

Path Forward Committee Meeting Butner Town Hall, March 7, 2023



Agenda

- Opening Comments, Agenda Review/Revisions
- Modeling and Regulatory Support Project Budget Amendment for FY2023
- Modeling and Regulatory Support Status
- Gathering Data from Local Governments to Support the Cost Benefit Analysis
- Developing Recommendations for a Revised Nutrient Management Strategy and a Petition for a Site-Specific Chlorophyll-a Water Quality Standard
- Prospective Budget for FY2024
- Communications Support
- Other Status Items
- Closing

**Modeling and Regulatory
Support Project Budget
Amendment for FY2023**

Modeling and Regulatory Support Project Budget Amendment for FY2023

- Finalizing the watershed and lake models required extensive reviews and discussions with the subject matter experts and DWR modeling staff
- Code modifications and a new graphical user interface (GUI) were required for the WARMF model
 - Required a training of DWR modeling staff and UNRBA members
 - Training workshop held on February 6, 2023
- As a result of these additional efforts and to maintain the necessary project schedule, the modeling team requested, and the Board approved in January the allocation of reserve funding for this purpose in the amount of \$180,000
- The draft amendment to the contract and scope of work was distributed to the PFC prior to this meeting for review
- The PFC will consider the amendment for recommendation to the Board for approval at their March 15th meeting

Modeling and Regulatory Support Status

Watershed Model Report

- The watershed modeling report and appendices have been revised
 - Address MRSW and DWR comments
 - Include results of the watershed model sensitivity analyses and scenarios
- Revised report has been provided to Forrest and Michelle for review
- Next, it will be distributed to the MRSW for review and additional comment (mid March)
- Following refinements in response to the 2nd MRSW review, a clean version will be provided to the PFC for review and comment (late March)
- Following additional refinements, the report will be formally submitted to DWR (April); the model executable, input files, and output files have already been provided to DWR

Sensitivity Analyses and Scenarios Evaluated

Short Name	Description/Purpose
UNRBA Study Period	Calibrated model for the UNRBA Study Period (2015-2018)
20% less rainfall	Simulate changes to delivered nutrient loading with less rainfall
20% more rainfall	Simulate changes to delivered nutrient loading with more rainfall
25% less atm dep.	Simulate changes to delivered nutrient loading with less atmospheric deposition which affects all land surfaces
25% more atm dep.	Simulate changes to delivered nutrient loading with more atmospheric deposition which affects all land surfaces
All Forest, study period rainfall	Simulate the lowest loading to Falls Lake that could hypothetically occur if human inputs were removed all land converted to forests
All Forest, 20% less rainfall	Same as above with less rainfall

Comparison of Delivered Loads to Falls Lake

- The following tables show the total loads delivered to Falls Lake from either the
 - Entire Watershed (~492 thousand acres)
 - Upper five tributaries (~316 thousand acres, 64% of area)
- Only the upper five tributaries were assigned load allocations in the Falls Lake Rules
- Allowable loads and baseline loads were based on year 2006 conditions (Falls Lake Rules)
 - Baseline loads based on observed flows and tributary water quality data from the five largest tributaries
 - 2006 was within the historic drought period, but that year had three very large storms and the total was close to the average amount for the watershed
 - Water quality observations used to set the load allocations reflect inputs of fertilizer, atmospheric deposition, and WWTP discharges present during the baseline period

Scenario Variants (Table Columns)

- **Land uses** - 2015 to 2018, 2006, or “all forests and wetlands”
- **Rainfall** - average to wet based on the 6-hr precipitation inputs for the 2015 to 2018 model, dry to average rainfall where each of the 6-hr precipitation inputs is multiplied by 0.8, or very wet where each of the 6-hr precipitation inputs is multiplied by 1.2
- **Human inputs** (other than atmospheric deposition) - 2015 to 2018 inputs, 2006 inputs, or “none” to represent the “all forests and wetlands” condition
- **Rates of atmospheric deposition** - based on data collected near the watershed for 2015 to 2018, the 2015 to 2018 rates multiplied by 0.75 to represent 25 percent less atmospheric deposition, the 2015 to 2018 rates multiplied by 1.25 to represent 25 percent more atmospheric deposition, or the 2006 conditions inherently captured in the baseline tributary monitoring data.

Scenario Variants Table

Short Name	Land use	Rainfall	Human Inputs	Atm. Dep.
UNRBA Study Period	2015-18	Avg. to wet	2015-18	2015-18
25% less atm. dep	2015-18	Avg. to wet	2015-18	-25%
25% more atm. dep	2015-18	Avg. to wet	2015-18	+25%
20% less rainfall	2015-18	Dry to avg.	2015-18	2015-18
20% more rainfall	2015-18	Very wet	2015-18	2015-18
All Forest, study period rainfall	Forest	Avg. to wet	None	2015-18
All Forest, 20% less rainfall	Forest	Dry to avg	None	2015-18

Atmospheric Deposition, Entire Watershed

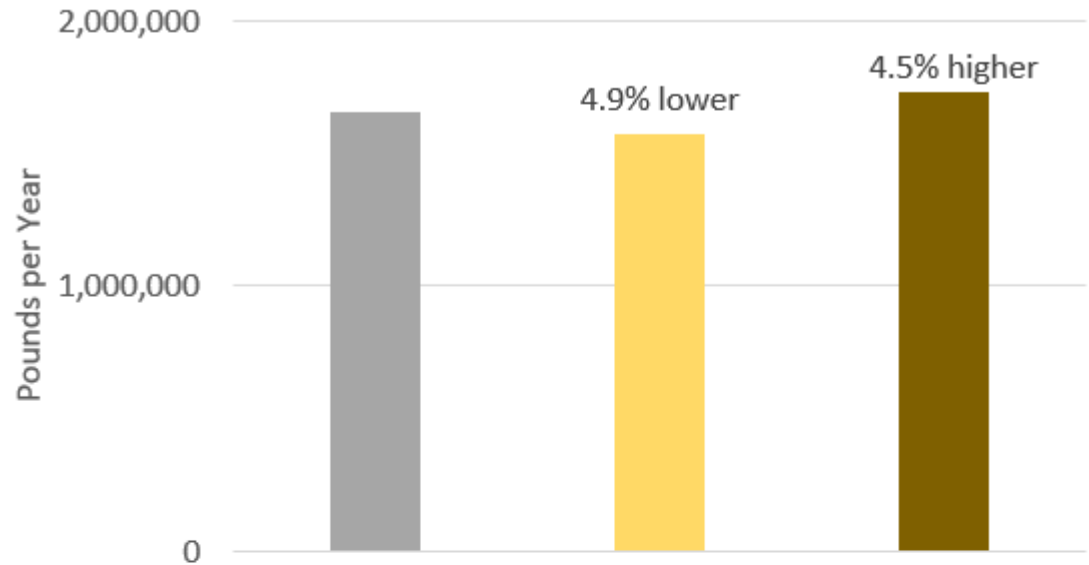
25% less atmospheric deposition:

- 4.9% less TN
- 0.8% less TP

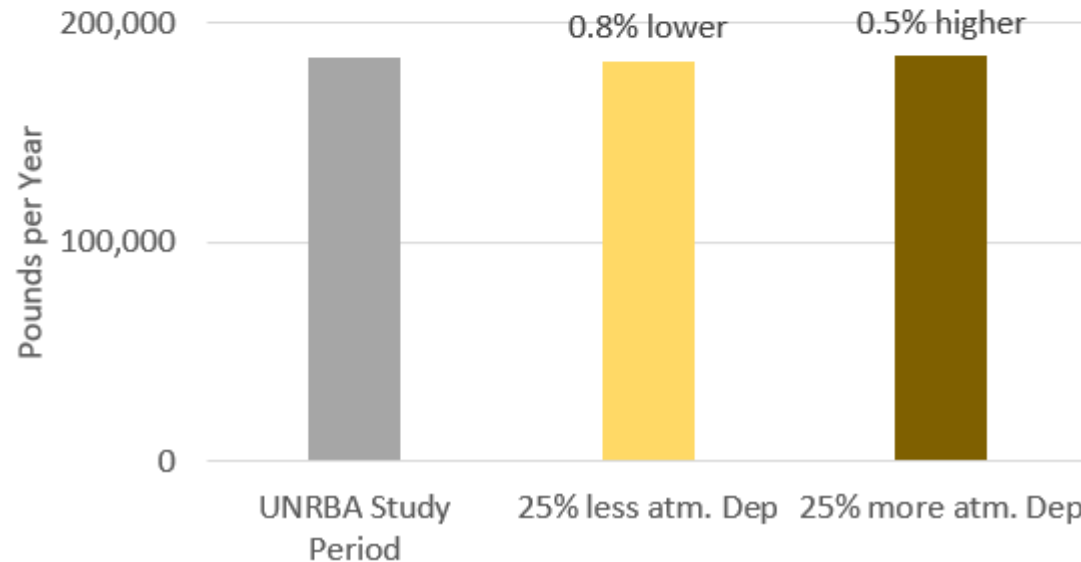
25% more atmospheric deposition :

- 4.5% more TN
- 0.5% more TP

Total Nitrogen Delivered to Falls Lake



Total Phosphorus Delivered to Falls Lake



Rainfall, Entire Watershed

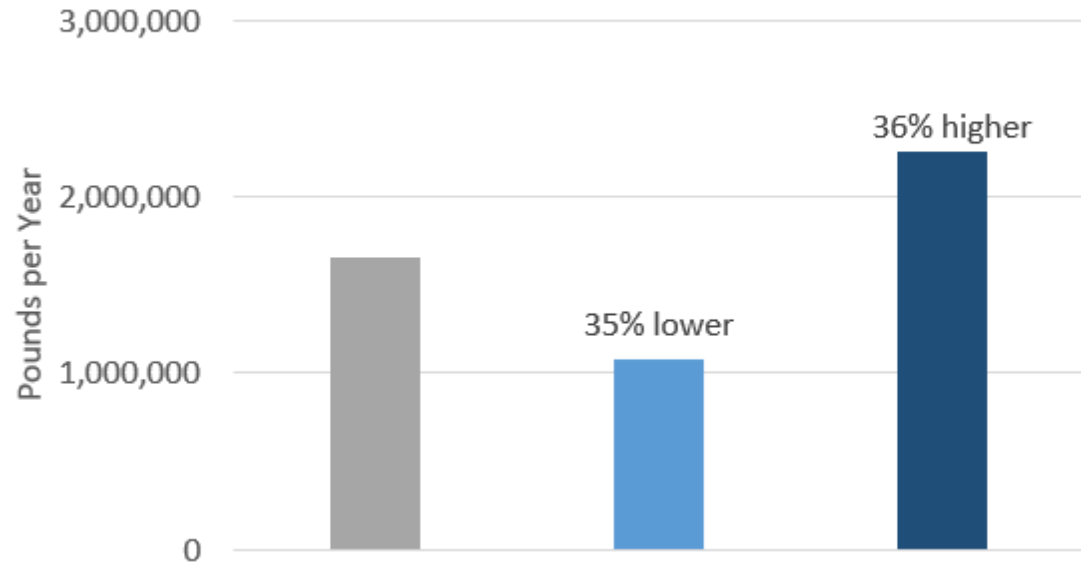
20% less rainfall:

- 35% less TN
- 42% less TP

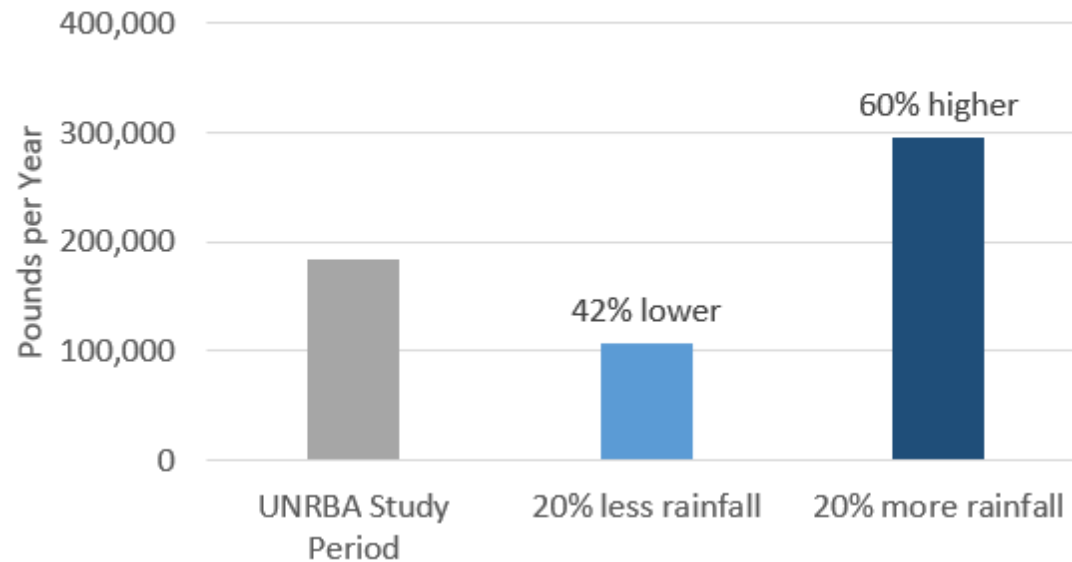
20% more rainfall:

- 36% more TN
- 60% more TP

Total Nitrogen Delivered to Falls Lake



Total Phosphorus Delivered to Falls Lake



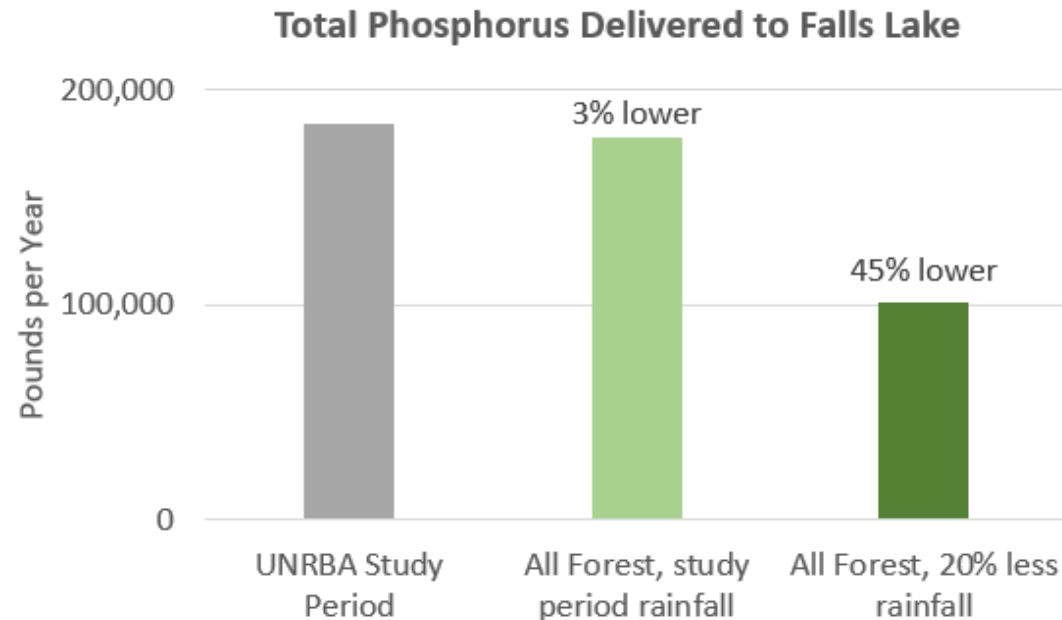
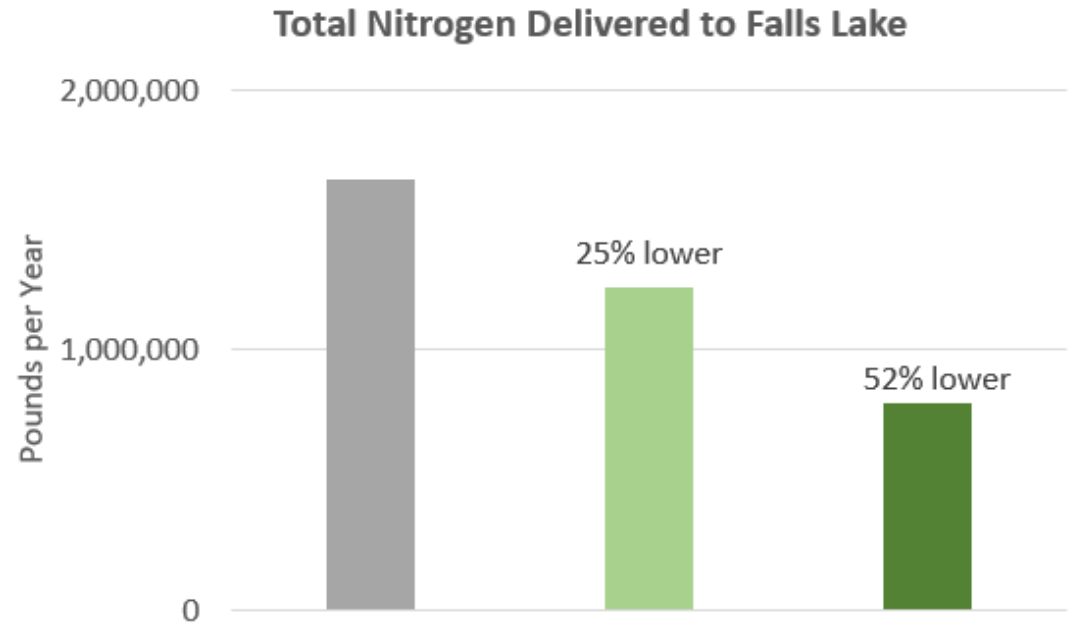
All Forest Scenario, Entire Watershed

2015 to 2018 rainfall:

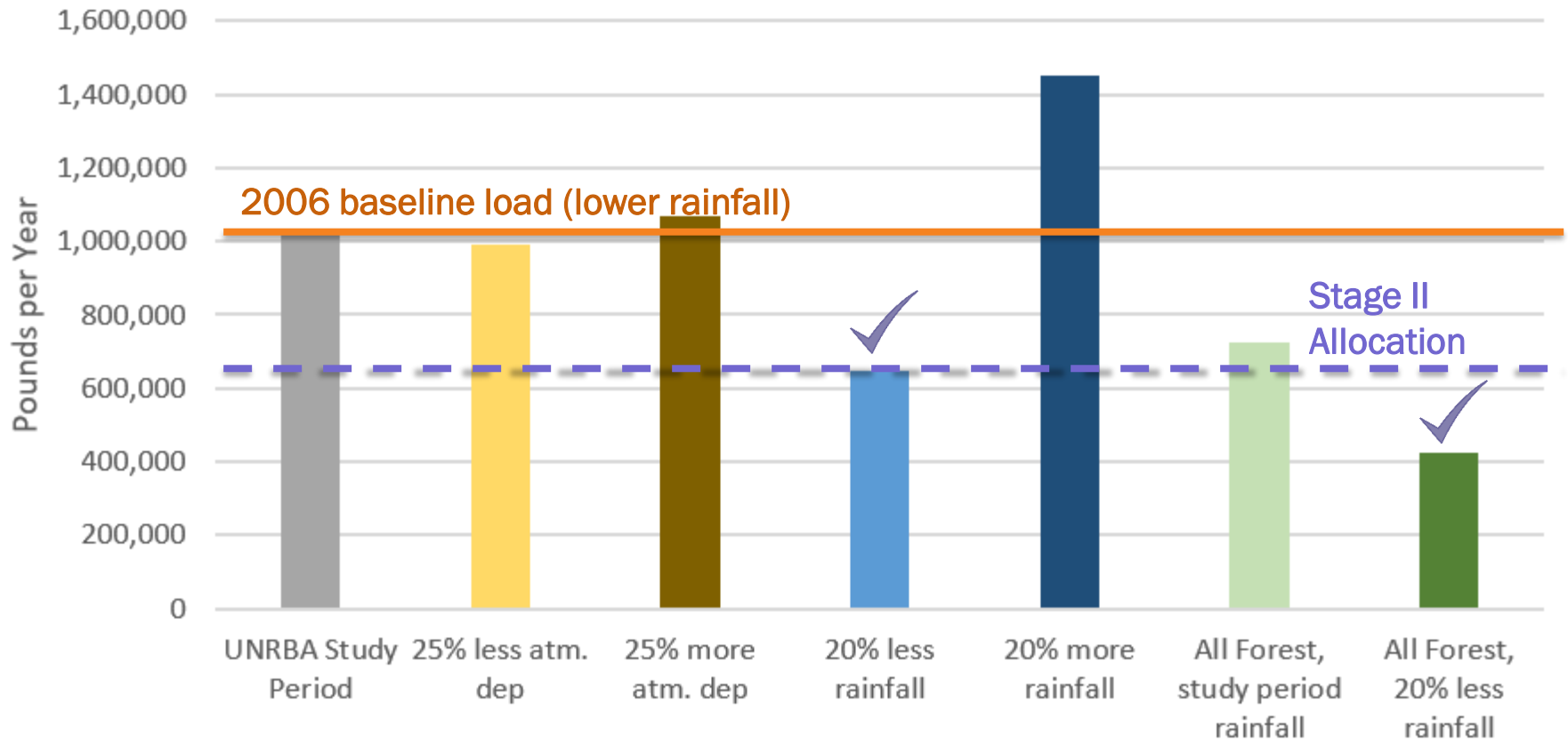
- 25% less TN
- 3% less TP

20% less rainfall:

- 52% less TN
- 45% less TP

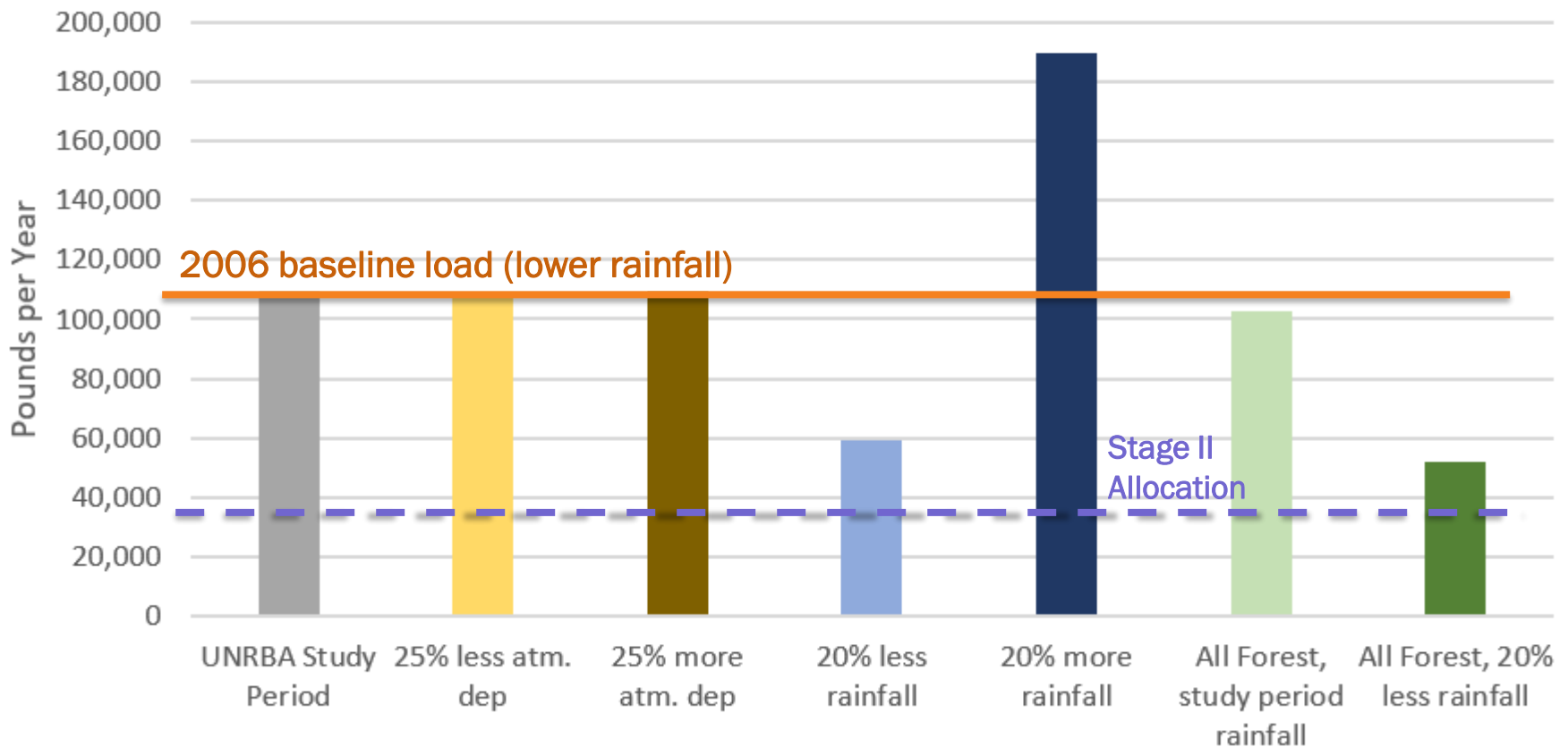


Total Nitrogen Delivered to Falls Lake from Upper Five Tributaries



- As a result of improvements in the watershed, loads during the UNRBA study period were similar to baseline loads despite having higher rainfall
- With 20% less rainfall, the current watershed activities would meet the Stage II allocation
- All forest with 2015 to 2018 rainfall does not meet the Stage II allocation
- All forest with lower rainfall does meet the Stage II allocation

Total Phosphorus Delivered to Falls Lake from Upper Five Tributaries



- As a result of improvements in the watershed, loads during the UNRBA study period were similar to baseline loads despite having higher rainfall
- No scenario meets the Stage II Allocation for TP, not even the hypothetical conversion of all land to forests and removal of human inputs.

Key Findings from the Watershed Analyses - Loading

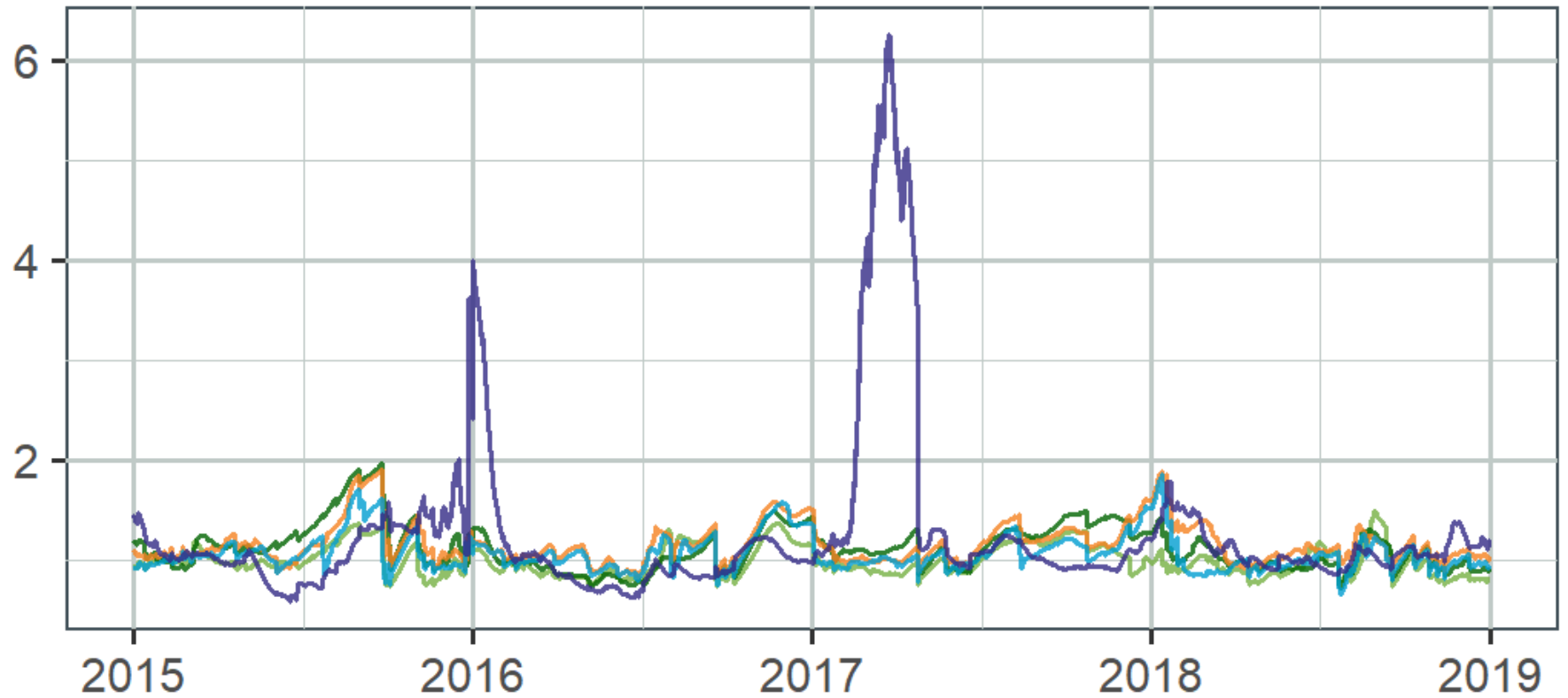
- The driver of delivered loading to Falls Lake is hydrology
- Under average to wet rainfall (like 2015 to 2018)
 - Even the hypothetical removal of humans with instant land conversion to forests does not achieve Stage II allocations for either TN or TP
- For dry to average rainfall (similar to 2005 to 2007)
 - TN loads have achieved Stage II allocations
 - Stage II allocations for TP are not feasible
- The Stage II allocations in the Rules are not feasible and did not consider the hydrology of the baseline period (historic drought)

Comparison of Lake Water Quality Among Scenarios

- The following slides show simulated lake water quality
 - Three segments (segment 1 with zoomed in images)
 - TN, TP, TOC, chlorophyll-a
- Many interacting processes are affected by scenarios
 - Accumulation of nutrients and timing of washoff events
 - Processes in upstream impoundments
 - Less rainfall
 - Delivers less wet deposition
 - More stagnant conditions in Falls Lake
 - More thermal stratification in the summer
 - Greater importance of nutrient releases from lake sediments

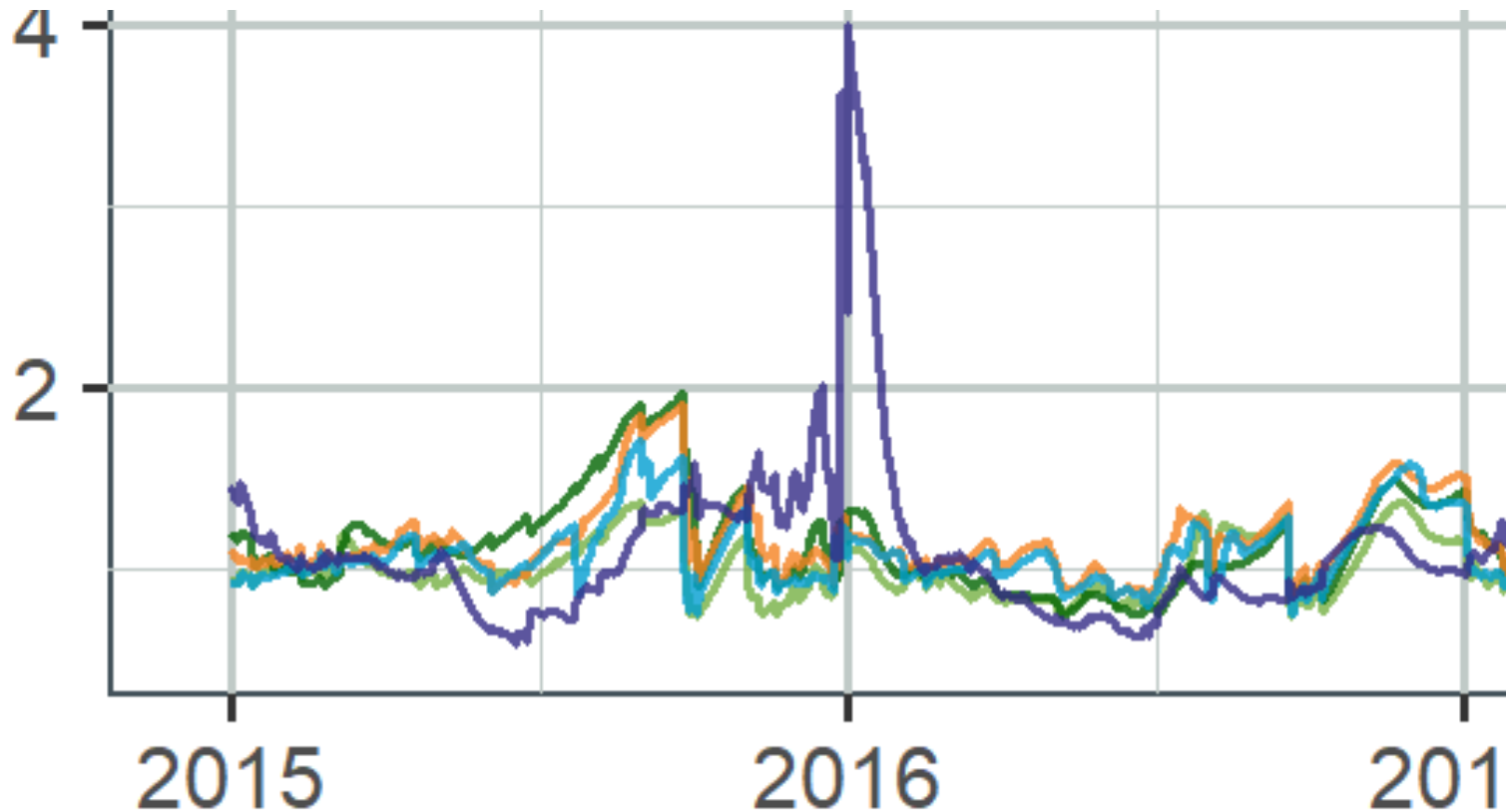
Total Nitrogen (mg/L) – WARMF Lake Scenarios

Segment 1



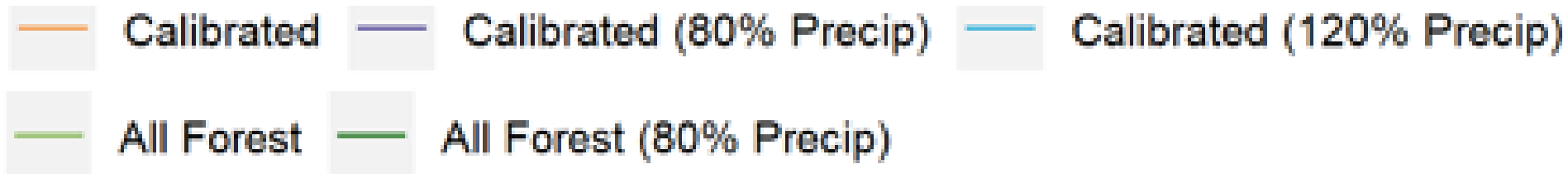
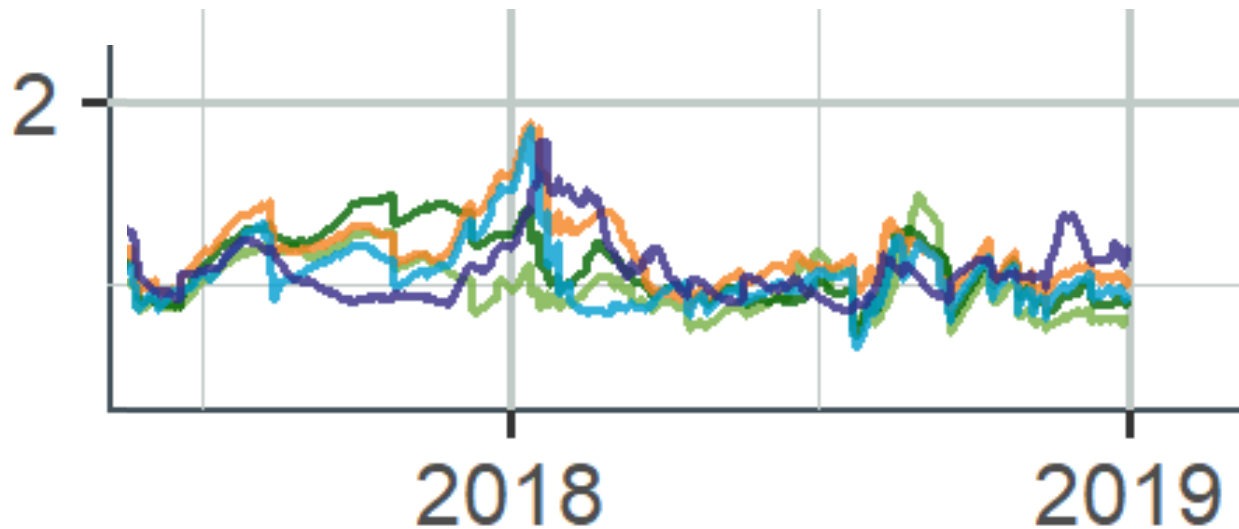
- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

Total Nitrogen (mg/L) – WARMF Lake Scenarios Segment 1, 2015-2016)



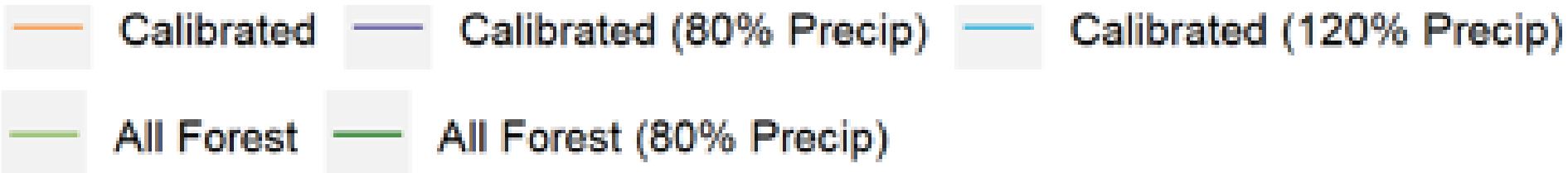
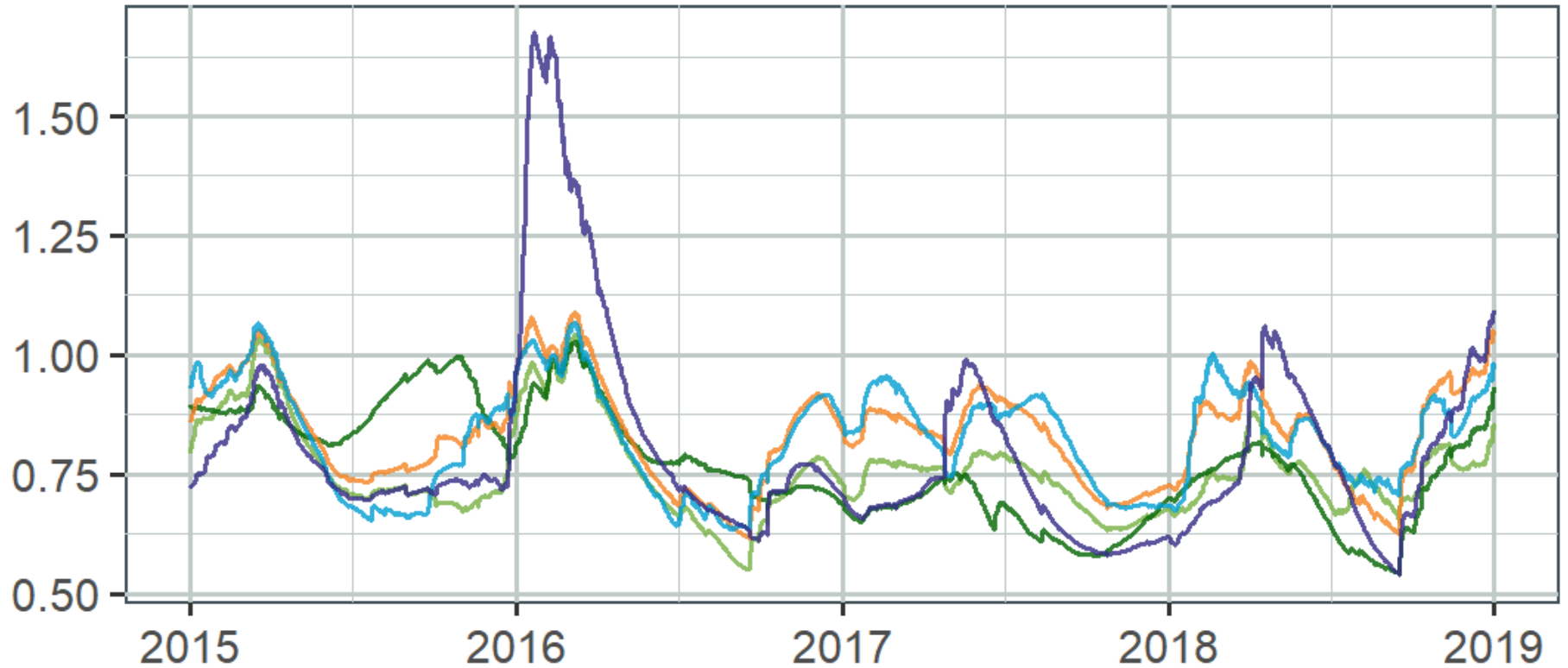
- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

Total Nitrogen (mg/L) – WARMF Lake Scenarios Segment 1, late spring 2017-2018



Total Nitrogen (mg/L) – WARMF Lake Scenario Comparison

Segment 4



Total Nitrogen (mg/L) – WARMF Lake Scenario Comparison

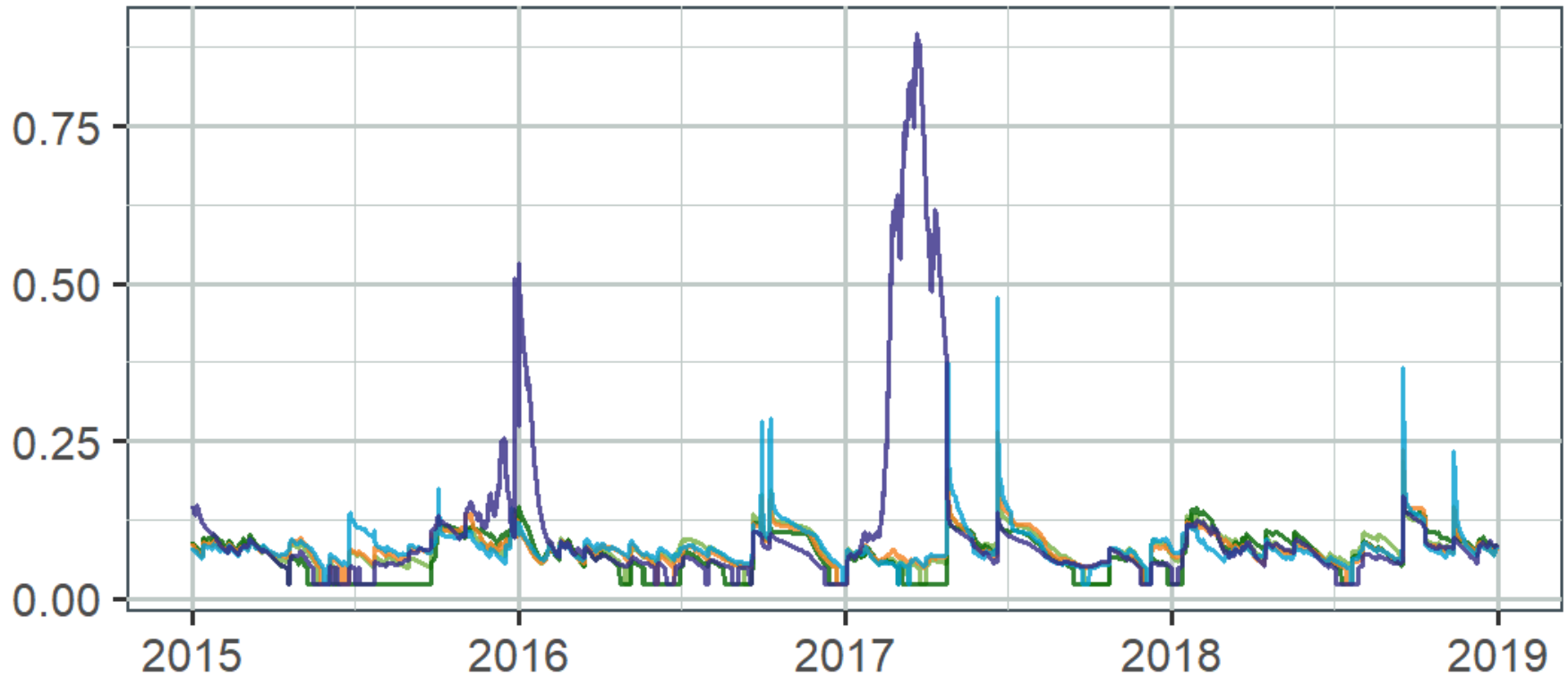
Segment 6



- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

Total Phosphorus (mg/L) – WARMF Lake Scenario Comparison

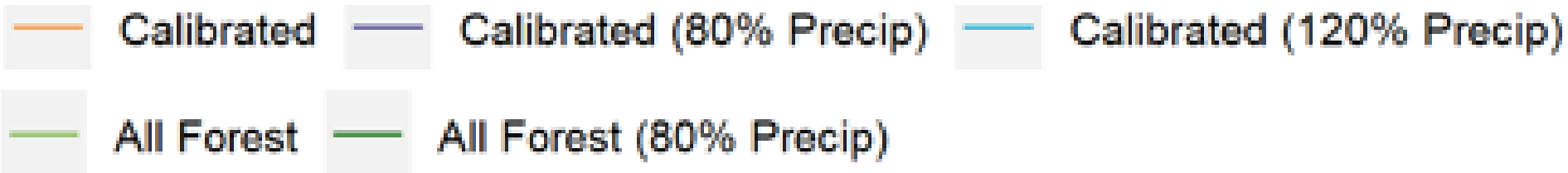
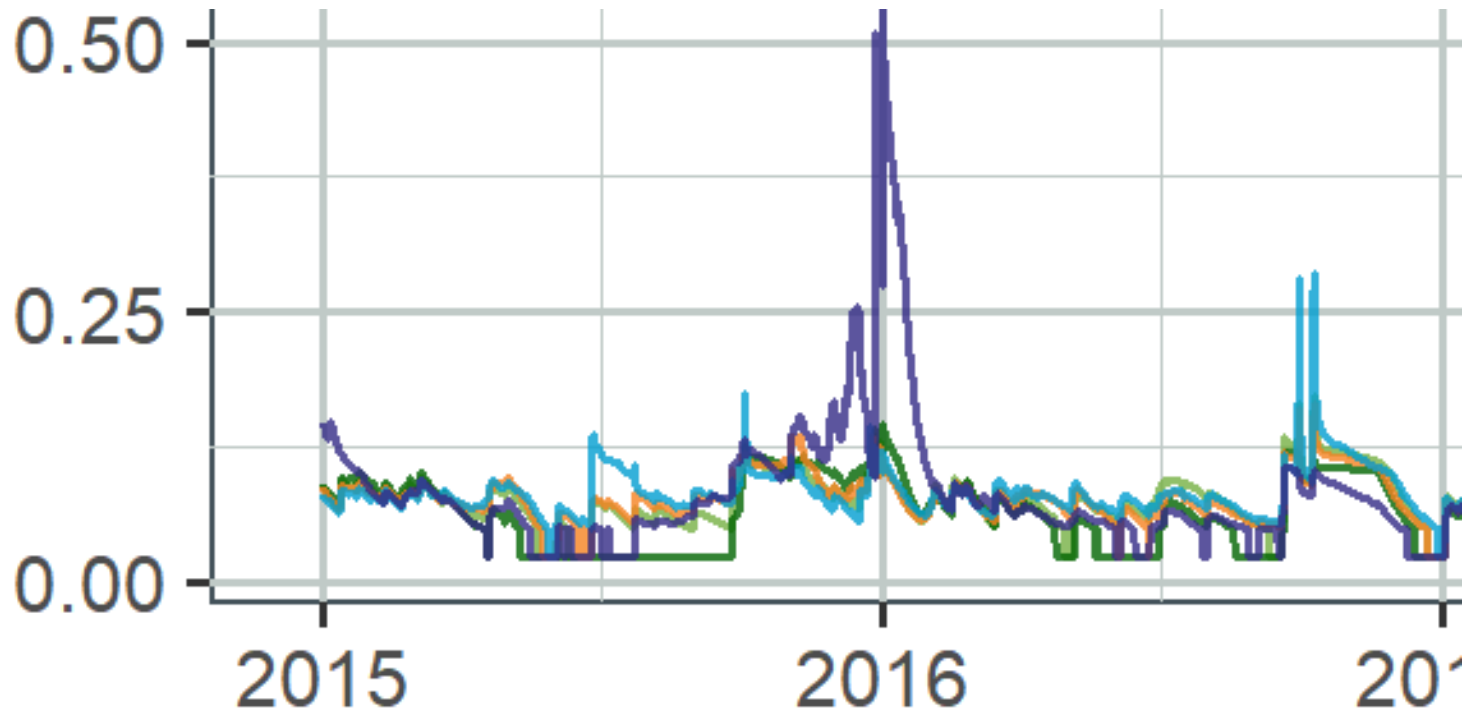
Segment 1



- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

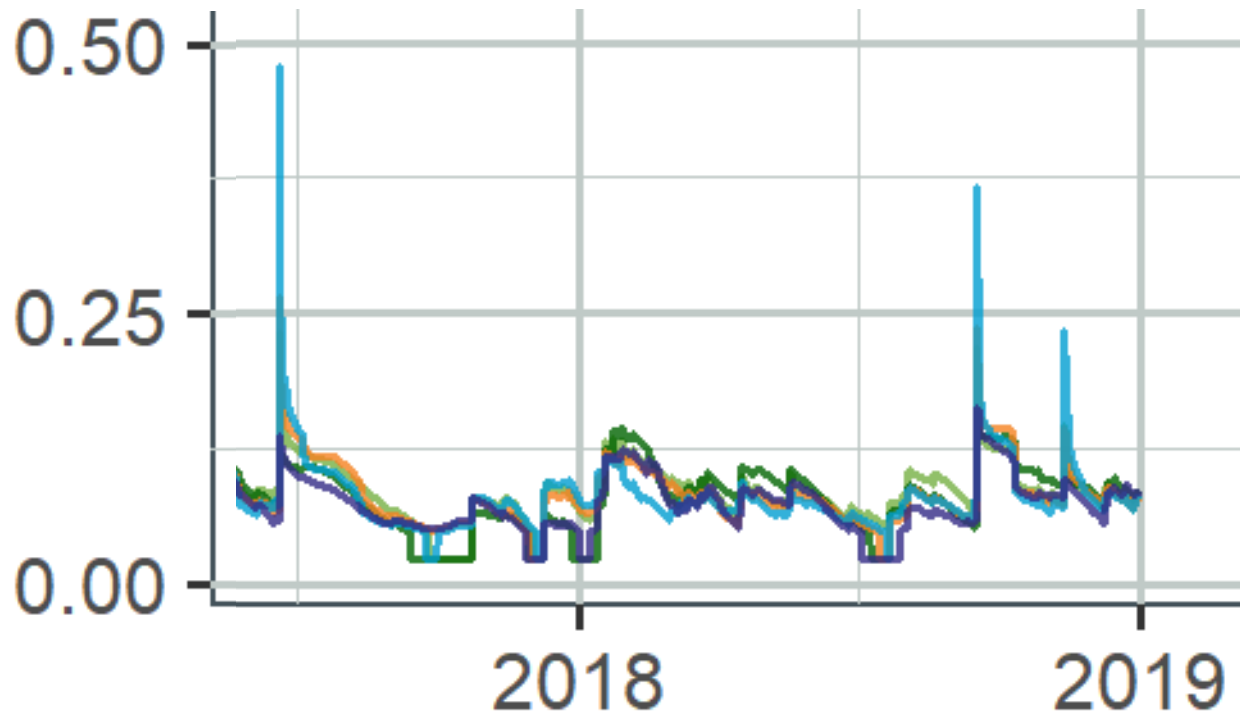
Total Phosphorus (mg/L) – WARMF Lake Scenario Comparison

Segment 1



Total Phosphorus (mg/L) – WARMF Lake Scenario Comparison

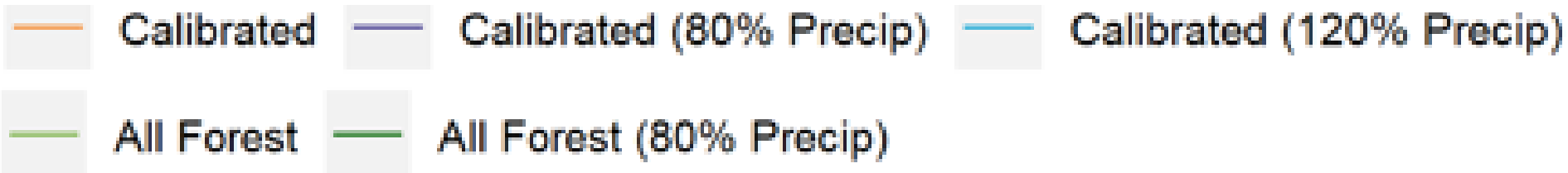
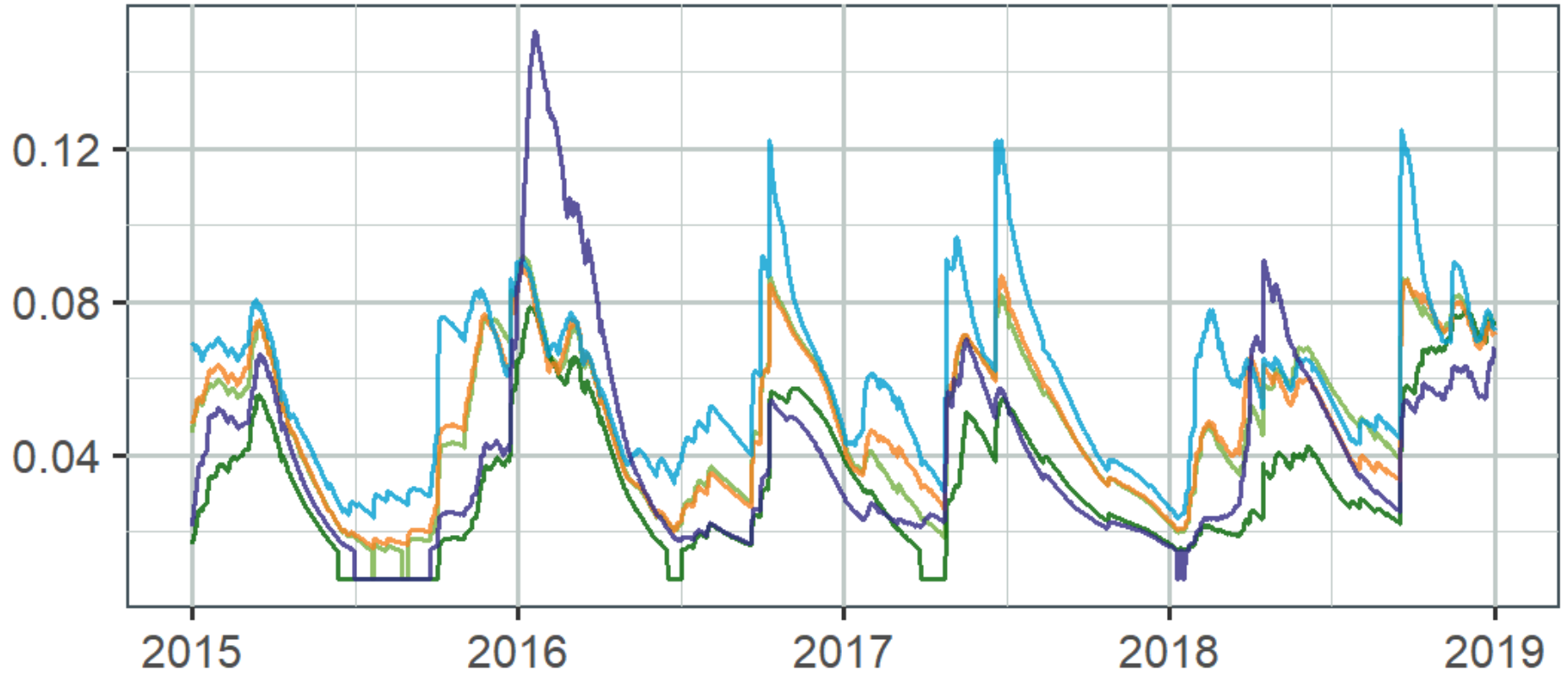
Segment 1



- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

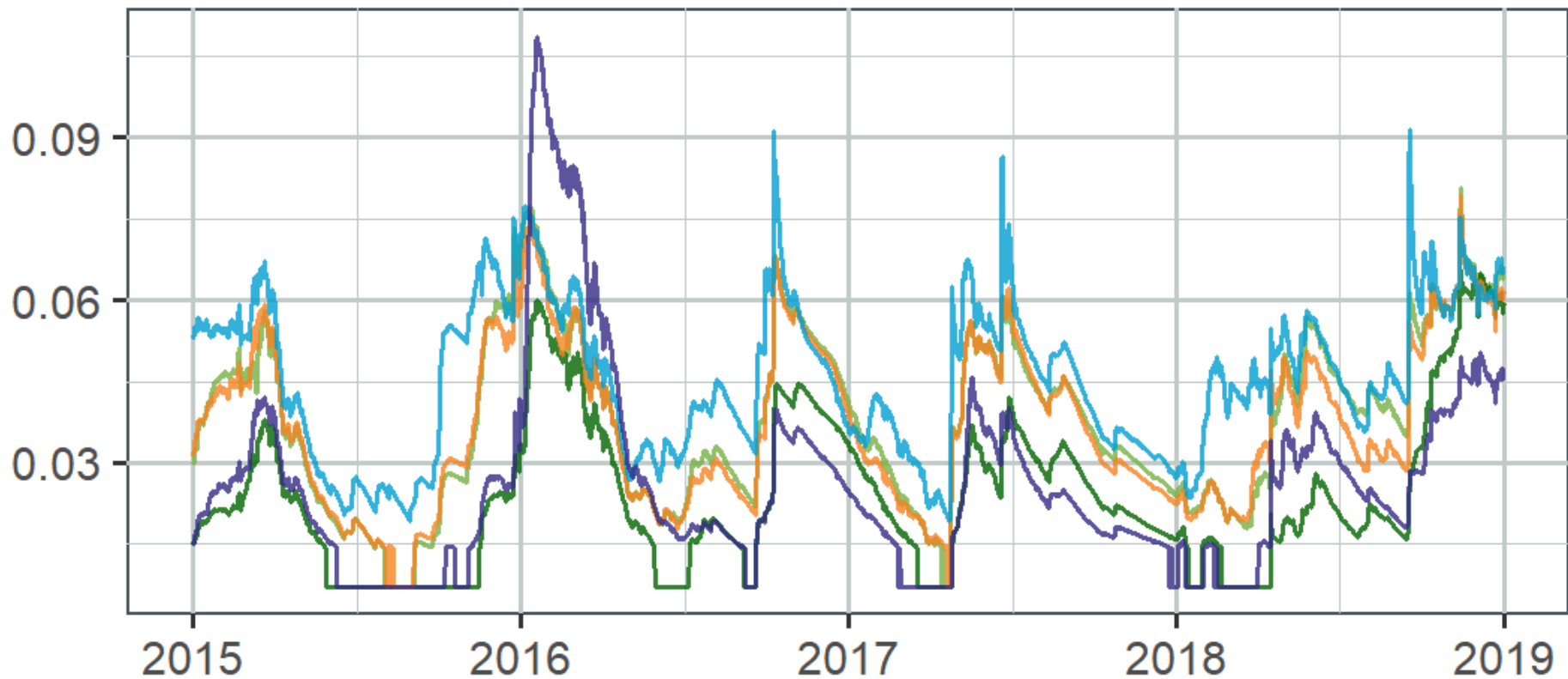
Total Phosphorus (mg/L) – WARMF Lake Scenario Comparison

Segment 4



Total Phosphorus (mg/L) – WARMF Lake Scenario Comparison

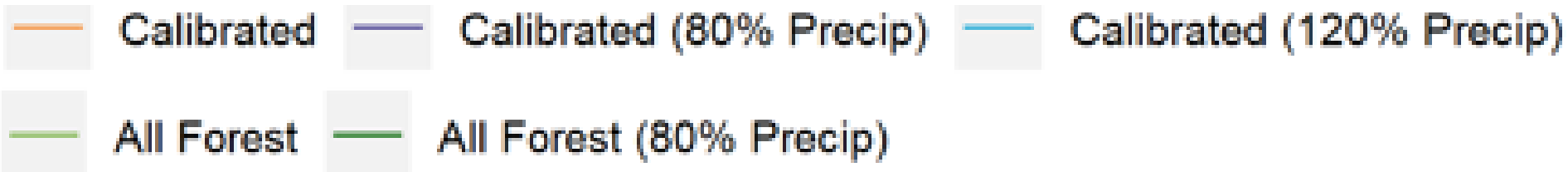
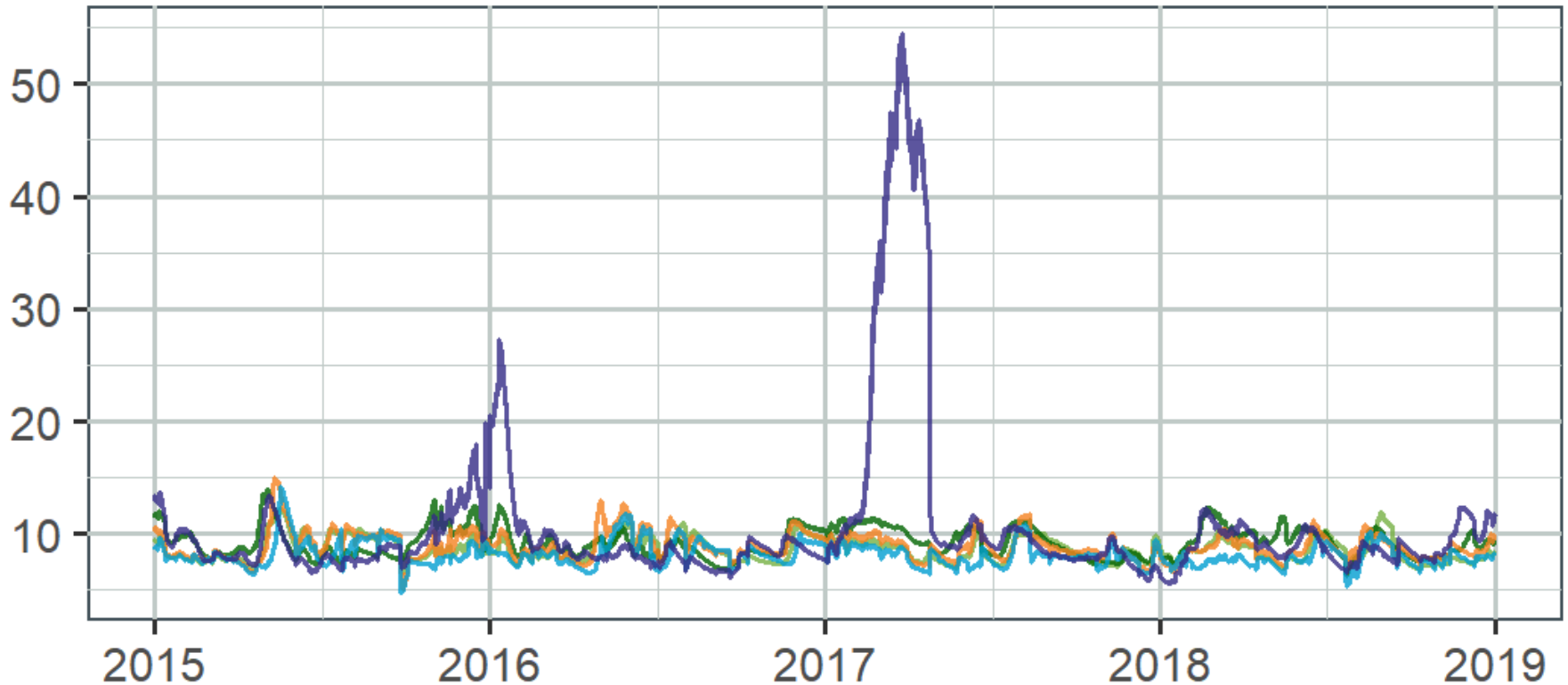
Segment 6



- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

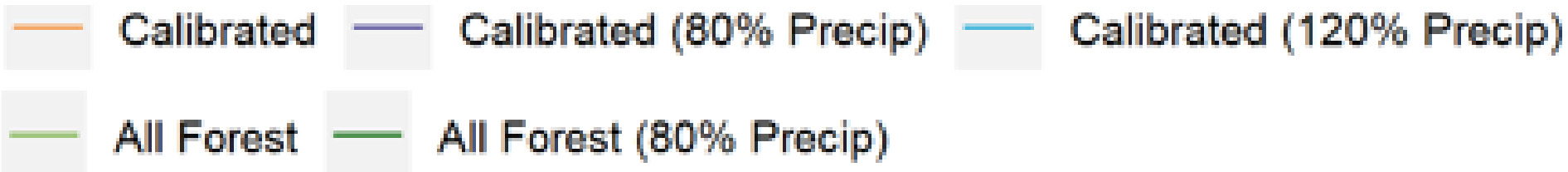
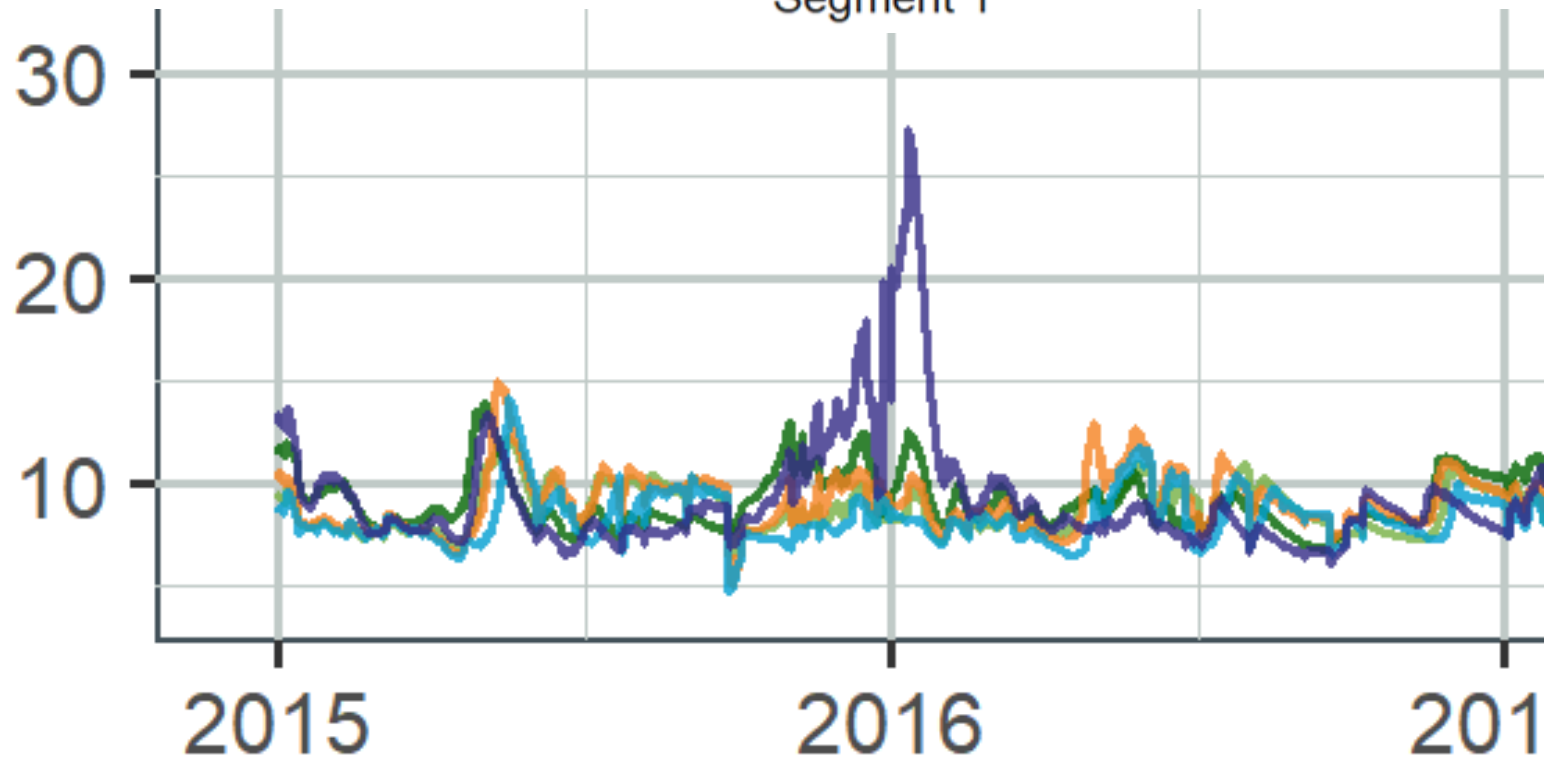
Total Organic Carbon (mg/L) – WARMF Lake Scenario Comparison

Segment 1



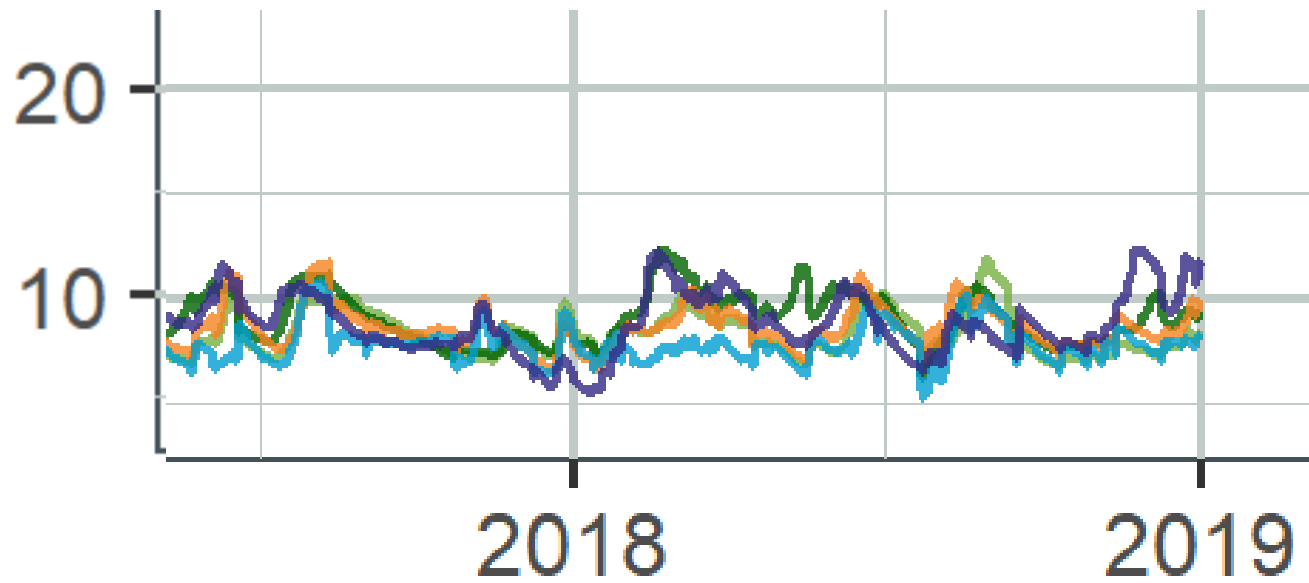
Total Organic Carbon (mg/L) – WARMF Lake Scenario Comparison

Segment 1



Total Organic Carbon (mg/L) – WARMF Lake Scenario Comparison

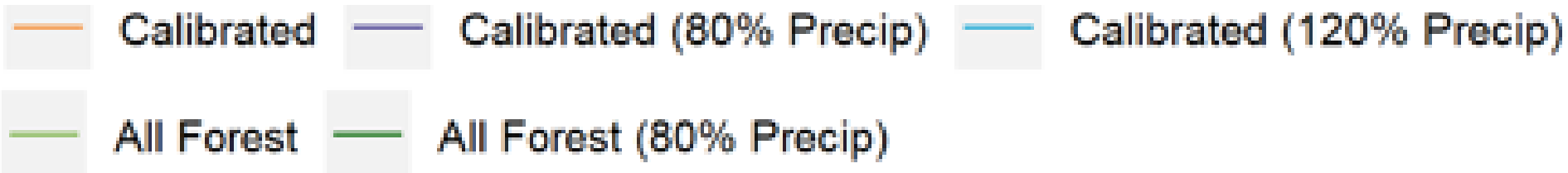
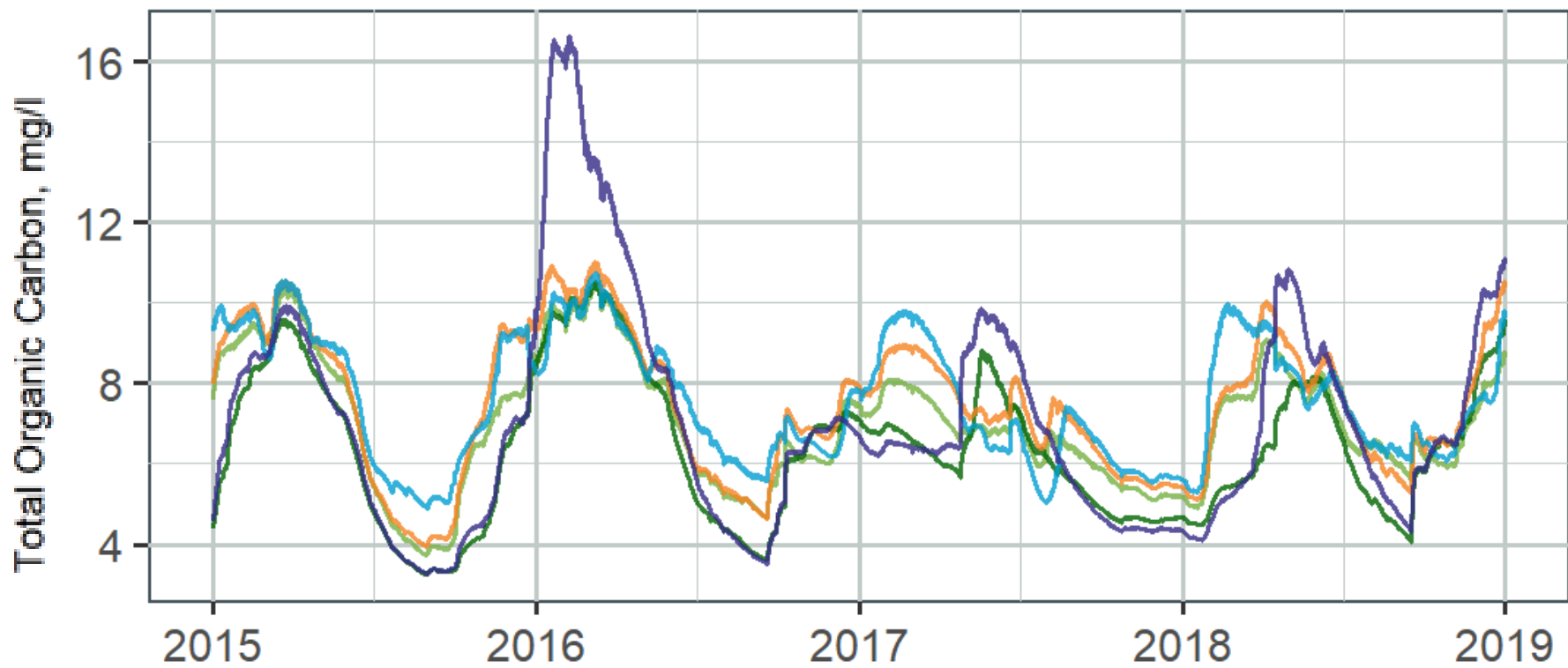
Segment 1



- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

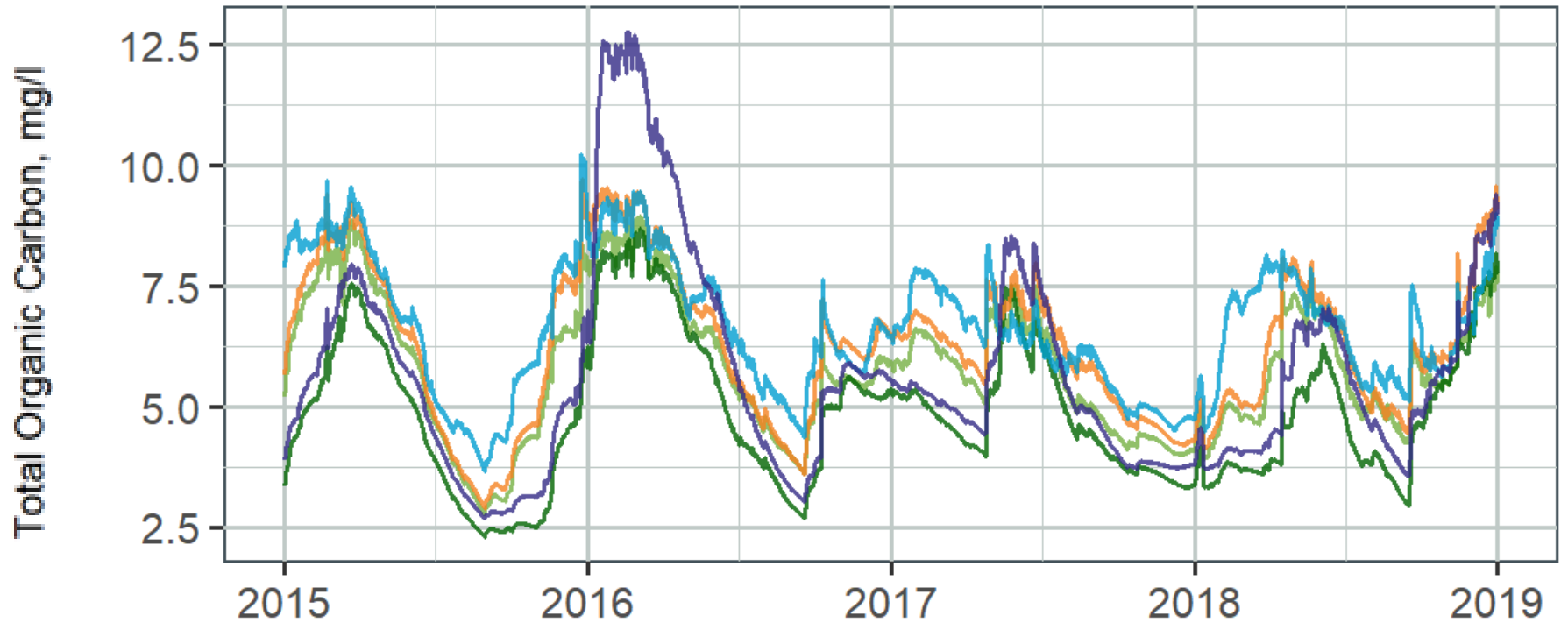
Total Organic Carbon – WARMF Lake Scenario Comparison

Segment 4



Total Organic Carbon – WARMF Lake Scenario Comparison

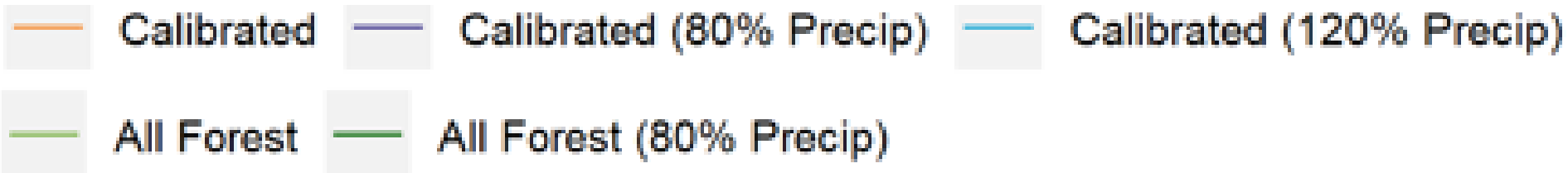
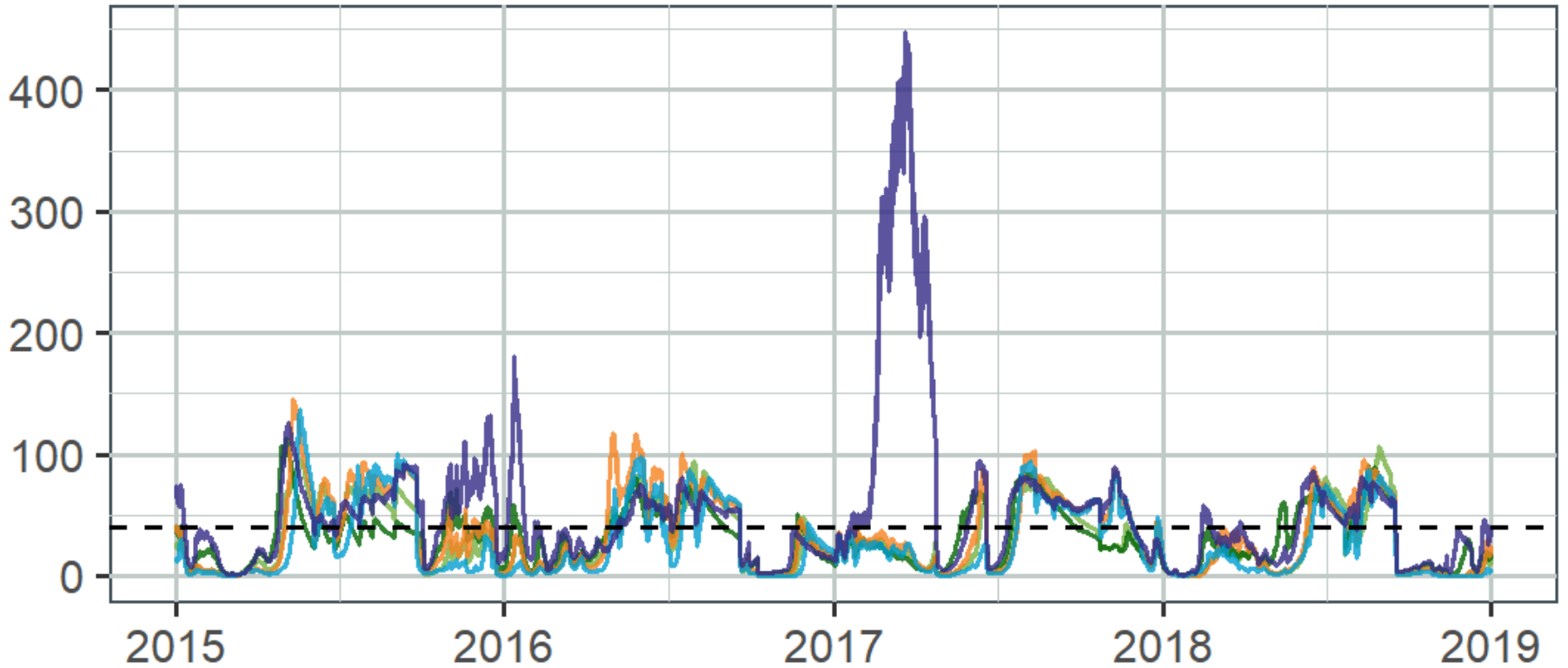
Segment 6



- Calibrated
- Calibrated (80% Precip)
- Calibrated (120% Precip)
- All Forest
- All Forest (80% Precip)

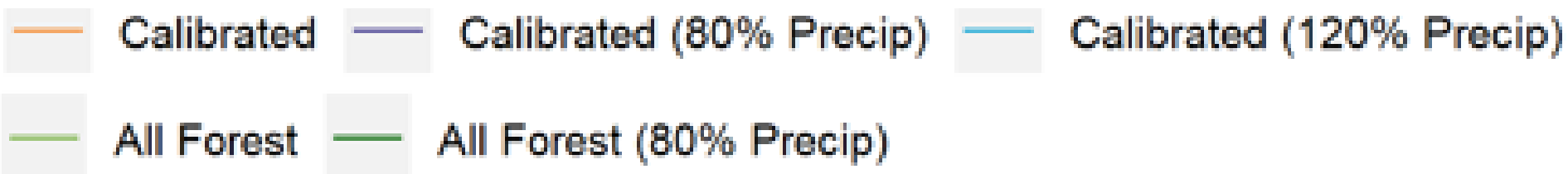
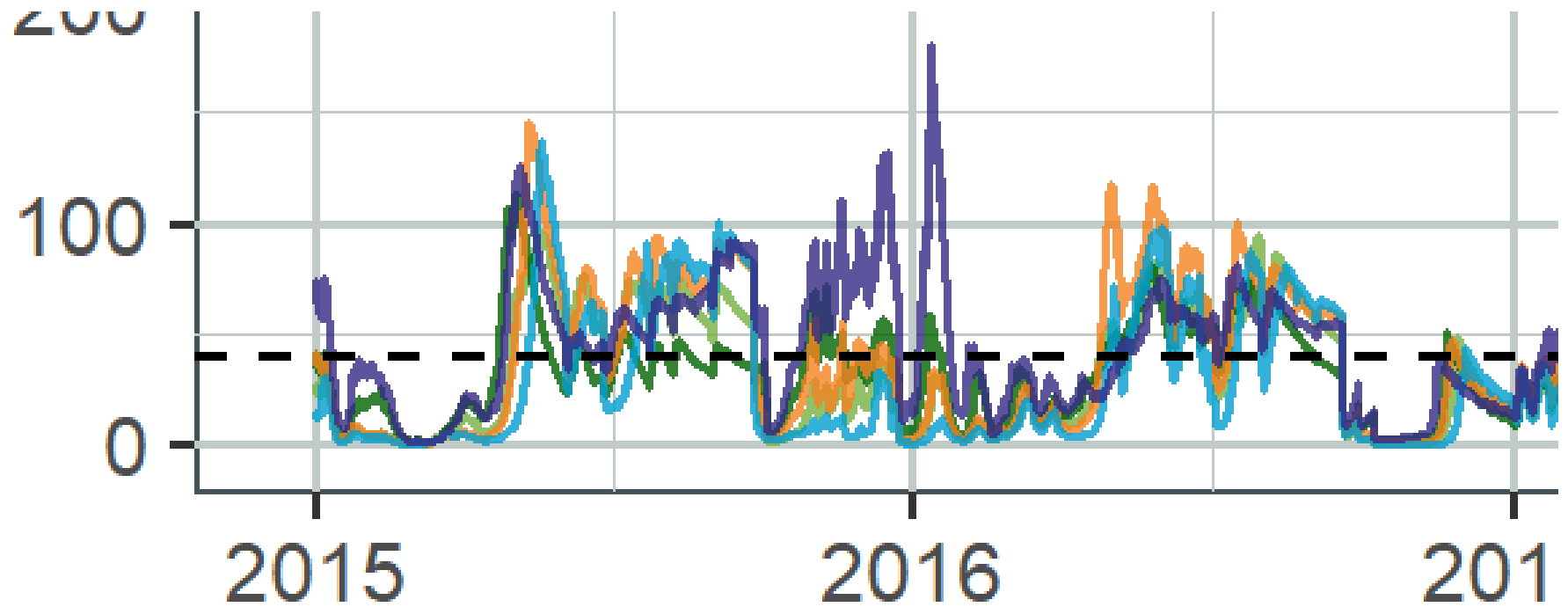
Chlorophyll-a ($\mu\text{g/L}$), WARMF Lake Scenario Comparison

Segment 1



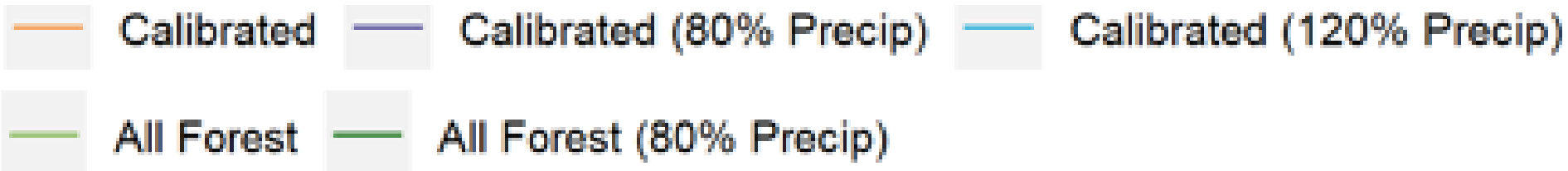
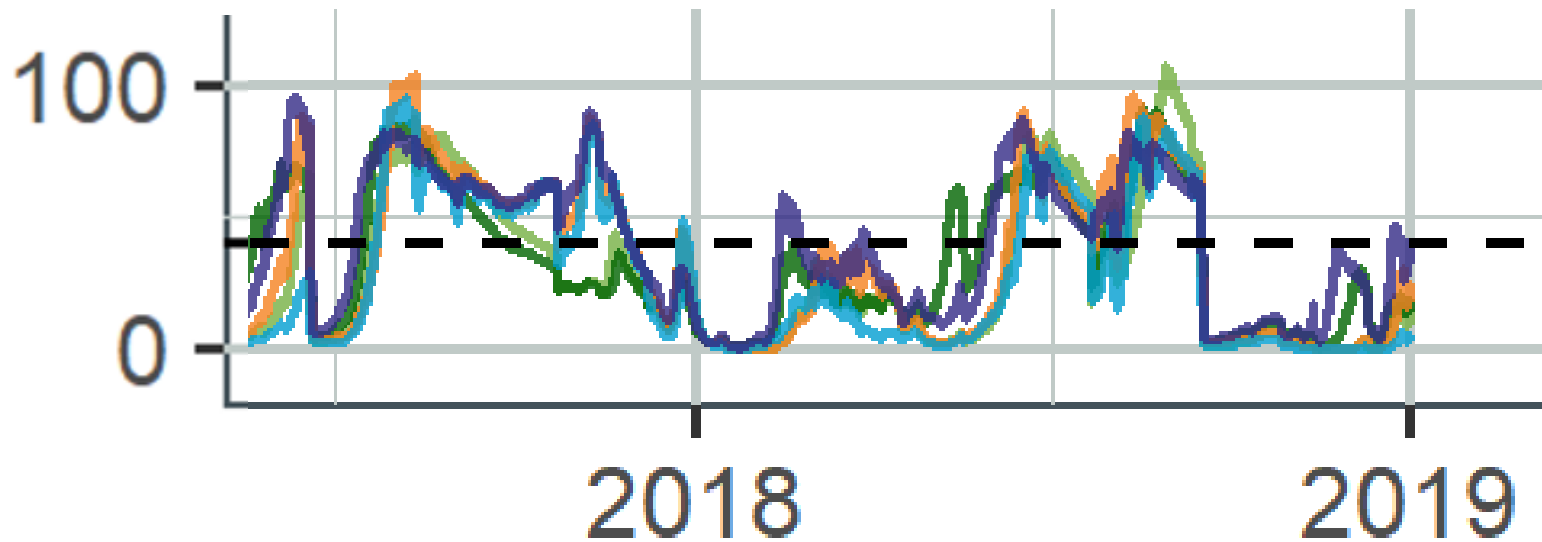
Chlorophyll-a ($\mu\text{g/L}$), WARMF Lake Scenario Comparison

Segment 1



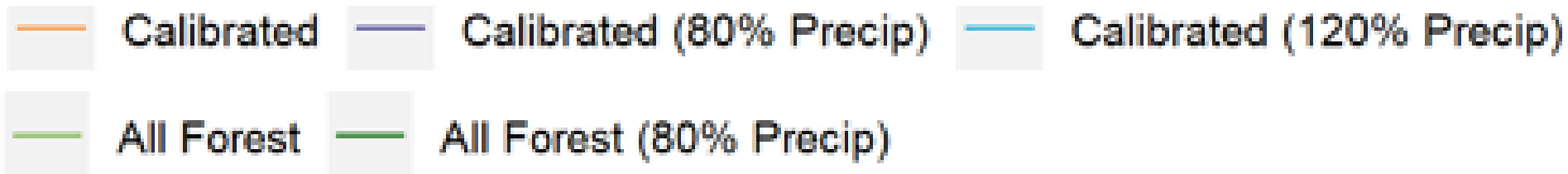
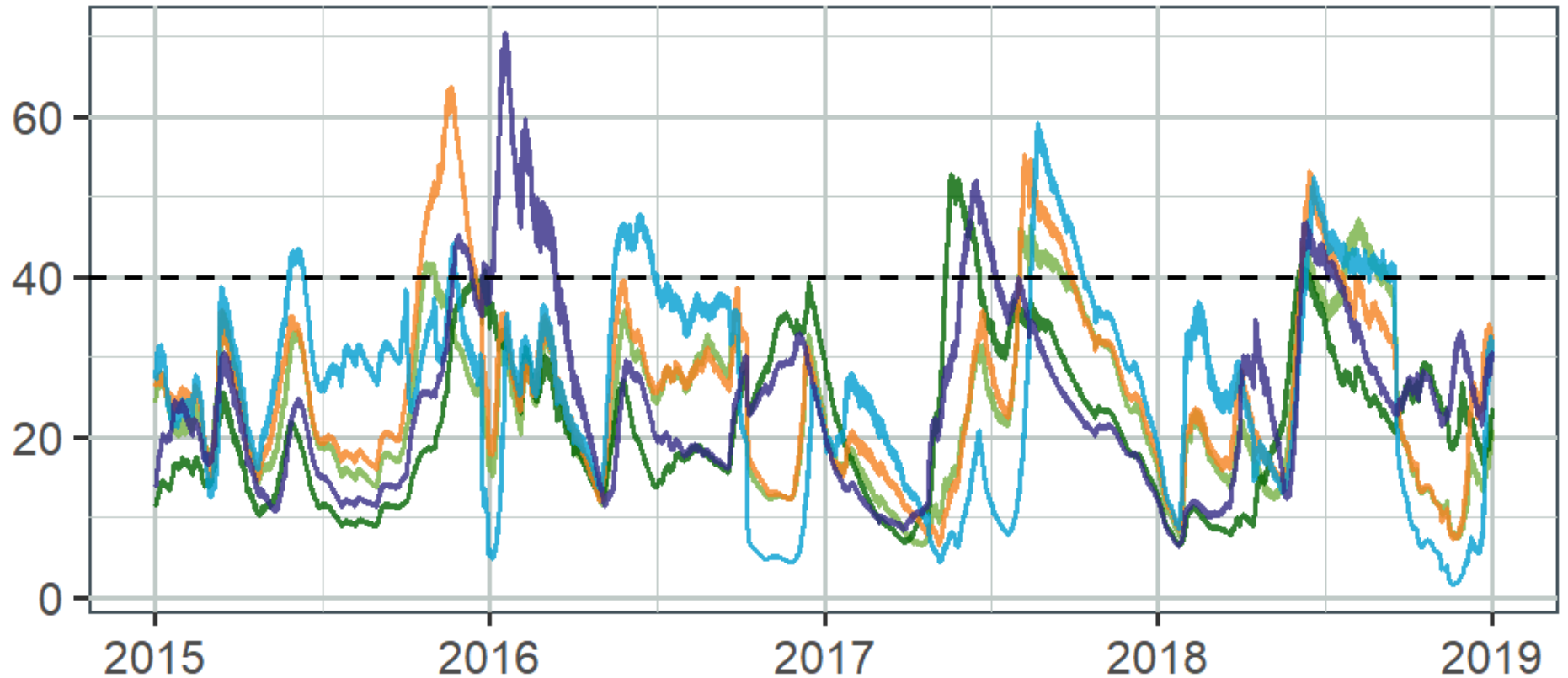
Chlorophyll-a ($\mu\text{g/L}$), WARMF Lake Scenario Comparison

Segment 1



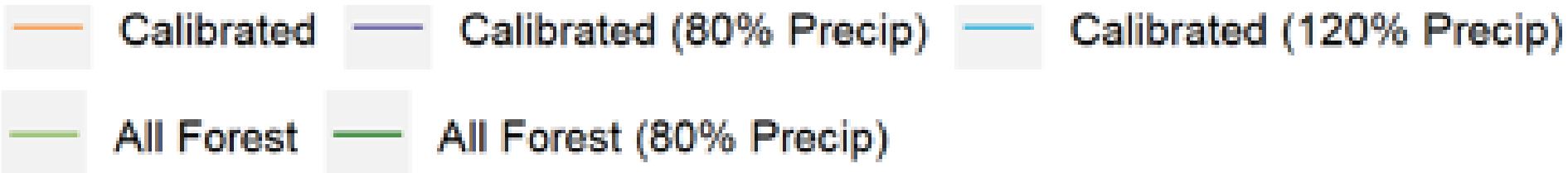
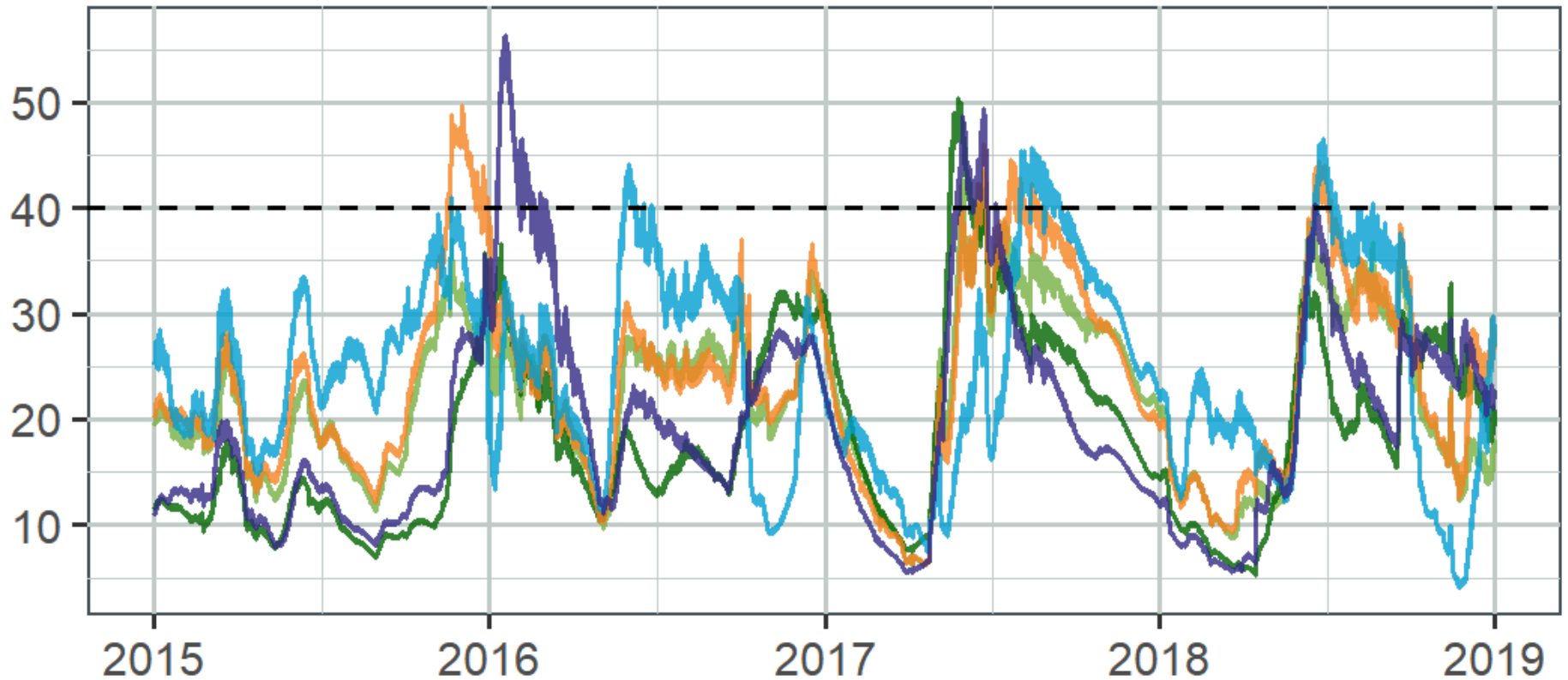
Chlorophyll-a ($\mu\text{g/L}$), WARMF Lake Scenario Comparison

Segment 4



Chlorophyll-a ($\mu\text{g/L}$), WARMF Lake Scenario Comparison

Segment 6



Preliminary Findings from WARMF Lake Analyses

- None of the modeling scenarios will meet the chlorophyll-a criterion in Segment 1 upstream of I-85
- Segment 1 is particularly sensitive to rainfall
- Scenarios affect water quality differently at various times and locations
- Exceedances of 40 $\mu\text{g}/\text{L}$ chlorophyll-a decrease in the downstream direction

Statistical/Bayesian Modeling Status

- The modeling team has conducted an extensive effort to compile, merge, review, and format datasets for the statistical model.
- The Technical Advisors Workgroup (TAW) met in February to review the last three data sets and categorization
- The third-party model reviewers have reviewed the input datasets and categorization
- The modeling team is exploring correlations among the datasets now for review by the TAW and third-party reviewers
- Plan to bring correlations to the PFC in April and May

Lake Model Reporting Status

- The modeling team is continuing to draft sections and appendices of the lake modeling report.
- The lake modeling report will include technical appendices for each lake model
- Sections of the draft lake model report will be reviewed by the MRSW in late spring 2023
- We have worked with the MRSW and subject matter experts on time series comparisons to observed lake data

Gathering Data from Local Governments to Support the Cost Benefit Analysis

Gathering Data from Local Governments to Support the Cost Benefit Analysis

- An important component of the re-examination is understanding the costs of past and possible future actions in the watershed as well as the benefits
 - Nutrient load reductions
 - Improvements in lake water quality
- At the February PFC meeting we discussed the types of data and information we are seeking to initiate this process
- Please email initial information to amatos@brwncald.com and ashley@brindlecreek.com and copy Forrest.Westall@mcgillassociates.com.
- Structured data requests will follow after existing data and reports have been reviewed and compiled.

**Developing Recommendations
for a Revised Nutrient
Management Strategy and a
Petition for a Site-Specific
Chlorophyll-a Water Quality
Standard**

Development of Principles and Concepts for a Revised Strategy

- During the [November](#), [December](#), and [January](#) PFC meetings, the PFC discussed concepts and principles under consideration for inclusion in the UNRBA's recommendations for a revised Falls Lake Strategy/Revised Falls Lake Rules.
 - Used to develop a preliminary draft document that describes the concepts and principles.
 - Provided to the PFC ahead of this meeting for review
 - Outline follows on the next slides
- The development of principles and concepts for review and approval by the PFC will lead to specific recommendations for revised rules.
- The UNRBA will continue to work in cooperation with DEQ and DWR to consider specific rule modifications, the revised strategy, and petition for site-specific chlorophyll-a standard
- The UNRBA and other stakeholders have identified an expanded list of stakeholders to begin reaching out

Outline of the Draft Document (Sections 1-3)

1. Background and Supporting Information
 - A. History of the Reservoir and the Falls Lake Rules
 - B. Regulatory and Statutory Requirements, UNRBA Response, and Limitations of the Current Management Approach
 - C. Adaptive Management Provision--Reexamination of the Rules
 - D. Key Findings from the Monitoring and Modeling Studies
 - i. UNRBA Monitoring Program
 - ii. UNRBA Watershed Modeling
 - iii. Lake Water Quality Modeling
 - E. Stakeholder Involvement
 - F. Stage I Existing Development Interim Alternative Implementation Approach (IAIA)
 - G. Development of the UNRBA Recommendations for a Revised Management Strategy
2. Guiding Principles for a Revised Strategy
3. Nutrient Reduction Opportunities

Outline of the Draft Document (Sections 4-7)

4. Comprehensive Approach to Nutrient Management
 - A. Site-Specific Chlorophyll-a Standard
 - B. Urban Development, State, Federal, and Institutional Lands
 - C. Opportunities for Partnering on Agricultural Lands
 - D. Forest Lands
 - E. Streambank Erosion
 - F. Atmospheric Deposition and Climate Resilience
 - G. Distributed Wastewater Sources
 - H. Point Sources (Major and Minor)
 - I. New Development
 - J. Ideas Discussed but Not Included
5. Program Administration
 - A. Structure of the Watershed Organization
 - B. Investments
 - C. Duration
 - D. Reporting
 - E. Compliance Determination
6. Status of the Concepts and Principles Document
7. References

Petition for Site-Specific Chlorophyll-a Criteria and Evaluations of Legal Approaches

- The subject matter experts continue to evaluate other State's site-specific standards for chlorophyll-a and nutrient-related standards.
- Dr. Marty Lebo continues to integrate his work into the statistical modeling and regulatory support efforts.
- The modeling efforts will also inform development of an appropriate, attainable site-specific criteria
- The legal group met after the January Board meeting to discuss options for a pathway to a revised strategy and the development of a site-specific standard proposal/petition

Timeline for Developing Recommendations

- **March 2023**
 - Discuss preliminary document describing concepts and principles
- **April 2023**
 - Discuss correlations of statistical model data inputs
- **Spring 2023**
 - Expand stakeholder engagement
 - Meet with DWR and EPA
- **Summer 2023**
 - Propose legislation as needed; update draft recommendations package
- **Fall 2023**
 - Stakeholder workshop to review a final draft document
 - Provide our report to the Collaboratory for reference
- **December 2023 - Legislative requirements for Submittals**
 - NC Policy Collaboratory final Falls Lake report
 - Submittals from other groups (UNRBA)
- **DWR to begin rule making within 6 months/no later than December 2024**
 - DWR to begin their stakeholder process
- **DWR anticipates rules readoption by 2026/2027**

Continued engagement with Collaboratory researchers

Prospective Budget for FY2024

Budget Expenditures for FY2024

Expenditures	Budget
Executive Director Services, Travel, and Other Support Services	\$235,440
Modeling and Regulatory Support	\$620,000 plus \$180,000 contingency*
Communications Support	\$60,000
Legal Support	\$100,000
Administrative Costs	\$6,000
Website Improvements	\$3,500
Total	\$1,204,940

*The amount in contingency may change as the scope of work is developed.

Communications Outreach and Preparation

Communications Outreach and Preparation

- Continued engagement with DWR and Collaboratory researchers (meeting planning underway)
- WRI Falls Lake Session
 - March 23, 2023
- Joint symposium with NC Policy Collaboratory
 - April 19, 2023
- Workshop with DWR/NC Policy Collaboratory/NGOs
 - Late spring/early summer 2023
- UNRBA Technical Stakeholder Workshop
 - Fall 2023
- Regulatory forum to discuss rules revision process
 - Spring 2024
- Recent staff changes at member local governments highlight the need for UNRBA engagement from multiple staff across the levels of each local government.

Communications Outreach and Preparation

- The Executive Director will continue to reach out to local government staff to identify needs and support staff with implementation of the IAIA Program and participation in developing the revised nutrient management strategy.
- Planning a press release on the Neuse River of the Year for the upper part of the watershed following event details from American Rivers
 - The Board suggests including the Year 1 IAIA Report and the 2022 UNRBA Status Report as part of this release
- BC communications staff have been identified to support development of press releases and videos

Other Status Items

Ongoing Items

- More intensive outreach and stakeholder engagement and management of expectations and resources—A lot to do between now and recommendations in 2023
- Ongoing DEQ/DWR Items
 - Continued engagement with staff and leadership
 - Building agreement with timeline for EPA outreach
 - MOA
 - Neuse Watershed Model Information Session – Delivery Factors for WWTP—Update provided by John Huisman

Future Meetings as Currently Scheduled:

Next BOD Meeting: March 15, 2023, 9:30 AM to Noon

WRRRI Falls Lake Session: March 23, 2023, 2:45 PM to 4:15 PM

Next PFC Meeting: April 4, 2023

**Falls Lake Symposium: April 19, 2023, all day
(start and end times to be determined)**

Closing Comments

Additional Discussion