UNRBA Monitoring Program

PFC Meeting

April 2016

March 23, 2016

FY2016 Annual Report

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Routine Monitoring

- Lake Loading Stations (25% of FY2016 Monitoring Program Budget)
  - 18 Stations sampled monthly, 5 of them twice monthly
  - 19 parameters measured
- Jurisdictional Boundary Stations (8% of FY2016 Monitoring Program Budget)
  - 20 Stations sampled monthly
  - 10 parameters measured
- In-Lake (DWR & City of Durham)
  - 12 Stations sampled monthly (DWR)
    - 17 parameters measured
  - 2 Stations sampled weekly (April-October)
    - 14 parameters measured
- Data Evaluated Continuously for QA/QC and for Patterns
- Data Posted to UNRBA website

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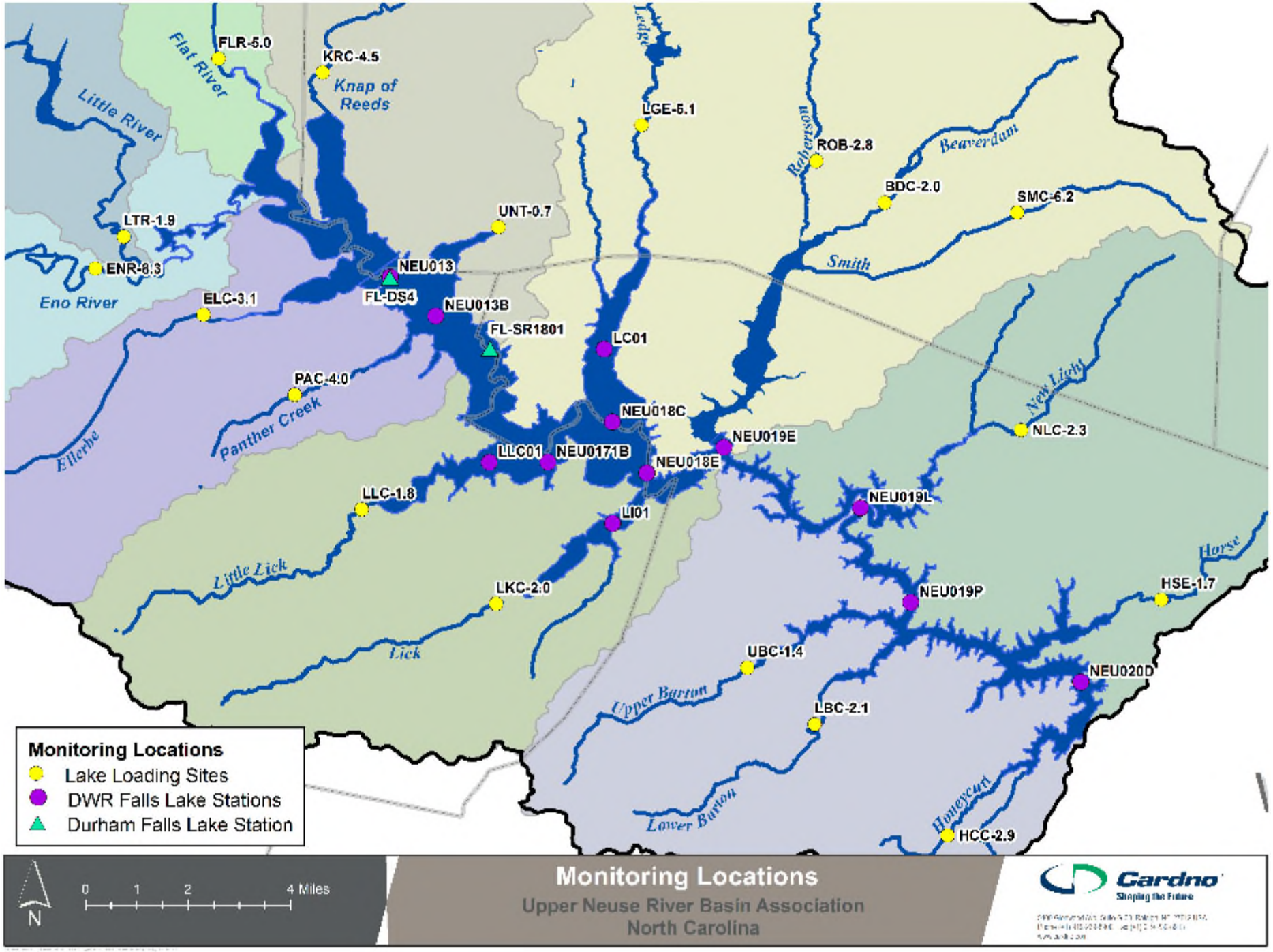
FLR-5.0
KRC-4.5
Knap of Reeds
Flat River
Little River
LGE-5.1
ROB-2.8
Roberson
Beaverdam
BDC-2.0
SMC-6.2
Smith
LTR-1.9
ENR-8.3
Eno River
UNT-0.7
NEU013
FL-DS4
NEU013B
ELC-3.1
FL-SR1801
LC01
PAC-4.0
Panther Creek
Ellerbe
NEU018C
NEU019E
New Light
NLC-2.3
LLC01
NEU0171B
NEU018E
LLC-1.8
LI01
NEU019L
Horse
Little Lick
LKC-2.0
NEU019P
HSE-1.7
Lick
UBC-1.4
NEU020D
Upper Barton
LBC-2.1
Lower Barton
Honeycutt
HCC-2.9
Monitoring Locations
Lake Loading Sites
DWR Falls Lake Stations
Durham Falls Lake Station
N
0 1 2 4 Miles
Monitoring Locations
Upper Neuse River Basin Association
North Carolina
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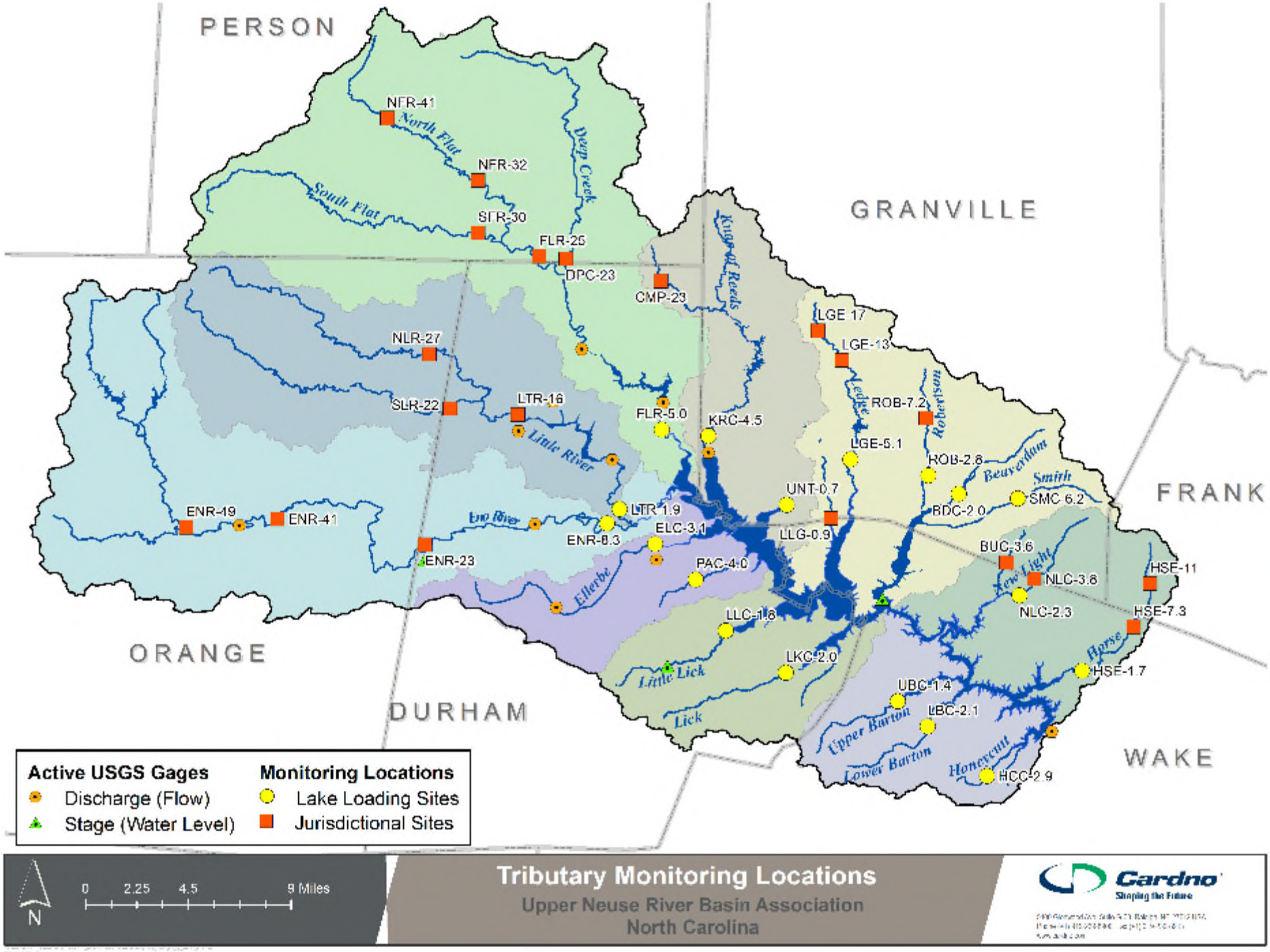
PERSON
GRANVILLE
FRANK
ORANGE
DURHAM
WAKE
NFR-41
North Flat
NFR-32
South Flat
SFR-30
Deep Creek
FLR-25
DPC-23
CMP-23
King of Reeds
NLR-27
SLR-22
LTR-16
Little River
FLR-5.0
KRC-4.5
LGE 17
LGE-13
Ledge
ROB-7.2
Robertson
LGE-5.1
ROB-2.6
Beaverdam
Smith
SMC 6.2
BDC-2.0
UNT-0.7
LLG-0.9
ENR-19
ENR-41
Eno River
LTR 1.9
ELC-3.1
ENR-8.3
ENR-23
PAC-4.0
Ellerbe
BUC-3.6
New Light
NLC-3.8
NLC-2.3
HSE-11
HSE-7.3
HSE-1.7
Horse
LLC-1.8
LKC-2.0
Little Lick
Lick
UBC-1.4
UBC-2.1
Upper Barton
Lower Barton
Honeycutt
HCC-2.9
Active USGS Gages
Discharge (Flow)
Stage (Water Level)
Monitoring Locations
Lake Loading Sites
Jurisdictional Sites
N
0
2.25
4.5
9 Miles
Tributary Monitoring Locations
Upper Neuse River Basin Association
North Carolina
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Special Studies (36% of FY2016 Monitoring Program Budget)

SPECIAL STUDY	INITIATED IN
Storm Event Sampling	FY2015
High Flow Sampling	FY2015
Falls Lake Sediment Sampling	FY2015
Support Development of Alternative Nutrient Strategy	FY2015
Falls Lake Constriction Point Study	FY2016
Measure VSS at Lake Loading and Inlake stations	FY2016
Light Extinction Data Evaluation	FY2016
Basic Evaluation of Model Performance	FY2016
Recreational Use Assessment	FY2016

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Quality Assurance

- All data collected under the UNRBA program are subject to stringent ongoing QA/QC review
- During F2015, laboratory issues were found associated with analyzing field blanks for some nutrient parameters
- The issues were addressed and changes made by the laboratory for FY2016 work
- Data quality is now very good
- The laboratory was audited by Cardno in 2015 and will be visited again before the end of FY2016
- The laboratory was audited in August of 2015 by DWR

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Reservoir Water Levels

2014-2015

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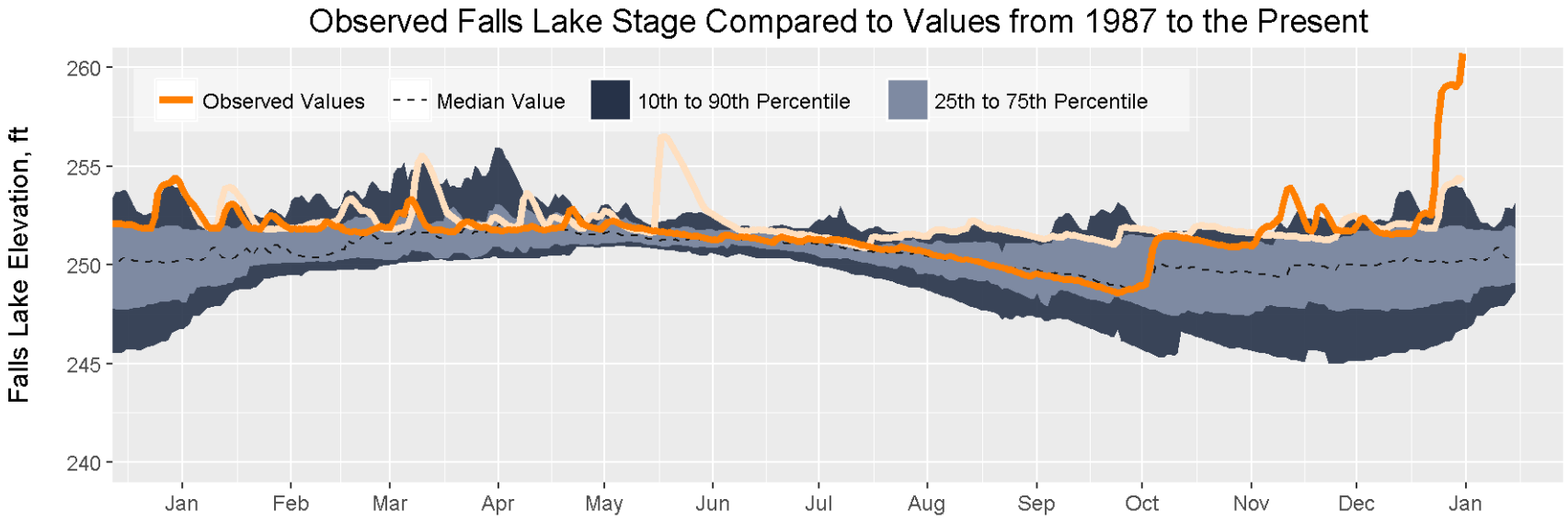

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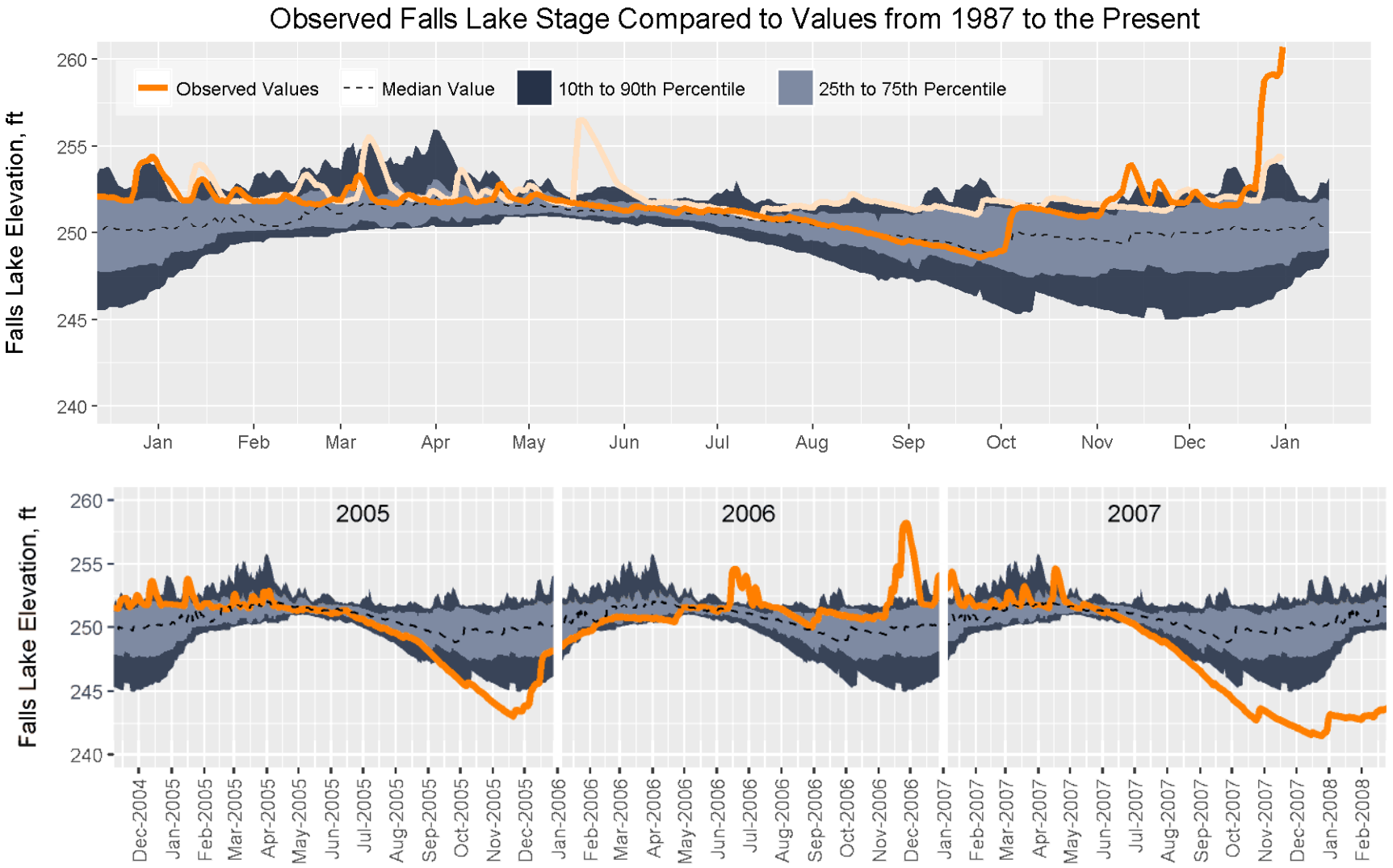

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Falls Lake and Lake Loading Stations

2014-2015

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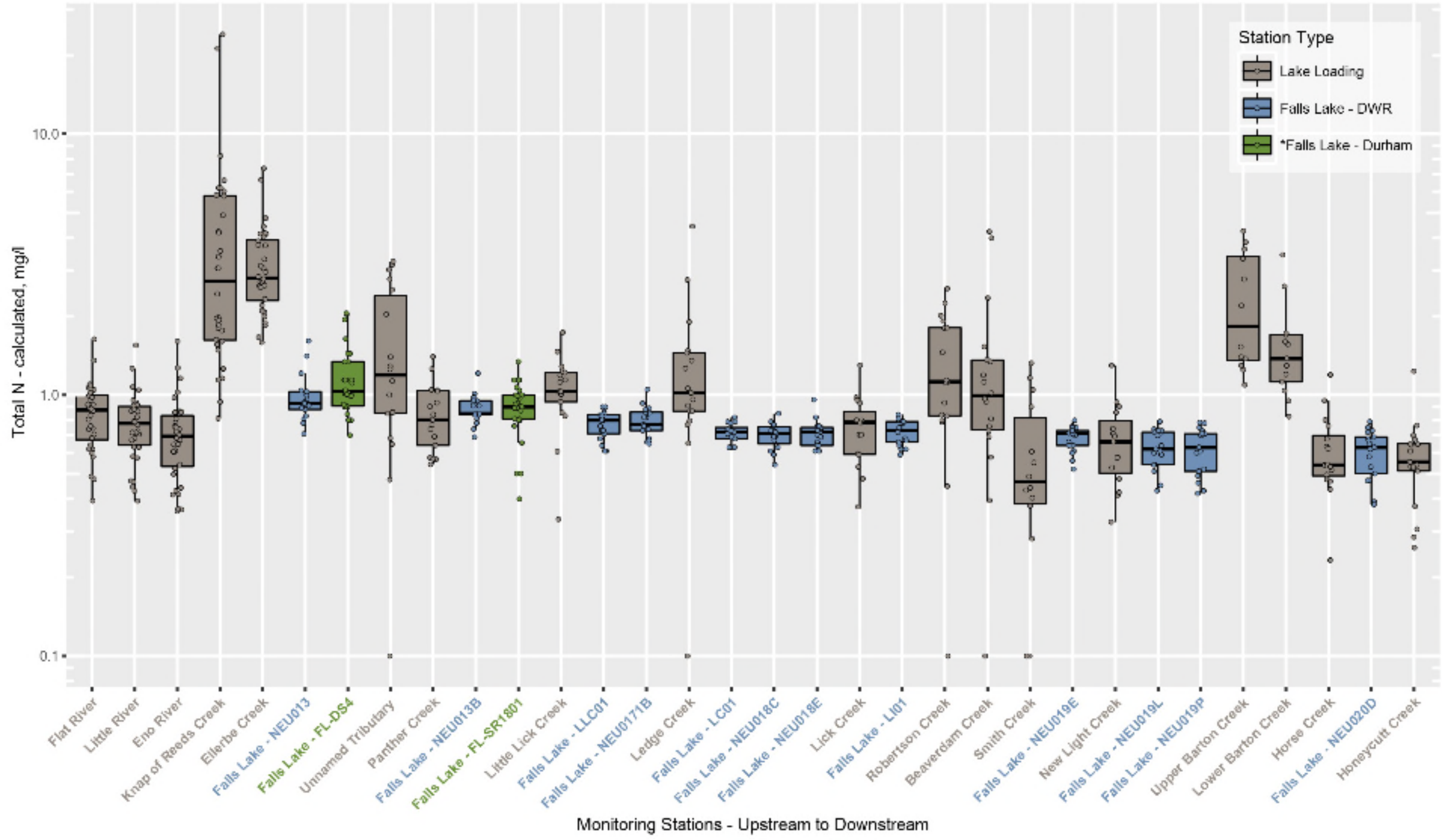
Total Nitrogen



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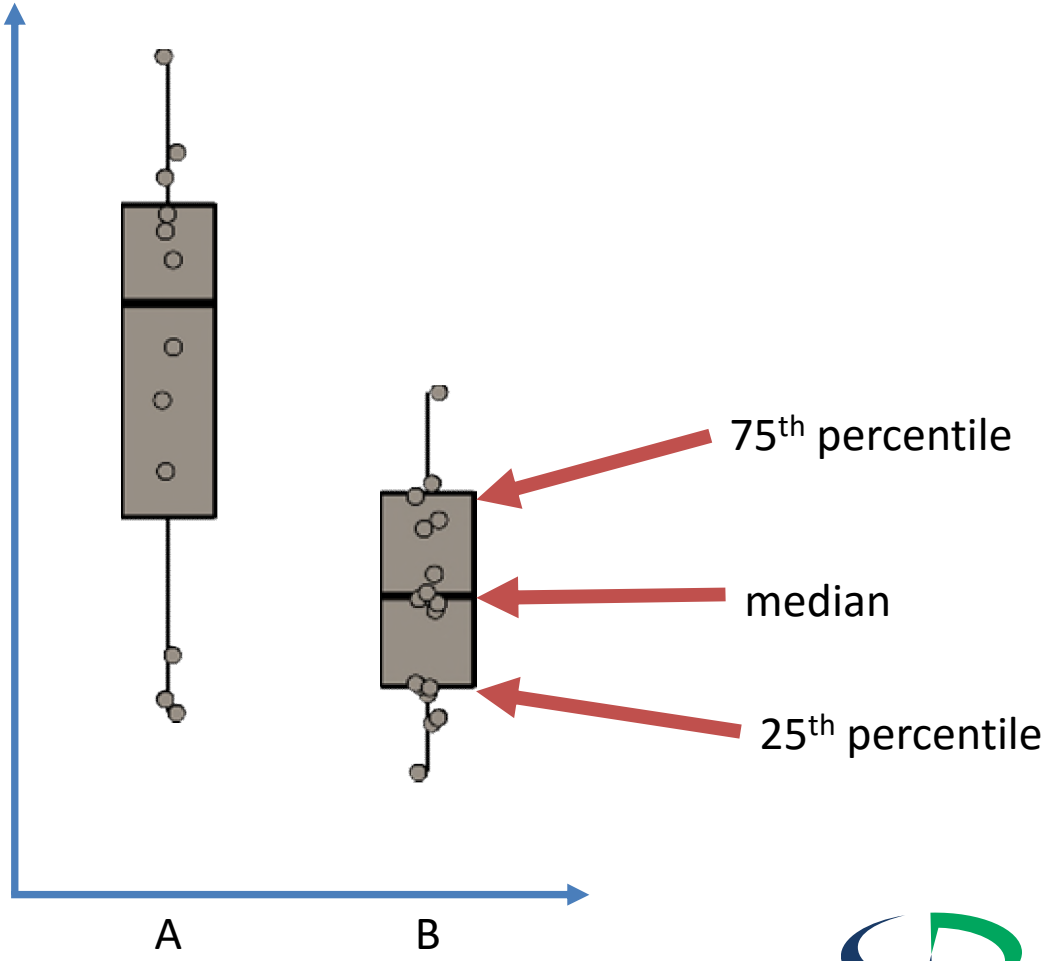

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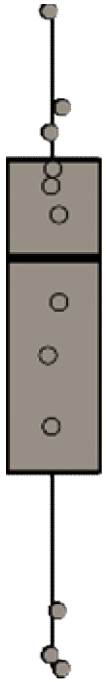
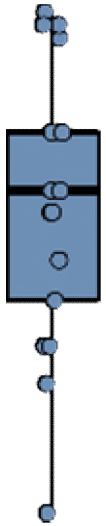


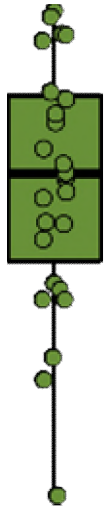
Lake Loading Station

(August 2014 – December 2015)



DWR – Falls Lake

(August 2014 – December 2015)



Durham – Falls Lake

(April – October 2015)

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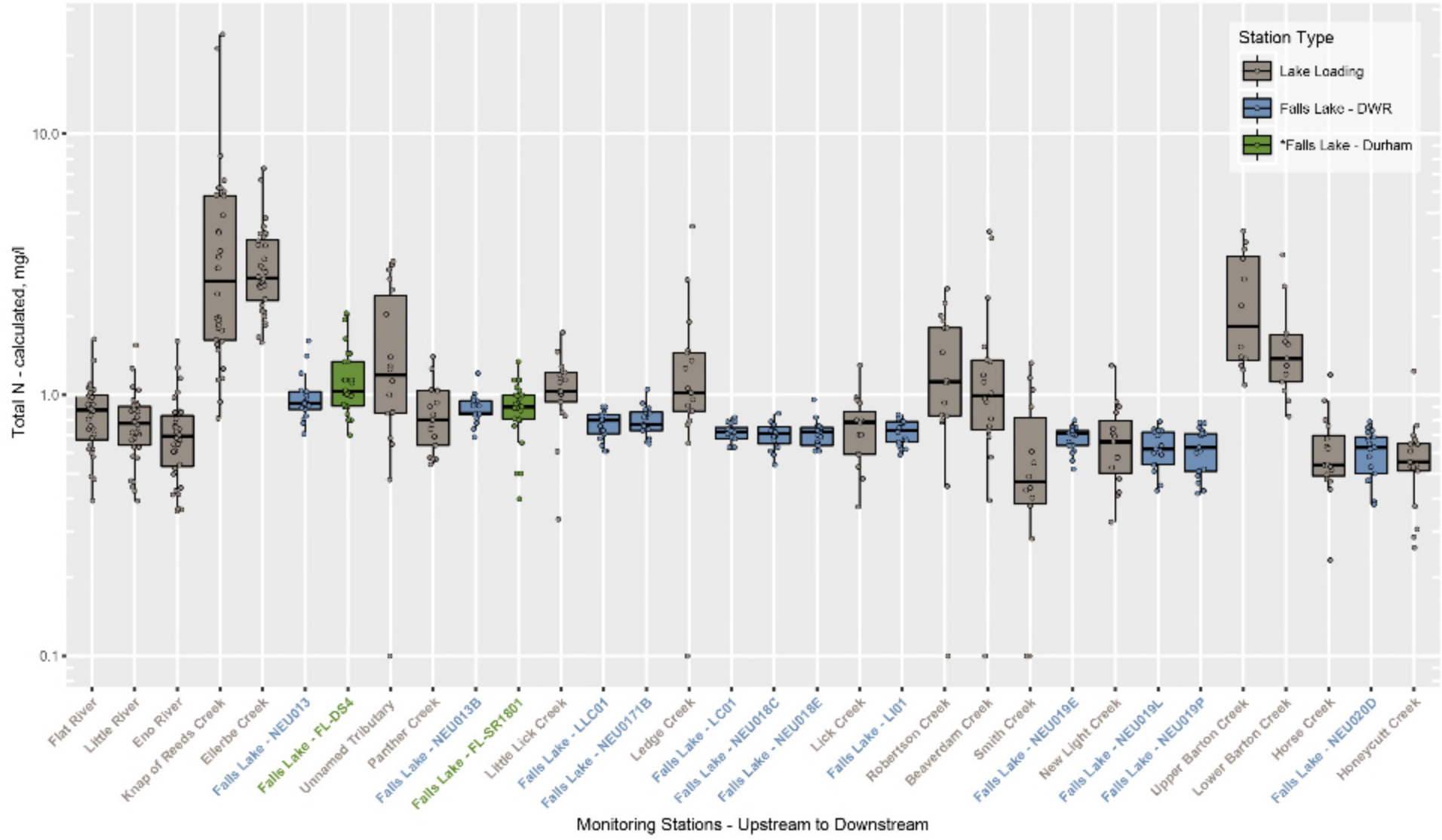
Total Nitrogen: 2014-2015.



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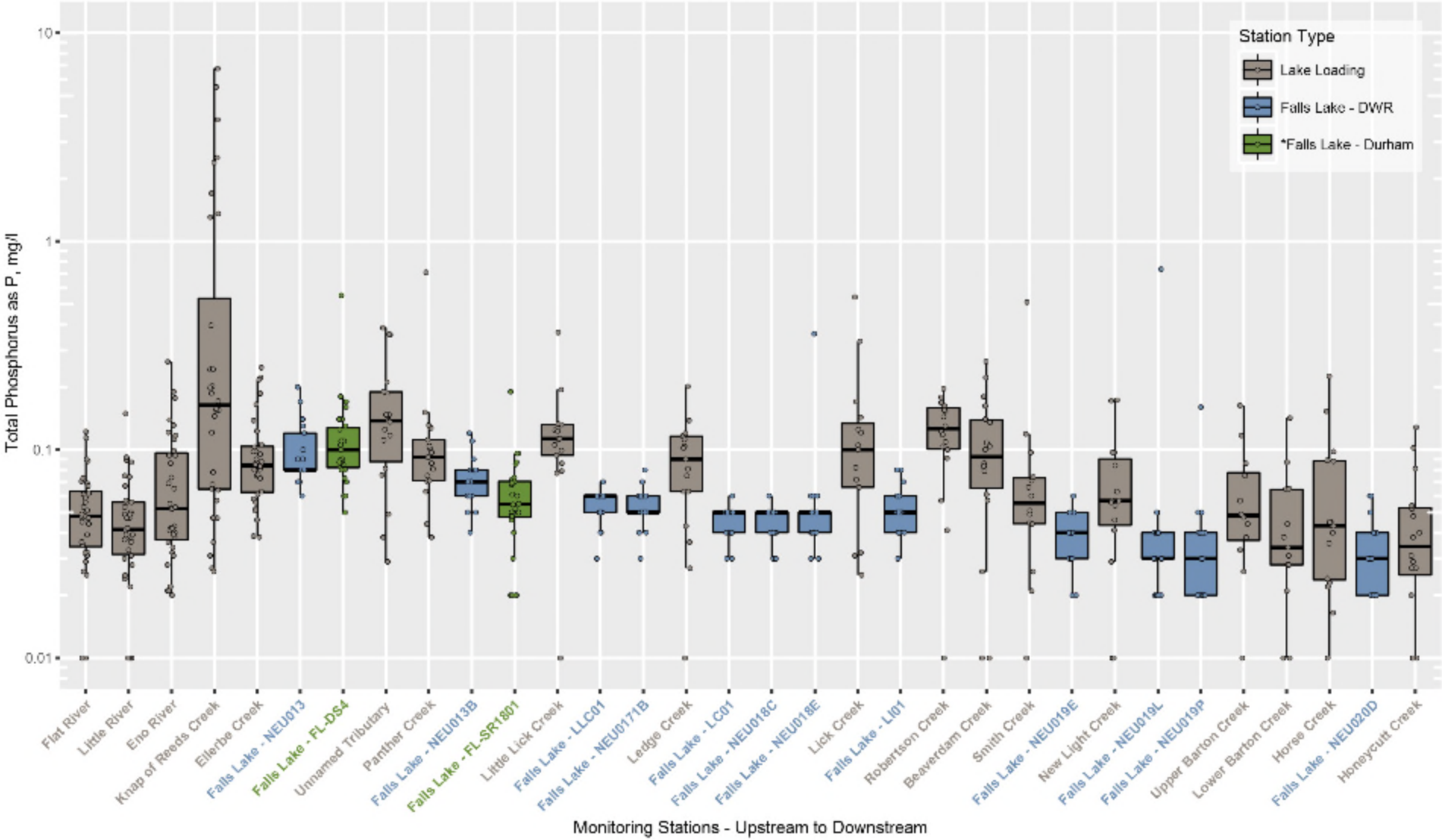
Total Phosphorus



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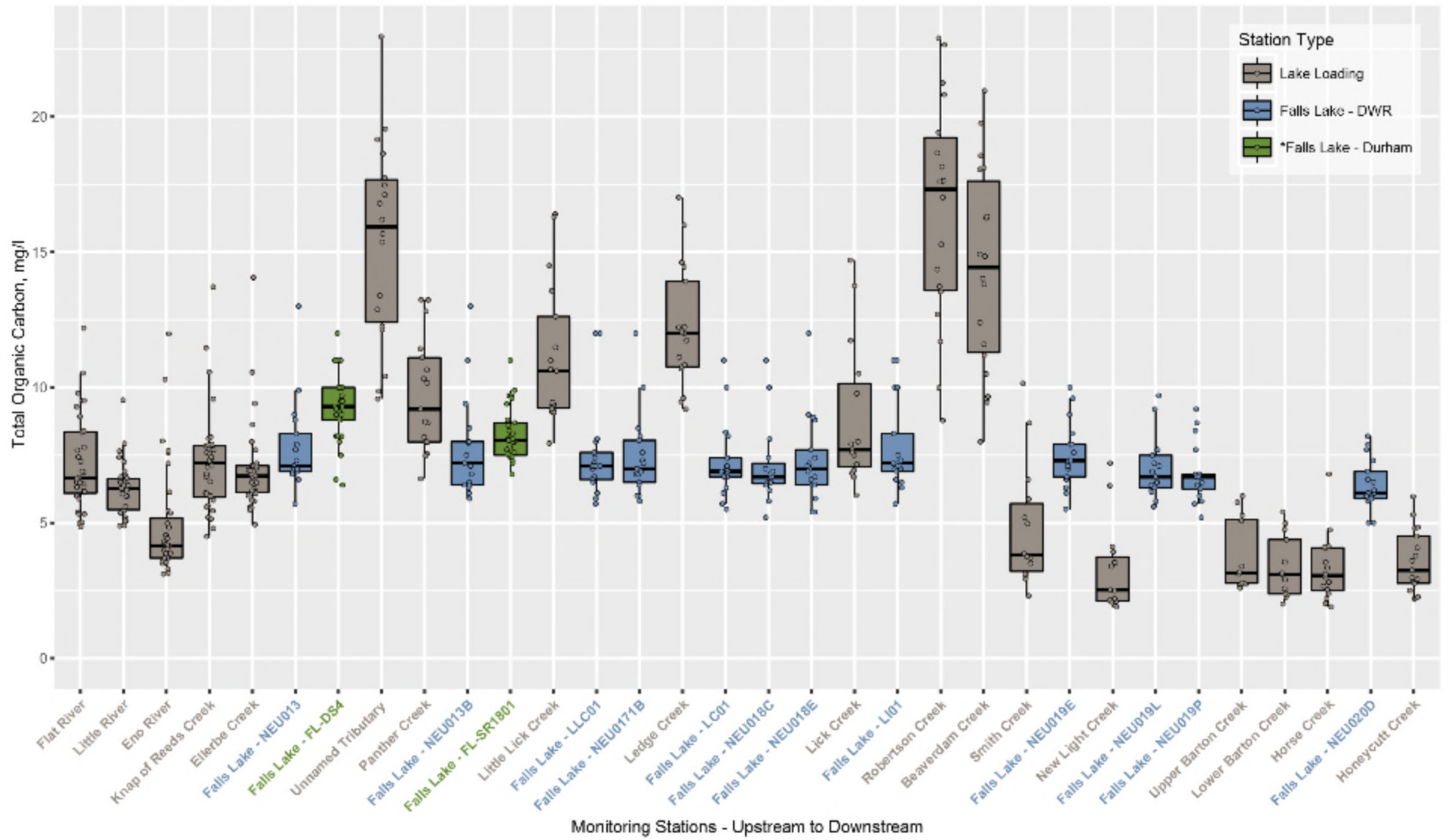
Total Organic Carbon



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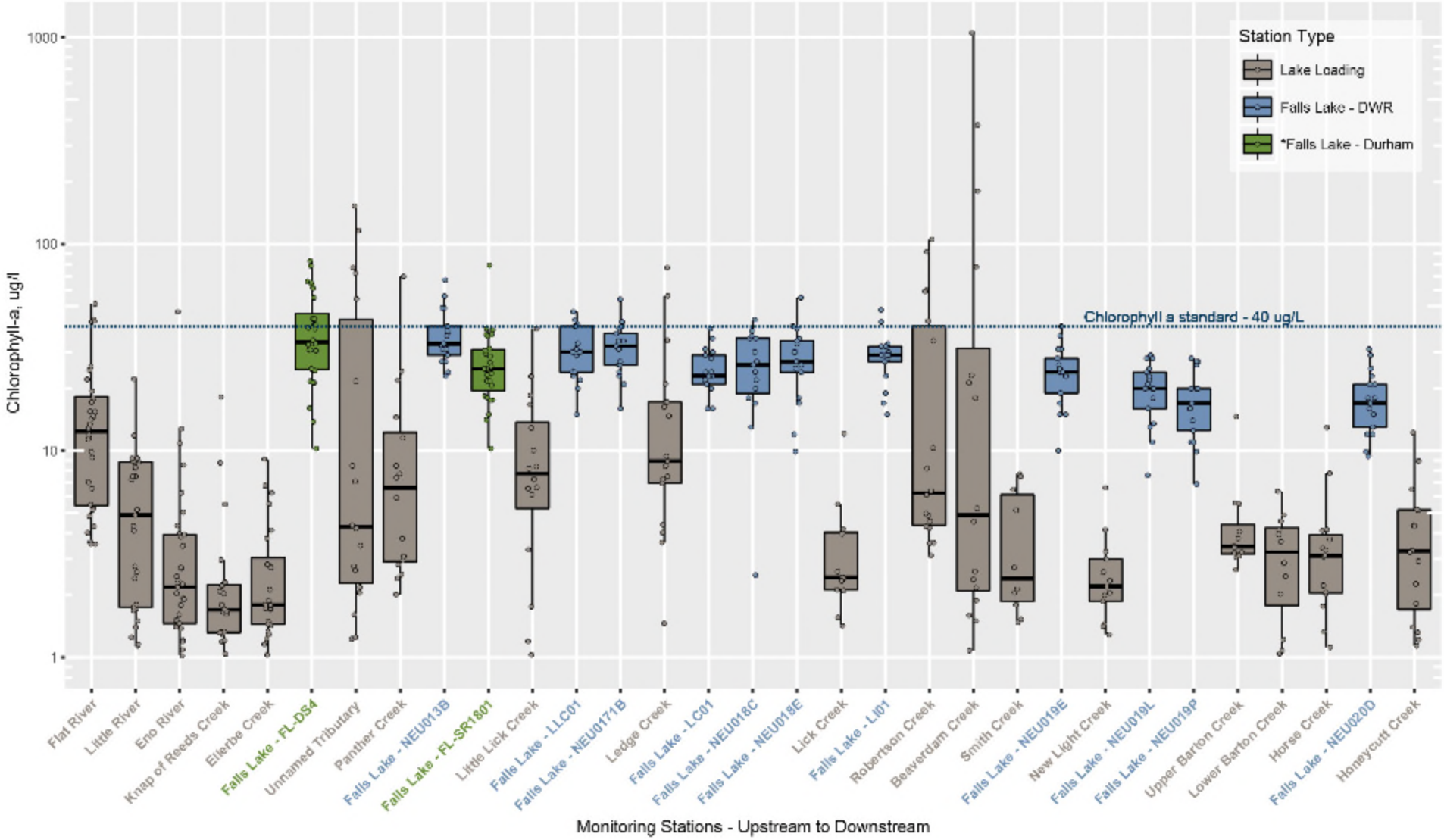
Chlorophyll *a*



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Observations of Data Value For Select Parameters at Lake Loading Stations

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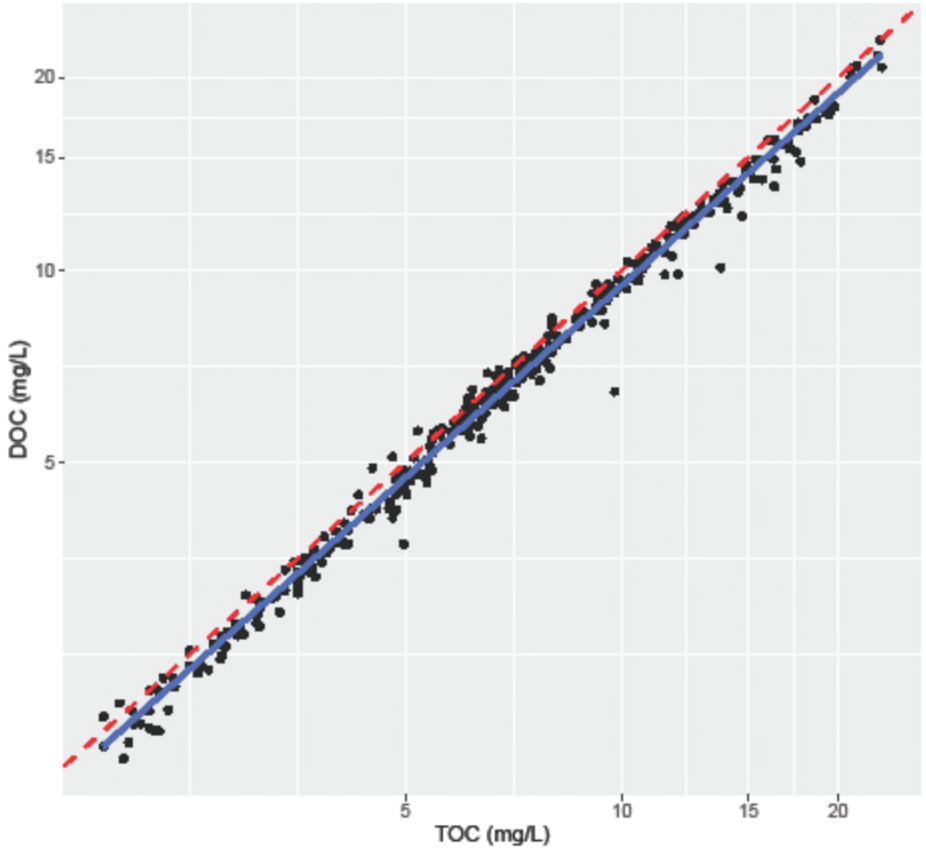
DOC and TOC



- TOC is ~95% DOC and 5% POC
- Relationship between the two parameters is very tight.
- DWR version of model assumed OC was 50% DOC.
- Recommend eliminating DOC measurement from Lake Loading sites

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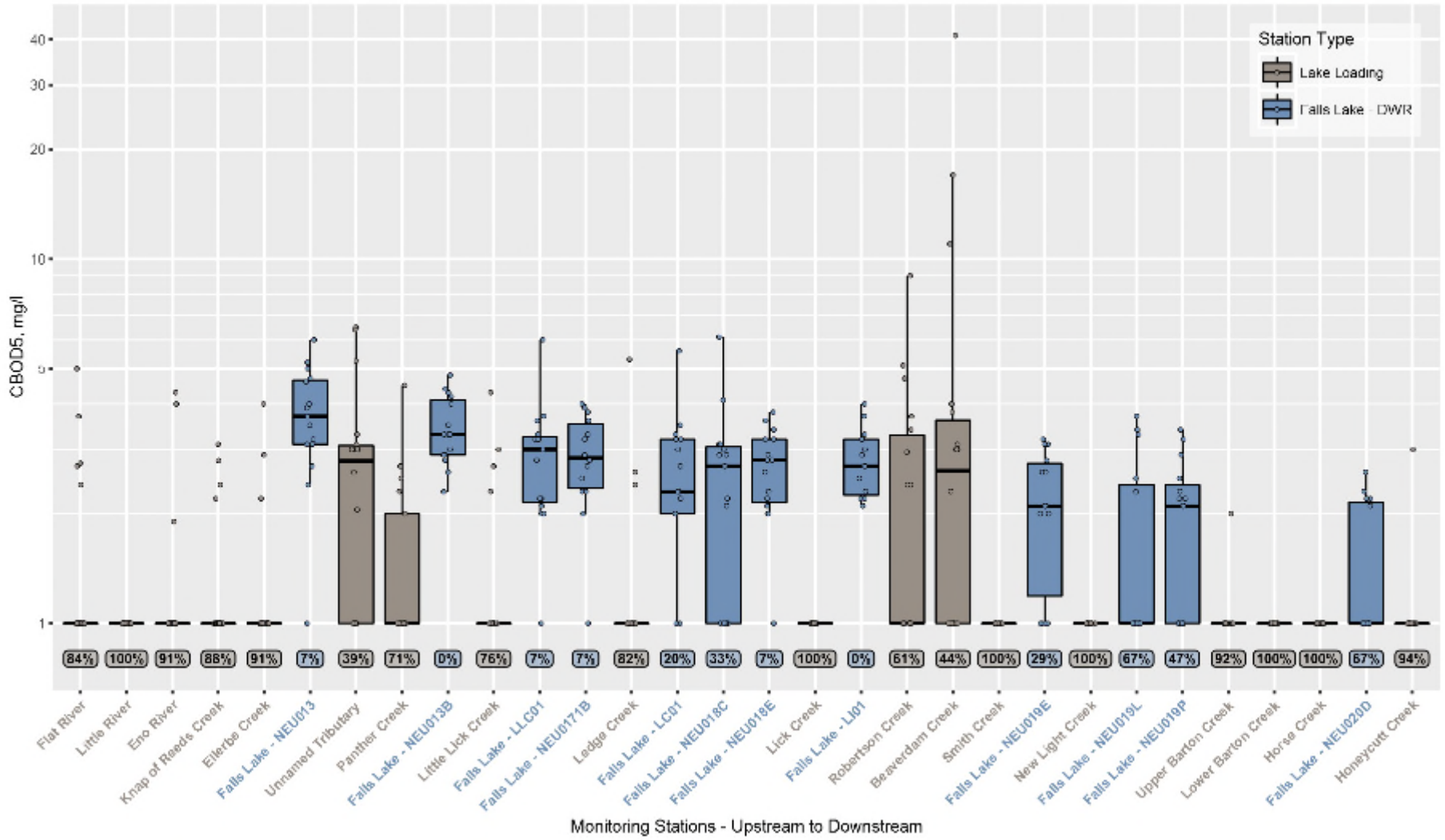
CBOD



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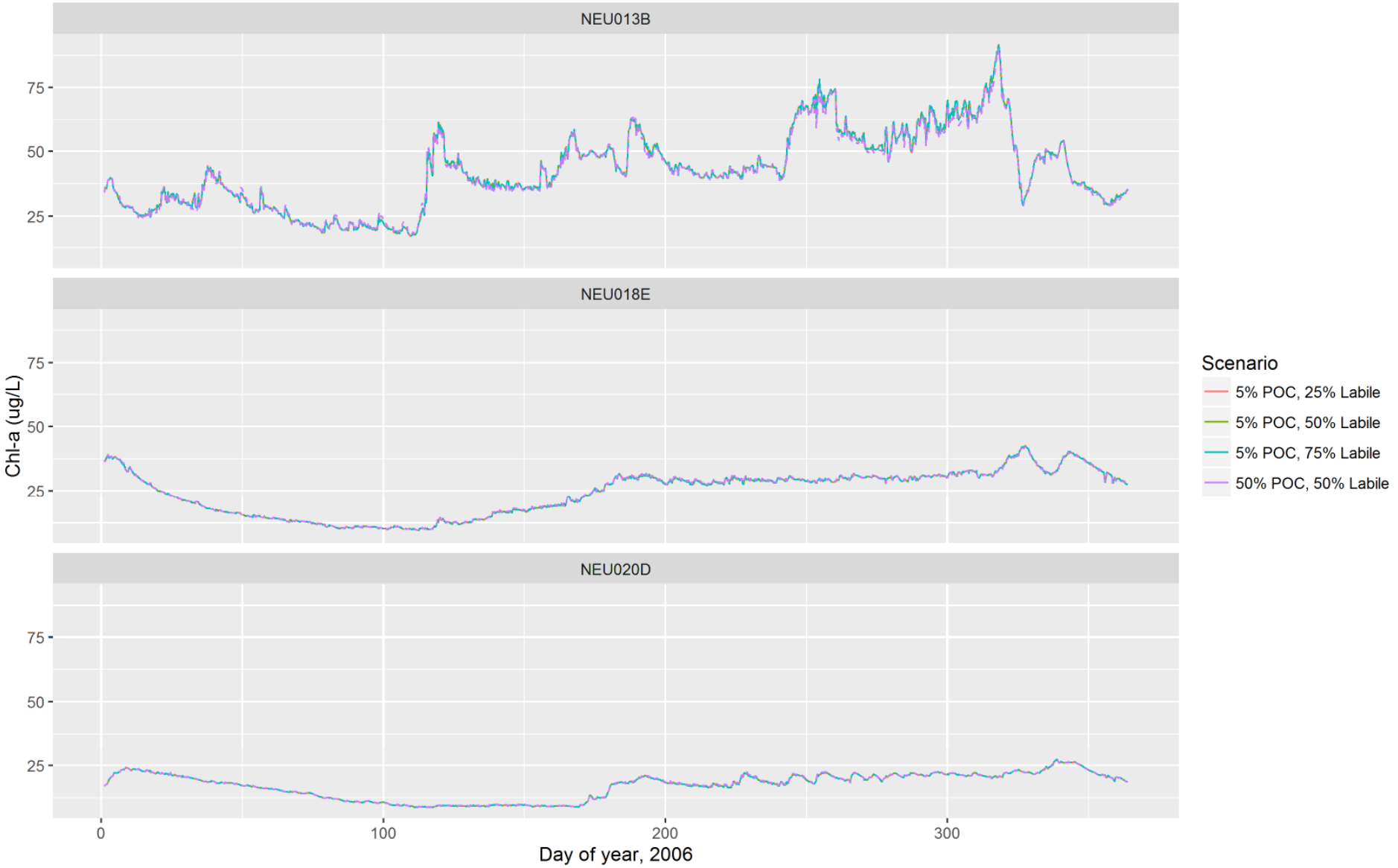
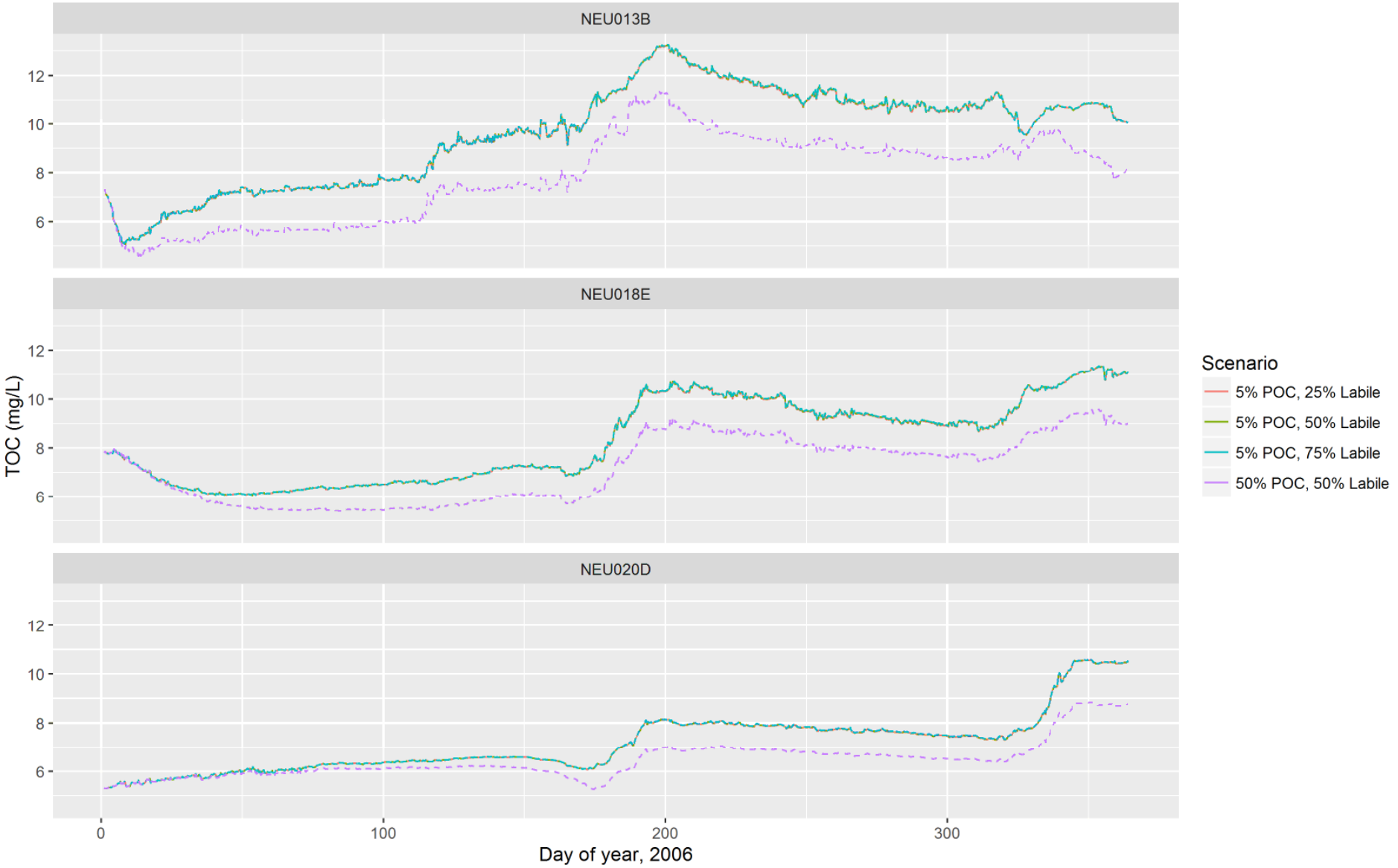
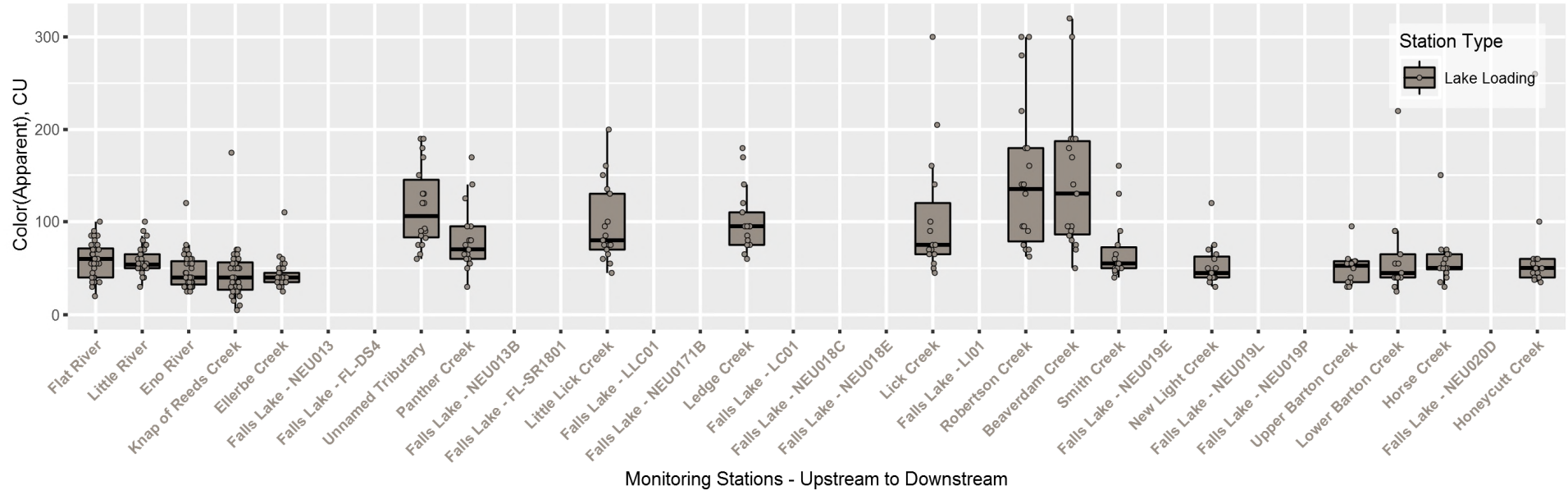
EFDC Sensitivity Test: Is modeled chlorophyll *a* sensitive to labile vs. refractory POC when it is only 5% of the total?

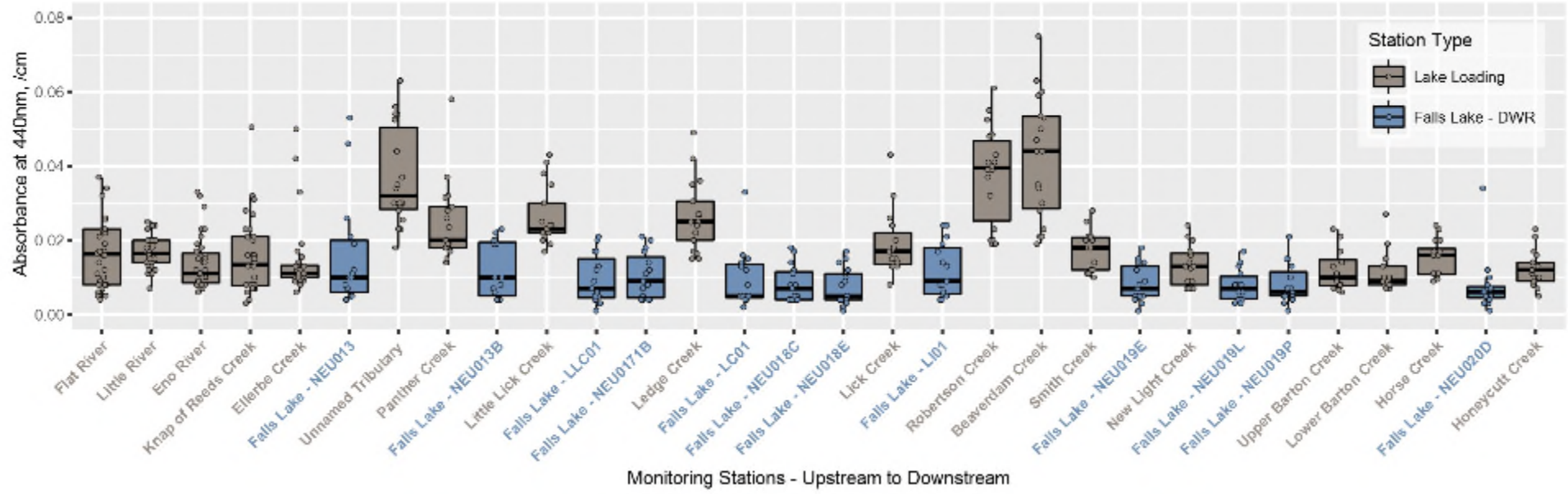


EFDC Sensitivity Test: Is modeled TOC sensitive to labile vs. refractory POC when it is only 5% of the total?



Color: used to characterize the nature of organic matter





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Jurisdictional and Lake Loading Stations

2014-2015

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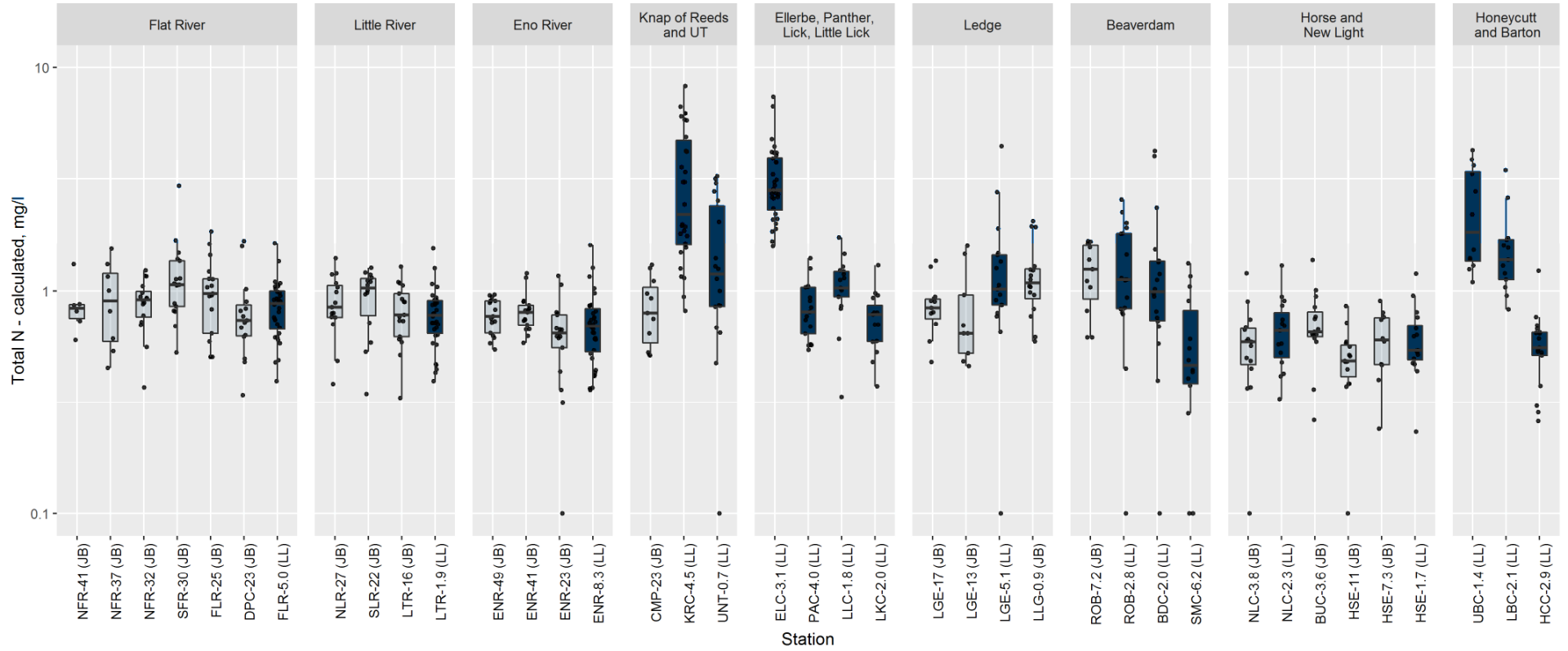
Total Nitrogen



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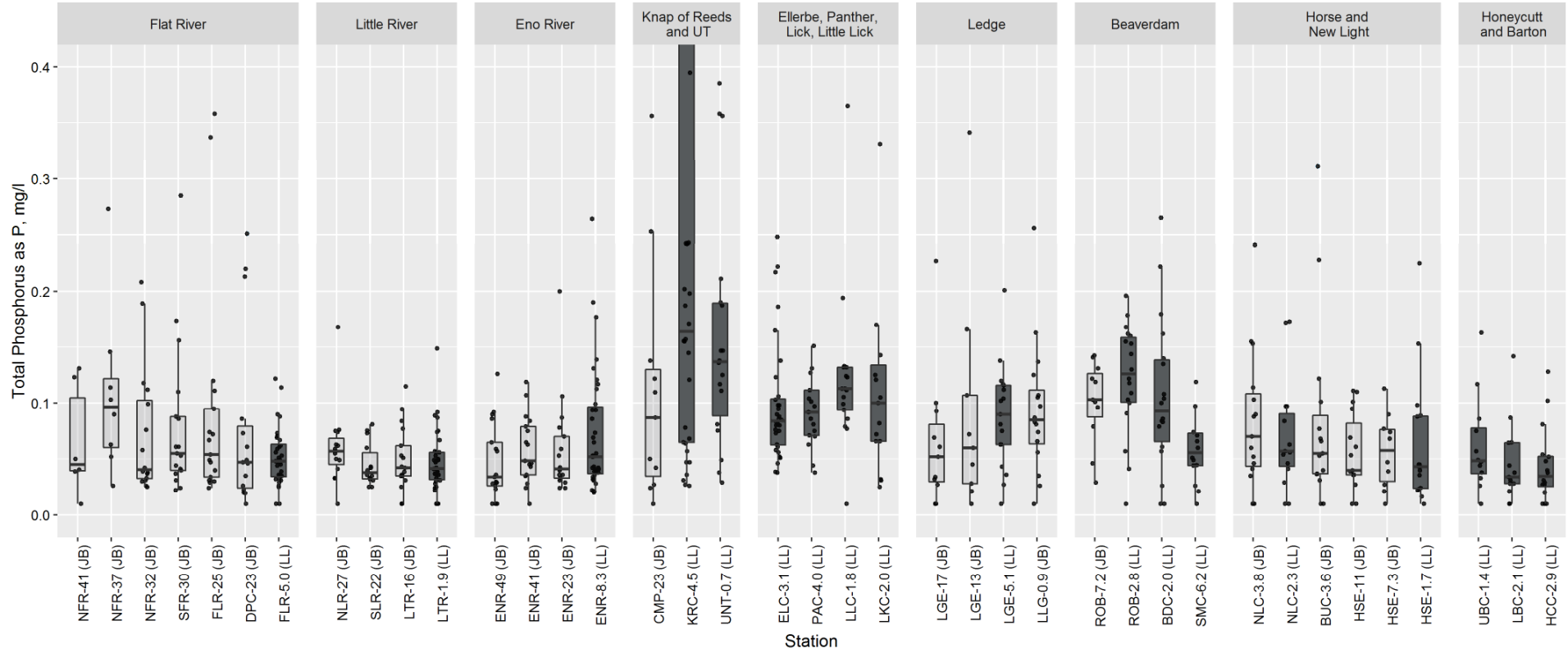
Total Phosphorus



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Observations of Data Value For Select Parameters at Jurisdictional Stations

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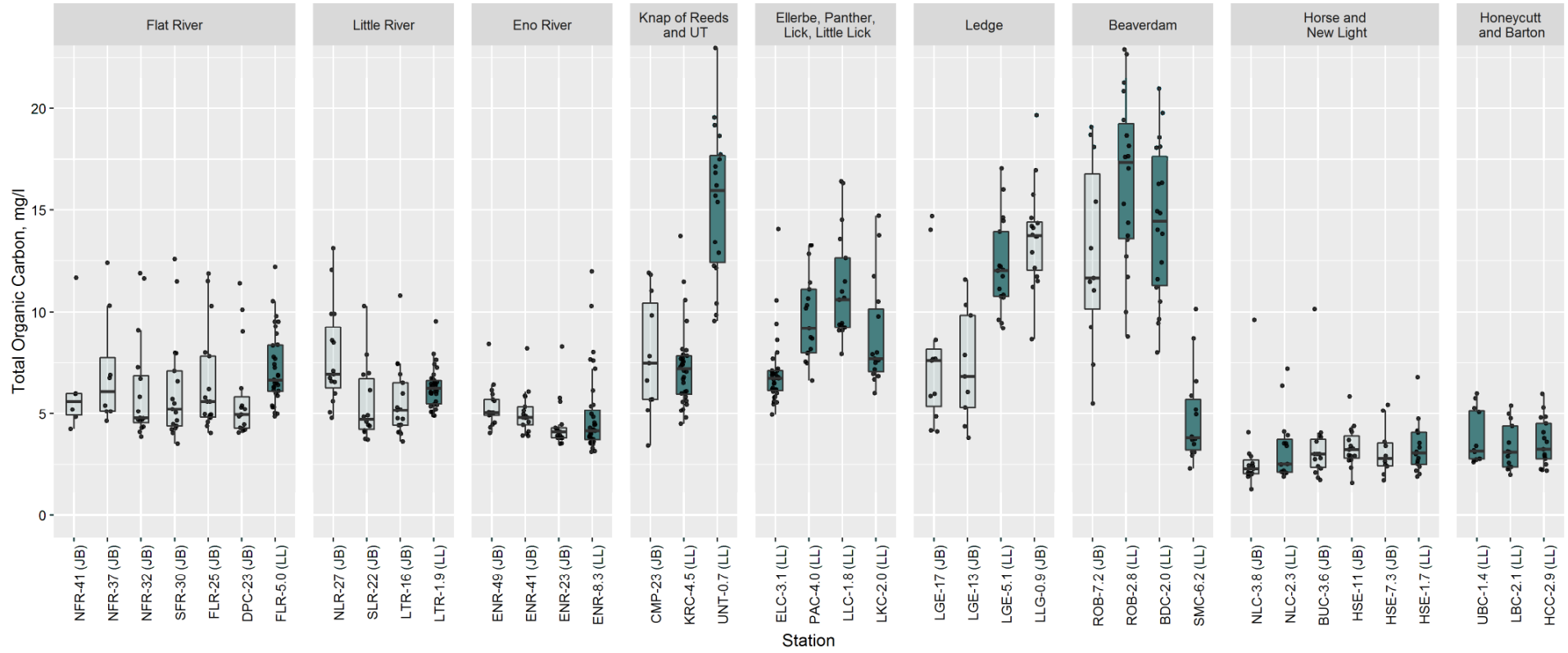
Total Organic Carbon



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Questions on Routine Monitoring?

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Special Studies

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Storm Event and High Flow

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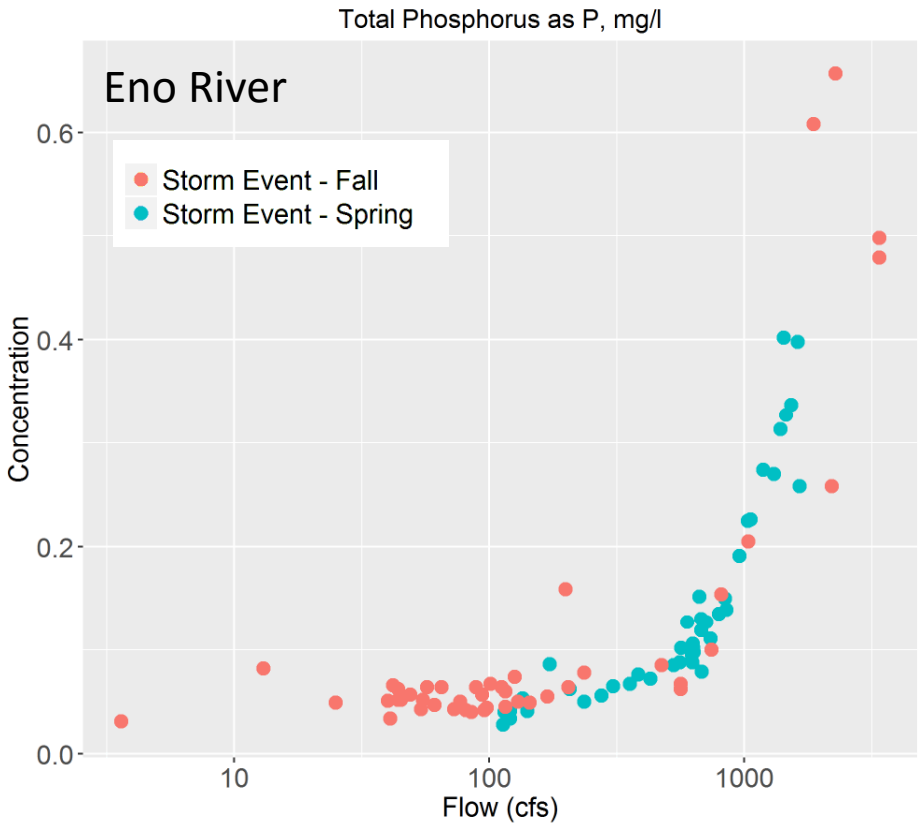
Storm Event Sampling

- Models require water quality information at time scales shorter than can be practically measured.
- Flow measured continuously at USGS stations.
- If water quality is related to flow, we can use flow to better estimate WQ during unmeasured periods.
- These studies aim to determine which parameters and sites have predictable concentration based on flow.



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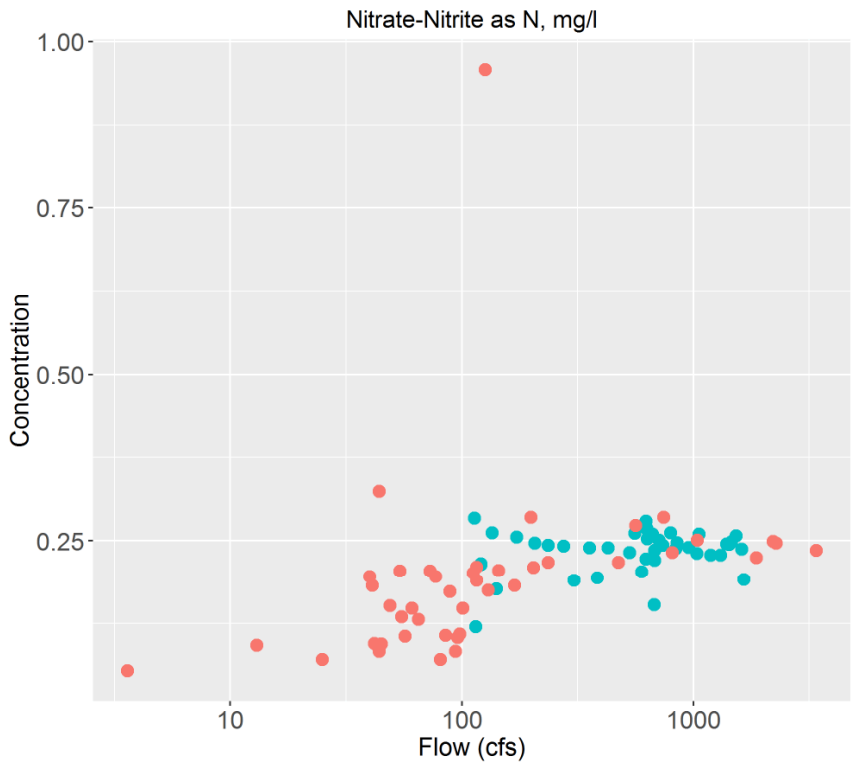

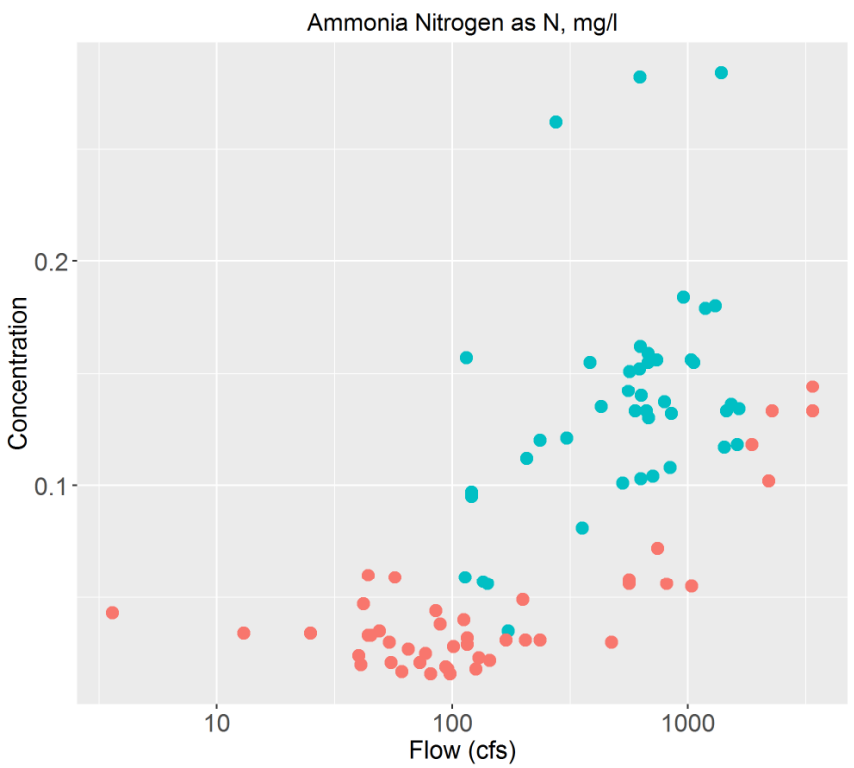

Eno River

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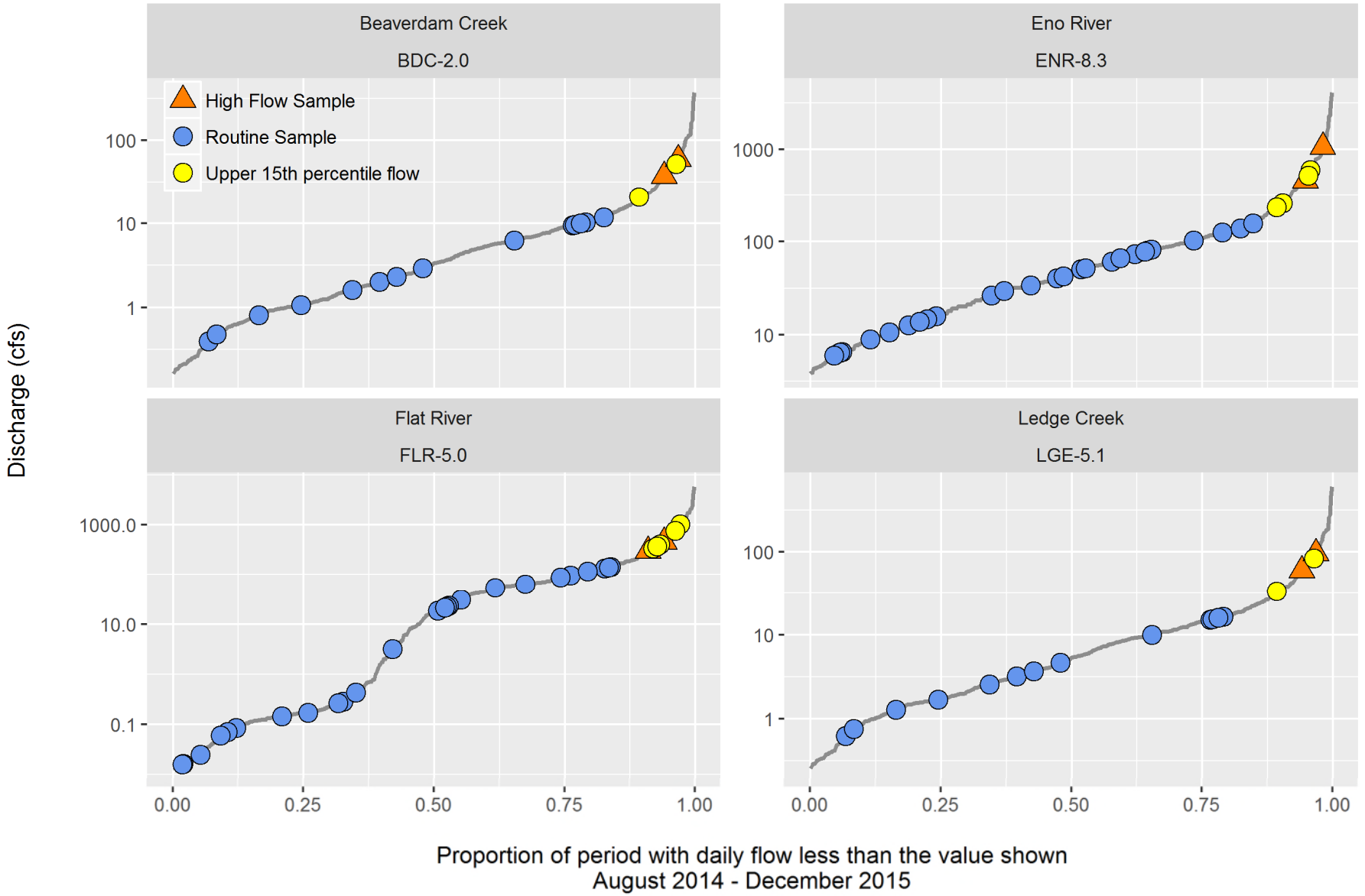
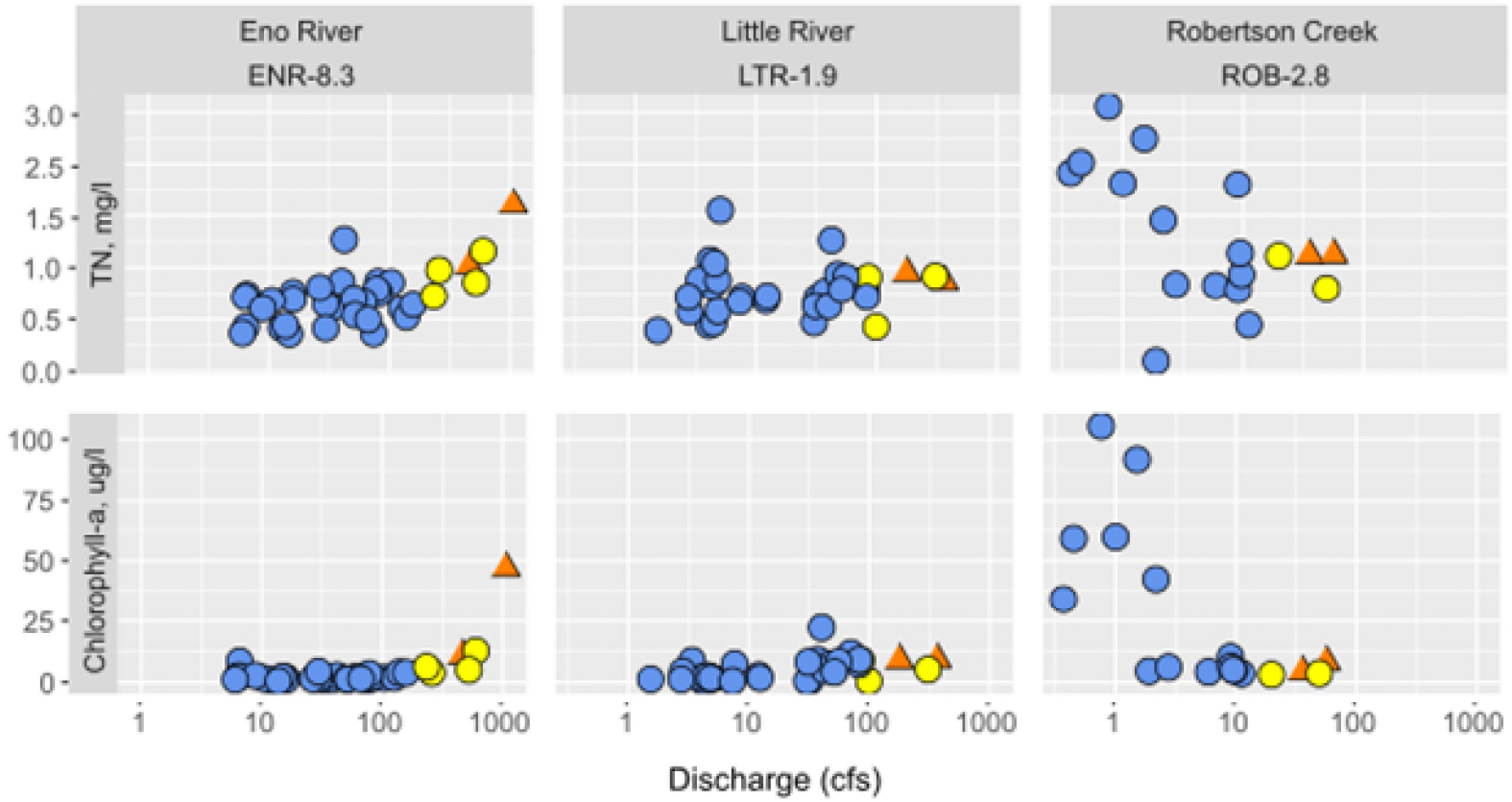
High Flow Sampling





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Sediment Core Evaluation

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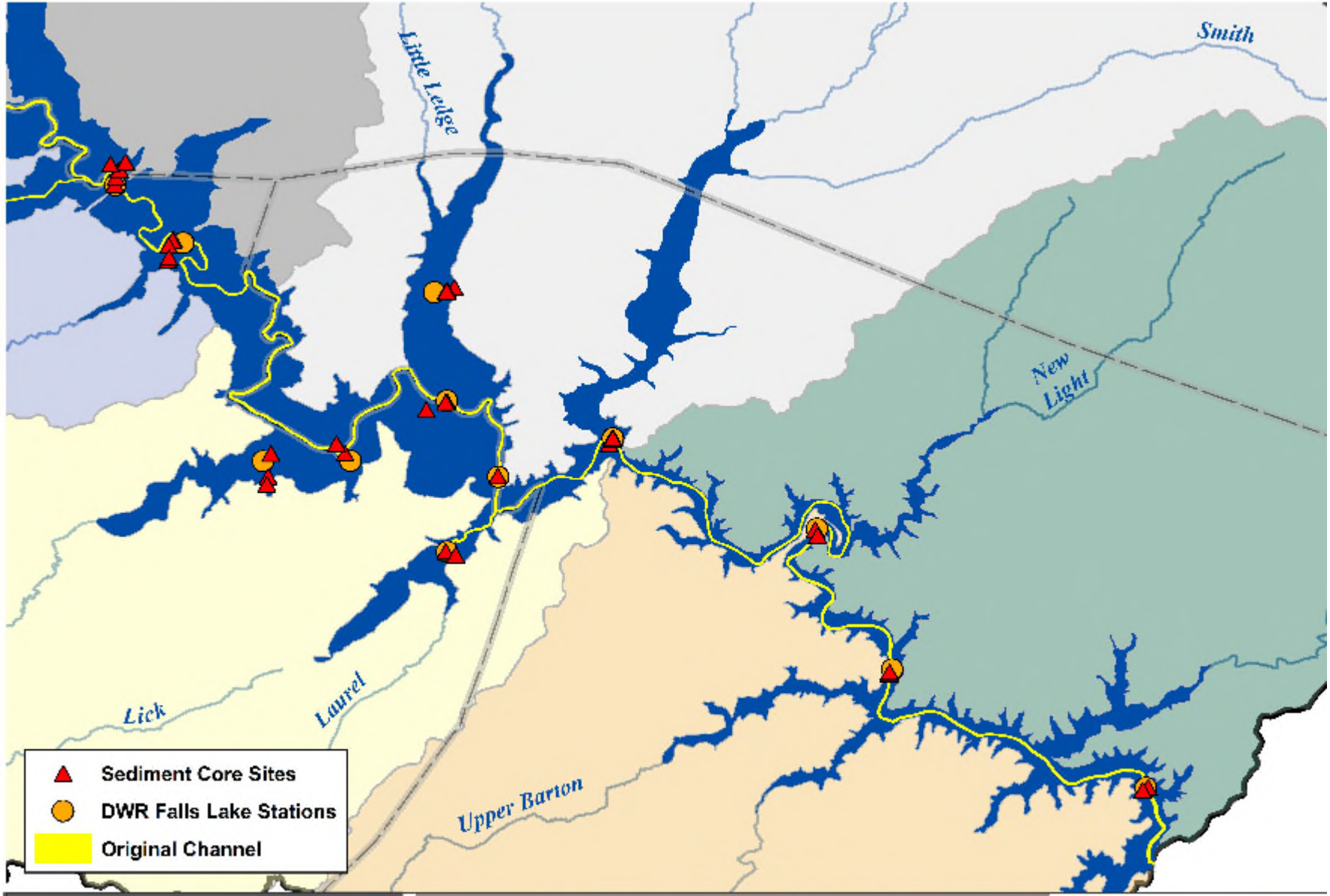
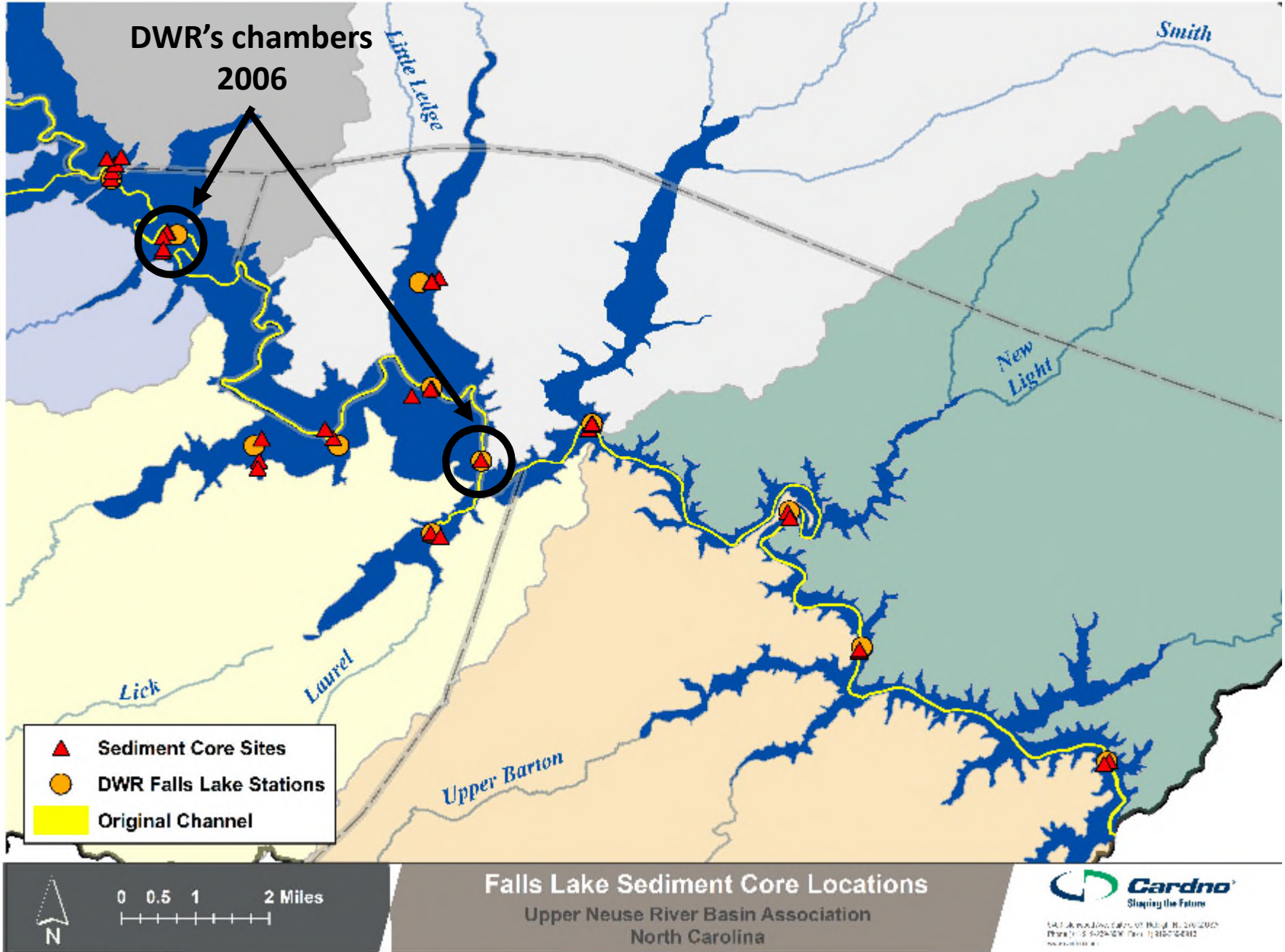
Sediment Core Evaluation



Sediment Core Evaluation



Constriction Point Study

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Constriction Point Study

- Designed to better quantify movement of water and nutrients between segments of Falls Lake
- Data collected at the I-85 and Hwy 50 bridge crossings
- Measures water movement and water quality
- Targets sampling during periods of higher flows
- Conducted first of two planned events in early January

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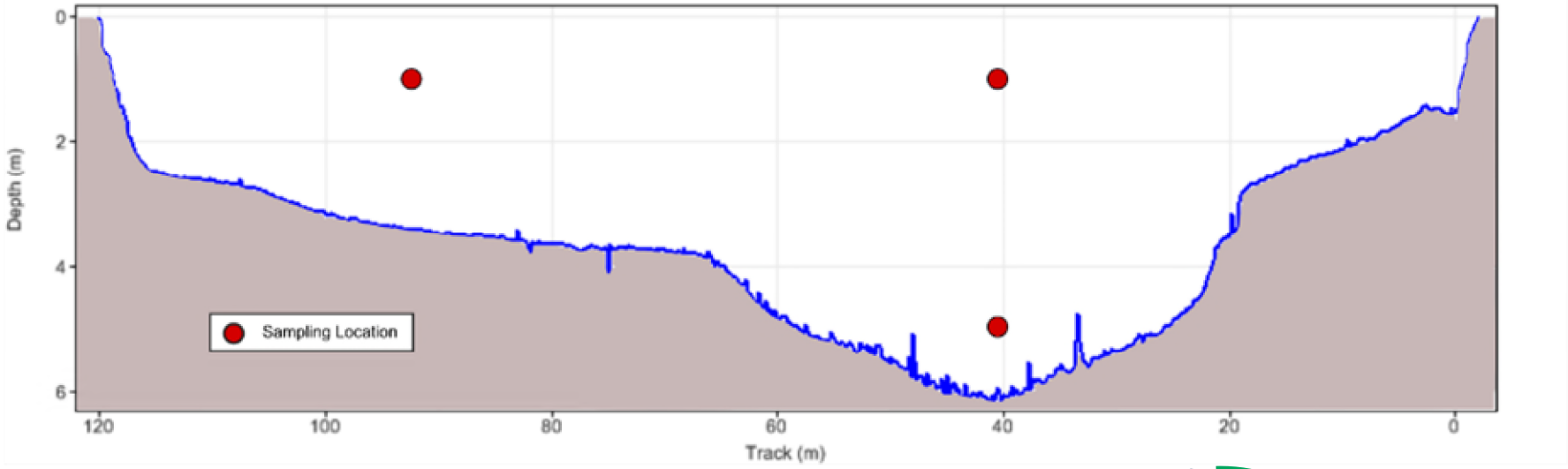

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Constriction Point Summary

- Samples collected January 8, 11, 14, and 18.
- Measured velocity profiles across channels every day (4 replicates per site per day).
- Measured DO, temperature, and conductivity profiles (well mixed)
- Collected water samples for nutrients (NH3, Nox, TKN, TP), TOC, TSS, VSS, and Chlorophyll *a*.
- Data will be used for model calibration including hydrodynamic parameters and nutrient flux between basins.
- We will target a spring event and revisit results of both events together.

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Evaluation of Light Extinction Data

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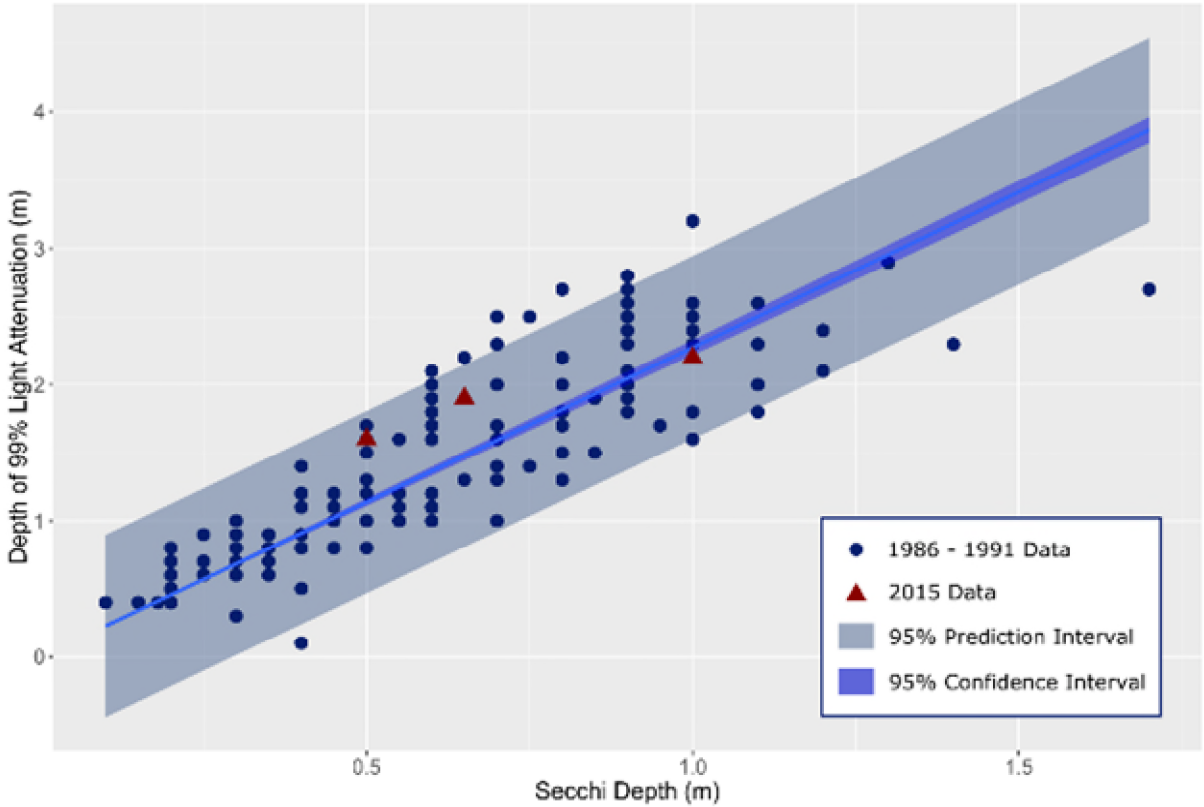
Light Extinction

How much light is available for photosynthesis?

Measured by light meter

Estimated by Secchi depth

Modeled from color, TSS, chlorophyll.



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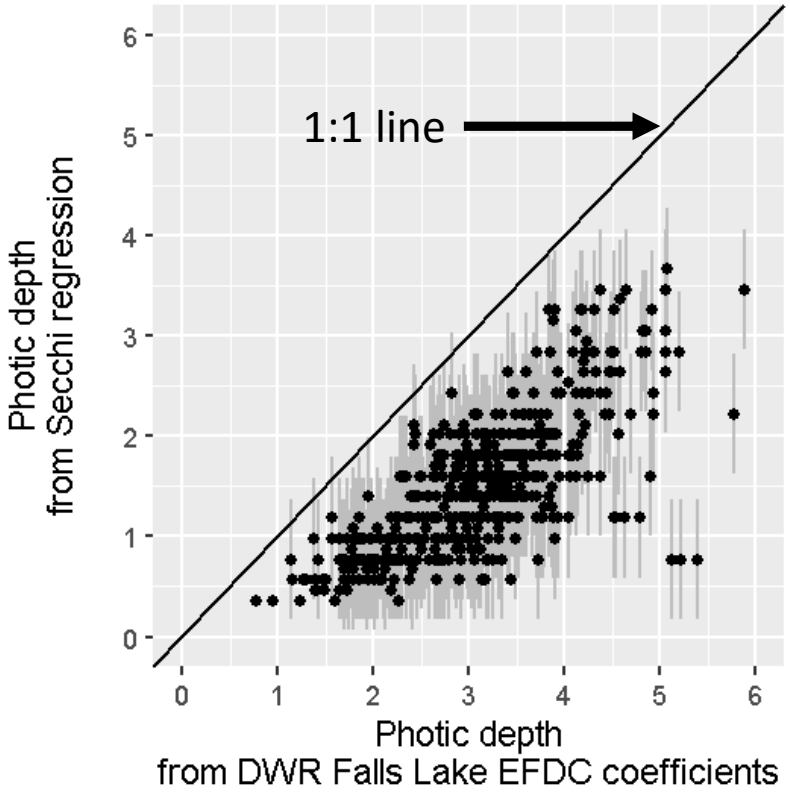
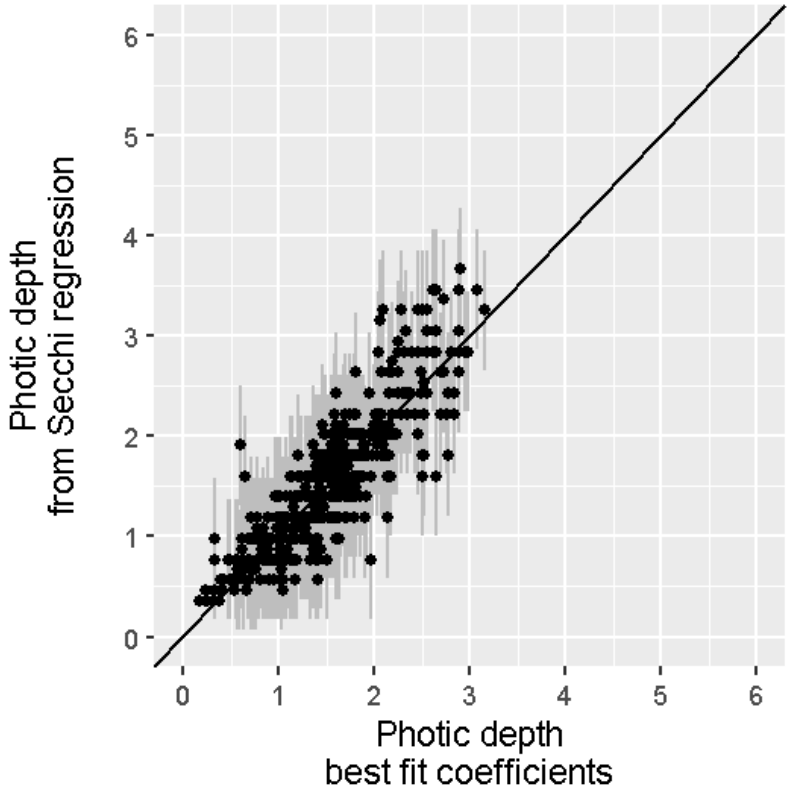
DWR's EFDC-modeled photic depths were twice as deep as those measured with Secchi depth





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Light Extinction summary

Secchi depth can be used to approximate photic depth.

The biggest improvements to how light extinction is determined comes from better choices of model parameters which are specific to Falls Lake, rather than using values from other systems.

EFDC sensitivity tests showed that modeled Chlorophyll *a* concentrations are lower when more accurate extinction parameters are used. The degree of the effect likely depends on other co-limiting factors such as nutrients.

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Model Evaluation

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Model evaluation

A stand-alone report is forthcoming.

The annual report highlights several model investigations and sensitivity tests examining parameter assumptions and data needs for select parameters.

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Recreational Use Evaluation

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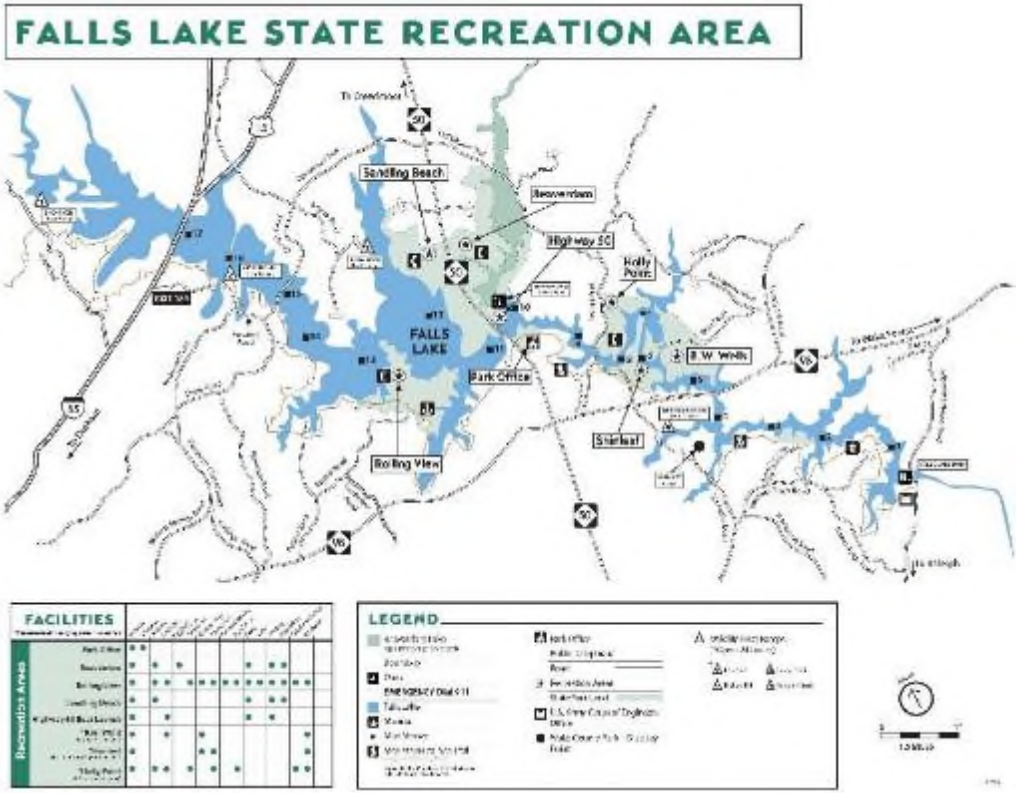
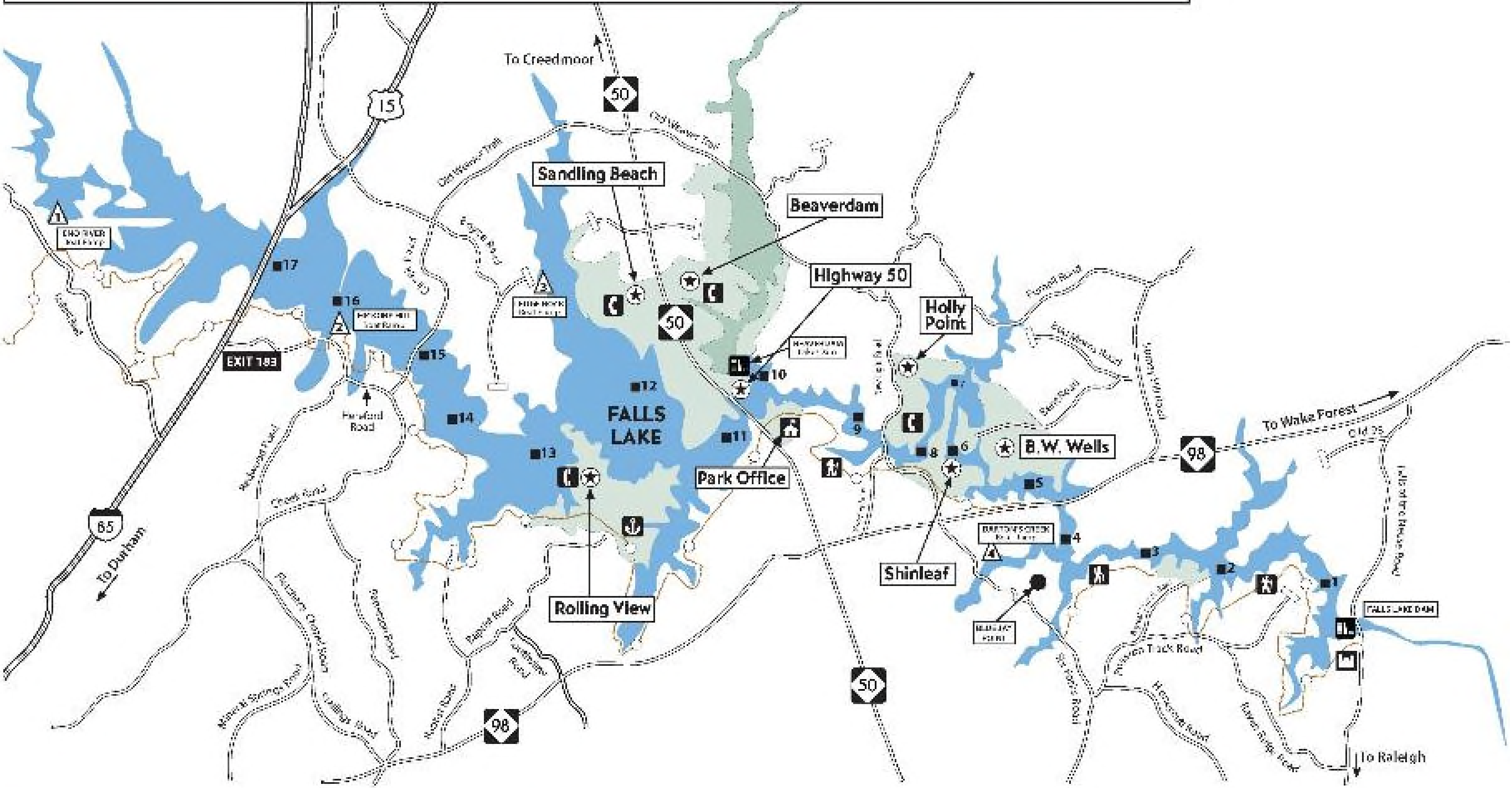
Recreational Use Evaluation

Are water quality conditions affecting recreational use of Falls Lake, or preventing the lake from attaining the recreational facet of its Designated Uses?



FALLS LAKE STATE RECREATION AREA



FACILITIES

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Recreation Areas																
Park Office	●	●														
Beaverdam	●		●		●						●		●	●		
Rolling View	●		●	●		●	●	●	●	●	●	●	●	●	●	●
Sandling Beach	●		●								●		●	●		
Highway 50 Boat Launch	●			●							●		●			
*B.W. Wells	●			●			●									●
*Shinleaf	●						●	●								●
*Holly Point	●		●	●		●		●		●					●	●

LEGEND

- Beaverdam Lake (gas motors prohibited)
- Boundary
- Dam
- EMERGENCY Dial 911
- Falls Lake
- Marina
- Mile Marker
- Mountains to Sea Trail
- Park Office
- Public Telephone
- Road
- Recreation Areas
- State Park Land
- U.S. Army Corps of Engineers Office
- Wake County Park – Blue Jay Point
- Wildlife Boat Ramps (*Open 24 hours)

North

0 1"

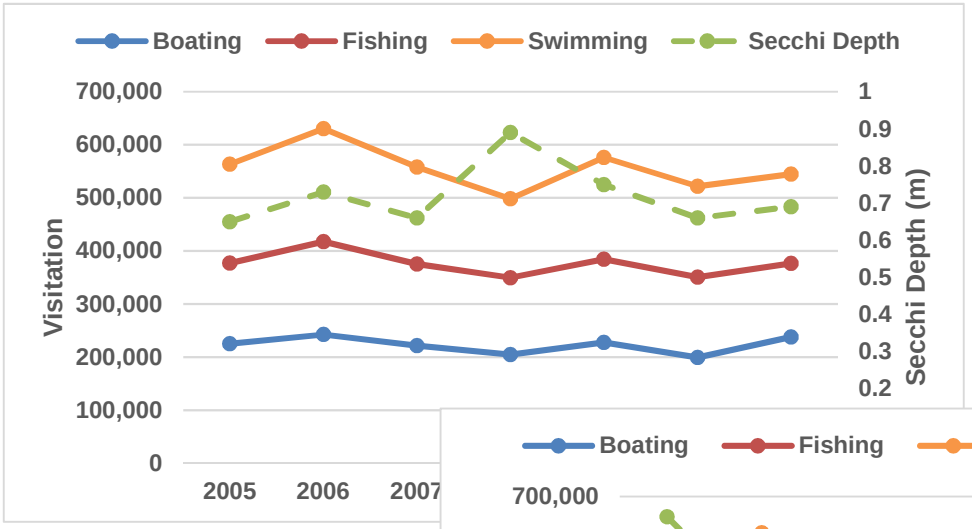
1.5 MILES

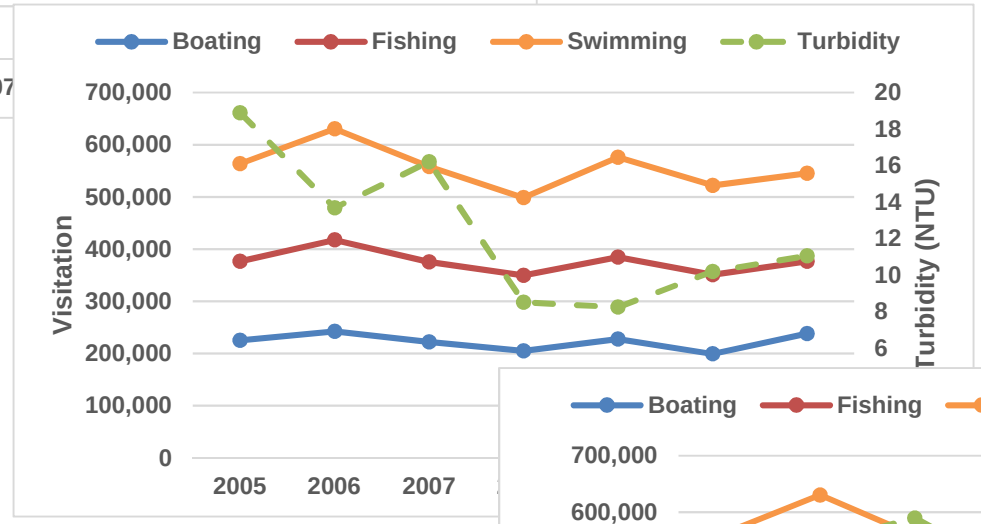
Recreational Use Evaluation

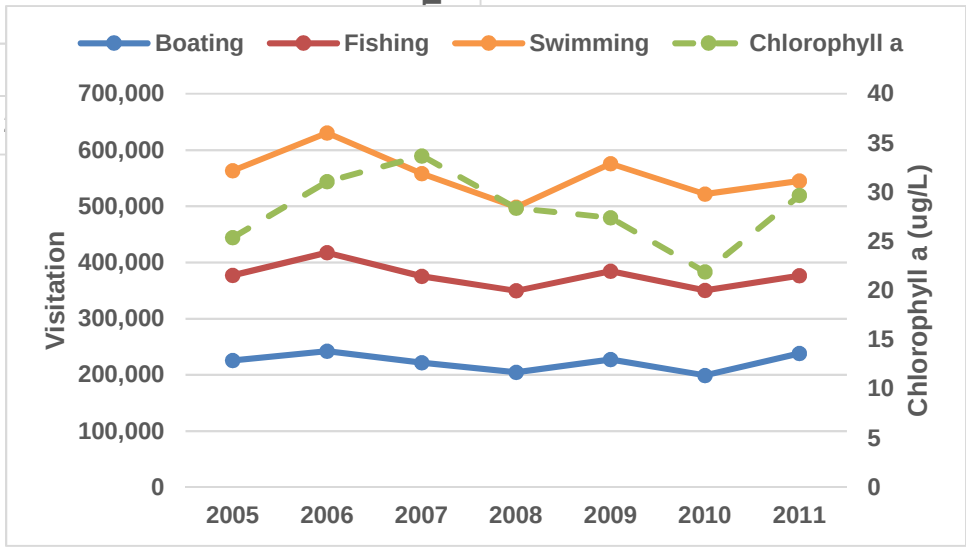
Year	Boating	Fishing	Swimming	Total Water-Based Visitation
2005	225,509	151,409	186,635	563,553
2006	242,437	175,095	212,874	630,406
2007	221,916	153,583	182,625	558,124
2008	204,820	144,819	148,715	498,354
2009	227,700	156,808	191,575	576,083
2010	199,232	151,433	170,984	521,649
2011	238,192	138,636	168,163	544,991

- North Carolina State Comprehensive Outdoor Recreation Plan (SCORP):
  - *"The quality of surface water within the reservoir is influenced by conditions throughout its watershed, including land use patterns and the presence of pollution sources. Despite water quality concerns throughout the watershed, water quality in the reservoir allows for all forms of recreational use to continue."*
  - *"Recreational facilities at Falls Lake currently meet the most popular recreational activities highlighted in the SCORP."*
- USACE 2013 Master Plan for Falls Lake indicates that the carrying capacity of Falls Lake limits annual visitation, but water quality is not a limiting factor.
- NC 2014 305(b) report contains no indication that nutrients or chlorophyll a are causing non-attainment of recreational use standards in Falls Lake.

Recreational Use Evaluation







Summary and Recommendations

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Summary

- Routine Monitoring has collected more than 14,000 water quality observations from 38 stations on tributaries throughout the watershed.
- Incorporated analysis of DWR monthly monitoring at 12 stations in the Falls Lake Reservoir.
- Successfully collected and analyzed more than 90 percent of samples anticipated in the sampling design.
- Created an online database including a guidance document and graphics generator to help users access the data and visualize results.
- Developed Study Plans for six Special Studies which were posted to the UNRBA monitoring website.
- Significantly improved laboratory quality assurance protocols and data turnaround times
- Significantly improved efficiency in the monitoring and reporting process

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Recommendations:

Routine Monitoring

- Suspend collection of Dissolved Organic Carbon at Lake Loading stations.
- Suspend collection of Platinum-Cobalt color at Lake Loading stations.
- Suspend collection of CBOD5 at Lake Loading stations.
- Suspend collection of Total Organic Carbon at Jurisdictional Boundary stations.

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Recommendations:

Special Studies

- Suspend the Storm Event Special Study in its current form
- Adapt the High Flow Sampling Special Study to increase the number of stations and sampling frequency of events, and suspend the analysis of CBOD5 and dissolved fractions of parameters
- Allocate a small portion of the overall program budget for ongoing consideration of sediment issues, but do not budget for additional sediment data collection during FY 2017.
- Allocate a small portion of the program budget to prepare for discussions with regulators to ensure that the UNRBAs efforts will address agency concerns over proposed re-examination strategies. Include sufficient funding for travel and attendance at a small number of agency meetings in FY 2017.

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Recommendations:

Special Studies (cont.)

- Continue the Constriction Point Special Study into FY 2017, with potential adaptation to the protocol based on findings from both sampling events in FY 2016.
- Suspend consideration of volatile suspended solids data collection as a Special Study, and instead consider it a component of Routine Monitoring.
- Suspend consideration of further collection of light extinction data in FY 2017
- Suspend the Basic Evaluation of Model Performance Special Study in FY 2017, but provide adequate funding in data analysis portions of Routine Monitoring and Special Studies to allow support of the initiation of modeling efforts.
- Suspend further assessment of recreational uses with respect to water quality in FY 2017.

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