Modeling and Regulatory Support Workgroup Meeting September 1, 2020

Remote Access Only (see next slides)

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

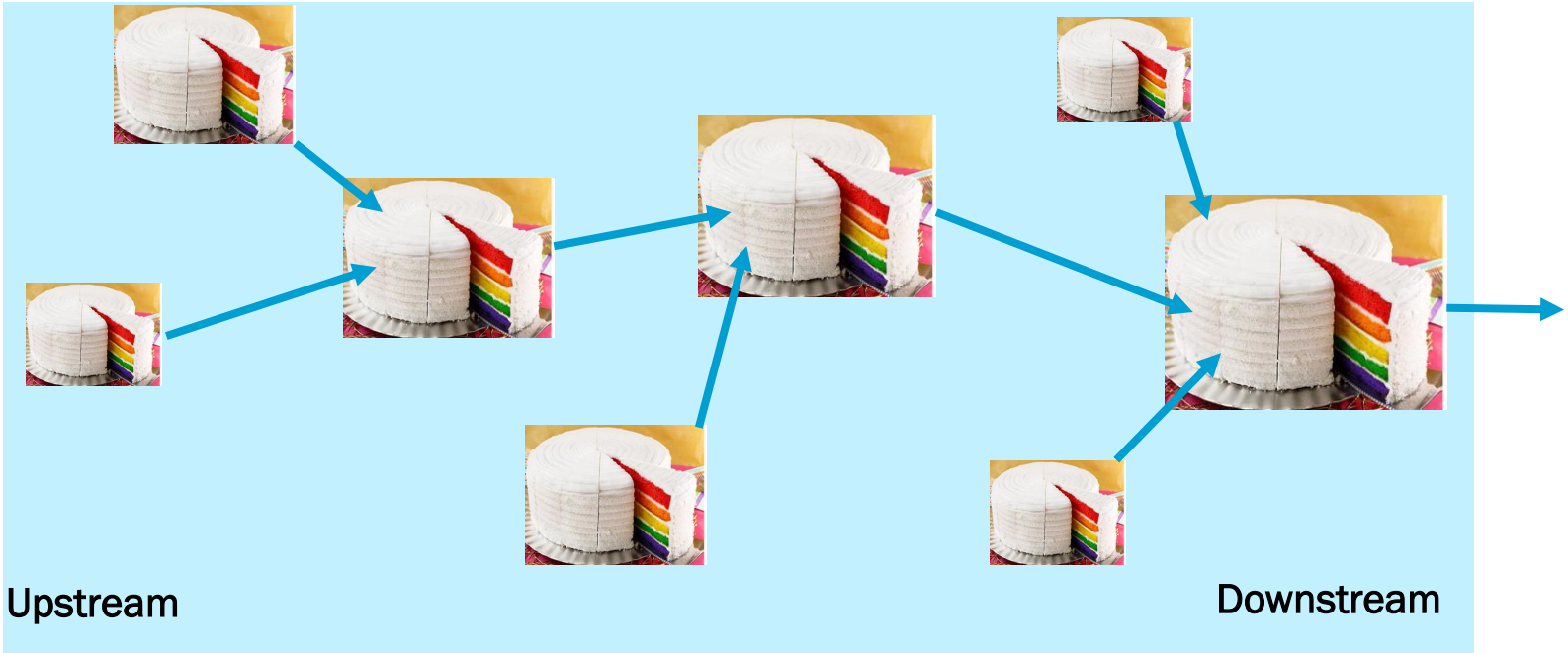
- **Discuss WARMF Lake segmentation**
  - Overview of WARMF Lake
  - Discuss regulatory considerations
  - Review available data and July 14th discussion with subject matter experts
  - Provide recommendation for WARMF Lake segmentation
  - Discuss approval of WARMF Lake segmentation with MRSW
- **Discuss potential training topics for MRSW**
- **Modeling and Regulatory Support status**

WARMF Lake Segmentation

Overview of WARMF Lake

WARMF Lake - Cake Analogy

- Each model segment in WARMF Lake is like a layer cake
  - Each segment has 40 layers (perfectly mixed)
  - Refreshed every 6 hours (model time step)
- Segments can be different sizes with different characteristics (lake arms versus mid-lake)
- Every segment is uniform (perfectly mixed, uniform depth)
- Segments are linked together where one provides input the next



Considerations for Determining where to Segment the Lake

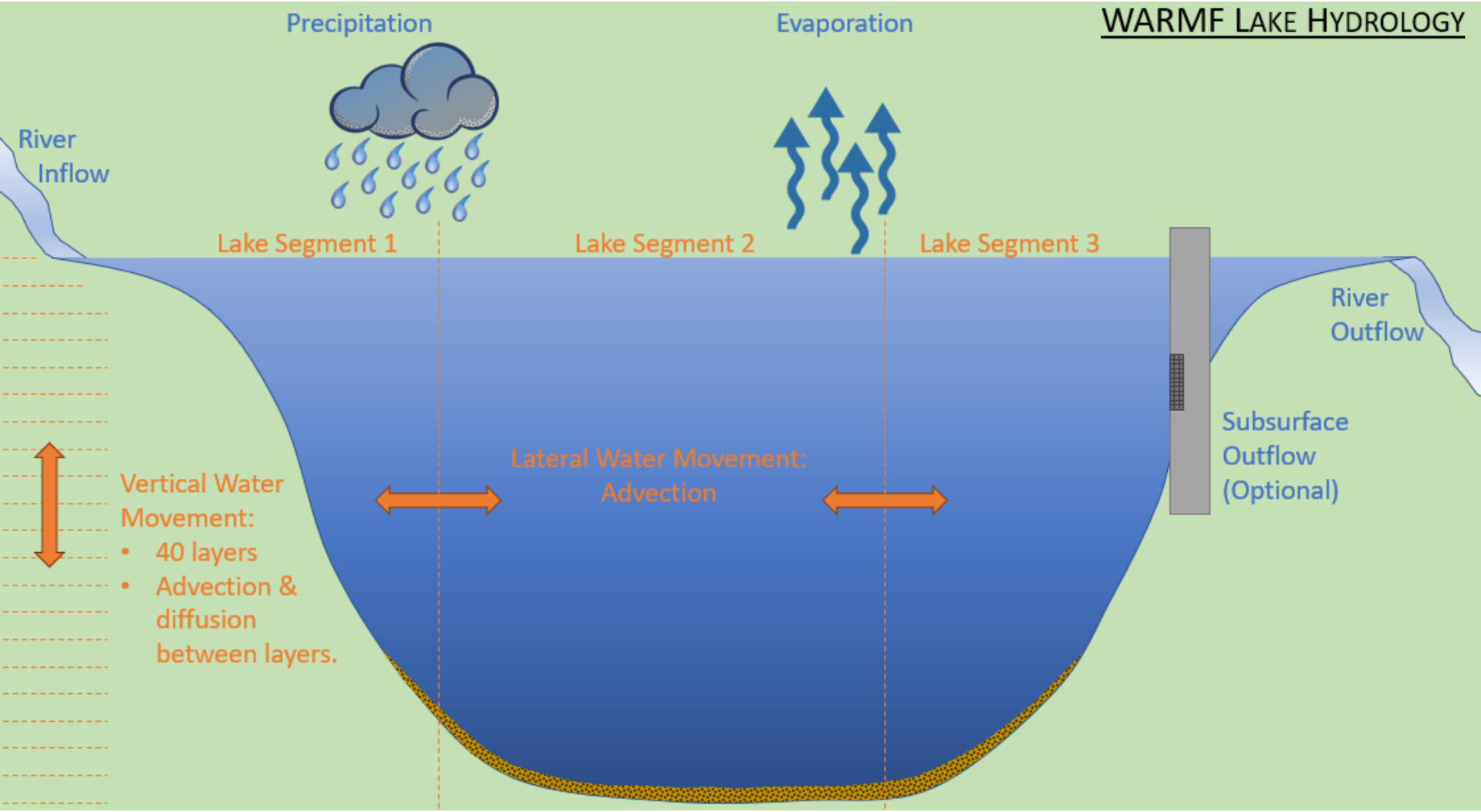
- Modeling constraints for segment-based model
  - Within a segment, everything is uniform
- Characteristics of the lake
  - Water quality
  - Bathymetry/morphometry
  - Sediments
  - Hydrology
- Regulatory framework

Today we will review these considerations and discuss a recommendation from the modelers and subject matter experts for segmentation of Falls Lake.

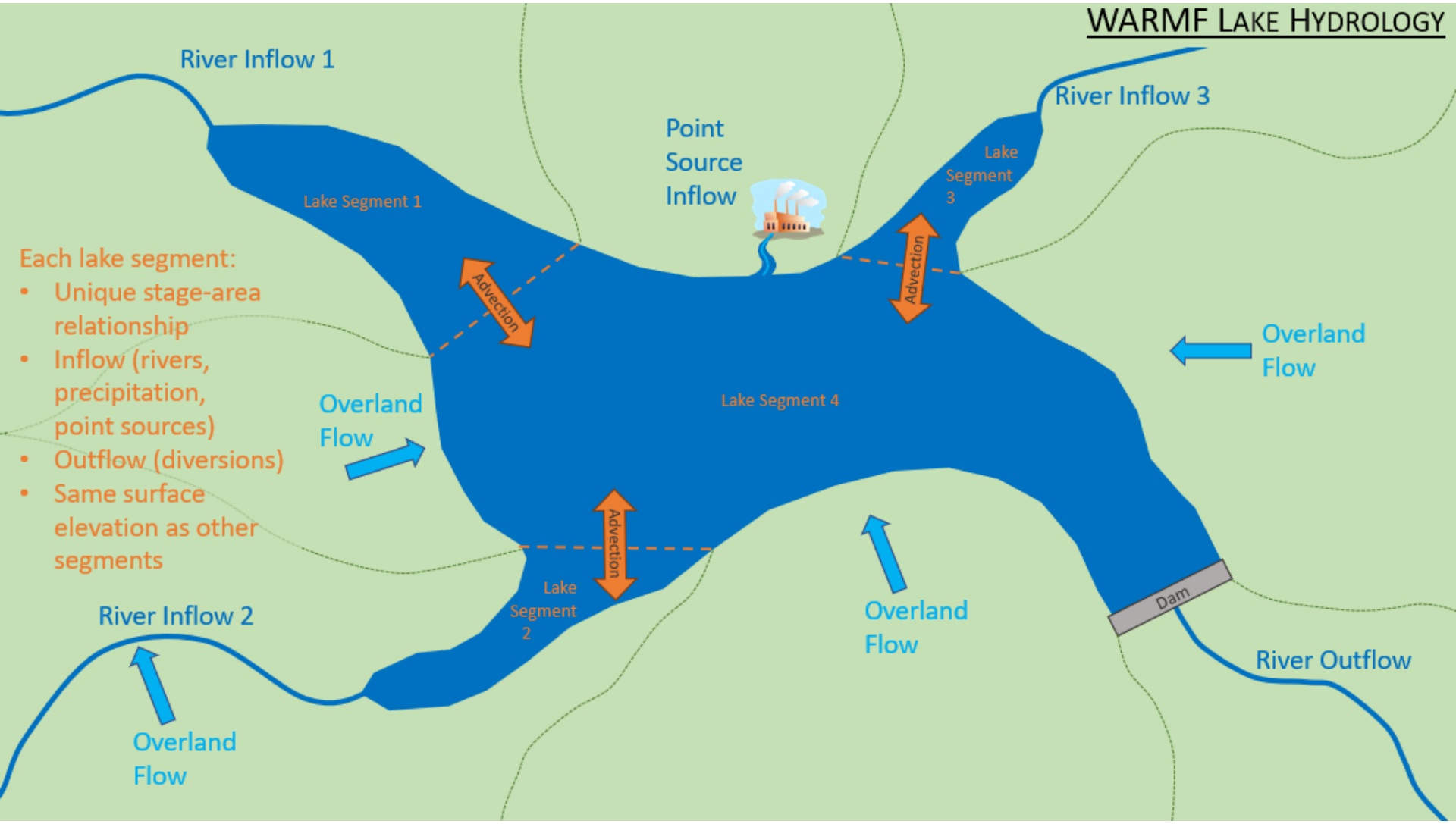
WARMF Lake is a Segment-Based Model

- Performs calculations for each lake segment
  - Each segment has the same average characteristics at every location in the segment (e.g., depth)
  - Each segment has 40 layers
  - Within a layer, the segment is completely mixed
- Segments are linked from upstream to downstream
- Segments receive inputs from
  - Upstream segments or lake arms
  - From tributaries (from the WARMF watershed)

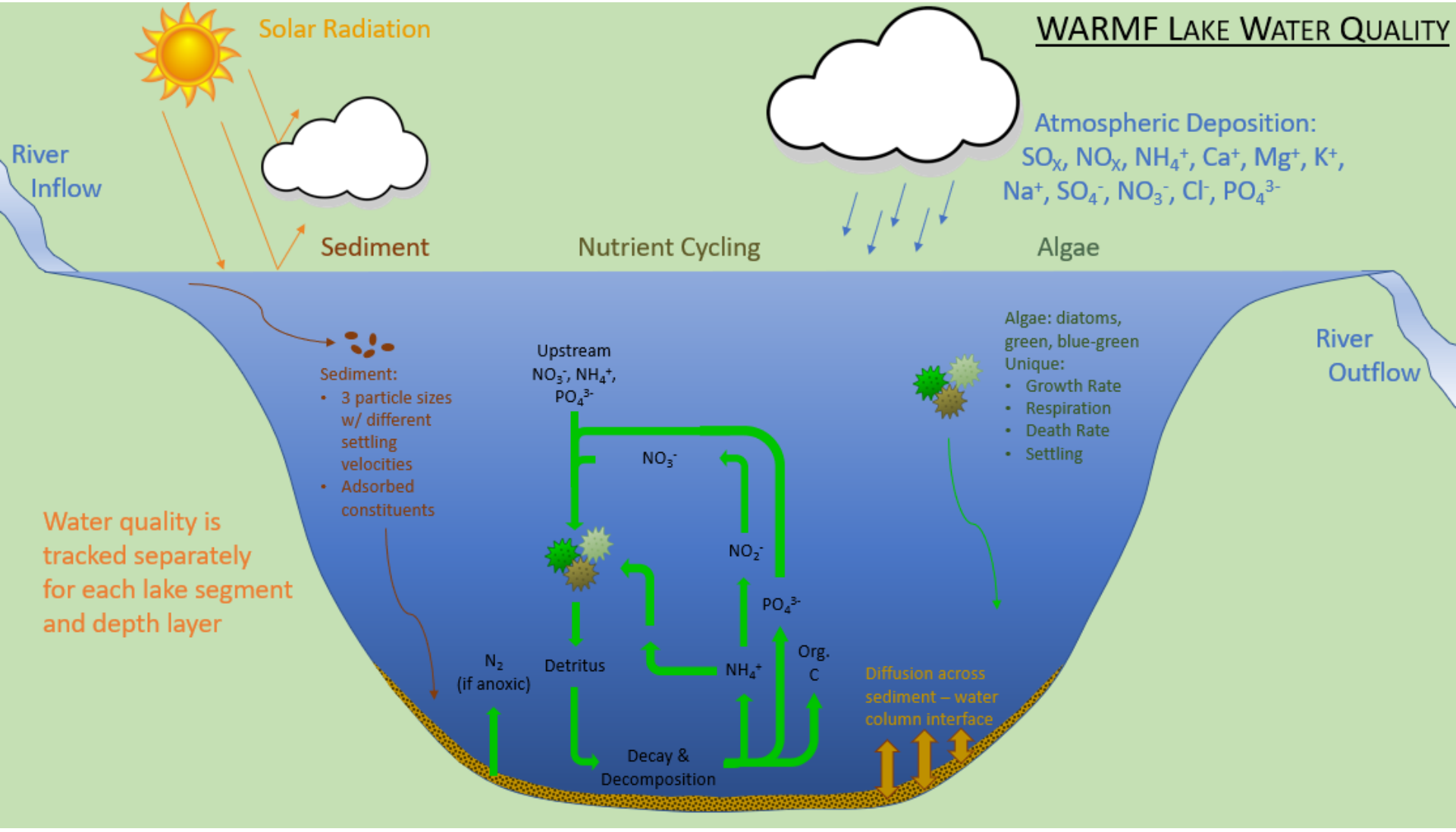
WARMF Lake Hydrology



WARMF Lake Hydrology



WARMF Lake Simulates Processes



Calibration Approach for Segment-Based Models Can Vary by Purpose

- Calibrate to the average condition of each segment
  - Based on midpoint or averaging of stations
  - Often appropriate when segments are managed separately, there is only one segment, or data are only available near the mid point
- Calibrate to the downstream end of each segment
  - Based on downstream monitoring station
  - Flow and concentration leaving one segment provide accurate inputs to the downstream segment

Regulatory Considerations

Regulatory Considerations of Lake Segmentation

- Segmentation defines the resolution of model output
  - Assessment of impairment of water quality standards
  - Evaluation of site specific criteria
- Lake segmentation should also consider
  - EPA Clean Water Act guidance on segmentation
  - DWR assessment procedures and changes over time
  - NC High Rock Lake Scientific Advisory Council recommendations (High Rock Lake Chlorophyll-a Report)

EPA Guidance for Water Quality Assessment Units

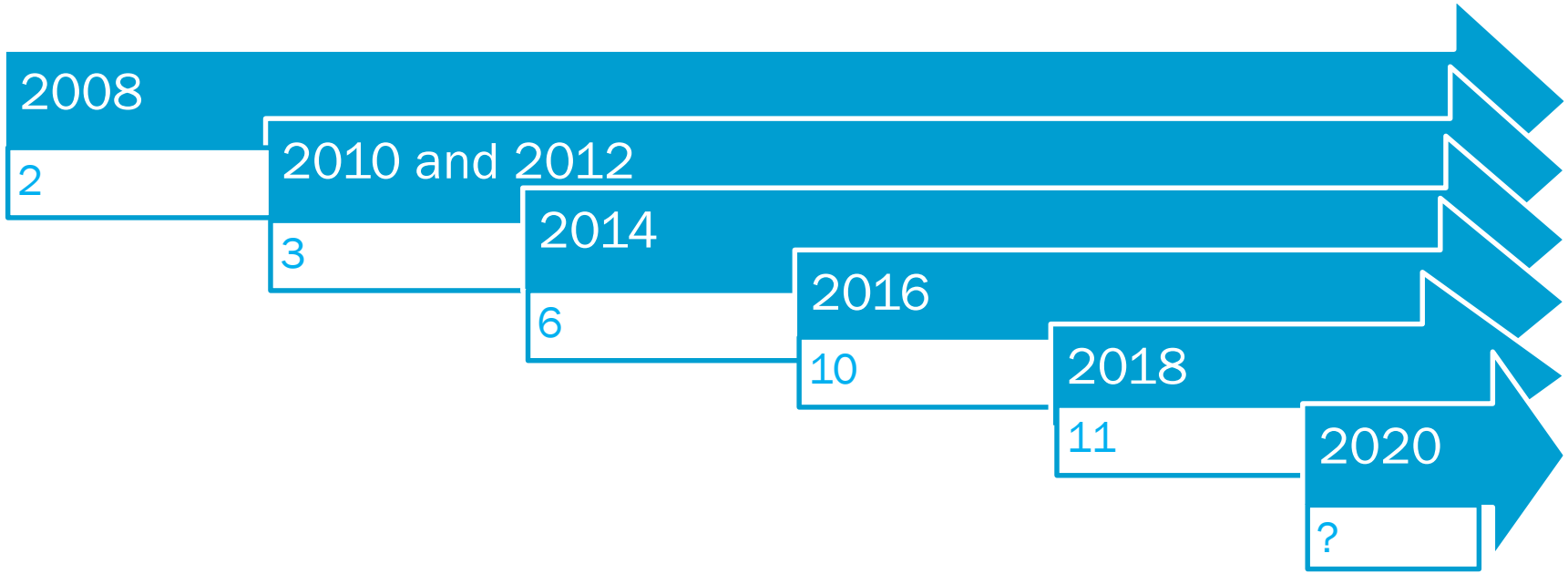
- Waterbodies can be split into assessment units (segments) to determine compliance with standards
- Assessments should be based on monitoring
- Segments (lakes, streams, estuaries) should represent a homogeneous parcel of water considering several factors
  - Morphology
  - Substrate
  - Riparian condition and adjoining land uses
  - Stream network
  - Sources of pollutant loading
- Also need to consider EPA's recently proposed criteria, use of monitoring data, and selection of locations

DWR 303(d) Assessments/WQ Impairments

- DWR's approach to assessment of Falls Lake has changed since the lake was originally listed as impaired
- When the Falls Lake Rules were adopted
  - Two assessment units in Falls Lake (2008 assessment)
  - DWR data from 12-13 stations was used
- Latest assessment (2018)
  - Eleven assessment units in Falls Lake
  - Also included CAAE data
- Currently DWR is evaluating individual stations, some of which are in arms to the lake or along the shoreline

Number of Falls Lake Assessment Units

- DWR has maintained 12-13 monitoring stations in the lake throughout this period
- DWR added CAAE monitoring stations into the assessment process in 2016 (currently 29 stations total)



High Rock Lake Chlorophyll-a Report

- High Rock Lake - pilot waterbody for setting site specific chlorophyll-a criteria in lakes and reservoirs in NC
- SAC recommendations with respect to assessment
  - Growing season geometric mean should not exceed 35 µg/L in no more than one out of three years
  - Assess the central tendency of chl a concentrations over time for stations included in each assessment unit
  - Numeric assessment (calculation of geometric mean)
    - Use all monitoring data from open waters
    - Within assessment units
    - Collected during the months of April through October
  - Evaluate narrative criteria for monitoring locations in
    - Backwaters
    - Isolated coves
    - Where water depth is typically shallow (e.g., <10 feet)

Falls Lake Characteristics

Falls Lake Geology

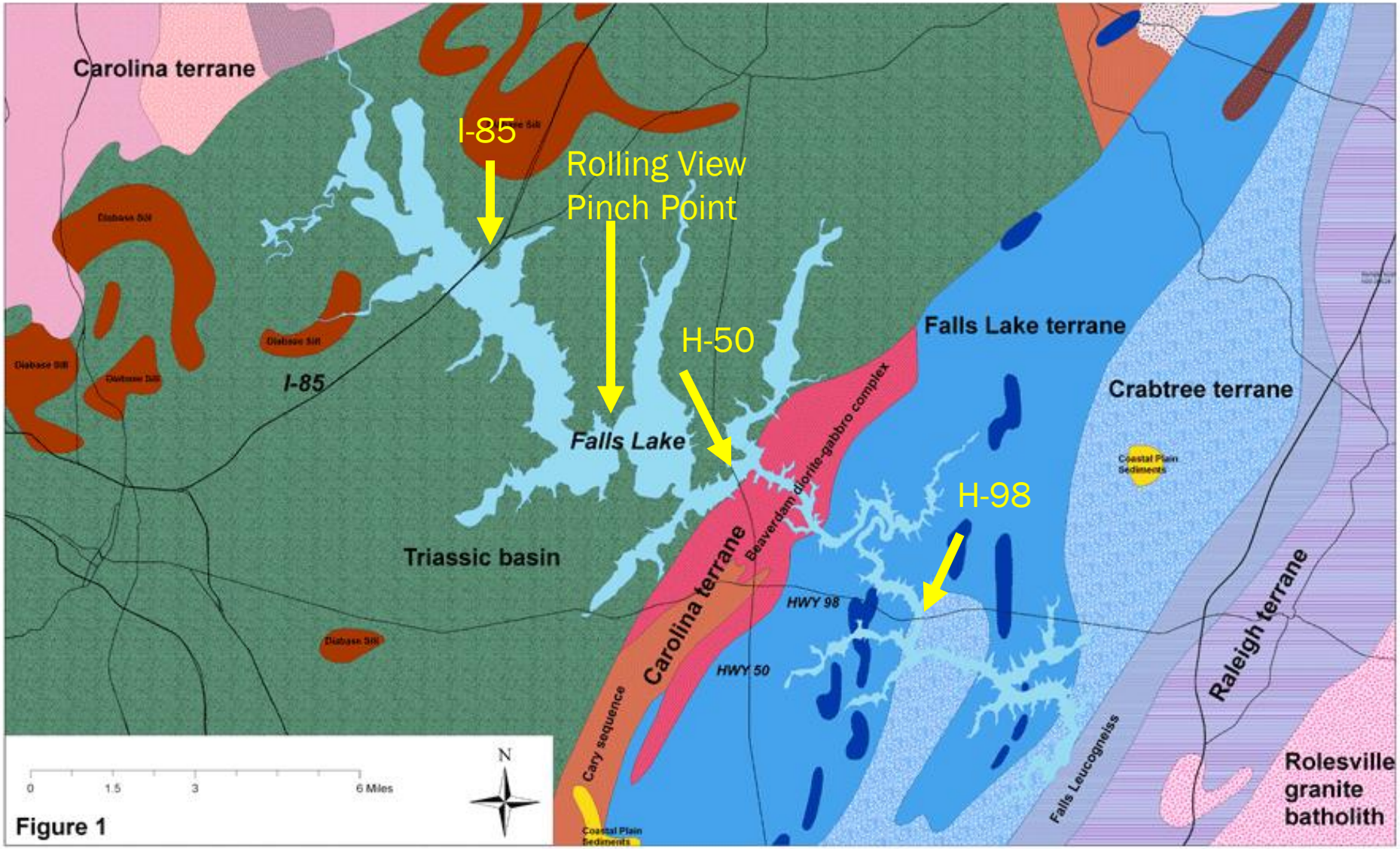
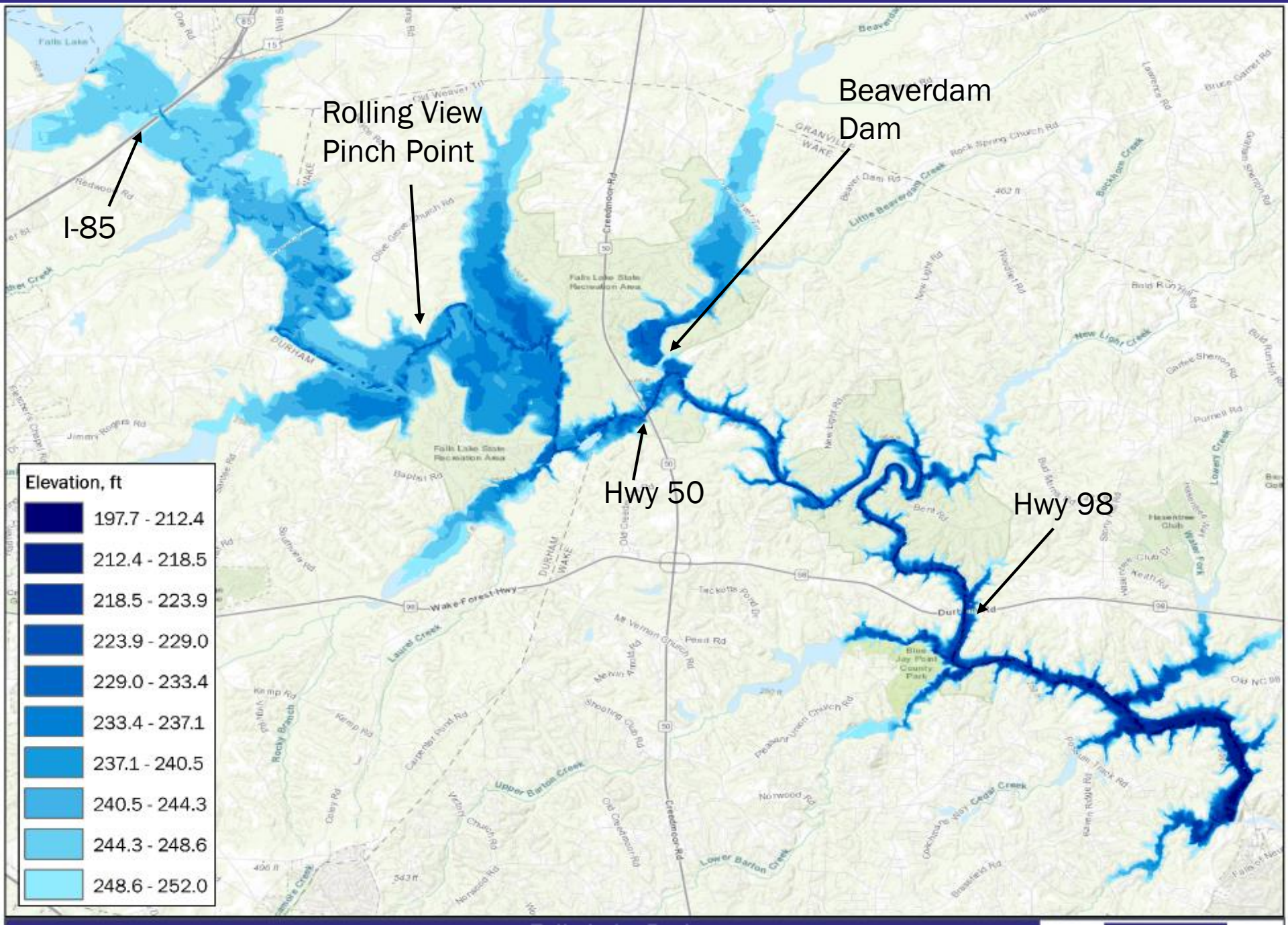
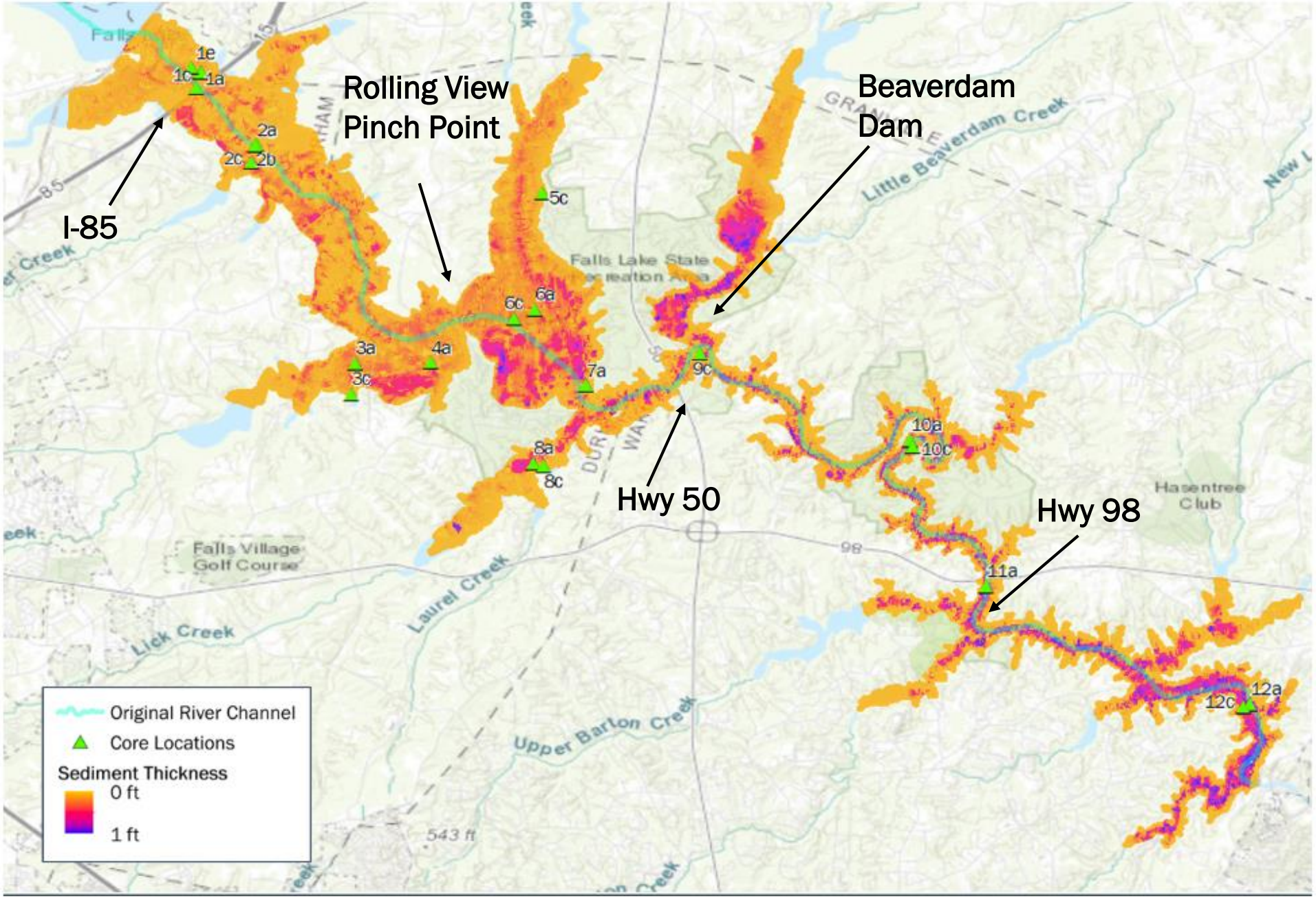


Figure 1

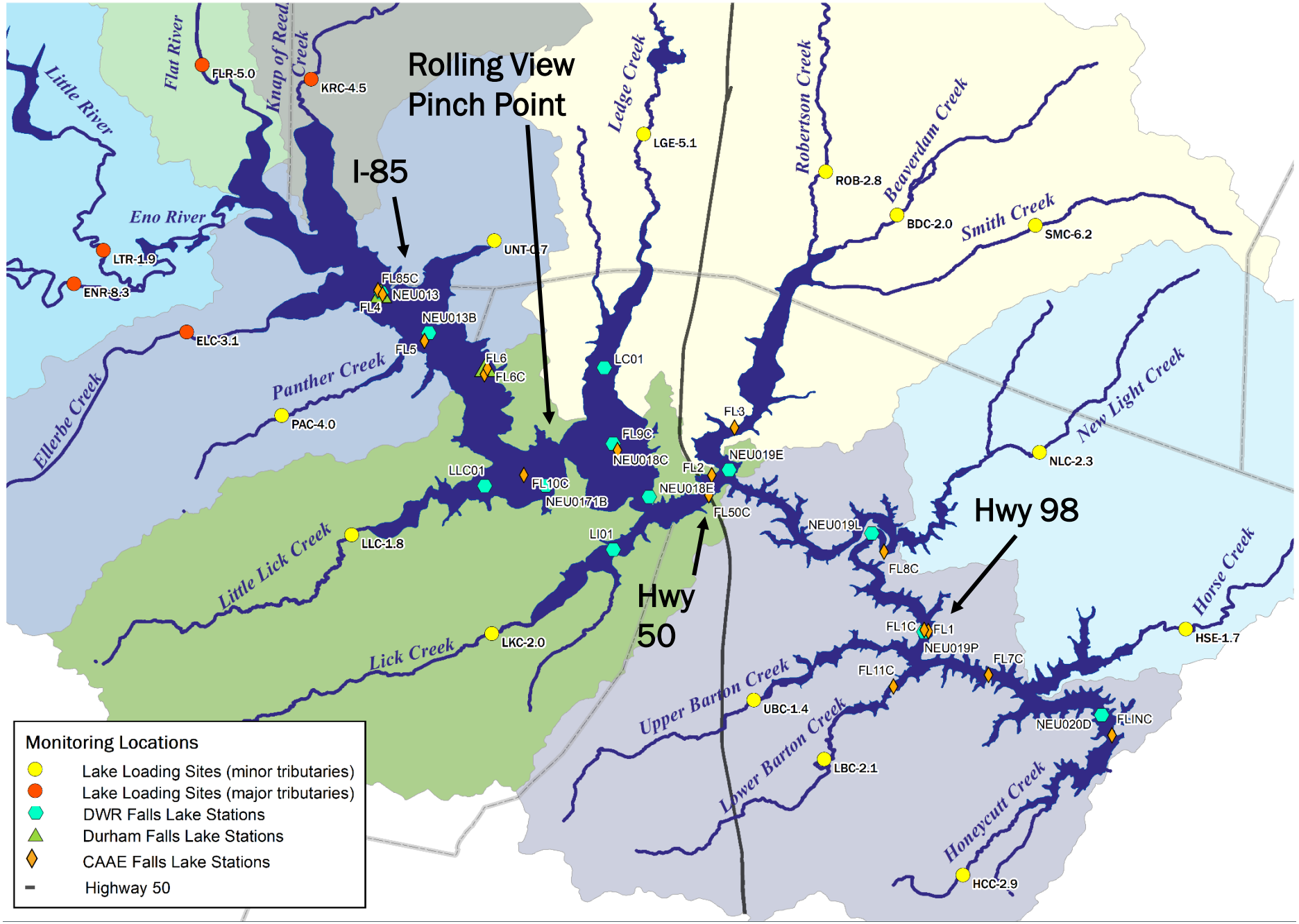
Falls Lake Bathymetry

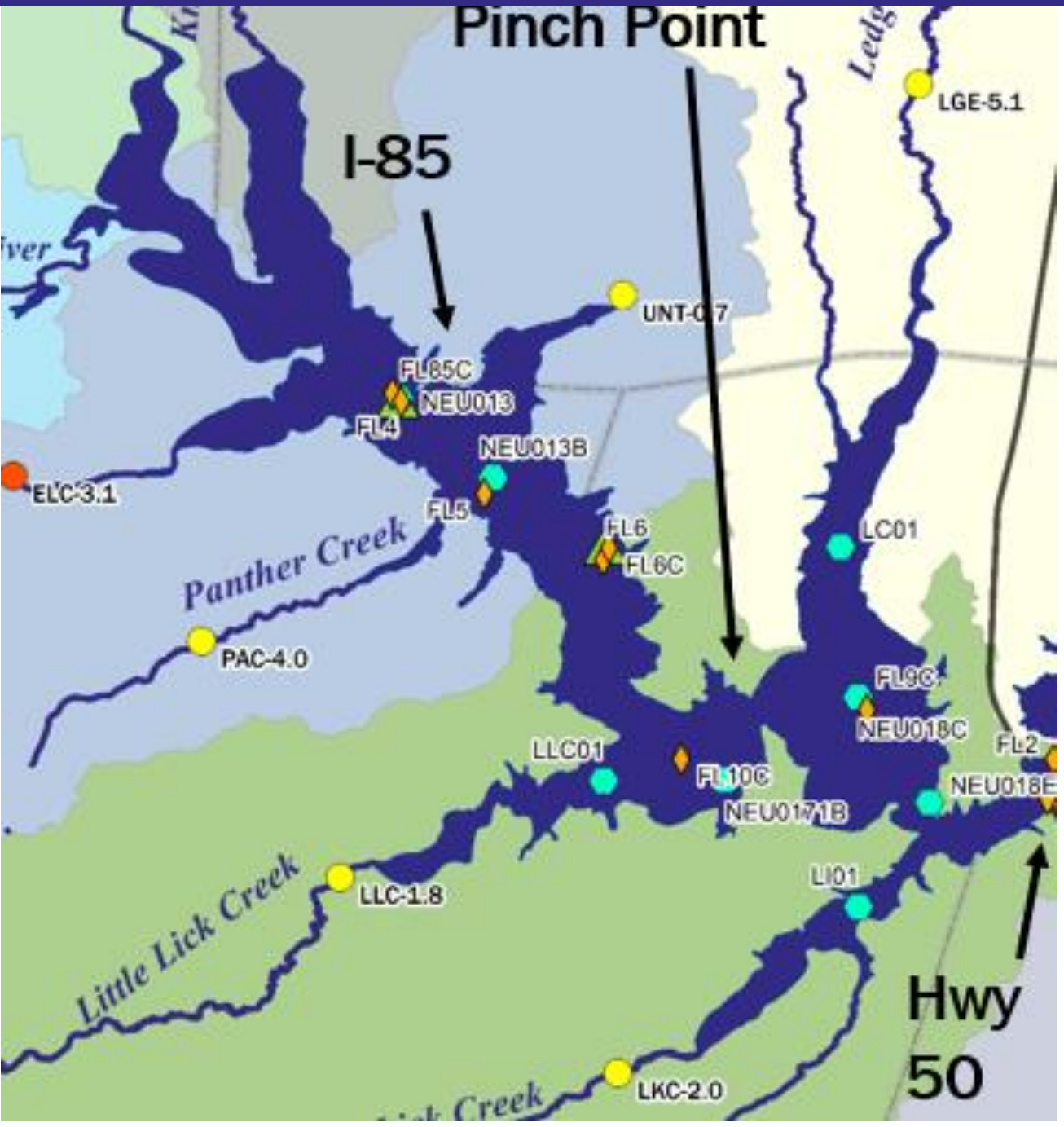


Falls Lake Sediment Thickness



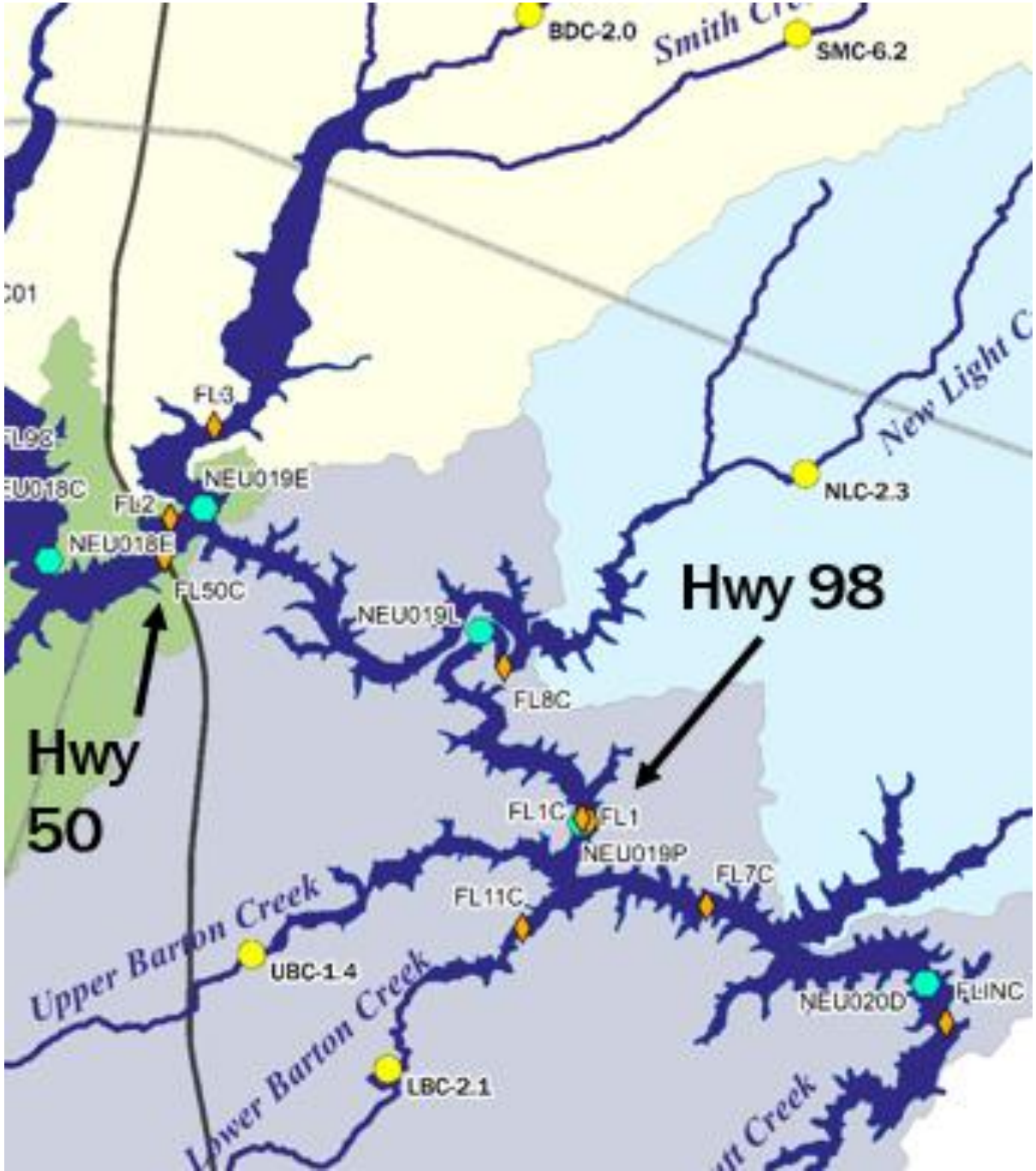
Falls Lake Water Quality Monitoring Stations



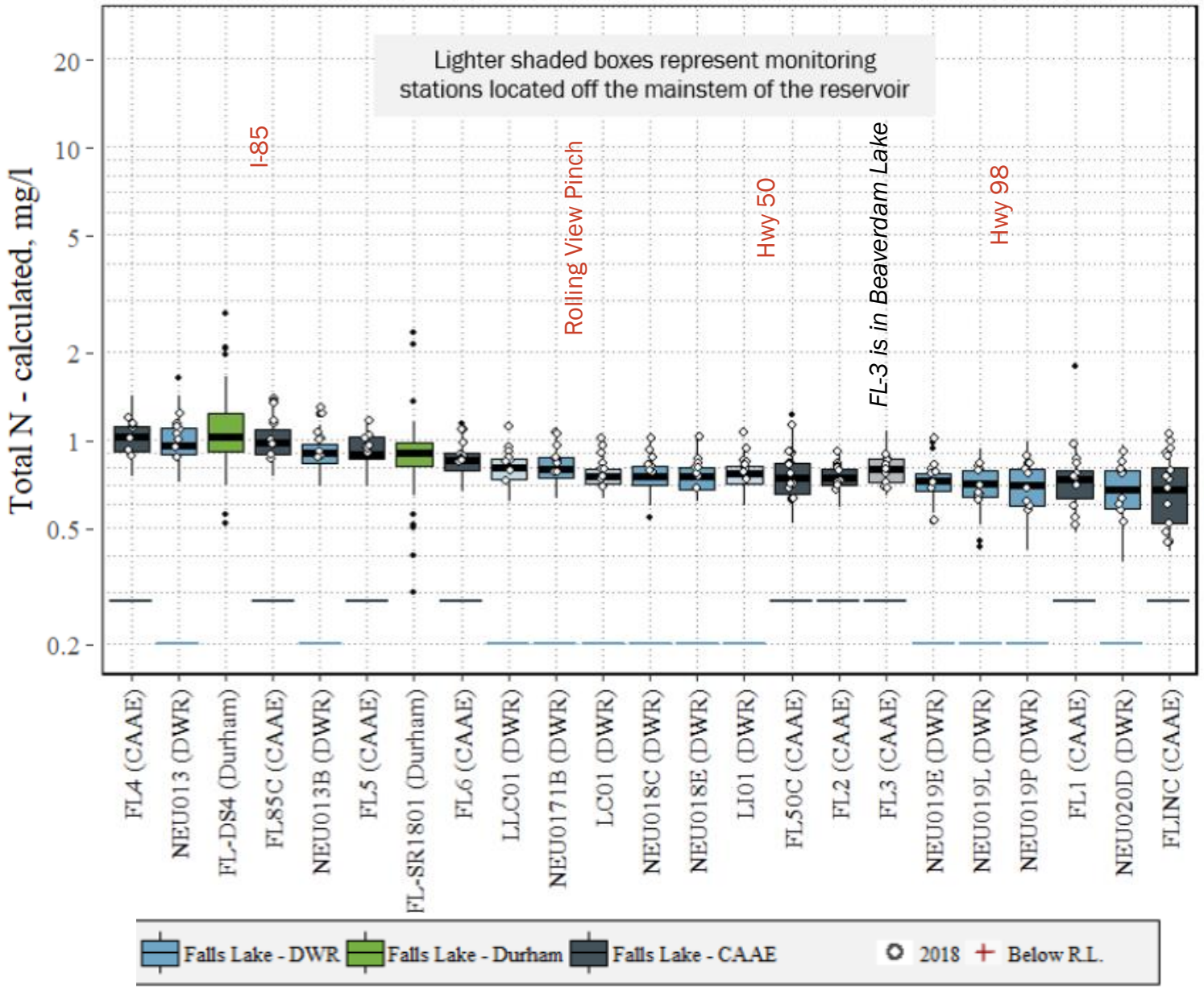


Falls Lake Water Quality Monitoring Stations above Highway 50

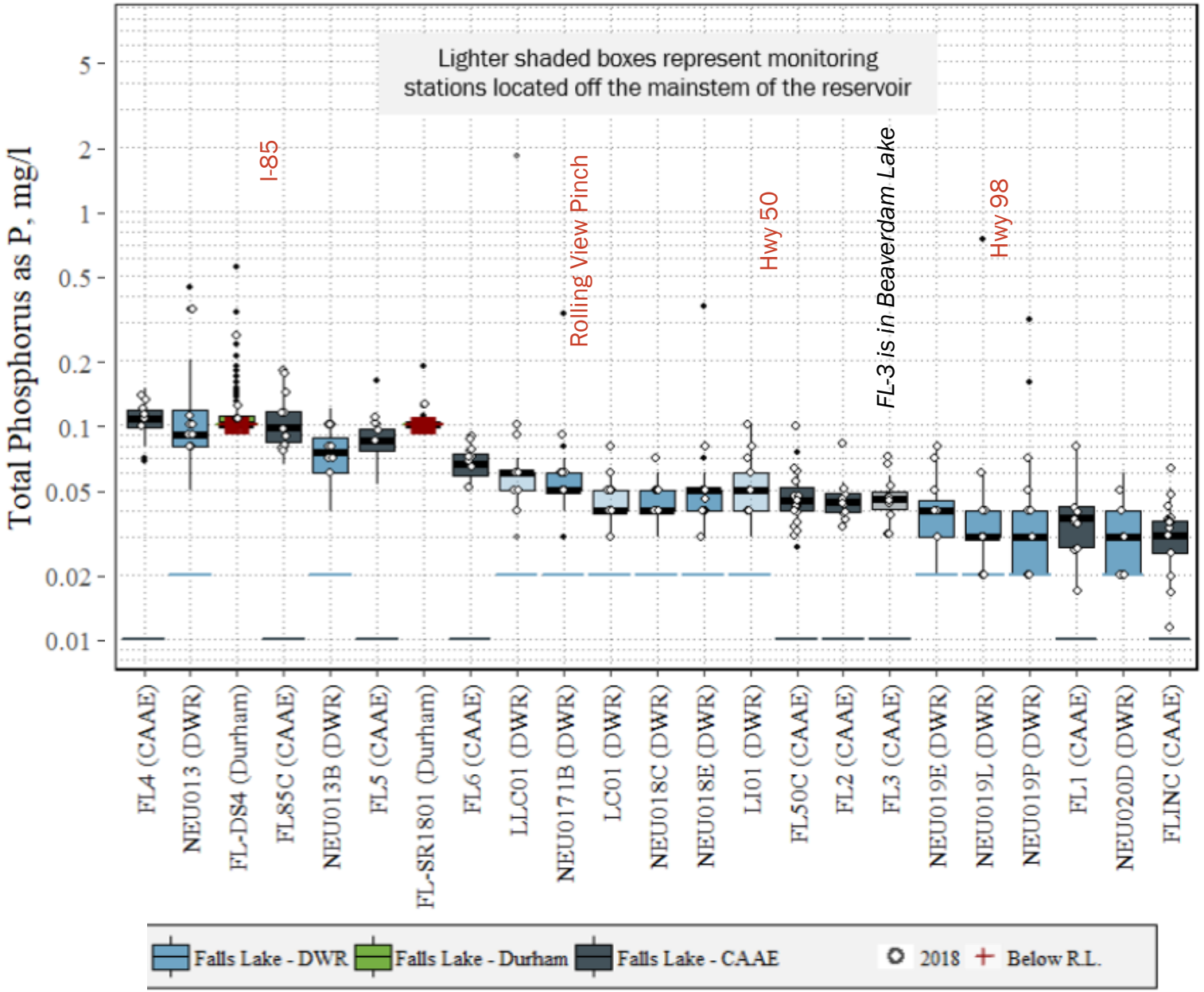
Falls Lake Water Quality Monitoring Stations below Highway 50



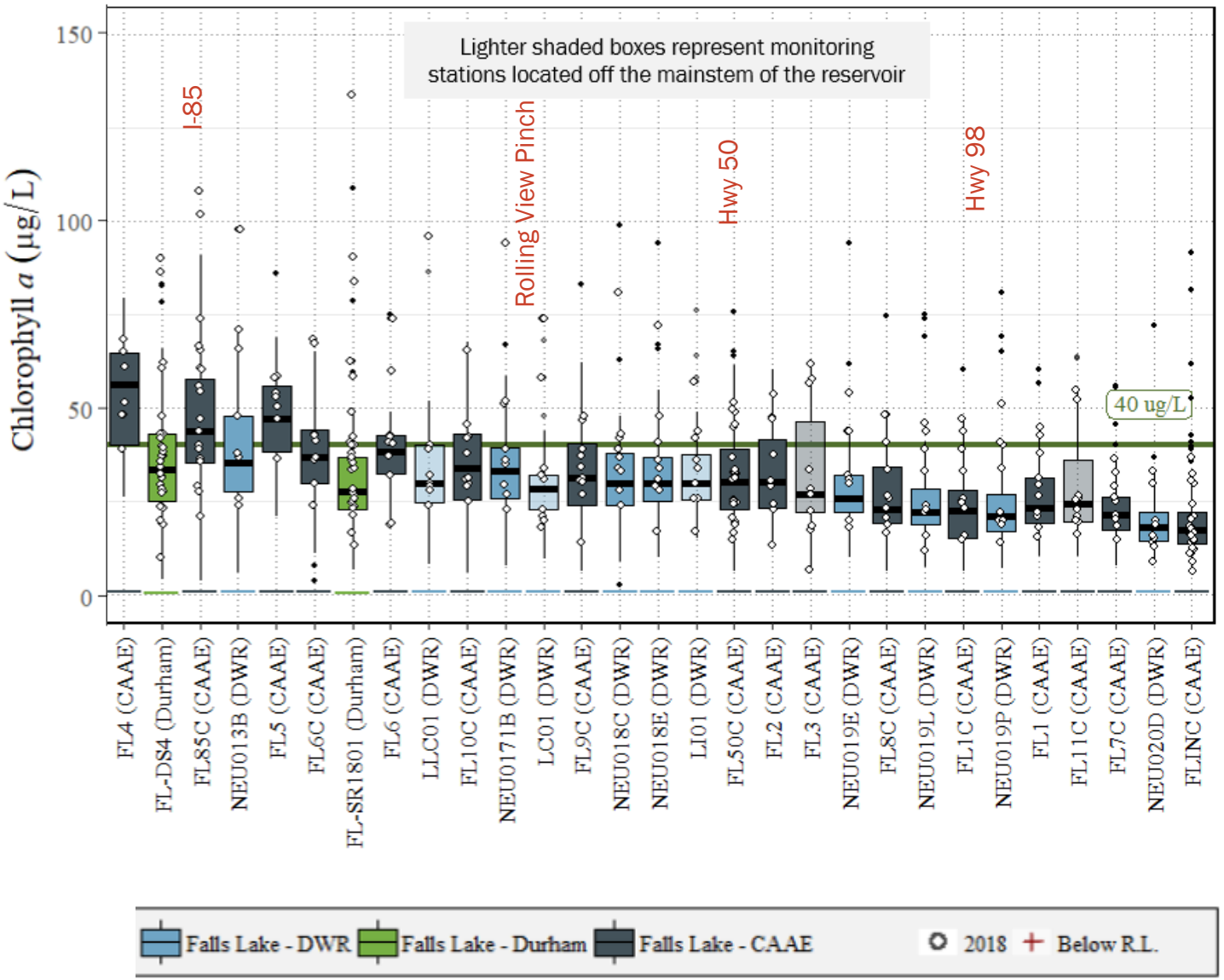
Total Nitrogen Data In Falls Lake (upstream to downstream, 2014 to 2018)



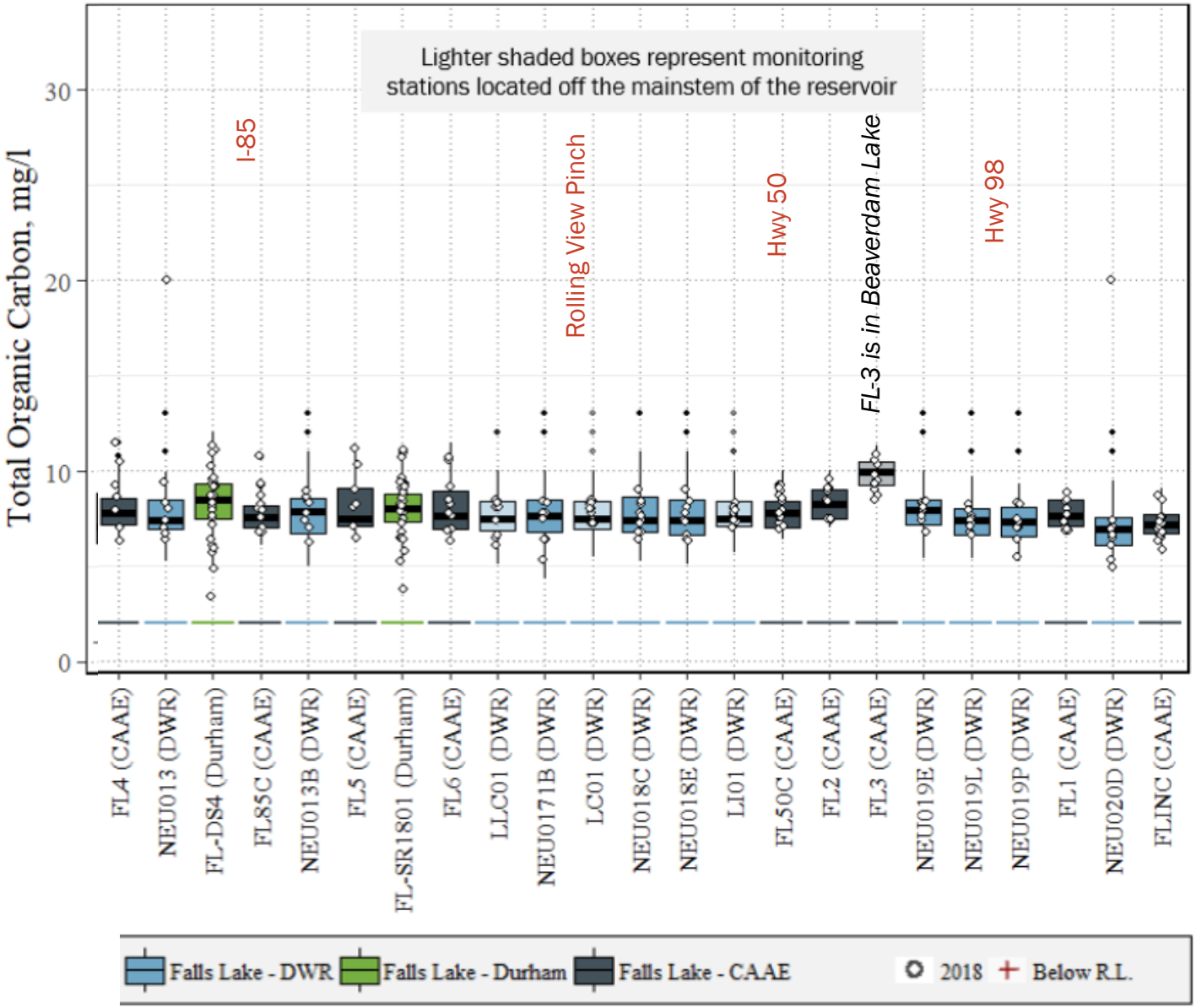
Total Phosphorus Data In Falls Lake (upstream to downstream, 2014 to 2018)



Chlorophyll-a Data In Falls Lake (upstream to downstream, 2014 to 2018)



Total Organic Carbon Data In Falls Lake (upstream to downstream, 2014 to 2018)

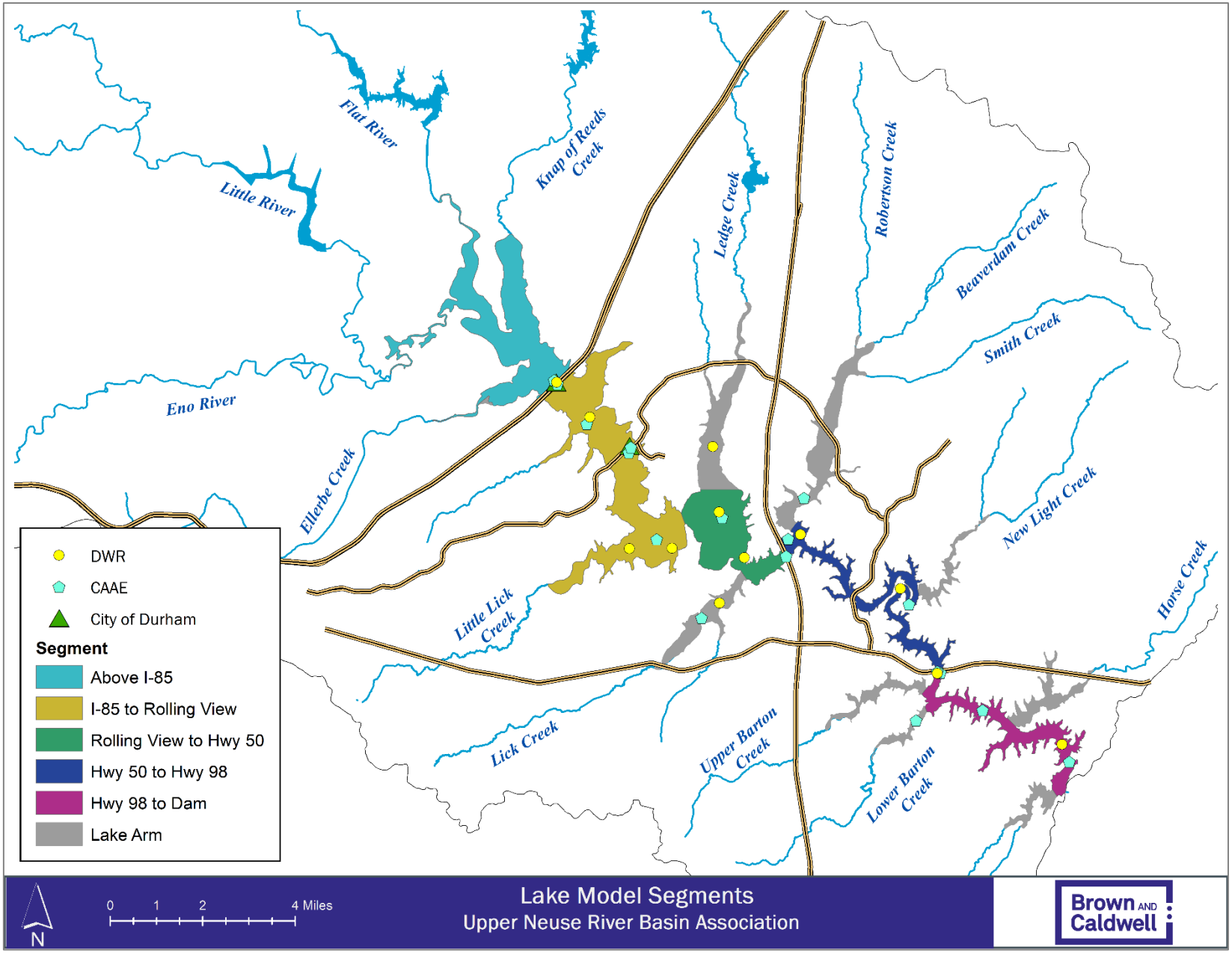


Recommendation for Segmentation of Falls Lake WARMF Model

Recommendation for WARMF Lake Segmentation for Falls Lake

- The modelers and subject matter experts discussed the technical and regulatory considerations on July 14th
- Recommendation is to simulate the arms to lake separately from main lake segments
  - Arms are more shallow than main lake, so assumption of the same depth across a segment will not work here
  - Arms will provide a transition between the tributary inputs and the main lake segment downstream
  - Five main lake segments
    - Above I-85
    - I-85 to Rolling View
    - Rolling View to Hwy 50
    - Hwy 50 to Hwy 98
    - Hwy 98 to the dam

Discuss Recommendation with MRSW



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.

Modeling and Regulatory Support Status

MRS Status

- WARMF Watershed Modeling for water quality
  - Modifying code to simulate several types of onsite wastewater treatment systems
  - Working with the UNC Collaboratory to fill spatial data gaps for onsite wastewater treatment systems
  - Interpolated effluent data for wastewater treatment plants and passed spreadsheets to major facilities for review
  - Integrating SSO data from DEQ, City of Durham and Town of Hillsborough for the recent modeling period
  - Inputting nutrient applications rates into the model for agricultural and urban land uses
- EFDC Falls Lake Hydrodynamic Model
  - Preliminary hydrodynamic calibration results were presented at the August 2020 MRSW meeting
  - Refining calibration and calculating additional performance criteria for upcoming discussions with DEQ

Planning Follow-up Discussions with DWR

- The FY2021 scope includes two workshops with DWR
  - UNRBA Monitoring Report
  - WARMF Watershed Model
  - EFDC workshop had been planned for early FY2022
- During the August MRSW meeting we presented preliminary hydrodynamic calibration results for EFDC
  - DWR asked some good questions during the meeting
  - There was insufficient time to answer them fully
  - Presentation had been targeted to the MRSW and did not go into the level of detail to support a detailed technical discussion
- Recommendation is to meet with DWR in October to continue these discussions

Interim Report

- Modeling team provided an interim draft report to the Executive Director for the WARMF watershed model (hydrologic component)
  - Model development and MRSW input described in text
  - Model performance provided figures and tables from MRSW meetings packaged as an appendix
  - Team can provide a draft that addresses Executive Director comments and improves model performance reporting if the MRSW would like, or wait for the next draft
- Next draft of the watershed modeling report
  - Describe inputs related to the water quality simulation
  - Provide hydrologic and water quality performance in the main report based on feedback from MRSW on formats
  - Executive Director to review new material and responses to his comments; Team to address additional comments
  - Provide a more complete draft to the MRSW for review than includes hydrology and water quality by the end of the fiscal year

MRSW discussion of when you would like to see the draft watershed modeling report.

MRSW Anticipated Meeting Schedule

- Seven meetings were scoped for FY2021
- **July**, **August**, and **September** presentations posted to UNRBA website
- **October** – no MRSW meeting*
- **November** – discuss statistical modeling framework (potential segmentation, inputs, modeling approach, desired outcomes)
- **December** - watershed modeling inputs related to water quality modeling
- **January to April** – no MRSW meetings*
- **May** –water quality calibration for the WARMF watershed model
- **June** – preliminary water quality calibration for the EFDC lake model

- Anticipate full PFC meetings for communications activities (discuss later today). Discuss expanding list of participants from Technical Workshop contact list.

Closing Comments
Additional Discussion