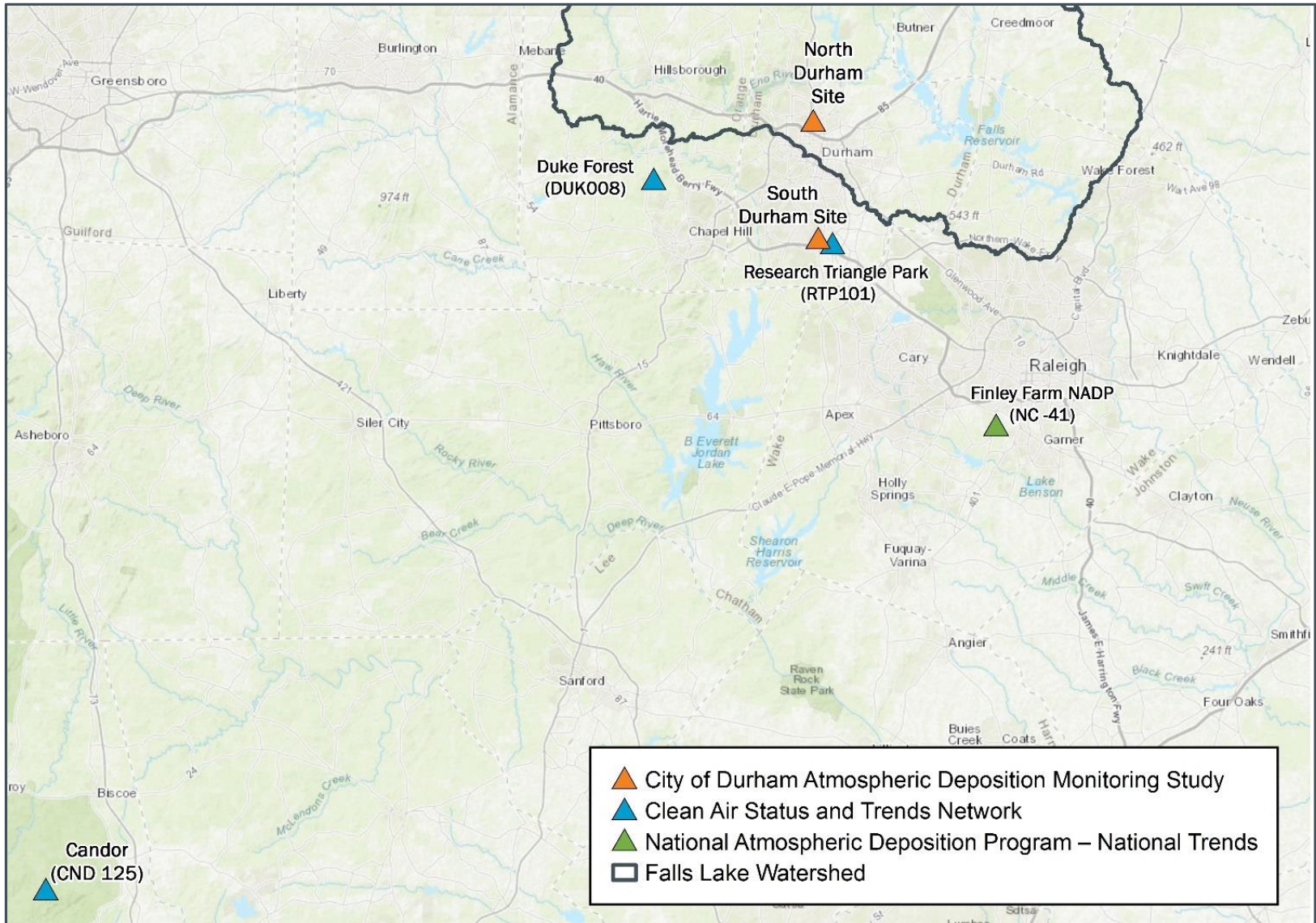
Atmospheric Deposition

- Both wet and dry atmospheric deposition data were used to develop the WARMF time series input files.
  - The dry deposition dataset was obtained from the Clean Air Status and Trends Network (CASTNET) while the wet deposition dataset was obtained using the National Atmospheric Deposition Program (NADP).
    - CASTNET Station: CND125 (Candor)
    - NADP Station: NC41 (Finley Farm)
  - Because air samplers are typically deployed for a week at a time, the Friday-midpoint of the weekly deployment was used as the date for the concentration data.
  - Missing values in the source data were linearly interpolated
- The City of Durham study does not overlap with either modeling period, but was used to confirm minimal phosphorus deposition
- Adjustments to Durham area nitrogen deposition rates may be considered during model calibration

Soils Data

- Soil Survey Geographic database (SSURGO)
- Used to characterize inputs for up to five soil layers per catchment
  - Parent materials
  - Soil series and depths
  - Hydrologic characteristics

Soil Series
Upper Neuse River Basin Association
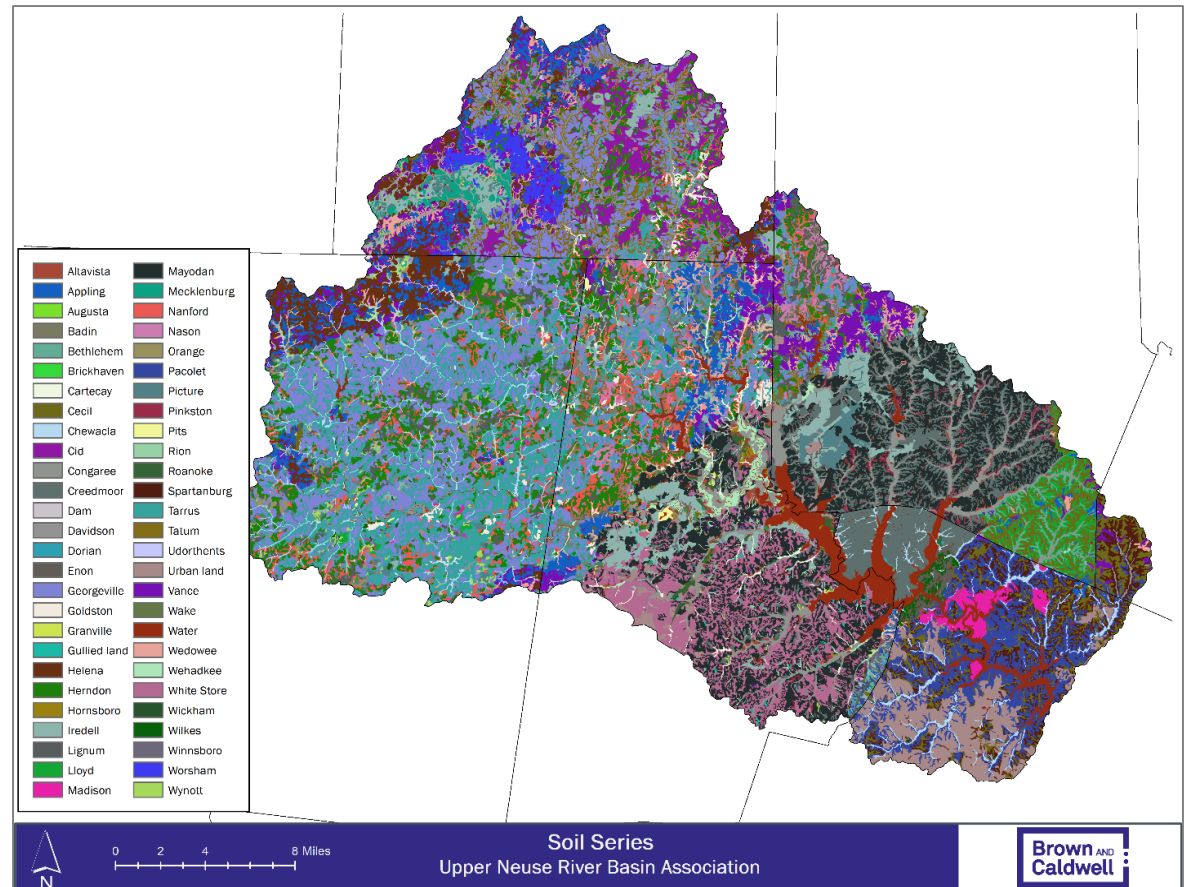
Soils Chemistry Data

- National Cooperative Soil Survey Soil Characterization Database (NCSS) data for samples collected within 6 counties that make up the Falls Lake watershed were used to set values for each soil layer/geologic basin
  - Cation exchange capacity
  - Base saturation (NH4, Al, H, Ca, Mg, Na, K)
  - PO4 adsorption isotherms
- Initial porewater concentrations (may be adjusted during calibration)
  - UNRBA monitoring data collected during low flows
  - 1984 NC soils systems data (Daniels 1984)
  - WARMF model defaults

Monitoring Sites and Modeling Catchments
Upper Neuse River Basin Association
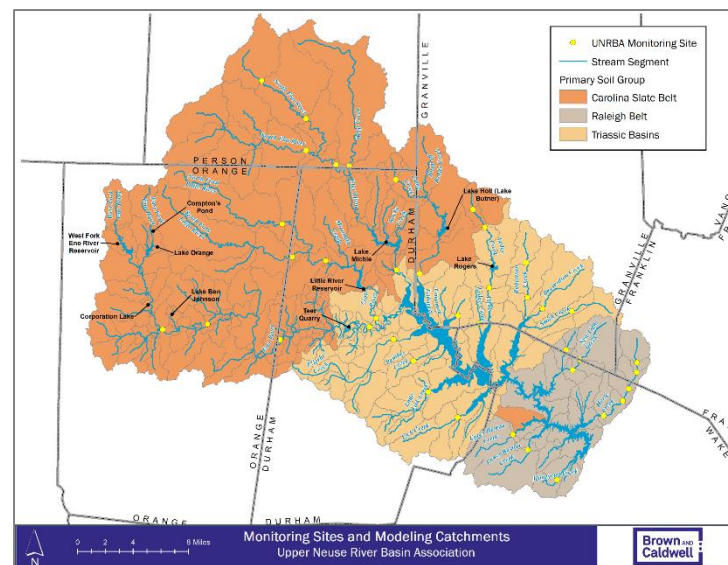
Nutrient Application Rates to Cropland and Pasture

- WARMF simulates nutrients applied to land surfaces based on monthly inputs
- Nitrogen application rates were provided by NC Department of Agriculture
  - By county, month, and crop type
  - Includes manure deposition/application and volatilization
- Phosphorus and potassium application rates were based on the Neuse agriculture report (Osmond, 2011)
  - By county and crop type
  - Assumed same timing as nitrogen
 - Includes rates for inorganic and organic phosphorus
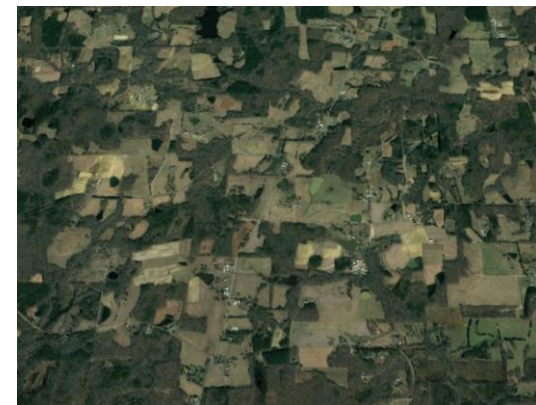
Nutrient Application Rates to Developed Areas

- Two local surveys of homeowner practices
    - Durham County (Fleming, 2013)
    - Cary, NC (Osmond and Hardy, 2004)
- Studies showed that
    - Approximately ½ of homeowners apply fertilizer
    - Half of those apply themselves versus contractor
    - Timing of application is often incorrect for grass type
    - Smaller lots tend to over apply, larger lots under apply
- Rates reported in these studies were adjusted by lot size as a starting point and will be refined during calibration

Wildlife Impoundments

- North Carolina Wildlife Resources Commission provide spatial data
- Modeling team to request information about flooding schedule and waterfowl estimates
- Use literature to estimate nutrient content of feces
- Apply as point source to the impoundment areas to account for loading
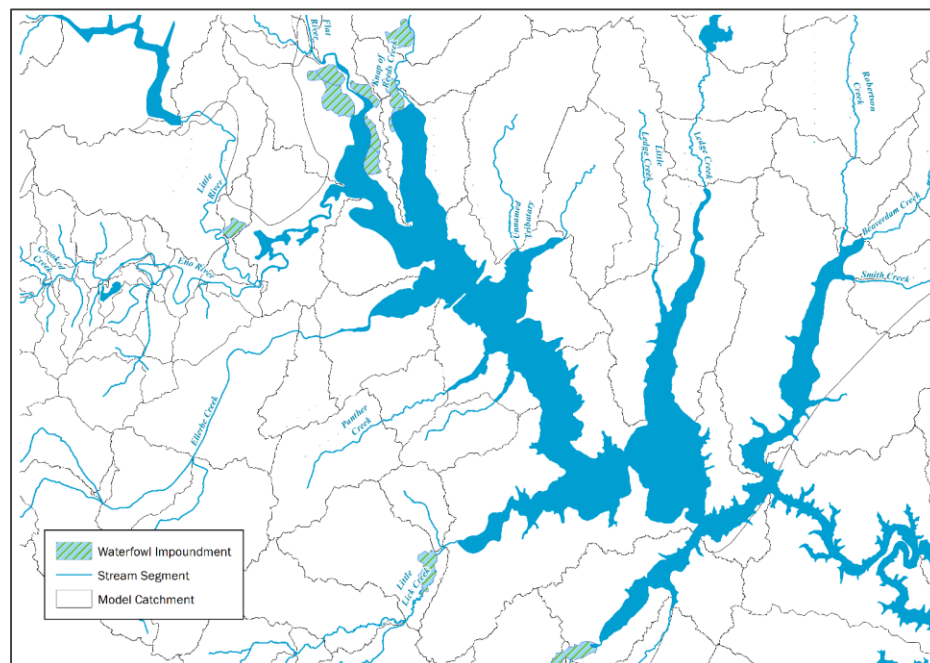
Communications and Reporting

Planning for DWR Meeting to Follow Up on EFDC Hydrodynamic Modeling

- During the August MRSW meeting, the modeling team presented preliminary modeling results for the hydrodynamic calibration of the Falls Lake EFDC model
- DWR modeling staff requested additional information about the model development and calibration
  - Additional performance criteria
  - Discussion of water balance assumptions
- Modeling team is continuing to work on model calibration
- Will compile the requested information and schedule a meeting with DWR to discuss next iteration
- MRSW and PFC members are welcome to participate in this remote meeting (not yet scheduled)

Reporting Status

- Executive Director has provided comments on an interim draft of the hydrologic model development and calibration for the WARMF watershed model
- Modeling team is working to address these comments and include the model calibration output formats requested by the MRSW
- Modeling team anticipates a draft for review by the MRSW in November or December
- Deliverables associated with FY2020 need to be generated first (contract ends December 31, 2020 based on Amendment 2 to the FY2020 contract)
  - 319 report to DWR regarding model code revisions for WARMF
 - Transition Monitoring technical memorandum

Discuss Revised Recommendation for Watershed Analysis Risk Management Framework Lake Modeling

Outstanding Decisions from the September 1, 2020 MRSW Meeting

- 1. Where to segment the Falls Lake WARMF Model
- 2. Where to calibrate the WARMF Lake Segments (downstream end of the segment or to average conditions within the entire segment)
- On September 22, 2020, the MRSW Chair distributed a slide deck containing a revised set of recommendations and requested feedback from the MRSW via email

WARMF Lake Segmentation

Revised Recommendation for WARMF Lake Segmentation for Falls Lake
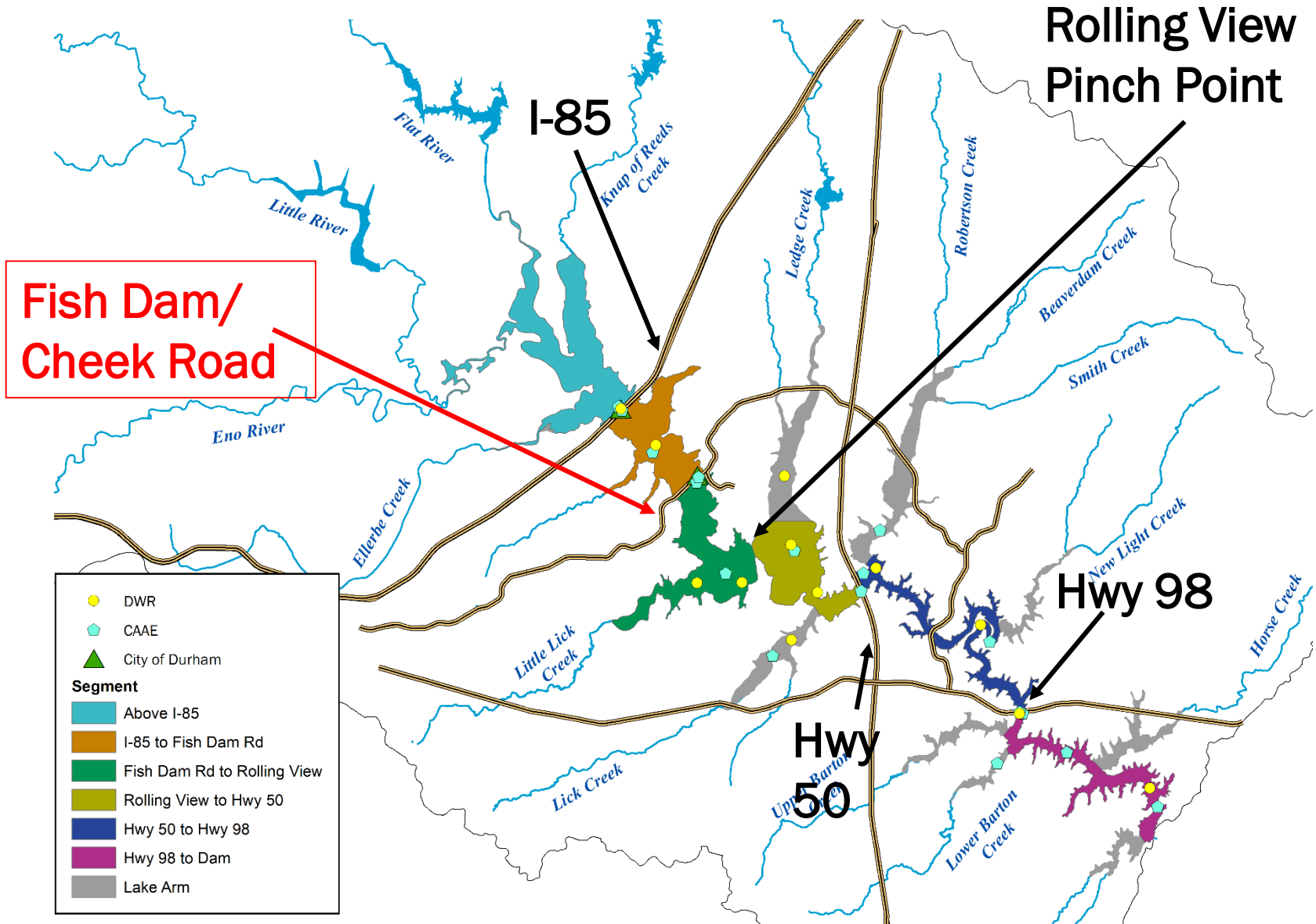
Summary of Feedback on Lake Segmentation

- MRSW members indicated agreement with the revised recommendation for lake segmentation
    - Person County
    - Orange County
    - Town of Hillsborough
    - Wake County
    - City of Durham
- Third party modeling reviewers (Daniel Obenour and Nathan Hall) support this recommendation
- DWR did not provide additional comment on this topic

MRSW to finalize this decision during the meeting.

WARMF Lake Calibration Approach

Recommendation for Calibration of Lake Segments to the Downstream Stations

- Ensure that flux of materials from one segment to the next is accurate
- Utilizes water quality data representing the full variability of observations (highest concentrations observed are at the downstream end of upper most segment)
- Reporting for WARMF Lake calibration would clarify downstream locations
- Post processing and reporting can be used to estimate concentrations near the middle of each segment

Summary of Feedback on Calibration Approach (Members and 3rd Party Reviewers)

- MRSW members indicated agreement with the revised recommendation for lake segmentation
  - Person County
  - Orange County
  - Town of Hillsborough
  - Wake County
  - City of Durham
- Third party modeling reviewers (Daniel Obenour and Nathan Hall) support this recommendation
  - Given small variations in concentrations across segments, either approach is technically fine
  - Flow does not reverse in Falls Lake, so calibrating to the downstream end may be more accurate
  - Ensures calibration at Raleigh's water supply intake

Summary of Feedback on Calibration Approach (DWR) and Responses

- If the state variables (concentrations) represent the overall condition within a segment, then all data from within the segment need to be compared with the model result accordingly.
  State variables will also reflect downstream conditions
- When measured flows are not available, calibration towards downstream concentration would not necessarily provide more accurate loading estimates.
  We will use best available information including inputs from the calibrated watershed model, gaged releases over the dam, and metered withdrawals from the water supply intake

Summary of Feedback on Calibration Approach (DWR) and Responses

- If downstream concentration measurements are used for model calibration of each model segment, we recommend the uses of the calibrated model to be limited to loading analysis and comparison between model results and water quality criteria cannot represent the overall status of the corresponding model segment.
  The model will be used to predict changes due to nutrient management scenarios
    - Simulated water quality at the downstream end of each segment for comparison to DWR monitoring stations
    - Loading between segments
    - Post processing of WARMF output will be used to estimate average water quality in each segment
    - The EFDC lake model will provide more refined spatial information

Discuss Potential Training Topics for MRSW

Potential Training Topics for MRSW

- During the July MRSW meeting we discussed training may be useful to
  - Improve understanding of model development and application
  - Answer questions and hear feedback
  - Increase comfort level for using the models to inform management decisions
  - Improve information sharing
  - Provide training on running the models for those interested
- Trainings can occur during model development and when models are being used to answer questions

Each month we will provide opportunity for MRSW members to suggest training topics or raise questions.

Closing Comments
Additional
Discussion