Appendix F: Additional Comparisons of Observed and Simulated Concentrations and Estimated Daily Loads

Introduction

This appendix provides additional graphical comparisons for the Upper Neuse River Basin Association (UNRBA) Falls Lake Watershed Analysis Risk Management Framework (WARMF) watershed model relative to what is provided in the main report.

Section 6 of the main report describes the model calibration and performance criteria, calibration challenges, third-party review (described more fully in Appendix H), and the model approval by the UNRBA. For reference, a description of the challenges associated with model calibration are repeated in this section.

Watershed models aim to simulate many processes that impact hydrology and pollutant loading. Accurate characterization of the watershed, meteorology, and nutrient inputs impact how well the model performs. Accuracy of the stream flow data and water quality observations also impact performance. Limitations associated with the input data sets are described in Section 3 and Section 4 of the main report.

The UNRBA Modeling Quality Assurance Project Plan (QAPP) describes the visual evaluations and statistical criteria used to gage the watershed model performance. While the goal is to achieve the best fit across as many parameters and locations as possible, there are constraints not only on model inputs but also on time and model development resources. Literature values and best professional judgement inform the range of potential variation in the model coefficients. The modeling team worked closely with subject matter experts and third-party reviewers throughout the calibration process. The range of adjustments that were evaluated reflects the expected variation based on other modeling efforts. Additionally, as the watershed model provides crucial input to the WARMF Lake and EFDC models of Falls Lake, timely completion was essential to meet the schedule of the reexamination.

The following challenges were discussed during UNRBA Modeling and Regulatory Support Workgroup (MRSW) and Path Forward Committee (PFC) meetings as the model was developed in addition to those associated with watershed characterization and input data sets:

- Model limitations for river reaches – The WARMF watershed model has been developed to simulate the transport of flow and material primarily through river. When the simulated flow in a river reach goes to zero, the model does not output a simulated concentration. Because river reaches are generally flowing, growth of algae in the simulation is difficult to achieve. To overcome these limitations and allow some growth of algae to occur prior to discharge to Falls Lake, some storage in the downstream reaches was assumed. These storage areas affect other water quality parameters as well, and the calibration aimed to fit as many parameters as possible. The WARMF model assumes that river reaches are fully mixed across the water column, and this assumption impacts the water temperature and dissolved oxygen concentrations simulated by the model. These parameters are important drivers of many reaction rates.
- Hydrologic response – some of the streams in the Falls Lake watershed have a “flashy” hydrologic response where the stream flows rise and fall relatively quickly in response to storm events. To simulate these patterns, the vertical hydraulic conductivities in these modeling catchments (e.g., Ellerbe Creek) were decreased relative to other catchments in the Triassic Basin. Triassic Basin soils already have lower vertical hydraulic conductivities compared to Carolina Slate Belt and Raleigh Belt soils. Decreasing the vertical hydraulic conductivities has the effect of lowering the baseflow contribution to the streams and limiting the amount of interaction with the subsurface soil layers in these catchments. Adjustments of vertical hydraulic conductivities were applied to catchments draining to a USGS stream flow gage, or to the catchments between two gages if applicable. Vertical hydraulic conductivities for ungaged tributaries were set based on those applied to nearby, gaged catchments.

- Low observed concentrations - When observed concentrations are very low on average, it can be difficult to meet the performance criteria which are based on percentages for the WARMF model as described in the QAPP. Low concentrations of some parameters may not greatly affect loading to the lake especially if they occur during low flows. For parameters that are linked in terms of reaction rates or other factors, the modeler may prioritize improving the model fit for the parameter that is a more substantial part of the load. For example, if the average ammonia concentration is 0.1 mg-N /L, a 50 percent bias could represent an average concentration of 0.05 mg-N /L or 0.15 mg-N /L. A difference in concentration of 0.05 mg-N/L does not significantly affect overall nitrogen loading to Falls Lake (0.05 mg-N/L in 100 L of water is 5 mg-N). Alternatively, if the average nitrate concentration is 1 mg-N/L, a 50 percent bias could be 0.5 mg-N /L or 1.5 mg-N /L. These higher concentrations have a greater potential to impact loading to the lake (0.5 mg-N/L in 100 L of water = 50 mg-N).
- Model input limitations - The model can only be as good as its inputs. While this watershed model represents more data and information than is usually available, some localized events may not be captured by the input data. For example, nitrate observations in Knap of Reeds Creek at the lake loading station (KRC-4.5) indicate relatively high concentrations for a period in late 2015 and early 2016 (Figure 6-2 of the main report). These could be due to variations at the WWTP that were not captured by the composite sampling conducted during that period, sanitary sewer overflow(s) that were not identified, or some other illicit discharge. The model does not perform well at this location during this period because the input files do not accurately reflect nutrient inputs to the stream. This negatively impacts the performance criteria at Knap of Reeds Creek for the calibration period, but the statistics improve during the validation period when the higher concentrations are no longer present. The only way to improve model performance would be to adjust the model input files until the simulated concentrations match those observed, which would not be considered good modeling practice.
- Upstream impoundments - The presence of upstream impoundments in the watershed also complicates the calibration. Frequent water quality measurements in these waterbodies are not available, so it is difficult to evaluate how well the model is simulating their processes. It is also difficult to pinpoint the best adjustments to model coefficients because these impoundments are less studied than Falls Lake. At the suggestion of the MRSW, the modeling team reviewed quarterly USGS measurements where available. This data guided revisions to simulated processes in Little River Reservoir and nitrogen simulations downstream at LTR-1.9 improved as a result. Further adjustment in the simulation of these impoundments could take a significant amount of effort given lack of information and would not represent a significant change in results. Without extensive data, there is no reasonable basis to develop more detailed lake behavior in these impoundments. For these reasons, model calibration efforts for stations downstream of these impoundments was deemed sufficient by the MRSW and PFC.
- Inconsistencies with simulated time steps and point-in-time water quality observations - Time presents another challenge to the model calibration. Water quality observations are collected at specific points in time and represent instantaneous conditions, not an average condition. The WARMF model time step is 6-hours, so each model output represents a 6-hour average, not a specific moment in time. Water quality concentrations can change quickly, especially in response to storm events. Therefore, comparing the 6-hour average simulated values to point-in-time observations is not an accurate comparison when conditions are changing quickly, particularly in response to storm events.

Monitoring locations in the watershed are shown in Figure F-1. The remaining sections of this appendix include loading comparisons, scatter plots, and performance statistics for comparison of simulated water quality compared to observations collected at several locations along the five largest, gaged tributaries in the watershed.

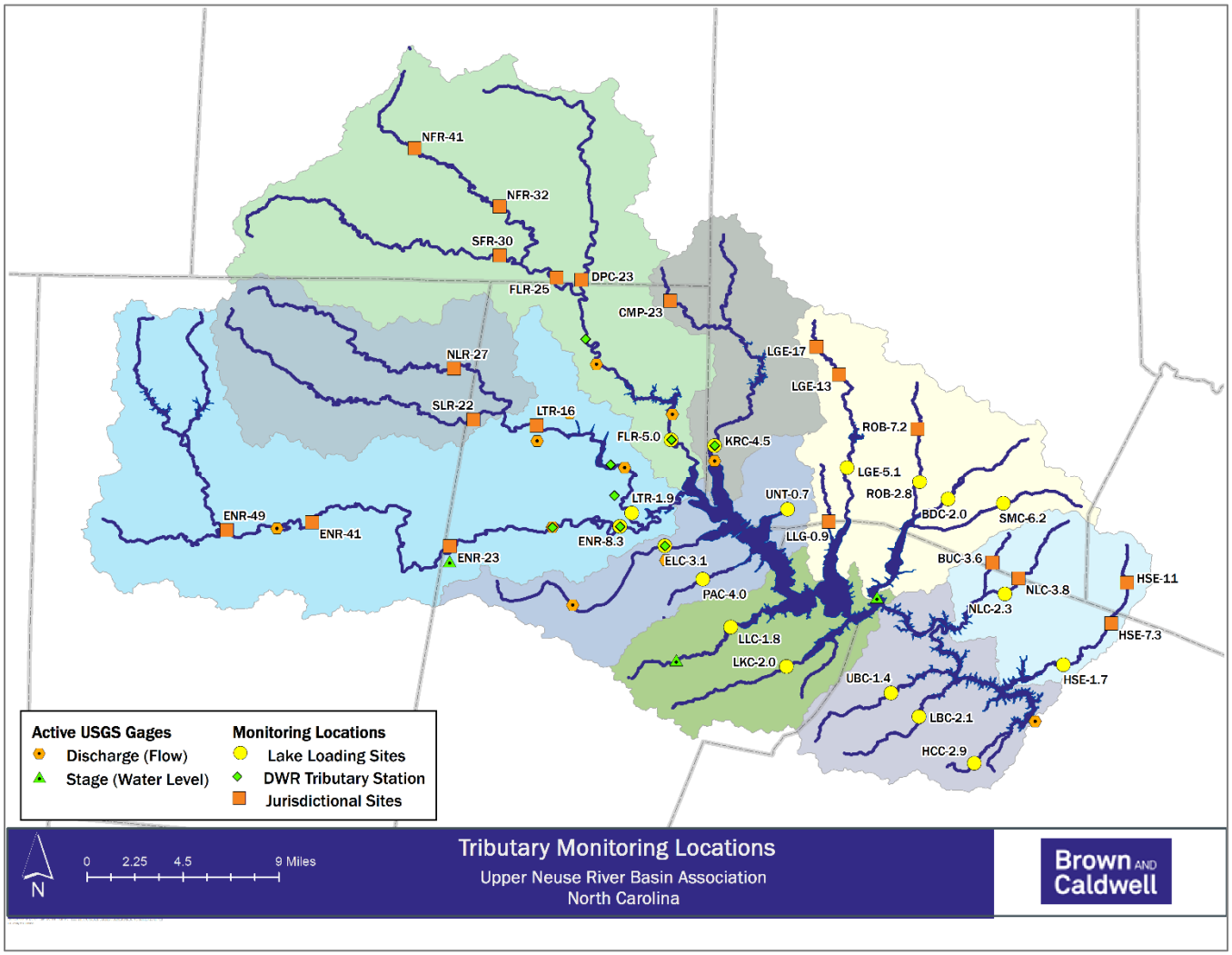

Figure F-1. Locations of sources of water quality data within the Falls Lake watershed

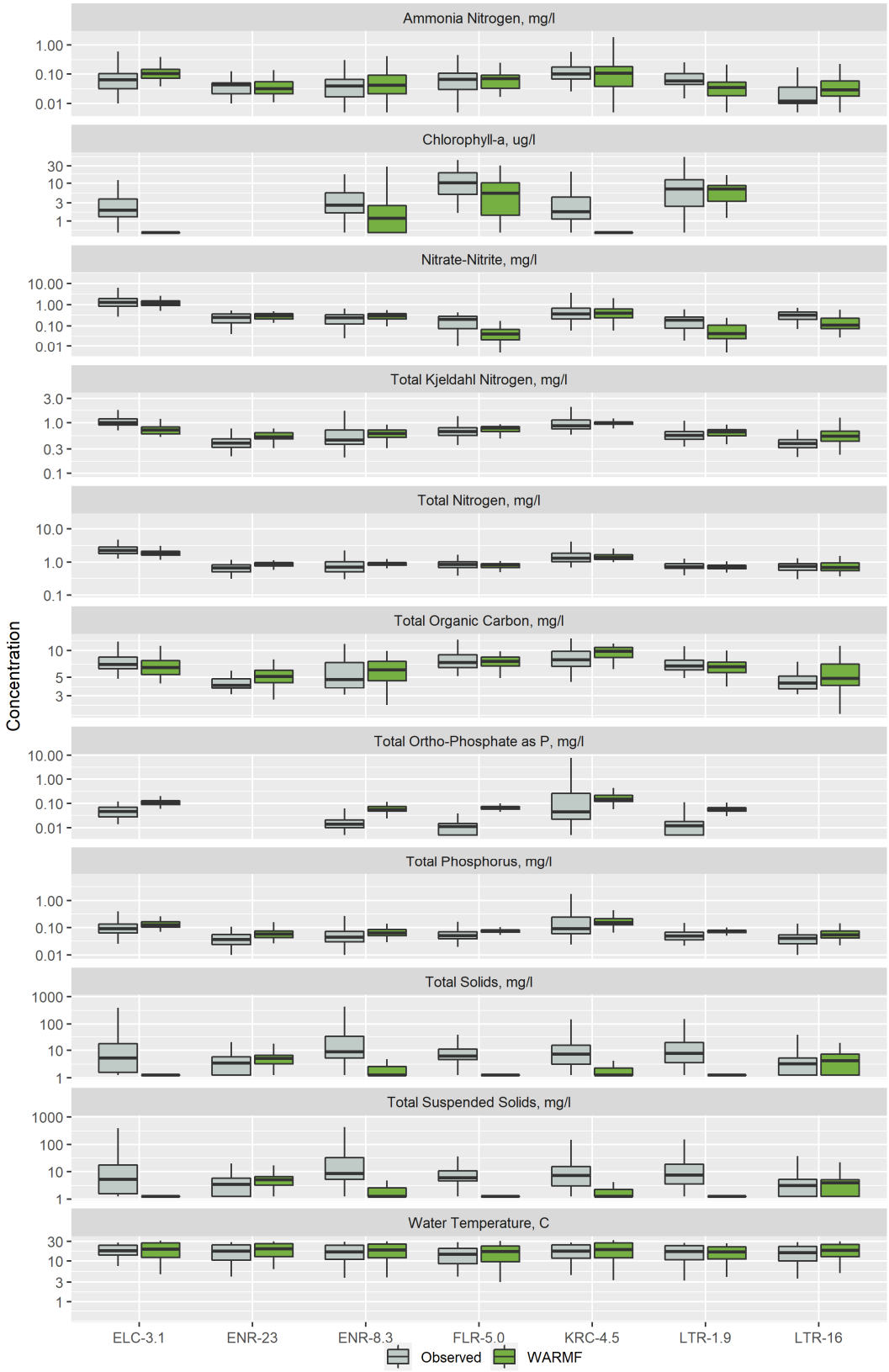

Figure F-2. Daily Water Quality Concentration Comparisons (2015-2018; log-scale).

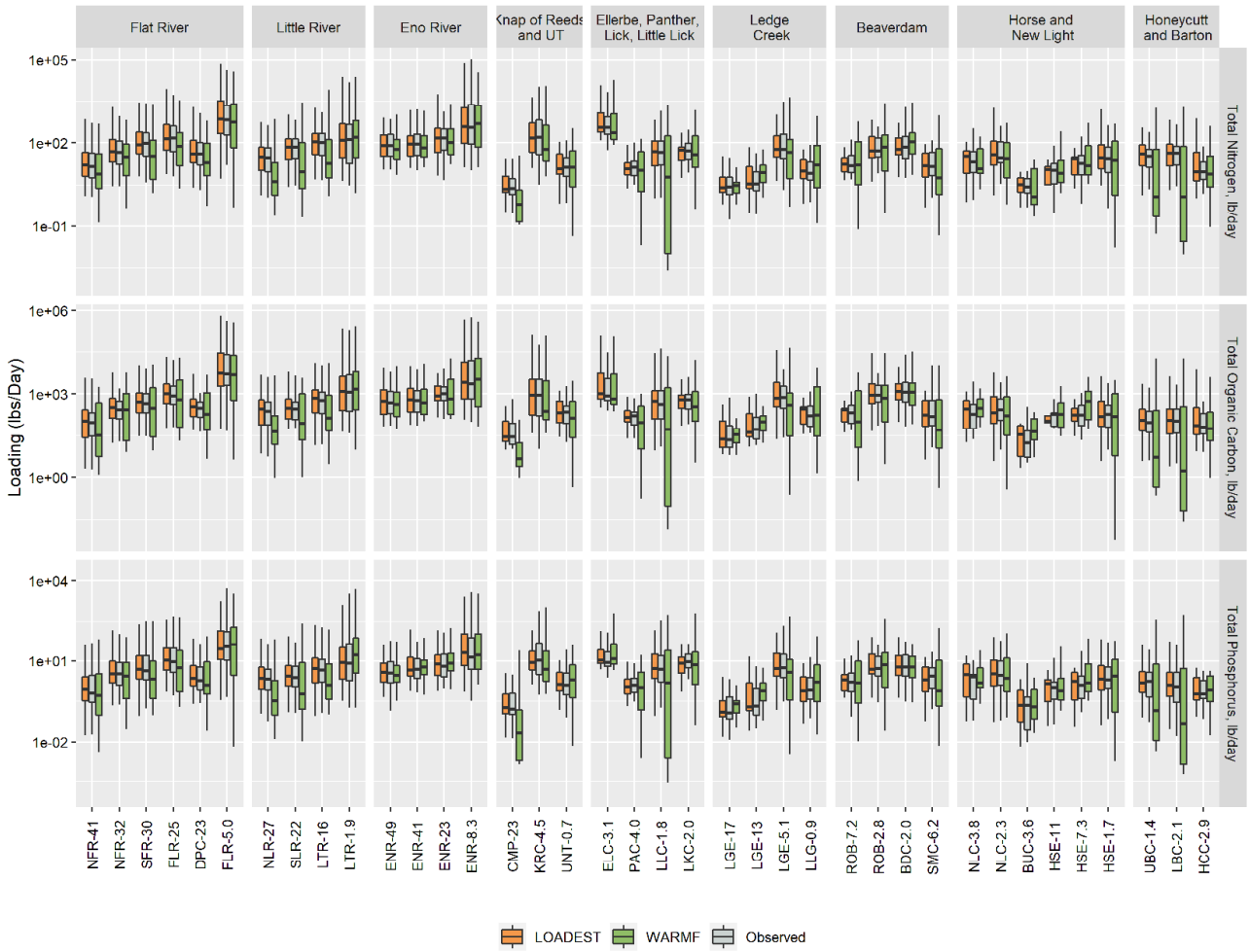

Figure F-3. Daily Loading Comparisons (2015-2018; log-scale).

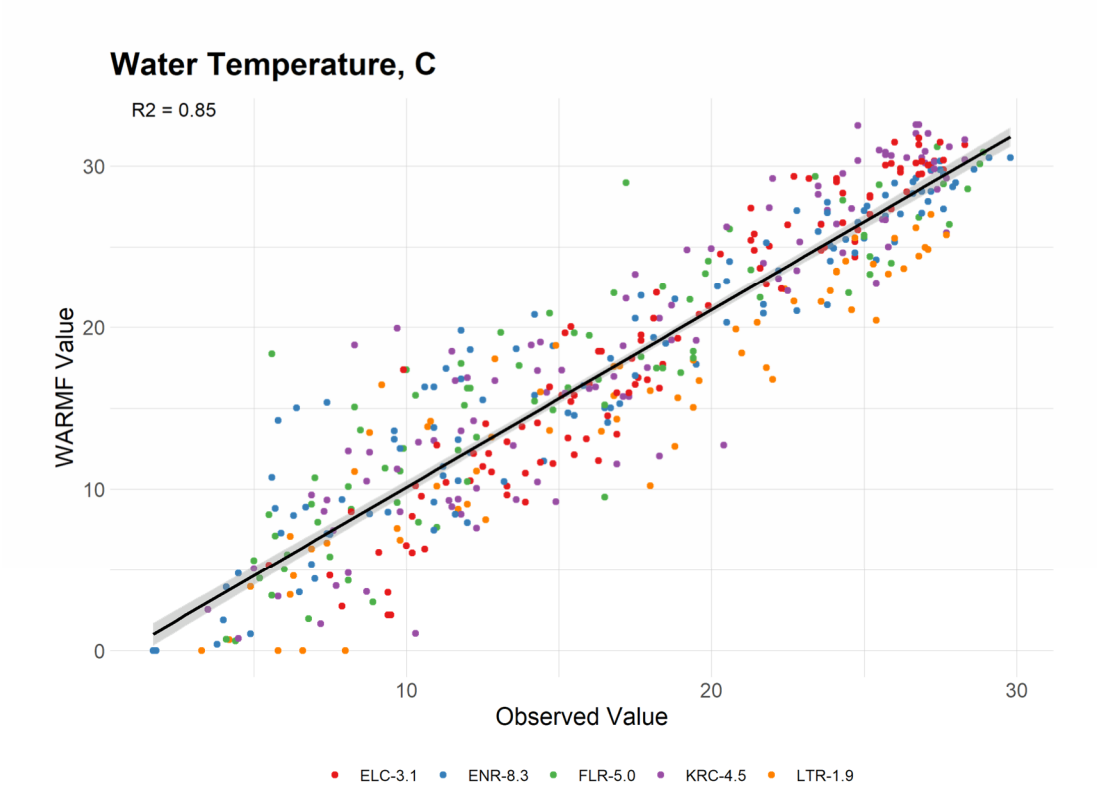

Figure F-4. Observed water temperatures vs simulated model temperatures.

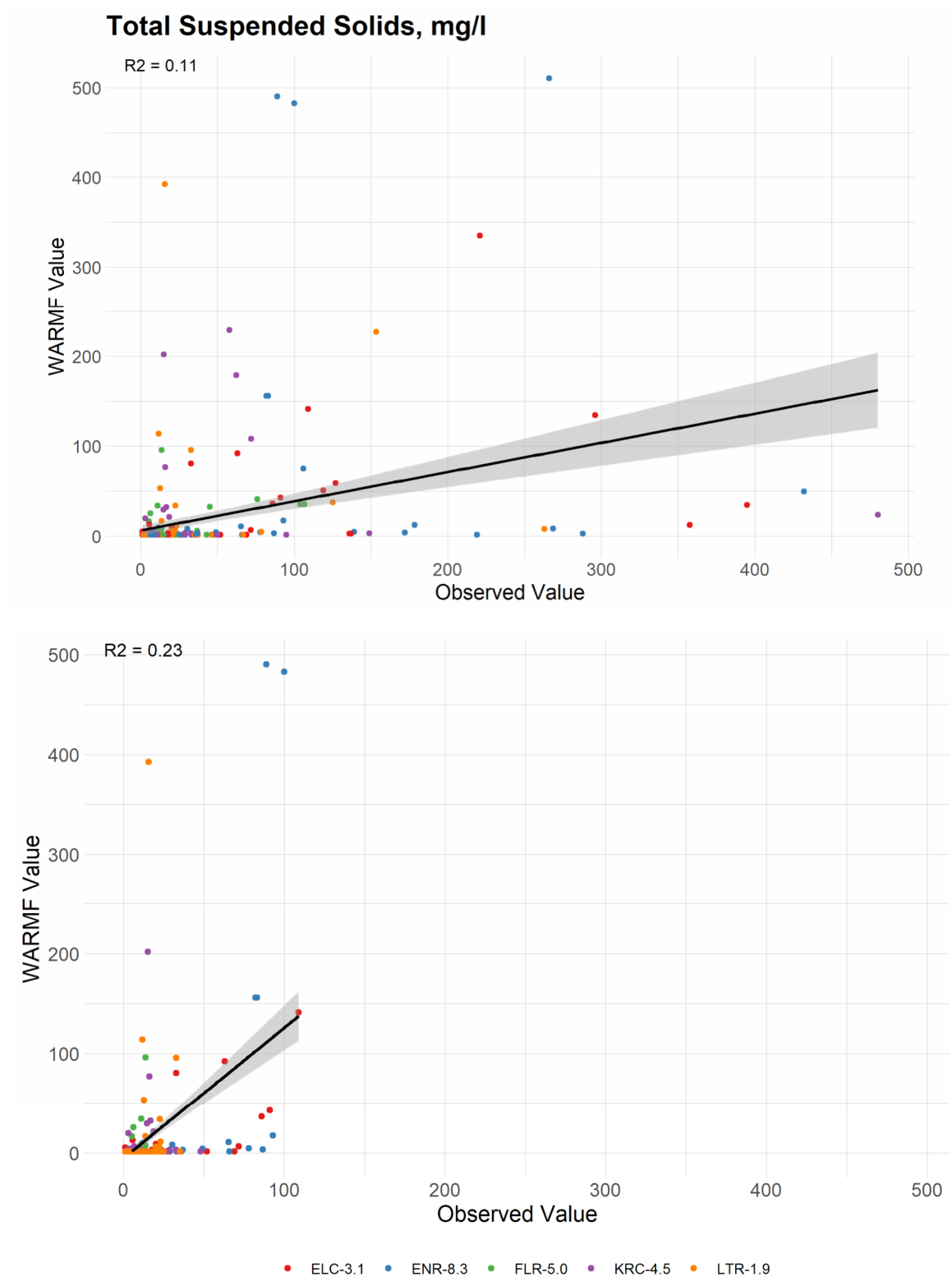

Figure F-5. Observed total suspended solids concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

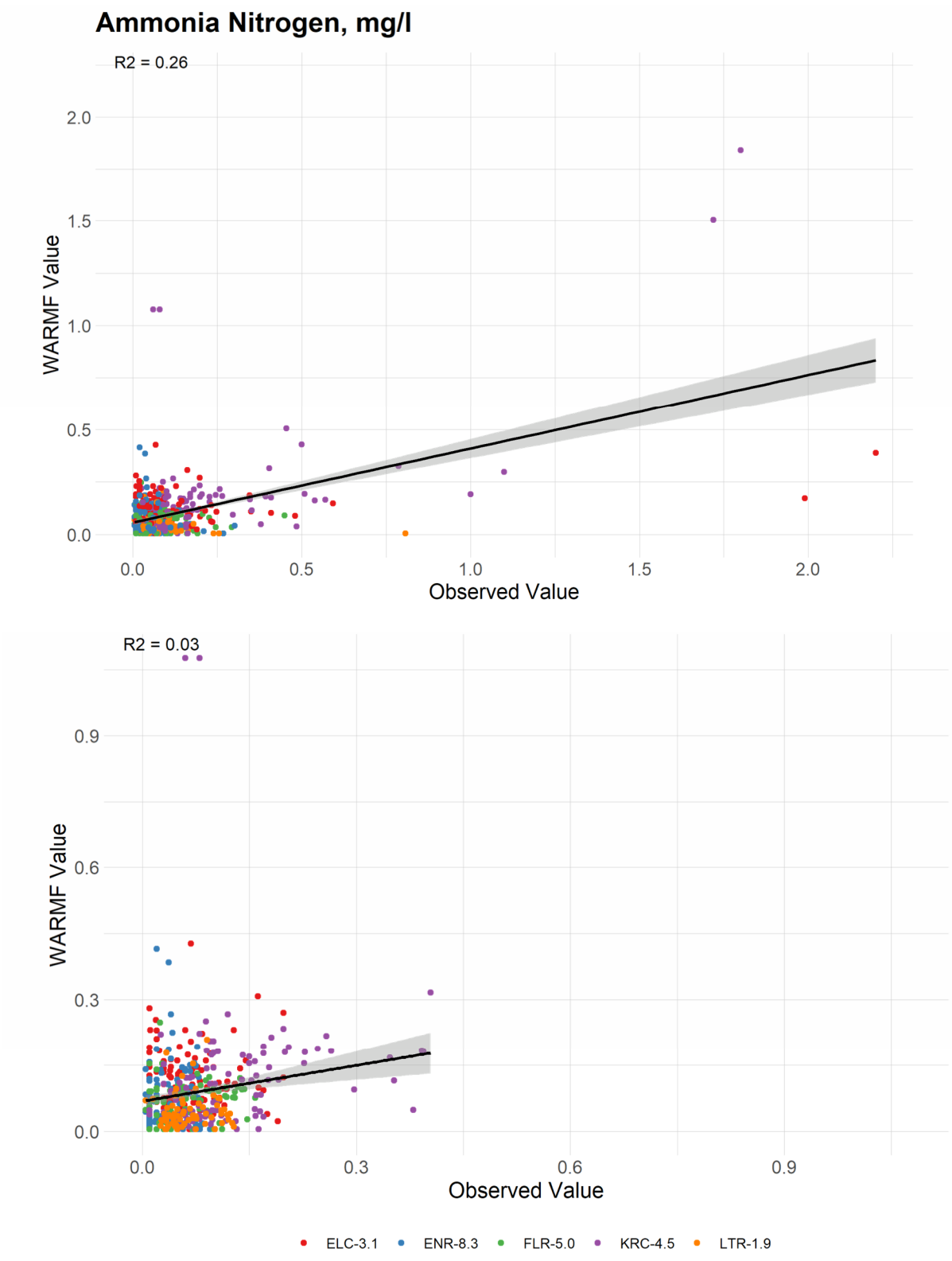

Figure F-6. Observed ammonia concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

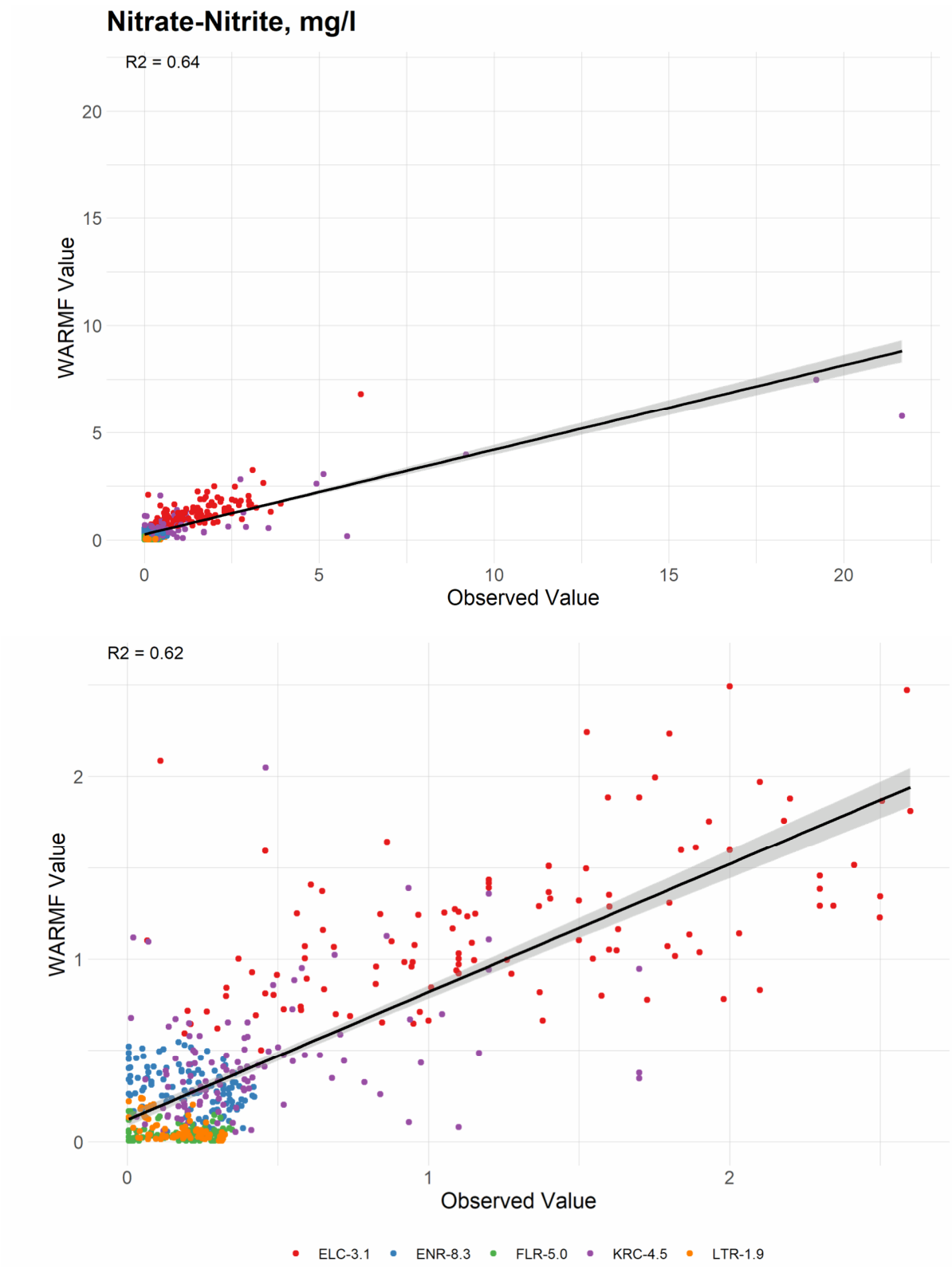

Figure F-7. Observed nitrate/nitrite concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

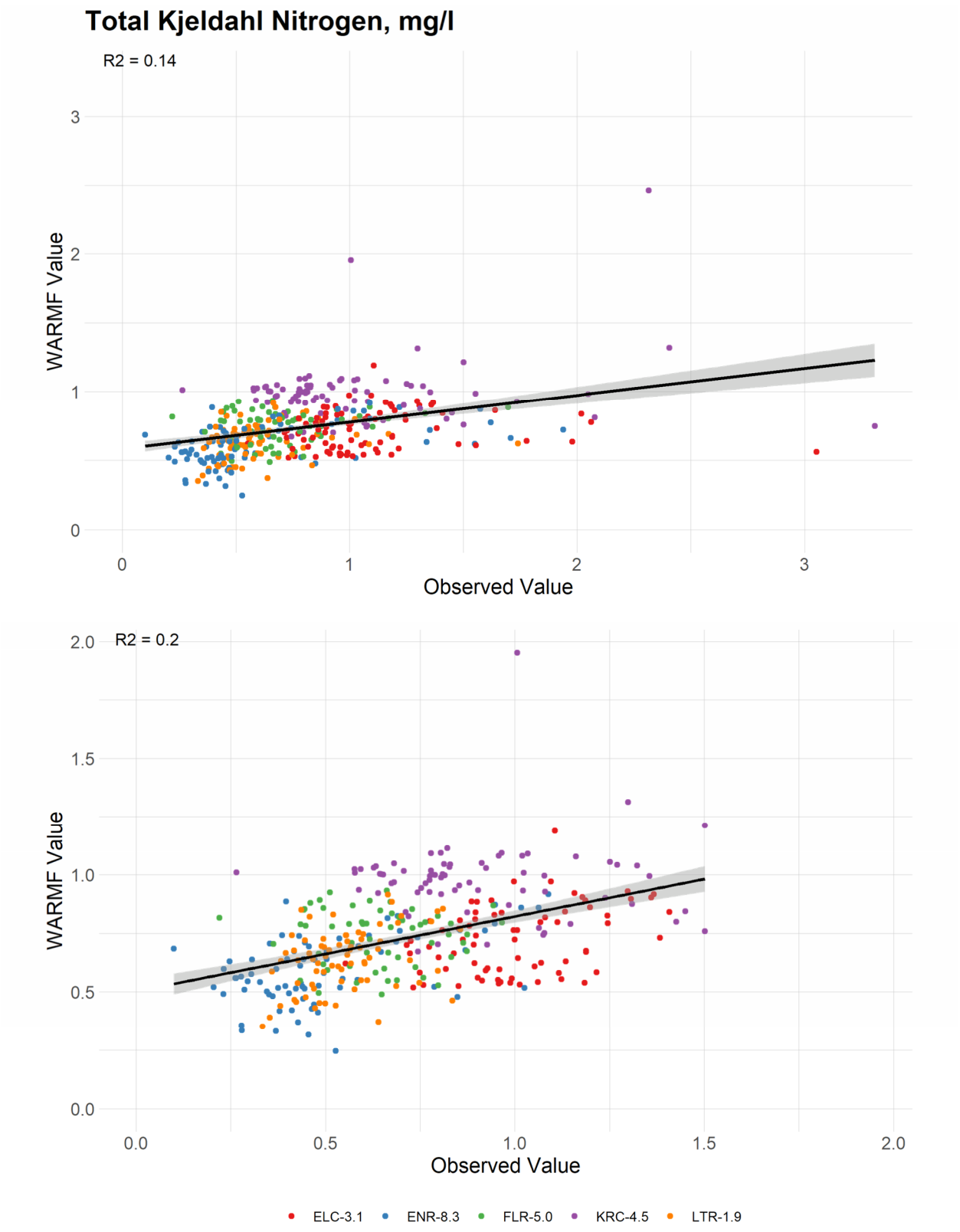

Figure F-8. Observed total Kjeldahl nitrogen concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

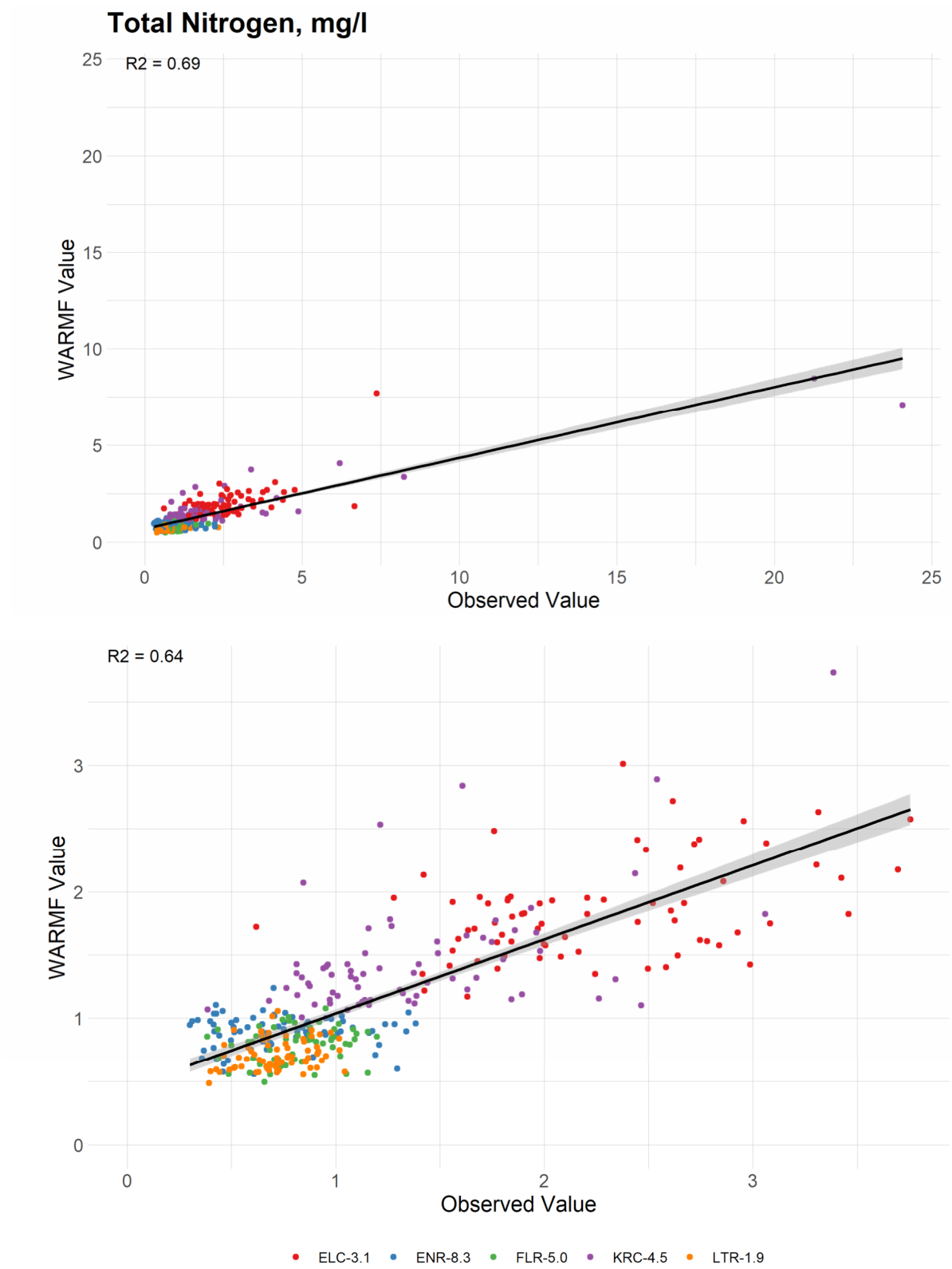

Figure F-9. Observed nitrogen concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

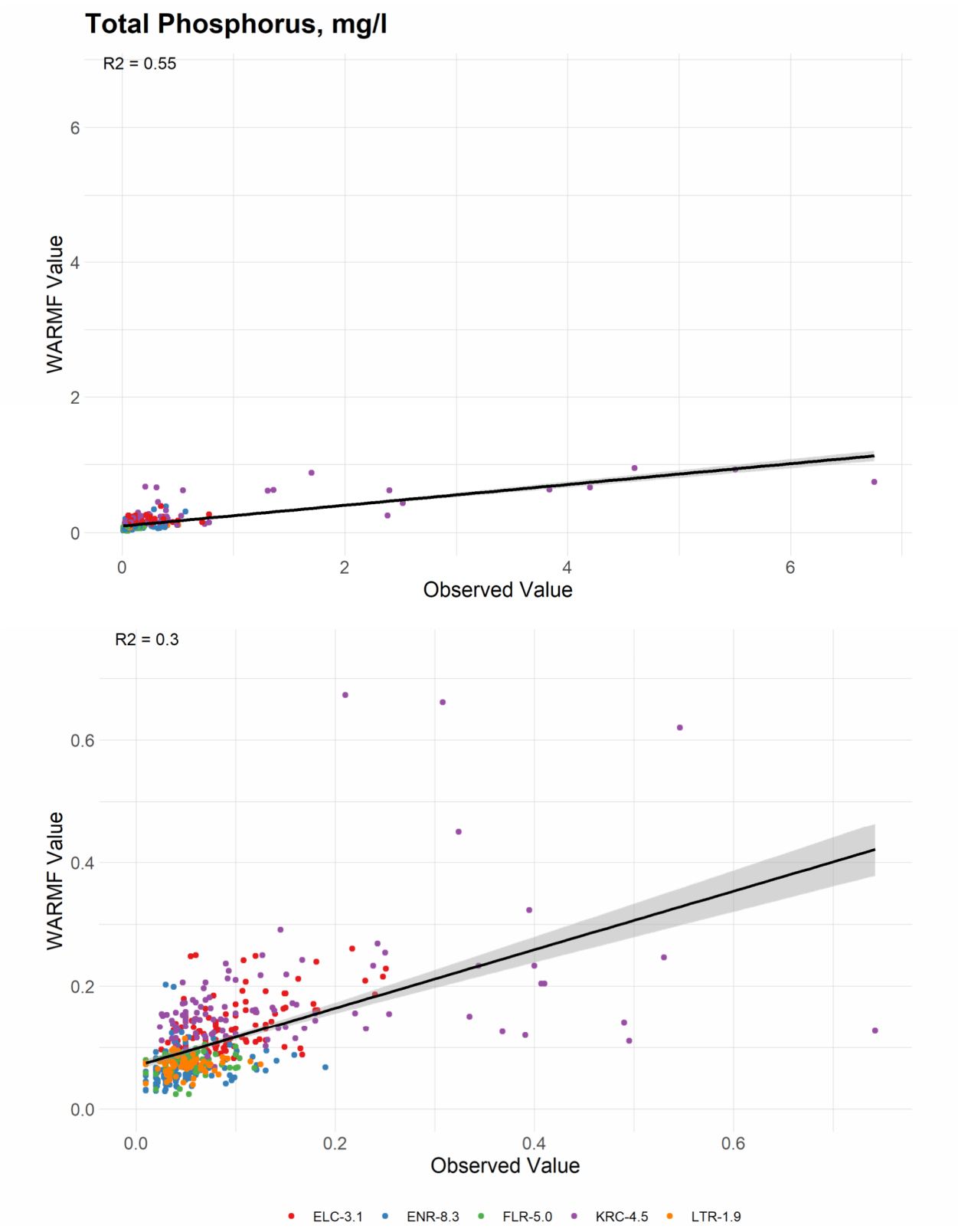

Figure F-10. Observed phosphorus concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

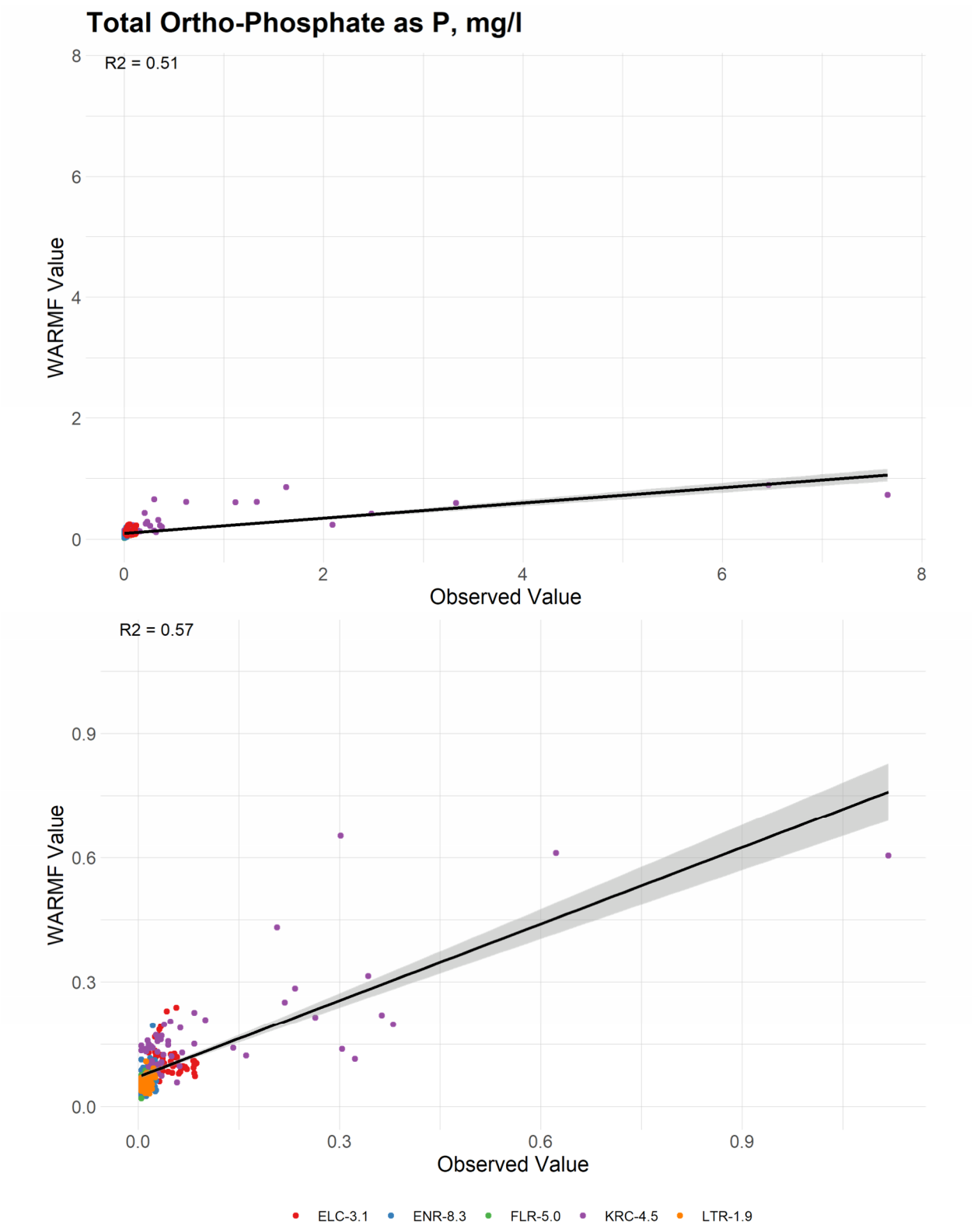

Figure F-11. Observed ortho-phosphate concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

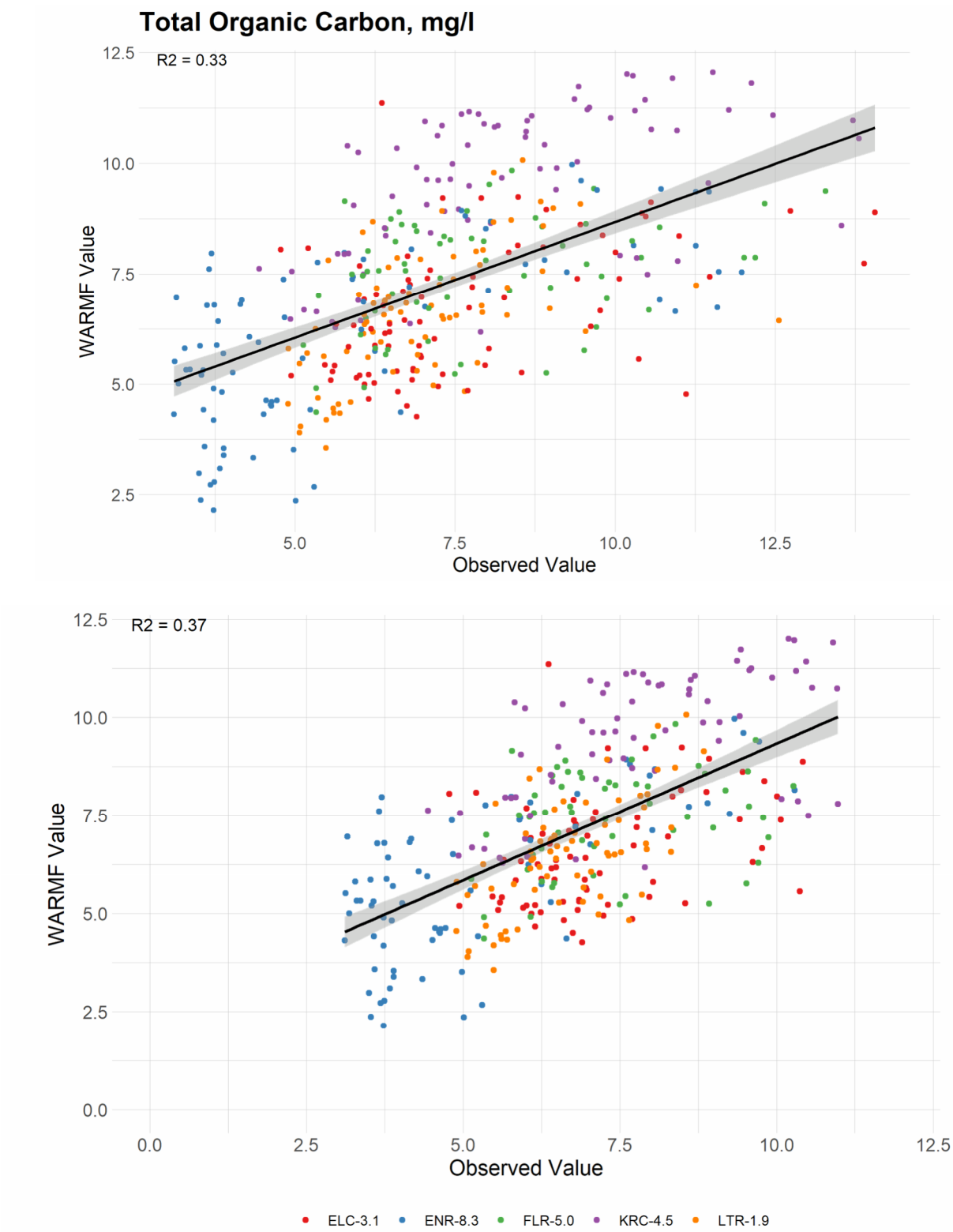

Figure F-12. Observed total organic concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

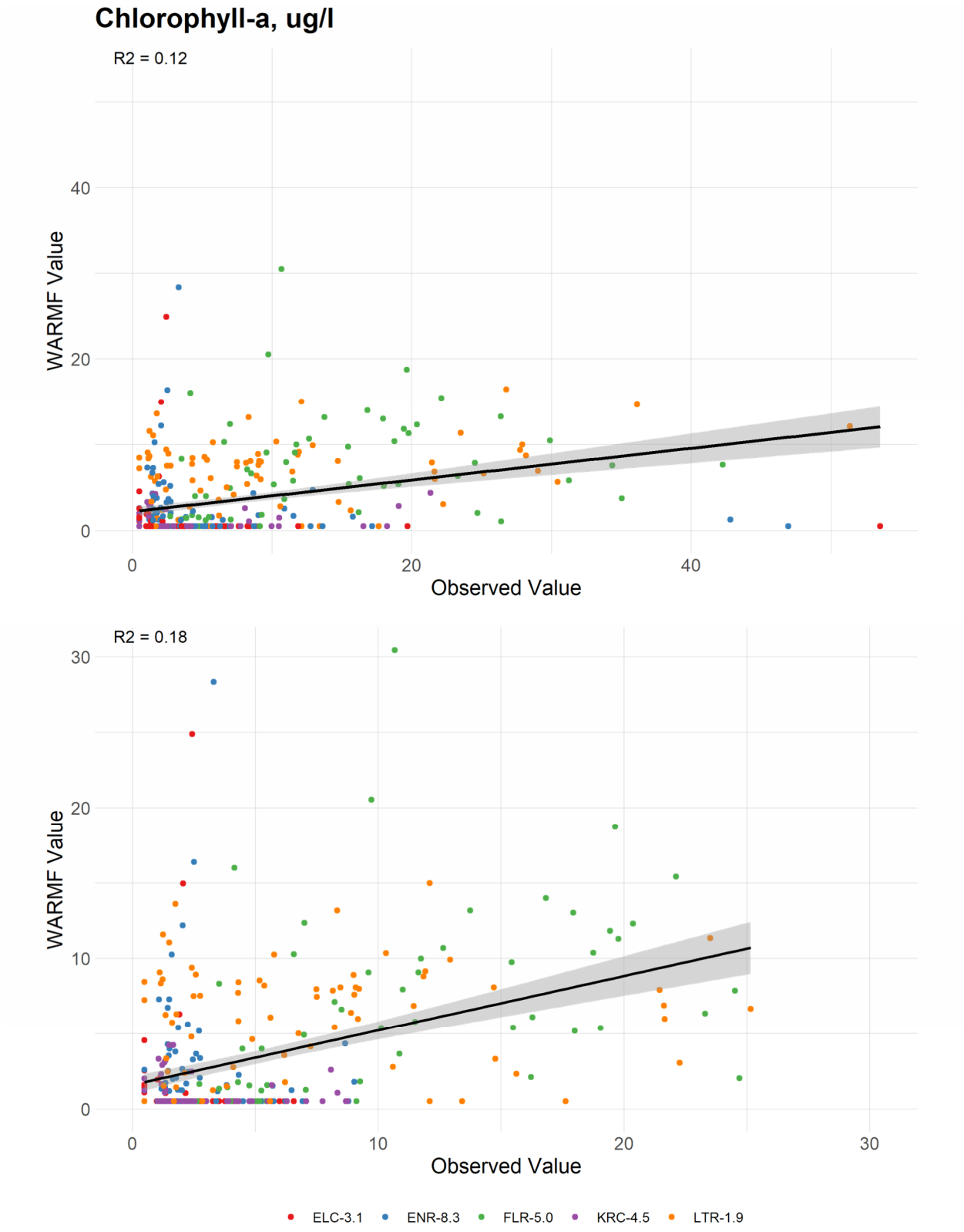

Figure F-13. Observed chlorophyll-a concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

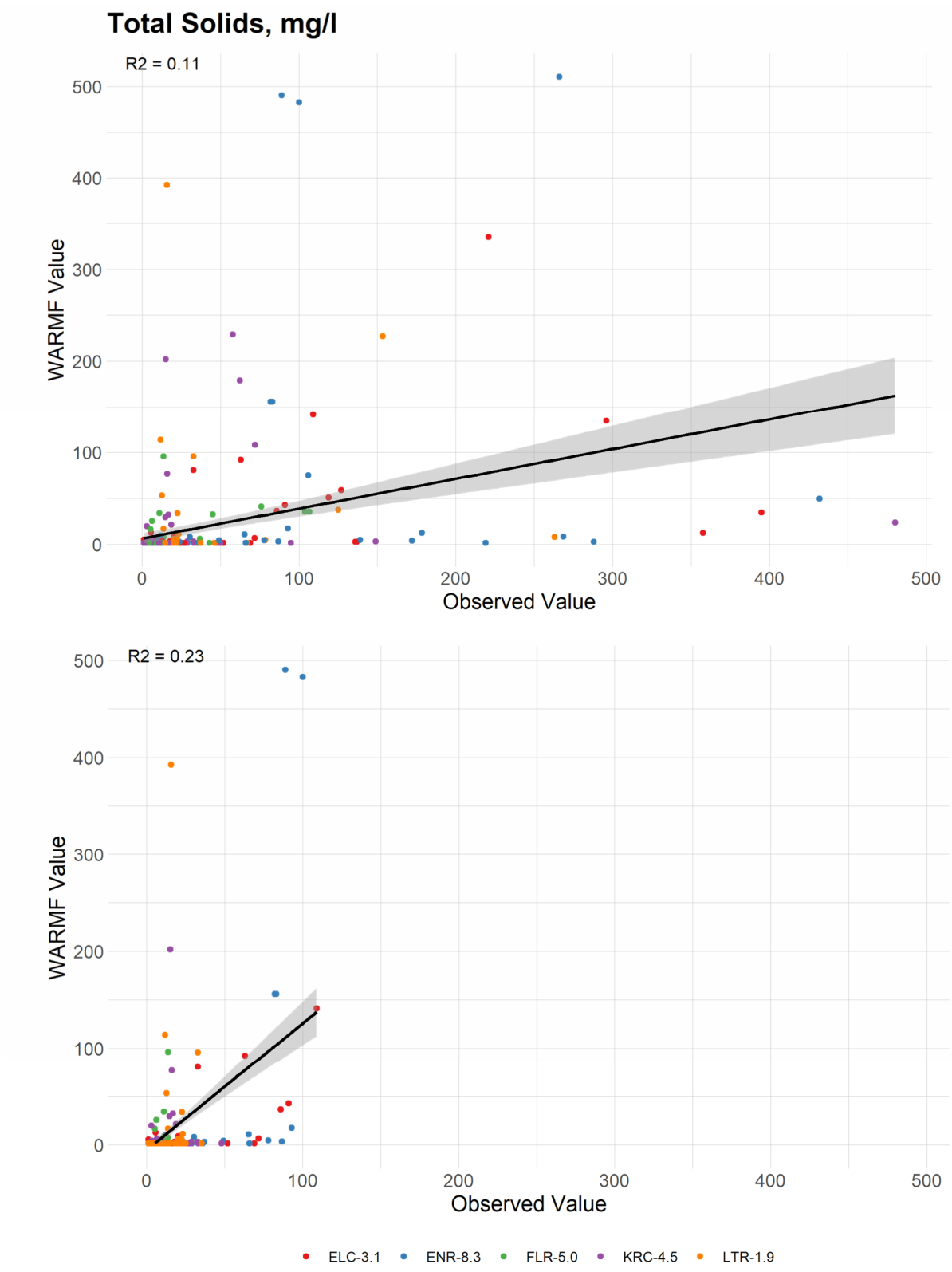

Figure F-14. Observed total solids concentrations vs simulated model concentrations (top pane includes all data; bottom pane excludes the top ten percent of observed concentrations at each station).

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
ELC-3.1	Ammonia Nitrogen, mg/l	Full	123	0.1	0.1	0.1	0.1	0.1	0.1	1.0	0.1	-1	Very Good
ELC-3.1	Ammonia Nitrogen, mg/l	Calibration Period	67	0.1	0.1	0.1	0.1	0.1	0.2	0.9	0.1	-18	Good
ELC-3.1	Ammonia Nitrogen, mg/l	Validation Period	56	0.1	0.1	0.1	0.1	0.1	0.0	1.3	-0.8	35	Outside Performance Criteria
ELC-3.1	Chlorophyll-a, ug/l	Full	81	3.6	1.2	2.0	0.5	3.6	0.0	1.2	-0.4	-66	Outside Performance Criteria
ELC-3.1	Chlorophyll-a, ug/l	Calibration Period	44	2.6	0.9	1.8	0.5	2.4	0.0	1.6	-1.6	-64	Outside Performance Criteria
ELC-3.1	Chlorophyll-a, ug/l	Validation Period	37	4.7	1.5	2.1	0.5	5.0	0.0	1.2	-0.4	-68	Outside Performance Criteria
ELC-3.1	Nitrate-Nitrite, mg/l	Full	126	1.5	1.3	1.3	1.2	0.5	0.5	0.7	0.5	-11	Very Good
ELC-3.1	Nitrate-Nitrite, mg/l	Calibration Period	67	1.7	1.4	1.6	1.3	0.5	0.6	0.7	0.5	-15	Good
ELC-3.1	Nitrate-Nitrite, mg/l	Validation Period	59	1.2	1.1	1.0	1.0	0.5	0.3	0.8	0.3	-5	Very Good
ELC-3.1	Total Kjeldahl Nitrogen, mg/l	Full	81	1.1	0.7	1.0	0.7	0.4	0.0	1.4	-1.1	-34	Fair
ELC-3.1	Total Kjeldahl Nitrogen, mg/l	Calibration Period	44	1.1	0.7	1.0	0.7	0.4	0.0	1.4	-1.0	-35	Outside Performance Criteria
ELC-3.1	Total Kjeldahl Nitrogen, mg/l	Validation Period	37	1.1	0.8	1.0	0.8	0.4	0.0	1.5	-1.2	-32	Fair
ELC-3.1	Total Nitrogen, lb/day	Full	80	1,814.3	1,385.5	368.9	229.0	849.9	0.8	0.5	0.8	-24	Good
ELC-3.1	Total Nitrogen, lb/day	Calibration Period	44	707.0	685.9	372.6	190.4	425.1	0.7	0.6	0.6	-3	Very Good
ELC-3.1	Total Nitrogen, lb/day	Validation Period	36	3,167.7	2,240.6	356.2	337.5	1,369.1	0.8	0.5	0.8	-29	Fair
ELC-3.1	Total Nitrogen, lb/year	Full	4	200,813.6	172,627.4	220,398.6	173,210.9	28,186.3	0.8	0.7	0.5	-14	Very Good
ELC-3.1	Total Nitrogen, lb/year	Calibration Period	2	220,398.6	173,210.9	220,398.6	173,210.9	47,187.7	1.0	6.7	-43.9	-21	Good
ELC-3.1	Total Nitrogen, lb/year	Validation Period	2	181,228.7	172,043.8	181,228.7	172,043.8	9,184.8	1.0	0.2	1.0	-5	Very Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
ELC-3.1	Total Nitrogen, mg/l	Full	81	2.5	2.0	2.2	1.8	0.7	0.4	0.9	0.2	-22	Good
ELC-3.1	Total Nitrogen, mg/l	Calibration Period	44	2.7	2.1	2.5	1.8	0.8	0.5	0.9	0.2	-24	Good
ELC-3.1	Total Nitrogen, mg/l	Validation Period	37	2.2	1.8	2.0	1.8	0.5	0.1	1.1	-0.3	-18	Good
ELC-3.1	Total Organic Carbon, lb/day	Full	80	9,405.5	6,573.0	812.4	667.1	4,514.0	0.8	0.5	0.8	-30	Fair
ELC-3.1	Total Organic Carbon, lb/day	Calibration Period	44	3,331.5	2,849.1	778.3	533.3	1,810.5	0.7	0.6	0.7	-14	Very Good
ELC-3.1	Total Organic Carbon, lb/day	Validation Period	36	16,829.3	11,124.5	954.6	1,376.8	7,818.3	0.8	0.5	0.7	-34	Fair
ELC-3.1	Total Organic Carbon, lb/year	Full	4	821,556.6	721,029.7	838,473.9	711,915.8	100,526.9	0.9	0.5	0.8	-12	Very Good
ELC-3.1	Total Organic Carbon, lb/year	Calibration Period	2	838,473.9	711,915.8	838,473.9	711,915.8	126,558.1	1.0	4.4	-18.0	-15	Good
ELC-3.1	Total Organic Carbon, lb/year	Validation Period	2	804,639.4	730,143.7	804,639.4	730,143.7	74,495.7	1.0	0.2	1.0	-9	Very Good
ELC-3.1	Total Organic Carbon, mg/l	Full	81	7.6	6.7	7.0	6.4	1.5	0.2	1.1	-0.1	-12	Very Good
ELC-3.1	Total Organic Carbon, mg/l	Calibration Period	44	7.4	6.4	6.9	6.1	1.5	0.2	1.1	-0.1	-14	Very Good
ELC-3.1	Total Organic Carbon, mg/l	Validation Period	37	7.9	7.1	7.3	7.2	1.6	0.2	1.1	-0.1	-10	Very Good
ELC-3.1	Total Phosphorus, lb/day	Full	118	246.3	173.7	8.5	11.8	150.0	0.6	0.7	0.6	-29	Fair
ELC-3.1	Total Phosphorus, lb/day	Calibration Period	64	51.7	58.1	7.5	9.7	25.4	0.9	0.4	0.9	12	Very Good
ELC-3.1	Total Phosphorus, lb/day	Validation Period	54	476.9	310.8	10.4	14.3	297.6	0.5	0.7	0.5	-35	Fair
ELC-3.1	Total Phosphorus, lb/year	Full	4	23,014.1	18,223.4	22,299.7	16,300.9	5,351.1	0.8	0.6	0.7	-21	Good
ELC-3.1	Total Phosphorus, lb/year	Calibration Period	2	22,299.7	16,300.9	22,299.7	16,300.9	5,998.8	1.0	1.3	-0.8	-27	Fair

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
ELC-3.1	Total Phosphorus, lb/year	Validation Period	2	23,728.5	20,145.9	23,728.5	20,145.9	4,703.3	1.0	0.3	0.9	-15	Good
ELC-3.1	Total Phosphorus, mg/l	Full	124	0.1	0.1	0.1	0.1	0.1	0.3	0.9	0.2	10	Very Good
ELC-3.1	Total Phosphorus, mg/l	Calibration Period	66	0.1	0.1	0.1	0.1	0.0	0.3	1.0	0.0	28	Fair
ELC-3.1	Total Phosphorus, mg/l	Validation Period	58	0.2	0.2	0.1	0.1	0.1	0.2	0.9	0.2	-3	Very Good
ELC-3.1	Total Ortho-Phosphate, mg/l	Full	62	0.05	0.12	0.05	0.11	0.07	0.02	2.7	-6.0	121	Outside Performance Criteria
ELC-3.1	Total Ortho-Phosphate, mg/l	Calibration Period	41	0.05	0.11	0.05	0.10	0.06	0.07	2.5	-5.5	118	Outside Performance Criteria
ELC-3.1	Total Ortho-Phosphate, mg/l	Validation Period	21	0.05	0.12	0.05	0.11	0.07	0.01	2.8	-6.8	126	Outside Performance Criteria
ELC-3.1	Total Suspended Solids, mg/l	Full	81	33.7	14.1	5.3	1.3	25.4	0.3	0.9	0.2	-58	Outside Performance Criteria
ELC-3.1	Total Suspended Solids, mg/l	Calibration Period	44	17.2	7.7	3.4	1.3	11.3	0.8	0.6	0.6	-55	Outside Performance Criteria
ELC-3.1	Total Suspended Solids, mg/l	Validation Period	37	53.4	21.7	8.0	1.3	42.2	0.2	1.0	0.0	-59	Outside Performance Criteria
ELC-3.1	Water Temperature, C	Full	108	18.6	19.4	17.8	19.2	2.7	0.9	0.5	0.7	4	Very Good
ELC-3.1	Water Temperature, C	Calibration Period	64	18.6	19.5	17.8	19.4	2.8	0.9	0.5	0.7	4	Very Good
ELC-3.1	Water Temperature, C	Validation Period	44	18.6	19.4	17.5	18.5	2.5	0.9	0.5	0.7	4	Very Good
ENR-8.3	Ammonia Nitrogen, mg/l	Full	125	0.0	0.1	0.0	0.0	0.1	0.0	1.8	-2.4	33	Fair
ENR-8.3	Ammonia Nitrogen, mg/l	Calibration Period	70	0.0	0.1	0.0	0.0	0.0	0.0	2.7	-6.3	39	Outside Performance Criteria
ENR-8.3	Ammonia Nitrogen, mg/l	Validation Period	55	0.1	0.1	0.0	0.0	0.1	0.0	1.5	-1.2	26	Fair
ENR-8.3	Chlorophyll-a, ug/l	Full	83	5.1	2.4	2.6	1.2	5.1	0.0	1.2	-0.5	-52	Outside Performance Criteria
ENR-8.3	Chlorophyll-a, ug/l	Calibration Period	47	4.2	2.4	2.2	1.2	4.2	0.0	1.2	-0.4	-42	Outside Performance Criteria

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
ENR-8.3	Chlorophyll-a, ug/l	Validation Period	36	6.3	2.5	4.2	0.9	6.3	0.0	1.3	-0.7	-61	Outside Performance Criteria
ENR-8.3	Nitrate-Nitrite, mg/l	Full	128	0.2	0.3	0.2	0.3	0.2	0.1	1.5	-1.2	23	Good
ENR-8.3	Nitrate-Nitrite, mg/l	Calibration Period	70	0.2	0.3	0.2	0.3	0.2	0.1	1.7	-1.7	40	Outside Performance Criteria
ENR-8.3	Nitrate-Nitrite, mg/l	Validation Period	58	0.2	0.3	0.3	0.3	0.2	0.1	1.3	-0.8	4	Very Good
ENR-8.3	Total Kjeldahl Nitrogen, mg/l	Full	83	0.6	0.6	0.5	0.6	0.2	0.2	0.9	0.3	-2	Very Good
ENR-8.3	Total Kjeldahl Nitrogen, mg/l	Calibration Period	47	0.5	0.6	0.4	0.6	0.2	0.2	0.9	0.2	9	Very Good
ENR-8.3	Total Kjeldahl Nitrogen, mg/l	Validation Period	36	0.7	0.6	0.5	0.6	0.3	0.3	0.9	0.2	-13	Very Good
ENR-8.3	Total Nitrogen, lb/day	Full	82	4,823.5	2,522.9	350.3	480.4	2,756.7	0.9	0.6	0.6	-48	Outside Performance Criteria
ENR-8.3	Total Nitrogen, lb/day	Calibration Period	46	1,553.8	1,249.1	301.4	364.8	835.3	0.8	0.5	0.7	-20	Good
ENR-8.3	Total Nitrogen, lb/day	Validation Period	36	9,001.5	4,150.5	466.7	774.3	5,211.7	0.9	0.6	0.6	-54	Outside Performance Criteria
ENR-8.3	Total Nitrogen, lb/year	Full	4	314,489.8	286,506.2	317,586.6	289,676.9	27,983.6	1.0	0.3	0.9	-9	Very Good
ENR-8.3	Total Nitrogen, lb/year	Calibration Period	2	317,586.6	289,676.9	317,586.6	289,676.9	27,909.7	1.0	1.7	-1.9	-9	Very Good
ENR-8.3	Total Nitrogen, lb/year	Validation Period	2	311,392.9	283,335.5	311,392.9	283,335.5	28,057.4	1.0	0.2	1.0	-9	Very Good
ENR-8.3	Total Nitrogen, mg/l	Full	83	0.8	0.9	0.7	0.9	0.3	0.0	1.0	0.0	3	Very Good
ENR-8.3	Total Nitrogen, mg/l	Calibration Period	47	0.8	0.9	0.7	0.9	0.3	0.0	1.1	-0.2	17	Good
ENR-8.3	Total Nitrogen, mg/l	Validation Period	36	1.0	0.9	0.9	0.9	0.4	0.0	1.0	0.0	-12	Very Good
ENR-8.3	Total Organic Carbon, lb/day	Full	82	32,641.3	23,124.3	2,338.9	3,248.7	14,763.3	0.9	0.4	0.8	-29	Fair
ENR-8.3	Total Organic Carbon, lb/day	Calibration Period	46	11,274.3	10,559.3	1,683.1	1,855.2	5,802.6	0.9	0.4	0.9	-6	Very Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
ENR-8.3	Total Organic Carbon, lb/day	Validation Period	36	59,943.7	39,179.6	3,215.2	5,324.3	26,213.1	0.9	0.4	0.8	-35	Fair
ENR-8.3	Total Organic Carbon, lb/year	Full	4	2,146,377.6	2,236,289.6	2,023,097.4	2,235,757.6	122,748.2	0.9	0.2	0.9	4	Very Good
ENR-8.3	Total Organic Carbon, lb/year	Calibration Period	2	2,023,097.4	2,235,757.6	2,023,097.4	2,235,757.6	212,660.3	1.0	8.6	-73.6	11	Very Good
ENR-8.3	Total Organic Carbon, lb/year	Validation Period	2	2,269,657.8	2,236,821.6	2,269,657.8	2,236,821.6	32,836.2	1.0	0.0	1.0	-1	Very Good
ENR-8.3	Total Organic Carbon, mg/l	Full	83	5.8	5.9	4.7	6.0	1.6	0.4	0.8	0.4	1	Very Good
ENR-8.3	Total Organic Carbon, mg/l	Calibration Period	47	5.3	5.7	4.0	5.5	1.7	0.4	0.8	0.4	8	Very Good
ENR-8.3	Total Organic Carbon, mg/l	Validation Period	36	6.5	6.2	5.9	6.8	1.6	0.4	0.8	0.4	-5	Very Good
ENR-8.3	Total Phosphorus, lb/day	Full	119	719.3	537.5	13.7	16.8	251.8	0.9	0.3	0.9	-25	Fair
ENR-8.3	Total Phosphorus, lb/day	Calibration Period	65	152.0	118.0	12.9	16.1	70.0	0.8	0.5	0.8	-22	Good
ENR-8.3	Total Phosphorus, lb/day	Validation Period	54	1,402.2	1,042.5	24.1	26.2	470.6	0.9	0.3	0.9	-26	Fair
ENR-8.3	Total Phosphorus, lb/year	Full	4	46,579.5	35,997.0	45,101.8	32,316.6	14,513.4	0.6	0.8	0.4	-23	Good
ENR-8.3	Total Phosphorus, lb/year	Calibration Period	2	45,101.8	29,112.5	45,101.8	29,112.5	15,989.3	1.0	131.6	-17,329.0	-35	Outside Performance Criteria
ENR-8.3	Total Phosphorus, lb/year	Validation Period	2	48,057.2	42,881.5	48,057.2	42,881.5	13,037.4	1.0	0.4	0.8	-11	Very Good
ENR-8.3	Total Phosphorus, mg/l	Full	126	0.1	0.1	0.0	0.1	0.0	0.3	0.8	0.3	-3	Very Good
ENR-8.3	Total Phosphorus, mg/l	Calibration Period	69	0.1	0.1	0.0	0.1	0.0	0.1	1.0	0.0	19	Good
ENR-8.3	Total Phosphorus, mg/l	Validation Period	57	0.1	0.1	0.1	0.1	0.1	0.4	0.8	0.4	-20	Good
ENR-8.3	Total Ortho-Phosphate, mg/l	Full	65	0.02	0.06	0.01	0.05	0.05	0.06	5.2	-26.4	283	Outside Performance Criteria

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
ENR-8.3	Total Ortho-Phosphate, mg/l	Calibration Period	44	0.02	0.06	0.02	0.06	0.05	0.07	5.1	-25.1	266	Outside Performance Criteria
ENR-8.3	Total Ortho-Phosphate, mg/l	Validation Period	21	0.01	0.06	0.01	0.05	0.04	0.01	6.4	-40.0	334	Outside Performance Criteria
ENR-8.3	Total Suspended Solids, mg/l	Full	83	41.7	25.2	8.8	1.3	44.8	0.1	1.3	-0.7	-39	Fair
ENR-8.3	Total Suspended Solids, mg/l	Calibration Period	47	28.2	9.5	8.3	1.3	25.0	0.1	1.0	0.1	-66	Outside Performance Criteria
ENR-8.3	Total Suspended Solids, mg/l	Validation Period	36	59.3	45.8	12.8	1.3	70.6	0.1	1.6	-1.5	-23	Good
ENR-8.3	Water Temperature, C	Full	112	16.8	18.0	16.7	18.3	2.3	0.9	0.4	0.9	7	Good
ENR-8.3	Water Temperature, C	Calibration Period	67	16.7	18.1	16.7	18.6	2.2	0.9	0.3	0.9	8	Good
ENR-8.3	Water Temperature, C	Validation Period	45	16.8	17.8	17.0	17.7	2.6	0.9	0.4	0.8	6	Very Good
FLR-25	Ammonia Nitrogen, mg/l	Full	47	0.1	0.1	0.0	0.1	0.1	0.0	1.5	-1.3	60	Outside Performance Criteria
FLR-25	Ammonia Nitrogen, mg/l	Calibration Period	24	0.1	0.1	0.0	0.1	0.1	0.0	1.2	-0.5	39	Outside Performance Criteria
FLR-25	Ammonia Nitrogen, mg/l	Validation Period	23	0.1	0.1	0.0	0.1	0.1	0.0	2.1	-3.4	80	Outside Performance Criteria
FLR-25	Nitrate-Nitrite, mg/l	Full	48	0.4	0.2	0.4	0.2	0.2	0.2	1.7	-1.7	-52	Outside Performance Criteria
FLR-25	Nitrate-Nitrite, mg/l	Calibration Period	24	0.4	0.2	0.4	0.2	0.2	0.1	1.9	-2.5	-60	Outside Performance Criteria
FLR-25	Nitrate-Nitrite, mg/l	Validation Period	24	0.3	0.2	0.3	0.2	0.3	0.2	1.5	-1.3	-43	Outside Performance Criteria
FLR-25	Total Kjeldahl Nitrogen, mg/l	Full	48	0.6	0.7	0.4	0.7	0.3	0.1	1.1	-0.2	30	Fair
FLR-25	Total Kjeldahl Nitrogen, mg/l	Calibration Period	24	0.6	0.7	0.4	0.7	0.3	0.0	1.1	-0.3	25	Fair
FLR-25	Total Kjeldahl Nitrogen, mg/l	Validation Period	24	0.6	0.8	0.5	0.8	0.3	0.2	1.0	-0.1	34	Fair
FLR-25	Total Nitrogen, lb/day	Full	48	565.4	454.9	152.2	86.5	331.3	0.6	0.7	0.6	-20	Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
FLR-25	Total Nitrogen, lb/day	Calibration Period	24	312.4	299.0	185.6	86.2	163.5	0.7	0.8	0.3	-4	Very Good
FLR-25	Total Nitrogen, lb/day	Validation Period	24	818.4	610.9	148.2	99.6	499.0	0.6	0.7	0.6	-25	Fair
FLR-25	Total Nitrogen, lb/year	Full	4	499,788.3	179,283.2	518,746.3	166,294.1	320,505.1	0.0	2.7	-6.3	-64	Outside Performance Criteria
FLR-25	Total Nitrogen, lb/year	Calibration Period	2	518,746.3	221,399.8	518,746.3	221,399.8	297,346.5	1.0	3.8	-13.3	-57	Outside Performance Criteria
FLR-25	Total Nitrogen, lb/year	Validation Period	2	480,830.2	137,166.6	480,830.2	137,166.6	343,663.6	1.0	1.8	-2.4	-71	Outside Performance Criteria
FLR-25	Total Nitrogen, mg/l	Full	48	0.9	0.9	1.0	0.9	0.3	0.0	1.0	0.0	-2	Very Good
FLR-25	Total Nitrogen, mg/l	Calibration Period	24	1.0	0.9	1.0	0.9	0.2	0.1	1.0	0.1	-11	Very Good
FLR-25	Total Nitrogen, mg/l	Validation Period	24	0.9	1.0	0.9	0.9	0.3	0.0	1.0	0.0	6	Very Good
FLR-25	Total Organic Carbon, lb/day	Full	28	2,911.1	3,068.0	843.8	608.1	2,335.6	0.4	0.8	0.4	5	Very Good
FLR-25	Total Organic Carbon, lb/day	Calibration Period	20	2,334.8	3,351.0	1,269.5	907.3	2,102.9	0.4	1.2	-0.3	44	Outside Performance Criteria
FLR-25	Total Organic Carbon, lb/day	Validation Period	8	4,351.7	2,360.6	363.4	263.8	2,917.4	0.9	0.6	0.6	-46	Outside Performance Criteria
FLR-25	Total Organic Carbon, lb/year	Full	4	3,929,425.6	1,679,524.1	4,250,960.3	1,545,772.7	2,249,901.5	0.0	2.1	-3.3	-57	Outside Performance Criteria
FLR-25	Total Organic Carbon, lb/year	Calibration Period	2	4,264,281.2	2,099,615.5	4,264,281.2	2,099,615.5	2,164,665.7	1.0	2.7	-6.5	-51	Outside Performance Criteria
FLR-25	Total Organic Carbon, lb/year	Validation Period	2	3,594,570.0	1,259,432.6	3,594,570.0	1,259,432.6	2,335,137.4	1.0	1.5	-1.2	-65	Outside Performance Criteria
FLR-25	Total Organic Carbon, mg/l	Full	28	5.6	6.8	4.9	7.3	2.5	0.2	1.3	-0.7	21	Good
FLR-25	Total Organic Carbon, mg/l	Calibration Period	20	5.8	6.8	5.0	7.5	2.6	0.2	1.4	-1.0	19	Good
FLR-25	Total Organic Carbon, mg/l	Validation Period	8	5.2	6.7	4.1	7.2	2.3	0.3	1.1	-0.1	28	Fair
FLR-25	Total Phosphorus, lb/day	Full	46	52.1	58.5	9.3	8.2	40.9	0.6	0.8	0.3	12	Very Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
FLR-25	Total Phosphorus, lb/day	Calibration Period	23	21.6	32.4	11.0	5.0	22.1	0.4	1.5	-1.1	50	Outside Performance Criteria
FLR-25	Total Phosphorus, lb/day	Validation Period	23	82.5	84.5	8.9	12.4	59.6	0.6	0.8	0.3	2	Very Good
FLR-25	Total Phosphorus, lb/year	Full	4	34,679.1	22,220.0	34,590.5	20,523.9	13,602.4	0.0	1.4	-1.1	-36	Outside Performance Criteria
FLR-25	Total Phosphorus, lb/year	Calibration Period	2	34,590.5	27,236.4	34,590.5	27,236.4	9,640.6	1.0	1.5	-1.3	-21	Good
FLR-25	Total Phosphorus, lb/year	Validation Period	2	34,767.7	17,203.6	34,767.7	17,203.6	17,564.1	1.0	1.1	-0.2	-51	Outside Performance Criteria
FLR-25	Total Phosphorus, mg/l	Full	46	0.1	0.1	0.1	0.1	0.0	0.1	1.0	0.1	-6	Very Good
FLR-25	Total Phosphorus, mg/l	Calibration Period	23	0.1	0.1	0.1	0.1	0.0	0.0	1.1	-0.1	-7	Very Good
FLR-25	Total Phosphorus, mg/l	Validation Period	23	0.1	0.1	0.1	0.1	0.0	0.2	0.9	0.3	-5	Very Good
FLR-25	Total Suspended Solids, mg/l	Full	46	10.2	2.0	4.0	1.3	8.2	0.2	1.1	-0.1	-81	Outside Performance Criteria
FLR-25	Total Suspended Solids, mg/l	Calibration Period	24	9.0	1.5	4.5	1.3	7.5	0.1	1.1	-0.2	-84	Outside Performance Criteria
FLR-25	Total Suspended Solids, mg/l	Validation Period	22	11.5	2.5	3.7	1.3	8.9	0.3	1.0	0.0	-78	Outside Performance Criteria
FLR-25	Water Temperature, C	Full	46	16.8	16.8	17.2	18.5	2.4	0.9	0.4	0.9	0	Very Good
FLR-25	Water Temperature, C	Calibration Period	24	16.7	16.2	17.2	18.5	2.3	0.9	0.3	0.9	-3	Very Good
FLR-25	Water Temperature, C	Validation Period	22	17.0	17.5	17.4	18.1	2.5	0.9	0.4	0.9	3	Very Good
FLR-5.0	Ammonia Nitrogen, mg/l	Full	92	0.1	0.1	0.1	0.1	0.1	0.0	1.2	-0.4	-22	Good
FLR-5.0	Ammonia Nitrogen, mg/l	Calibration Period	53	0.1	0.1	0.1	0.1	0.0	0.0	1.2	-0.5	-11	Very Good
FLR-5.0	Ammonia Nitrogen, mg/l	Validation Period	39	0.1	0.1	0.1	0.0	0.1	0.0	1.2	-0.4	-34	Fair
FLR-5.0	Chlorophyll-a, ug/l	Full	65	12.6	6.5	10.1	5.4	7.8	0.1	1.2	-0.4	-48	Outside Performance Criteria

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
FLR-5.0	Chlorophyll-a, ug/l	Calibration Period	38	10.7	6.2	6.8	4.4	6.6	0.2	1.0	0.0	-42	Outside Performance Criteria
FLR-5.0	Chlorophyll-a, ug/l	Validation Period	27	15.4	7.0	12.7	6.1	9.6	0.0	1.5	-1.2	-55	Outside Performance Criteria
FLR-5.0	Nitrate-Nitrite, mg/l	Full	95	0.2	0.1	0.2	0.0	0.2	0.0	1.5	-1.3	-73	Outside Performance Criteria
FLR-5.0	Nitrate-Nitrite, mg/l	Calibration Period	53	0.2	0.0	0.2	0.0	0.2	0.3	1.5	-1.2	-76	Outside Performance Criteria
FLR-5.0	Nitrate-Nitrite, mg/l	Validation Period	42	0.2	0.1	0.2	0.0	0.2	0.1	1.6	-1.4	-68	Outside Performance Criteria
FLR-5.0	Total Kjeldahl Nitrogen, mg/l	Full	65	0.7	0.7	0.7	0.8	0.2	0.0	1.1	-0.1	6	Very Good
FLR-5.0	Total Kjeldahl Nitrogen, mg/l	Calibration Period	38	0.7	0.8	0.6	0.8	0.2	0.0	1.1	-0.1	7	Very Good
FLR-5.0	Total Kjeldahl Nitrogen, mg/l	Validation Period	27	0.7	0.7	0.7	0.8	0.2	0.0	1.0	0.0	5	Very Good
FLR-5.0	Total Nitrogen, lb/day	Full	64	4,273.2	2,956.2	707.0	563.6	2,732.6	0.5	0.7	0.5	-31	Fair
FLR-5.0	Total Nitrogen, lb/day	Calibration Period	38	2,552.2	2,332.6	683.2	563.6	1,484.4	0.7	0.6	0.7	-9	Very Good
FLR-5.0	Total Nitrogen, lb/day	Validation Period	26	6,788.6	3,867.6	1,065.2	773.3	4,556.9	0.4	0.8	0.3	-43	Outside Performance Criteria
FLR-5.0	Total Nitrogen, lb/year	Full	4	324,721.1	290,087.0	292,053.0	268,276.9	34,634.1	1.0	0.3	0.9	-11	Very Good
FLR-5.0	Total Nitrogen, lb/year	Calibration Period	2	292,053.0	268,276.9	292,053.0	268,276.9	23,776.1	1.0	0.4	0.8	-8	Very Good
FLR-5.0	Total Nitrogen, lb/year	Validation Period	2	357,389.1	311,897.0	357,389.1	311,897.0	45,492.1	1.0	0.3	0.9	-13	Very Good
FLR-5.0	Total Nitrogen, mg/l	Full	65	0.9	0.8	0.8	0.8	0.2	0.1	1.0	0.0	-10	Very Good
FLR-5.0	Total Nitrogen, mg/l	Calibration Period	38	0.9	0.8	0.9	0.8	0.2	0.2	1.0	0.1	-10	Very Good
FLR-5.0	Total Nitrogen, mg/l	Validation Period	27	0.9	0.8	0.8	0.8	0.2	0.0	1.1	-0.2	-9	Very Good
FLR-5.0	Total Organic Carbon, lb/day	Full	64	37,476.5	28,268.8	5,102.3	5,126.1	22,356.9	0.6	0.7	0.6	-25	Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
FLR-5.0	Total Organic Carbon, lb/day	Calibration Period	38	24,794.9	22,522.3	4,986.5	4,995.4	15,536.7	0.7	0.6	0.6	-9	Very Good
FLR-5.0	Total Organic Carbon, lb/day	Validation Period	26	56,011.2	36,667.5	6,655.8	6,977.7	32,324.9	0.5	0.7	0.5	-35	Fair
FLR-5.0	Total Organic Carbon, lb/year	Full	4	2,966,801.1	2,805,952.8	2,371,922.1	2,552,886.5	341,812.7	0.9	0.3	0.9	-5	Very Good
FLR-5.0	Total Organic Carbon, lb/year	Calibration Period	2	2,371,922.1	2,552,886.5	2,371,922.1	2,552,886.5	180,964.4	1.0	0.6	0.6	8	Very Good
FLR-5.0	Total Organic Carbon, lb/year	Validation Period	2	3,561,680.2	3,059,019.1	3,561,680.2	3,059,019.1	502,661.1	1.0	0.3	0.9	-14	Very Good
FLR-5.0	Total Organic Carbon, mg/l	Full	65	7.8	7.5	7.3	7.6	1.5	0.1	1.0	0.0	-5	Very Good
FLR-5.0	Total Organic Carbon, mg/l	Calibration Period	38	8.0	7.6	7.3	7.6	1.8	0.0	1.1	-0.2	-5	Very Good
FLR-5.0	Total Organic Carbon, mg/l	Validation Period	27	7.7	7.3	7.3	7.7	1.2	0.3	0.8	0.3	-5	Very Good
FLR-5.0	Total Phosphorus, lb/day	Full	89	356.0	212.8	33.9	42.9	243.6	0.6	0.7	0.5	-40	Outside Performance Criteria
FLR-5.0	Total Phosphorus, lb/day	Calibration Period	50	238.7	183.1	31.6	49.6	191.5	0.6	0.7	0.5	-23	Good
FLR-5.0	Total Phosphorus, lb/day	Validation Period	39	506.3	250.9	45.6	35.3	310.5	0.7	0.7	0.5	-50	Outside Performance Criteria
FLR-5.0	Total Phosphorus, lb/year	Full	4	27,299.4	26,427.3	20,923.1	25,314.8	6,770.5	0.8	0.5	0.8	-3	Very Good
FLR-5.0	Total Phosphorus, lb/year	Calibration Period	2	19,416.3	25,314.8	19,416.3	25,314.8	5,898.4	1.0	1.7	-1.8	30	Fair
FLR-5.0	Total Phosphorus, lb/year	Validation Period	2	35,182.4	27,539.8	35,182.4	27,539.8	7,642.6	1.0	0.4	0.8	-22	Good
FLR-5.0	Total Phosphorus, mg/l	Full	94	0.1	0.1	0.1	0.1	0.0	0.0	1.1	-0.1	19	Good
FLR-5.0	Total Phosphorus, mg/l	Calibration Period	52	0.1	0.1	0.0	0.1	0.0	0.0	1.2	-0.4	35	Fair
FLR-5.0	Total Phosphorus, mg/l	Validation Period	42	0.1	0.1	0.1	0.1	0.0	0.1	0.9	0.2	2	Very Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
FLR-5.0	Total Ortho-Phosphate, mg/l	Full	49	0.01	0.07	0.01	0.06	0.05	0.12	7.2	-50.6	458	Outside Performance Criteria
FLR-5.0	Total Ortho-Phosphate, mg/l	Calibration Period	34	0.01	0.07	0.01	0.07	0.06	0.07	7.3	-52.8	435	Outside Performance Criteria
FLR-5.0	Total Ortho-Phosphate, mg/l	Validation Period	15	0.01	0.05	0.01	0.05	0.04	0.01	8.0	-62.9	543	Outside Performance Criteria
FLR-5.0	Total Suspended Solids, mg/l	Full	65	13.0	6.2	6.1	1.3	11.0	0.2	1.0	0.1	-52	Outside Performance Criteria
FLR-5.0	Total Suspended Solids, mg/l	Calibration Period	38	10.8	4.5	5.4	1.3	8.1	0.5	0.8	0.3	-58	Outside Performance Criteria
FLR-5.0	Total Suspended Solids, mg/l	Validation Period	27	16.2	8.7	7.0	1.3	15.0	0.2	1.0	0.0	-46	Outside Performance Criteria
FLR-5.0	Water Temperature, C	Full	80	15.1	16.4	14.5	17.0	2.9	0.8	0.5	0.7	9	Good
FLR-5.0	Water Temperature, C	Calibration Period	49	14.9	16.3	14.2	17.5	2.9	0.8	0.5	0.7	9	Good
FLR-5.0	Water Temperature, C	Validation Period	31	15.3	16.6	14.7	16.2	2.8	0.8	0.5	0.8	8	Good
KRC-4.5	Ammonia Nitrogen, mg/l	Full	118	0.2	0.2	0.1	0.1	0.1	0.5	0.8	0.4	-20	Good
KRC-4.5	Ammonia Nitrogen, mg/l	Calibration Period	64	0.2	0.1	0.1	0.1	0.1	0.3	0.9	0.2	-36	Outside Performance Criteria
KRC-4.5	Ammonia Nitrogen, mg/l	Validation Period	54	0.2	0.2	0.1	0.1	0.1	0.6	0.7	0.6	-3	Very Good
KRC-4.5	Chlorophyll-a, ug/l	Full	78	3.7	1.0	1.8	0.5	3.1	0.0	1.1	-0.3	-73	Outside Performance Criteria
KRC-4.5	Chlorophyll-a, ug/l	Calibration Period	43	2.8	0.9	1.7	0.5	2.4	0.0	1.2	-0.4	-70	Outside Performance Criteria
KRC-4.5	Chlorophyll-a, ug/l	Validation Period	35	4.7	1.2	2.3	0.5	4.0	0.1	1.1	-0.3	-75	Outside Performance Criteria
KRC-4.5	Nitrate-Nitrite, mg/l	Full	121	1.1	0.6	0.4	0.4	0.7	0.8	0.7	0.5	-40	Outside Performance Criteria
KRC-4.5	Nitrate-Nitrite, mg/l	Calibration Period	64	1.7	0.9	0.6	0.6	1.1	0.8	0.7	0.5	-46	Outside Performance Criteria
KRC-4.5	Nitrate-Nitrite, mg/l	Validation Period	57	0.3	0.3	0.3	0.3	0.1	0.2	1.1	-0.3	-3	Very Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
KRC-4.5	Total Kjeldahl Nitrogen, mg/l	Full	78	1.0	0.8	0.9	0.9	0.4	0.0	1.2	-0.5	-17	Good
KRC-4.5	Total Kjeldahl Nitrogen, mg/l	Calibration Period	43	1.0	0.8	0.8	0.8	0.4	0.1	1.3	-0.6	-24	Good
KRC-4.5	Total Kjeldahl Nitrogen, mg/l	Validation Period	35	1.0	0.9	0.9	0.9	0.3	0.1	1.1	-0.1	-8	Very Good
KRC-4.5	Total Nitrogen, lb/day	Full	77	737.5	838.3	158.0	50.5	535.9	0.6	0.9	0.2	14	Very Good
KRC-4.5	Total Nitrogen, lb/day	Calibration Period	43	611.4	616.4	158.0	49.5	524.9	0.5	0.8	0.3	1	Very Good
KRC-4.5	Total Nitrogen, lb/day	Validation Period	34	897.0	1,118.8	151.2	76.2	549.8	0.7	1.0	0.0	25	Good
KRC-4.5	Total Nitrogen, lb/year	Full	4	113,871.8	96,614.9	112,489.3	87,733.0	31,957.4	0.4	0.8	0.4	-15	Good
KRC-4.5	Total Nitrogen, lb/year	Calibration Period	2	136,947.3	87,733.0	136,947.3	87,733.0	49,214.3	1.0	0.9	0.1	-36	Outside Performance Criteria
KRC-4.5	Total Nitrogen, lb/year	Validation Period	2	90,796.3	105,496.8	90,796.3	105,496.8	14,700.5	1.0	0.4	0.9	16	Good
KRC-4.5	Total Nitrogen, mg/l	Full	78	2.2	1.5	1.3	1.2	0.9	0.8	0.7	0.4	-31	Fair
KRC-4.5	Total Nitrogen, mg/l	Calibration Period	43	3.0	1.8	1.6	1.4	1.4	0.9	0.8	0.4	-39	Outside Performance Criteria
KRC-4.5	Total Nitrogen, mg/l	Validation Period	35	1.3	1.2	1.1	1.1	0.3	0.1	1.0	0.0	-7	Very Good
KRC-4.5	Total Organic Carbon, lb/day	Full	77	5,286.8	7,621.5	874.5	216.0	4,086.4	0.7	1.2	-0.4	44	Outside Performance Criteria
KRC-4.5	Total Organic Carbon, lb/day	Calibration Period	43	3,246.9	5,225.4	834.8	197.0	3,451.4	0.7	1.3	-0.7	61	Outside Performance Criteria
KRC-4.5	Total Organic Carbon, lb/day	Validation Period	34	7,866.7	10,652.0	1,030.5	431.1	4,889.4	0.8	1.1	-0.2	35	Outside Performance Criteria
KRC-4.5	Total Organic Carbon, lb/year	Full	4	707,576.6	785,186.2	615,313.3	595,240.4	107,864.6	1.0	0.6	0.6	11	Very Good
KRC-4.5	Total Organic Carbon, lb/year	Calibration Period	2	615,313.3	595,240.4	615,313.3	595,240.4	40,437.1	1.0	0.3	0.9	-3	Very Good
KRC-4.5	Total Organic Carbon, lb/year	Validation Period	2	799,839.9	975,132.0	799,839.9	975,132.0	175,292.1	1.0	0.6	0.7	22	Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
KRC-4.5	Total Organic Carbon, mg/l	Full	78	8.3	7.9	7.9	8.4	1.8	0.4	1.0	-0.1	-4	Very Good
KRC-4.5	Total Organic Carbon, mg/l	Calibration Period	43	8.2	7.6	7.7	8.1	1.9	0.3	1.3	-0.6	-7	Very Good
KRC-4.5	Total Organic Carbon, mg/l	Validation Period	35	8.4	8.3	8.2	8.6	1.7	0.5	0.8	0.3	-1	Very Good
KRC-4.5	Total Phosphorus, lb/day	Full	112	57.8	100.3	10.7	4.9	81.5	0.5	2.2	-3.9	74	Outside Performance Criteria
KRC-4.5	Total Phosphorus, lb/day	Calibration Period	60	45.0	77.1	13.7	6.0	68.3	0.4	2.4	-4.8	72	Outside Performance Criteria
KRC-4.5	Total Phosphorus, lb/day	Validation Period	52	72.5	127.0	7.1	2.2	96.8	0.6	2.1	-3.4	75	Outside Performance Criteria
KRC-4.5	Total Phosphorus, lb/year	Full	4	9,142.6	15,230.0	8,946.0	12,671.5	6,087.4	0.8	2.9	-7.7	67	Outside Performance Criteria
KRC-4.5	Total Phosphorus, lb/year	Calibration Period	2	8,946.0	12,671.5	8,946.0	12,671.5	3,725.5	1.0	1.7	-1.8	42	Outside Performance Criteria
KRC-4.5	Total Phosphorus, lb/year	Validation Period	2	9,339.3	17,788.5	9,339.3	17,788.5	8,449.2	1.0	2.6	-5.8	90	Outside Performance Criteria
KRC-4.5	Total Phosphorus, mg/l	Full	119	0.4	0.2	0.1	0.2	0.3	0.6	0.9	0.2	-51	Outside Performance Criteria
KRC-4.5	Total Phosphorus, mg/l	Calibration Period	63	0.7	0.3	0.1	0.2	0.6	0.6	0.9	0.1	-59	Outside Performance Criteria
KRC-4.5	Total Phosphorus, mg/l	Validation Period	56	0.1	0.1	0.1	0.1	0.1	0.1	0.9	0.1	-5	Very Good
KRC-4.5	Total Ortho-Phosphate, mg/l	Full	62	0.51	0.23	0.05	0.15	0.43	0.53	0.9	0.2	-55	Outside Performance Criteria
KRC-4.5	Total Ortho-Phosphate, mg/l	Calibration Period	41	0.72	0.29	0.06	0.17	0.61	0.52	0.9	0.1	-60	Outside Performance Criteria
KRC-4.5	Total Ortho-Phosphate, mg/l	Validation Period	21	0.09	0.12	0.04	0.11	0.09	0.34	0.9	0.3	27	Fair
KRC-4.5	Total Suspended Solids, mg/l	Full	78	21.0	13.2	7.3	1.3	23.7	0.0	1.1	-0.3	-37	Fair
KRC-4.5	Total Suspended Solids, mg/l	Calibration Period	43	10.6	6.3	5.8	1.3	9.4	0.3	1.2	-0.4	-40	Fair

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
KRC-4.5	Total Suspended Solids, mg/l	Validation Period	35	33.8	21.6	9.8	1.3	41.3	0.0	1.2	-0.3	-36	Fair
KRC-4.5	Water Temperature, C	Full	107	17.8	19.2	17.5	19.1	3.4	0.8	0.6	0.7	8	Good
KRC-4.5	Water Temperature, C	Calibration Period	63	17.7	19.3	17.5	18.9	3.4	0.9	0.5	0.7	9	Good
KRC-4.5	Water Temperature, C	Validation Period	44	18.0	19.1	18.4	19.1	3.5	0.8	0.6	0.6	6	Very Good
LTR-1.9	Ammonia Nitrogen, mg/l	Full	77	0.1	0.0	0.1	0.0	0.1	0.0	1.2	-0.5	-48	Outside Performance Criteria
LTR-1.9	Ammonia Nitrogen, mg/l	Calibration Period	46	0.1	0.0	0.1	0.0	0.1	0.1	1.6	-1.7	-42	Outside Performance Criteria
LTR-1.9	Ammonia Nitrogen, mg/l	Validation Period	31	0.1	0.0	0.1	0.0	0.1	0.0	1.1	-0.3	-55	Outside Performance Criteria
LTR-1.9	Chlorophyll-a, ug/l	Full	80	9.9	6.6	7.0	7.2	6.8	0.1	1.0	0.0	-33	Fair
LTR-1.9	Chlorophyll-a, ug/l	Calibration Period	46	6.5	6.5	5.0	7.1	5.1	0.0	1.2	-0.4	0	Very Good
LTR-1.9	Chlorophyll-a, ug/l	Validation Period	34	14.5	6.8	11.3	7.4	9.0	0.3	1.0	-0.1	-53	Outside Performance Criteria
LTR-1.9	Nitrate-Nitrite, mg/l	Full	80	0.2	0.1	0.2	0.0	0.2	0.2	1.6	-1.6	-62	Outside Performance Criteria
LTR-1.9	Nitrate-Nitrite, mg/l	Calibration Period	46	0.2	0.1	0.2	0.0	0.2	0.3	1.8	-2.2	-67	Outside Performance Criteria
LTR-1.9	Nitrate-Nitrite, mg/l	Validation Period	34	0.2	0.1	0.2	0.0	0.1	0.0	1.4	-1.0	-52	Outside Performance Criteria
LTR-1.9	Total Kjeldahl Nitrogen, mg/l	Full	80	0.6	0.6	0.6	0.7	0.2	0.1	1.0	-0.1	7	Very Good
LTR-1.9	Total Kjeldahl Nitrogen, mg/l	Calibration Period	46	0.6	0.6	0.5	0.6	0.1	0.1	1.1	-0.2	8	Very Good
LTR-1.9	Total Kjeldahl Nitrogen, mg/l	Validation Period	34	0.7	0.7	0.6	0.7	0.2	0.0	1.0	0.0	5	Very Good
LTR-1.9	Total Nitrogen, lb/day	Full	80	2,063.7	1,317.0	137.4	172.0	1,127.0	0.8	0.7	0.5	-36	Outside Performance Criteria
LTR-1.9	Total Nitrogen, lb/day	Calibration Period	46	503.3	654.2	137.4	172.0	247.0	1.0	0.4	0.9	30	Fair

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
LTR-1.9	Total Nitrogen, lb/day	Validation Period	34	4,174.8	2,213.7	183.2	178.6	2,317.6	0.8	0.7	0.5	-47	Outside Performance Criteria
LTR-1.9	Total Nitrogen, lb/year	Full	4	114,250.5	113,083.4	76,832.2	83,094.8	8,685.8	1.0	0.1	1.0	-1	Very Good
LTR-1.9	Total Nitrogen, lb/year	Calibration Period	2	76,832.2	83,094.8	76,832.2	83,094.8	8,774.8	1.0	26.8	-717.6	8	Very Good
LTR-1.9	Total Nitrogen, lb/year	Validation Period	2	151,668.8	143,072.1	151,668.8	143,072.1	8,596.7	1.0	0.1	1.0	-6	Very Good
LTR-1.9	Total Nitrogen, mg/l	Full	80	0.8	0.7	0.7	0.7	0.2	0.0	1.0	0.0	-9	Very Good
LTR-1.9	Total Nitrogen, mg/l	Calibration Period	46	0.8	0.7	0.7	0.7	0.2	0.1	1.0	0.0	-12	Very Good
LTR-1.9	Total Nitrogen, mg/l	Validation Period	34	0.8	0.8	0.7	0.8	0.2	0.0	1.0	0.0	-7	Very Good
LTR-1.9	Total Organic Carbon, lb/day	Full	80	17,713.0	13,141.8	1,205.5	1,650.9	8,632.3	0.9	0.6	0.7	-26	Fair
LTR-1.9	Total Organic Carbon, lb/day	Calibration Period	46	4,541.9	6,572.4	1,160.6	1,650.9	2,565.3	1.0	0.4	0.8	45	Outside Performance Criteria
LTR-1.9	Total Organic Carbon, lb/day	Validation Period	34	35,532.6	22,029.7	1,493.7	1,639.0	16,840.6	0.9	0.6	0.7	-38	Outside Performance Criteria
LTR-1.9	Total Organic Carbon, lb/year	Full	4	1,007,152.9	1,111,235.3	665,691.8	817,305.7	105,694.0	1.0	0.2	0.9	10	Very Good
LTR-1.9	Total Organic Carbon, lb/year	Calibration Period	2	621,332.8	817,305.7	621,332.8	817,305.7	195,972.9	1.0	4.7	-21.1	32	Fair
LTR-1.9	Total Organic Carbon, lb/year	Validation Period	2	1,392,973.1	1,405,165.0	1,392,973.1	1,405,165.0	15,415.0	1.0	0.0	1.0	1	Very Good
LTR-1.9	Total Organic Carbon, mg/l	Full	80	7.0	6.6	6.7	6.6	1.0	0.3	1.0	0.0	-5	Very Good
LTR-1.9	Total Organic Carbon, mg/l	Calibration Period	46	6.7	6.2	6.5	6.4	0.9	0.3	1.0	0.0	-7	Very Good
LTR-1.9	Total Organic Carbon, mg/l	Validation Period	34	7.3	7.1	7.2	6.9	1.2	0.2	1.1	-0.1	-2	Very Good
LTR-1.9	Total Phosphorus, lb/day	Full	79	284.9	177.7	8.7	19.0	161.1	0.9	0.6	0.6	-38	Outside Performance Criteria
LTR-1.9	Total Phosphorus, lb/day	Calibration Period	46	50.9	75.9	8.3	18.4	28.1	1.0	0.3	0.9	49	Outside Performance Criteria

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
LTR-1.9	Total Phosphorus, lb/day	Validation Period	33	611.1	319.6	23.0	29.1	346.4	0.9	0.6	0.6	-48	Outside Performance Criteria
LTR-1.9	Total Phosphorus, lb/year	Full	4	9,878.2	12,246.2	6,163.8	9,288.1	2,368.0	0.9	0.4	0.9	24	Good
LTR-1.9	Total Phosphorus, lb/year	Calibration Period	2	5,272.9	9,288.1	5,272.9	9,288.1	4,015.2	1.0	2.9	-7.6	76	Outside Performance Criteria
LTR-1.9	Total Phosphorus, lb/year	Validation Period	2	14,483.5	15,204.3	14,483.5	15,204.3	720.8	1.0	0.1	1.0	5	Very Good
LTR-1.9	Total Phosphorus, mg/l	Full	79	0.1	0.1	0.0	0.1	0.0	0.2	0.9	0.2	10	Very Good
LTR-1.9	Total Phosphorus, mg/l	Calibration Period	46	0.1	0.1	0.0	0.1	0.0	0.1	1.0	-0.1	36	Outside Performance Criteria
LTR-1.9	Total Phosphorus, mg/l	Validation Period	33	0.1	0.1	0.1	0.1	0.0	0.2	0.9	0.2	-11	Very Good
LTR-1.9	Total Ortho-Phosphate, mg/l	Full	64	0.02	0.06	0.01	0.06	0.04	0.03	3.0	-7.8	277	Outside Performance Criteria
LTR-1.9	Total Ortho-Phosphate, mg/l	Calibration Period	44	0.02	0.06	0.01	0.06	0.04	0.03	2.6	-5.6	253	Outside Performance Criteria
LTR-1.9	Total Ortho-Phosphate, mg/l	Validation Period	20	0.01	0.05	0.01	0.05	0.04	0.08	6.8	-44.8	354	Outside Performance Criteria
LTR-1.9	Total Suspended Solids, mg/l	Full	80	19.1	13.7	7.7	1.3	22.1	0.1	1.5	-1.4	-28	Good
LTR-1.9	Total Suspended Solids, mg/l	Calibration Period	46	12.9	5.7	6.5	1.3	13.4	0.1	1.2	-0.5	-56	Outside Performance Criteria
LTR-1.9	Total Suspended Solids, mg/l	Validation Period	34	27.5	24.5	12.8	1.3	33.9	0.0	1.6	-1.6	-11	Very Good
LTR-1.9	Water Temperature, C	Full	65	16.8	15.3	17.0	16.1	2.6	0.9	0.4	0.8	-9	Good
LTR-1.9	Water Temperature, C	Calibration Period	44	16.3	15.0	16.8	15.9	2.4	0.9	0.4	0.8	-8	Good
LTR-1.9	Water Temperature, C	Validation Period	21	17.9	15.9	21.5	17.6	2.9	0.9	0.5	0.8	-11	Good
LTR-16	Ammonia Nitrogen, mg/l	Full	89	0.0	0.0	0.0	0.0	0.0	0.0	1.9	-2.7	62	Outside Performance Criteria
LTR-16	Ammonia Nitrogen, mg/l	Calibration Period	47	0.0	0.0	0.0	0.0	0.0	0.0	2.1	-3.5	52	Outside Performance Criteria

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
LTR-16	Ammonia Nitrogen, mg/l	Validation Period	42	0.0	0.1	0.0	0.0	0.0	0.0	1.8	-2.2	74	Outside Performance Criteria
LTR-16	Nitrate-Nitrite, mg/l	Full	90	0.3	0.3	0.3	0.1	0.4	0.1	4.0	-14.9	4	Very Good
LTR-16	Nitrate-Nitrite, mg/l	Calibration Period	47	0.3	0.3	0.3	0.1	0.4	0.1	5.0	-23.8	0	Very Good
LTR-16	Nitrate-Nitrite, mg/l	Validation Period	43	0.3	0.3	0.3	0.1	0.4	0.3	3.3	-9.6	9	Very Good
LTR-16	Total Kjeldahl Nitrogen, mg/l	Full	46	0.5	0.6	0.4	0.5	0.3	0.1	1.1	-0.1	27	Fair
LTR-16	Total Kjeldahl Nitrogen, mg/l	Calibration Period	24	0.5	0.5	0.4	0.5	0.3	0.2	0.9	0.3	4	Very Good
LTR-16	Total Kjeldahl Nitrogen, mg/l	Validation Period	22	0.4	0.6	0.4	0.6	0.2	0.0	2.6	-6.0	58	Outside Performance Criteria
LTR-16	Total Nitrogen, lb/day	Full	46	831.8	321.1	100.7	19.2	566.0	1.0	0.7	0.5	-61	Outside Performance Criteria
LTR-16	Total Nitrogen, lb/day	Calibration Period	24	1,386.2	441.3	111.0	20.1	978.3	1.0	0.7	0.5	-68	Outside Performance Criteria
LTR-16	Total Nitrogen, lb/day	Validation Period	22	227.0	189.9	76.8	17.8	116.2	0.8	0.5	0.7	-16	Good
LTR-16	Total Nitrogen, lb/year	Full	4	195,858.9	135,414.9	209,092.5	145,925.0	60,444.1	0.9	1.4	-1.0	-31	Fair
LTR-16	Total Nitrogen, lb/year	Calibration Period	2	227,449.3	154,965.0	227,449.3	154,965.0	72,484.3	1.0	13.3	-175.9	-32	Fair
LTR-16	Total Nitrogen, lb/year	Validation Period	2	164,268.6	115,864.8	164,268.6	115,864.8	48,403.8	1.0	1.1	-0.3	-29	Fair
LTR-16	Total Nitrogen, mg/l	Full	46	0.8	0.9	0.7	0.7	0.5	0.0	2.0	-3.1	13	Very Good
LTR-16	Total Nitrogen, mg/l	Calibration Period	24	0.9	0.8	0.8	0.7	0.4	0.0	1.5	-1.4	-10	Very Good
LTR-16	Total Nitrogen, mg/l	Validation Period	22	0.7	1.0	0.6	0.7	0.5	0.2	3.5	-11.2	45	Outside Performance Criteria
LTR-16	Total Organic Carbon, lb/day	Full	28	1,518.2	1,319.9	583.7	136.9	958.4	0.6	0.6	0.6	-13	Very Good
LTR-16	Total Organic Carbon, lb/day	Calibration Period	20	1,500.5	1,182.5	692.9	183.3	1,139.1	0.3	0.8	0.3	-21	Good

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
LTR-16	Total Organic Carbon, lb/day	Validation Period	8	1,562.5	1,663.3	291.2	63.9	506.5	1.0	0.3	0.9	6	Very Good
LTR-16	Total Organic Carbon, lb/year	Full	4	2,081,241.6	1,336,796.3	2,187,093.5	1,429,855.9	744,445.3	0.8	1.7	-2.0	-36	Outside Performance Criteria
LTR-16	Total Organic Carbon, lb/year	Calibration Period	2	2,382,042.6	1,533,264.3	2,382,042.6	1,533,264.3	848,778.4	1.0	5.8	-32.3	-36	Outside Performance Criteria
LTR-16	Total Organic Carbon, lb/year	Validation Period	2	1,780,440.6	1,140,328.3	1,780,440.6	1,140,328.3	640,112.3	1.0	1.4	-1.0	-36	Outside Performance Criteria
LTR-16	Total Organic Carbon, mg/l	Full	28	4.9	5.5	4.3	4.8	1.7	0.2	1.3	-0.6	13	Very Good
LTR-16	Total Organic Carbon, mg/l	Calibration Period	20	5.1	5.4	4.6	5.3	1.6	0.2	1.1	-0.2	5	Very Good
LTR-16	Total Organic Carbon, mg/l	Validation Period	8	4.3	5.8	3.5	4.6	2.1	0.2	1.6	-1.6	36	Outside Performance Criteria
LTR-16	Total Phosphorus, lb/day	Full	84	100.7	24.9	4.8	1.3	80.3	1.0	0.9	0.3	-75	Outside Performance Criteria
LTR-16	Total Phosphorus, lb/day	Calibration Period	44	174.3	33.4	4.5	1.5	146.6	1.0	0.9	0.3	-81	Outside Performance Criteria
LTR-16	Total Phosphorus, lb/day	Validation Period	40	19.7	15.5	5.0	1.2	7.3	0.9	0.3	0.9	-21	Good
LTR-16	Total Phosphorus, lb/year	Full	4	34,618.3	16,767.0	35,070.5	16,257.2	17,851.3	0.3	1.9	-2.6	-52	Outside Performance Criteria
LTR-16	Total Phosphorus, lb/year	Calibration Period	2	35,070.5	17,276.9	35,070.5	17,276.9	17,793.6	1.0	2.3	-4.2	-51	Outside Performance Criteria
LTR-16	Total Phosphorus, lb/year	Validation Period	2	34,166.1	16,257.2	34,166.1	16,257.2	17,908.9	1.0	1.3	-0.7	-52	Outside Performance Criteria
LTR-16	Total Phosphorus, mg/l	Full	87	0.1	0.1	0.0	0.1	0.0	0.0	1.2	-0.6	41	Outside Performance Criteria
LTR-16	Total Phosphorus, mg/l	Calibration Period	45	0.1	0.1	0.0	0.1	0.1	0.0	1.2	-0.4	35	Fair
LTR-16	Total Phosphorus, mg/l	Validation Period	42	0.0	0.1	0.0	0.1	0.0	0.1	2.0	-2.8	48	Outside Performance Criteria
LTR-16	Total Suspended Solids, mg/l	Full	46	23.5	7.5	3.2	3.9	19.0	1.0	0.8	0.3	-68	Outside Performance Criteria

Table F-1. WARMF Model Performance Criteria for Calibration (2015-2016), Validation (2017-2018), and Full (2015-2018) Model Periods (select stations only).

ID	Parameter	Period	Number of Samples	Mean (Observed)	Mean (WARMF)	Median (Observed)	Median (WARMF)	Absolute Error (AE)	R^2	RMSE-observations standard deviation ratio (RSR)	Nash Sutcliffe Efficiency (NSE)	% Bias	Performance Rating
LTR-16	Total Suspended Solids, mg/l	Calibration Period	24	39.5	9.4	3.6	3.1	31.8	1.0	0.8	0.3	-76	Outside Performance Criteria
LTR-16	Total Suspended Solids, mg/l	Validation Period	22	6.1	5.5	3.0	4.9	4.9	0.1	0.9	0.1	-10	Very Good
LTR-16	Water Temperature, C	Full	92	16.0	17.2	15.8	17.8	2.7	0.9	0.4	0.8	8	Good
LTR-16	Water Temperature, C	Calibration Period	47	16.2	17.5	16.4	17.9	2.4	0.9	0.4	0.9	8	Good
LTR-16	Water Temperature, C	Validation Period	45	15.7	17.0	14.4	15.2	3.0	0.8	0.5	0.8	9	Good