UNRBA Monitoring Program

PFC Meeting

July 2016

July 27, 2016

FY2016 Monitoring Program

Year End Status Update

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FY2016 Routine Monitoring

- Pending documents for FY2016 Monitoring Program:
  - Model Evaluation Special Study Report
    - Reviewed by Forrest, Jay, Haywood
    - Provided to PFC for review
  - FY2017 Monitoring Plan Update
    - Under review by Forrest, Jay, Haywood
  - FY2017 Monitoring QAPP Update
    - Under review by Forrest, Jay, Haywood

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FY2016 Routine Monitoring - Encumbered Funds to be expended in coming months

Project Phase and Task	Amount
Phase 1 - Tributary Monitoring	
1.1 Field Sampling and Laboratory Analyses (Environment 1)	$20,147
Phase 2 - Lake Monitoring	
2.1 Analysis of Falls Lake Samples by Environment 1	$670
Phase 5 – Monitoring Plan and QAPP Management	
5.1 Respond to UNRBA and DWR Comments	$7,000
Phase 6 - Special Studies	
SS.LR.2 Paired core / EPA chamber study	$12,500
SS.LR.5 Conduct Second Constriction Point Study Event	$25,000
SS.LR.8 Respond to Comments on Modeling Report	$5,000
Total Encumbered Amount	$70,317
Unencumbered Rollover available for FY2017 efforts	$20,000

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FY2017 Monitoring Plan Document

- Substantive revisions tracked in a table at front of document
  - Eliminated some parameters from the program at Lake Loading locations
    - $CBOD_5$, DOC, and Platinum-Cobalt Color
  - Reduced frequency of TOC sampling to quarterly at Jurisdictional Stations
  - Expanded the number of events and spatial coverage of high flow sampling
  - Added a bathymetric and sediment mapping special study

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1 Summary of Changes to the UNRBA Monitoring Plan

The UNRBA Monitoring Program is an adaptive monitoring program that will be revised periodically based on new information. The original plan was approved by DWR on July 15, 2014. Table 1 summarizes the changes to the UNRBA Monitoring Program that are reflected in this revised document; minor edits are not included.

Table 1 Revisions to the UNRBA Monitoring Program

Plan Component: Overview of the UNRBA Monitoring Program
Date Created: August 2014
Modified: July 2016
Changes: - Added text to describe the adaptive monitoring program and how it will support the multi-model approach to the reexamination of Stage II of the Falls Lake Nutrient Management Strategy. - Added references to the documents approved by DWR in 2014 including the Monitoring Plan and the Quality Assurance Project Plan. - Revised text regarding specific models to be used in the reexamination - Added text to explain the addition of the fiscal year to Table 2.
Reason: - Clarification and indication of plan approval by DWR. - When this Monitoring Plan was originally drafted, staff at DWR said that the Environmental Fluid Dynamics Code (EFDC) model would be required as the lake model to support the reexamination. During more recent discussions between the UNRBA and DWR, DWR staff indicated a willingness to consider other models and stated that EFDC would not be required by the State. - Clarification of adaptive monitoring plan.
Plan Component: Overview, Table 2 (UNRBA Monitoring Program Components)
Date Created: August 2014

FY2017 Quality Assurance Project Plan (QAPP)

- Draft under review by Forrest, Jay, Haywood
- Minor revisions:
  - Updated agency name throughout (now DEQ)
  - Updated project staff and roles
  - Made minor technical revisions to improve clarity
  - Cataloged revisions in table at front of document

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Basic Evaluation of Model Performance Report

- Evaluated models for Falls Lake to determine if the monitoring program is collecting the types of data needed to build the models
  - Tributary nutrient and carbon load estimation techniques such as USGS LOADEST
  - Falls Lake Environmental Fluid Dynamics Code (EFDC) model originally developed by NCDWR to develop the Falls Rules
  - Empirical/probabilistic/Bayesian conceptual model

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Load Estimation Methods

- Recommendation
  - Strive to include more measurements of nutrient concentrations during high flow conditions on major tributaries.
- Rationale
  - Best estimates of loading were produced when predictions were based on statistical relationships between water flow and nutrient concentrations which represented a wide range of flow conditions.
  - Seasonal or annual patterns may also be included in predictions if high flow data are collected across years and seasons.

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EFDC Model Evaluation

- Recommendation 1:
  - Suspend measurement of $CBOD_5$ in tributaries.
- Rationale:
  - **Sensitivity analyses** on the related model parameters (lability of carbon inputs) showed the model predictions were not affected by this, primarily due to the low concentration of particulate carbon being loaded to the lake.

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EFDC Model Evaluation

- Recommendation 2:
  - Allocation of additional resources for measuring light extinction is not necessary (beyond what is already part of routine monitoring).
- Rationale
  - **Sensitivity analyses** on light extinction parameters showed model predictions of Chlorophyll *a* were not highly sensitive to these parameters within reasonable ranges. Current model parameterization can be greatly improved with existing data; further refinements are expected to yield only marginal gains.

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EFDC Model Evaluation

- Recommendation 3:
  - Revisions to EFDC model should improve on the physical representation of the lake shape, including constrictions between segments and improved bathymetry.
  - Recommend a special study to **collect bathymetric data** for the lake.
- Rationale
  - In a 3-D model, water quality predictions are dependent on getting the water movement correct. Bridge causeways may constrict movement between basins and should be included in the model; underwater topography also affects water circulation patterns.

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EFDC Model Evaluation

- Recommendation 4:
  - Collect data on spatial distribution of sediment in the reservoir (in conjunction with the bathymetric survey).
- Rationale
  - Current EFDC model suggests a significant portion (~20%) of nutrient load comes from sediment.
  - Sediment core data set shows large spatial variability in presence of soft sediment and flux rates.
  - Low-cost survey will help identify the spatial extent and pattern of sediments to be used in refining model parameterization of benthic releases.

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Empirical/Probabilistic/Bayesian Modeling

- Recommendation:
  - No additional studies are necessary at this time; modelers should continue to evaluate data needs as the model framework is refined.
- Rationale:
  - Current model framework is supported by data collected by UNRBA and several other organizations. (Report includes an exhaustive table of data sources.)
  - In addition, this model structure can be supported by data from other waterbodies, demonstrated statistical relationships, and expert judgment.

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Basic Evaluation of Model Performance Report

- Draft report has been circulated to the PFC for comments and questions
  - Please provide comments or questions to Forrest

- Alternate lake response models and watershed model needs will be considered as part of the UNRBA's Modeling and Regulatory Options efforts.

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FY2017 Monitoring Program

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Routine Monitoring – Data generation status

Date	Sample Collection	Sample Analysis	Data Review	Posted to Database
Aug-Dec 2014	✓	✓	✓	✓
Jan-Dec 2015	✓	✓	✓	✓
Jan-2016	✓	✓	✓	✓
Feb-2016	✓	✓	✓	✓
Mar-2016	✓	✓	✓	✓
Apr-2016	✓	✓	✓	✓
May-2016	✓			
Jun-2016	✓			
Jul-2016	✓			
Aug-2016				
Sep-2016				
Oct-2016				
Nov-2016				
Dec-2016				

FY 2017 Special Studies

- High Flow Sampling Study Plan in preparation
  - Sample high flows at “Big 5” stations up to 12 times in FY2017
    - Target peak flow, as well as rising and falling portions when feasible
    - Include other significant tributaries as flows and budget allow

- Bathymetry and Sediment Mapping Study Plan to be prepared
  - Use Sonar equipment to map topography of lake bottom
  - Use dual-frequency Sonar to estimate distribution and thickness of unconsolidated sediment layer
  - Prepare bathymetric and sediment maps to support modeling and other purposes

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FY2017 Modeling Project

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Schedule for Contract Development

Draft scope and contract provided to Forrest on July 12

Discuss August 1st	Revise as needed

Draft to Modeling Subcommittee no later than August 5

Discuss August 11th	Revise as needed

Draft to PFC no later than August 19

Discuss August 24th	Revise as needed

Draft to BOD no later than September 7

Discuss September 21st	Sign contract

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Model report graphics

Center for Watershed Protection

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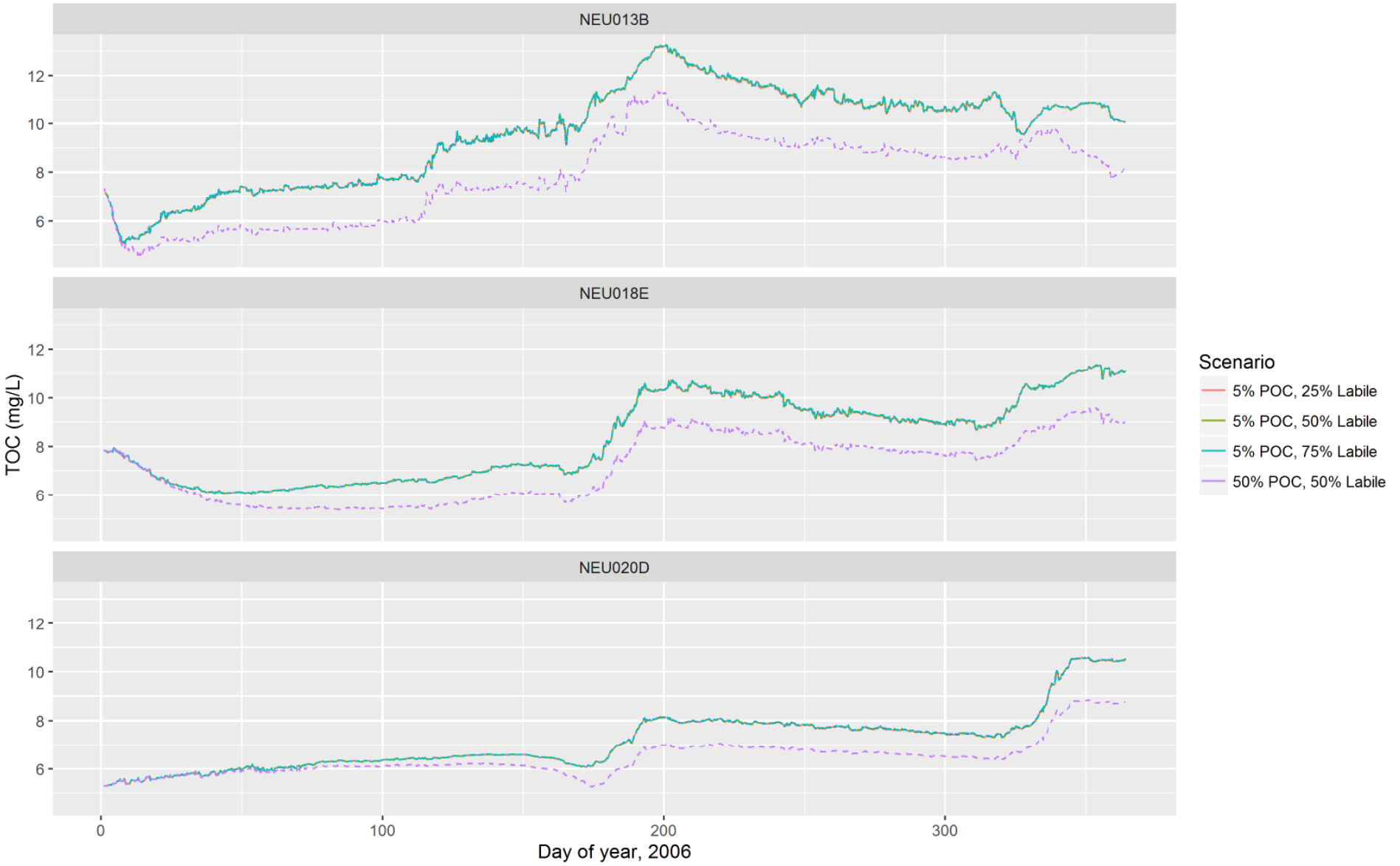
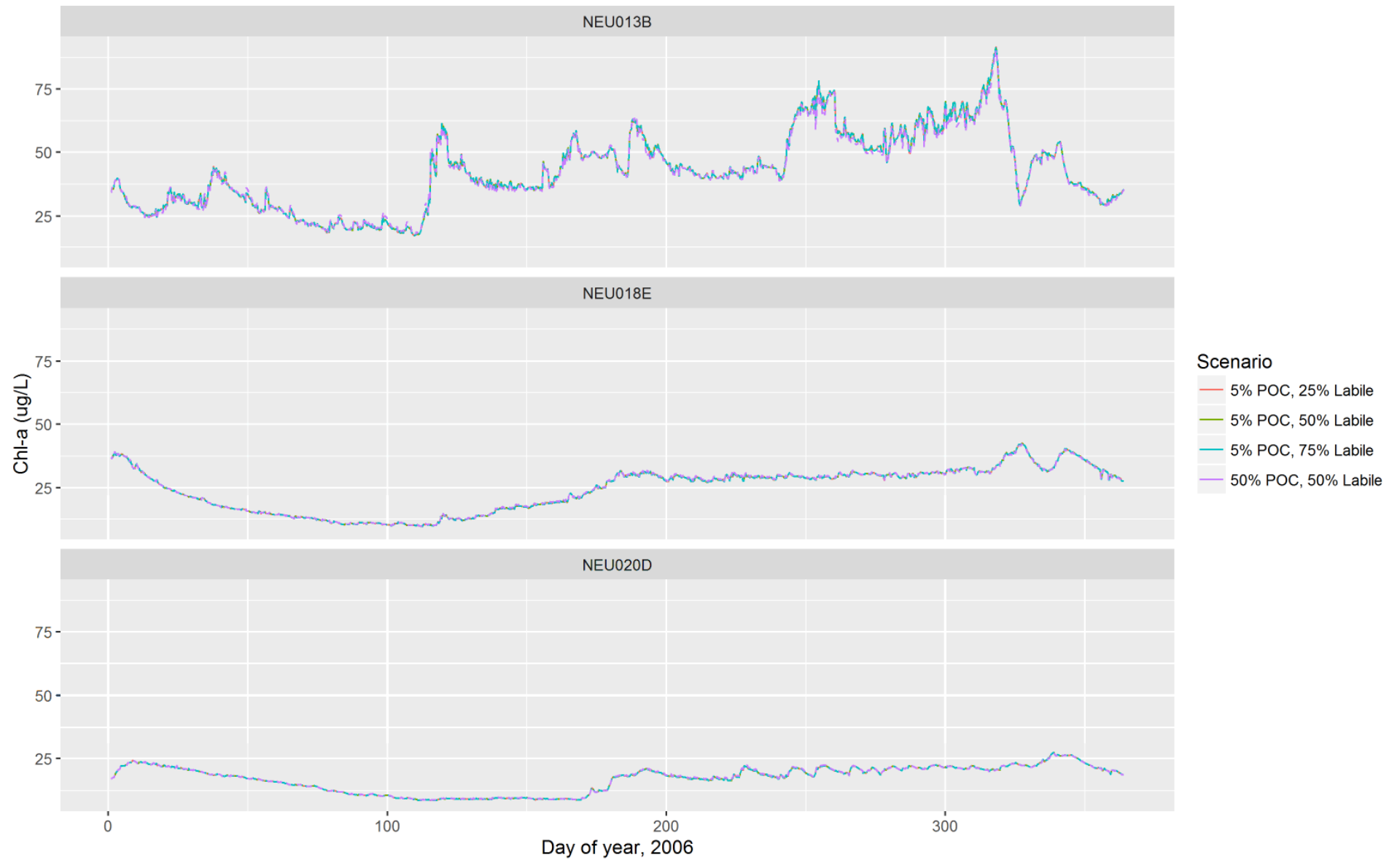
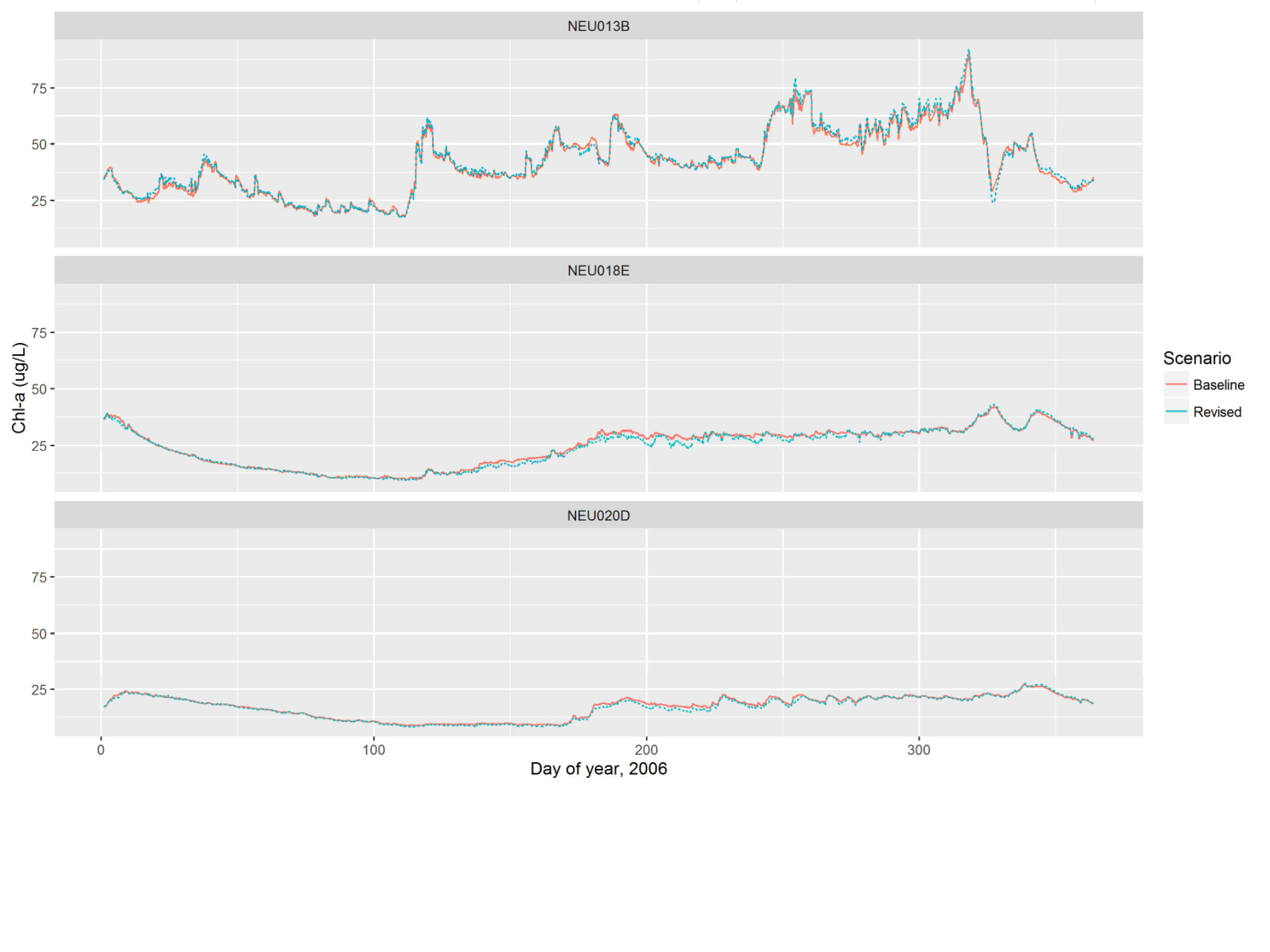
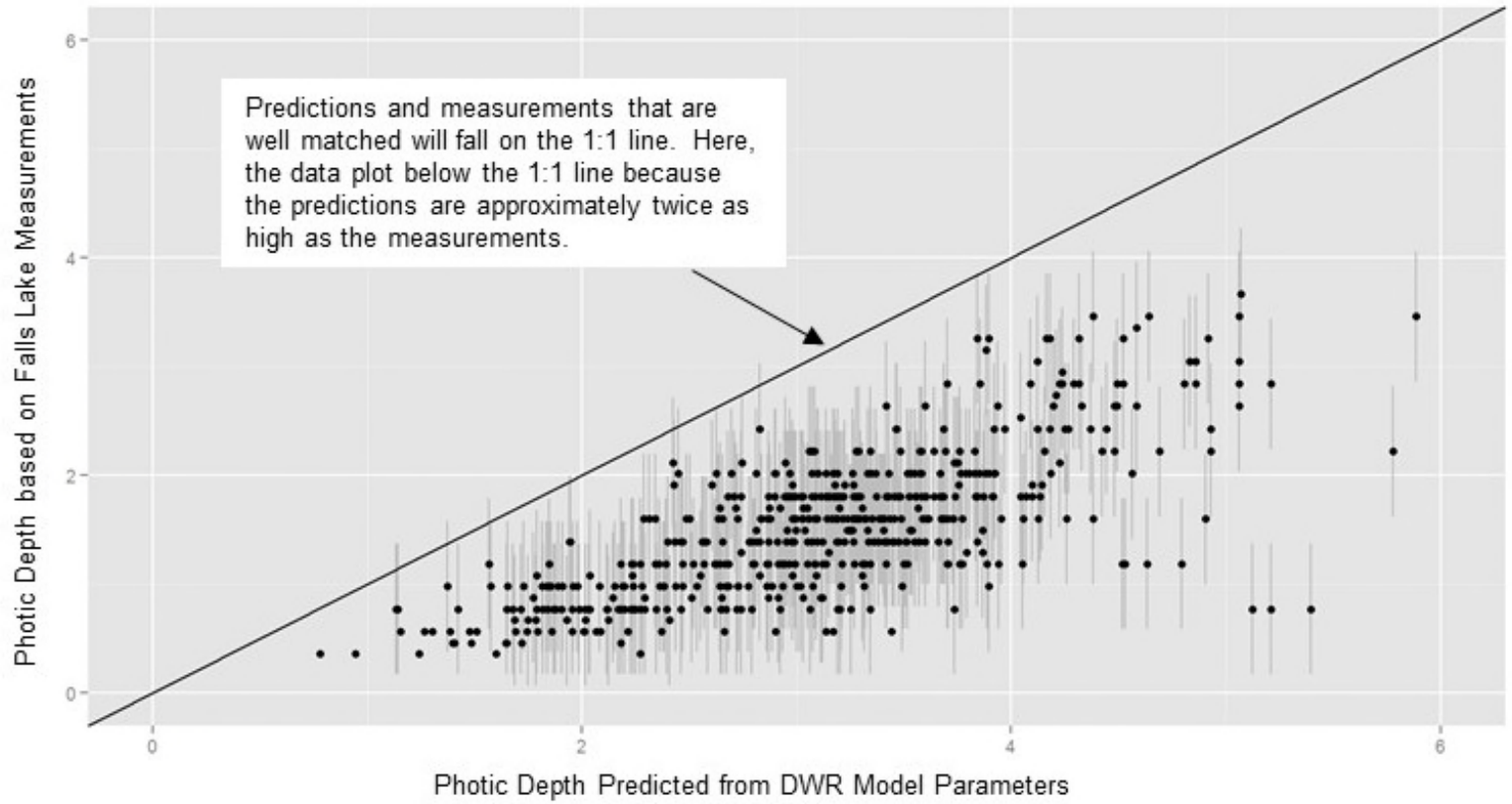
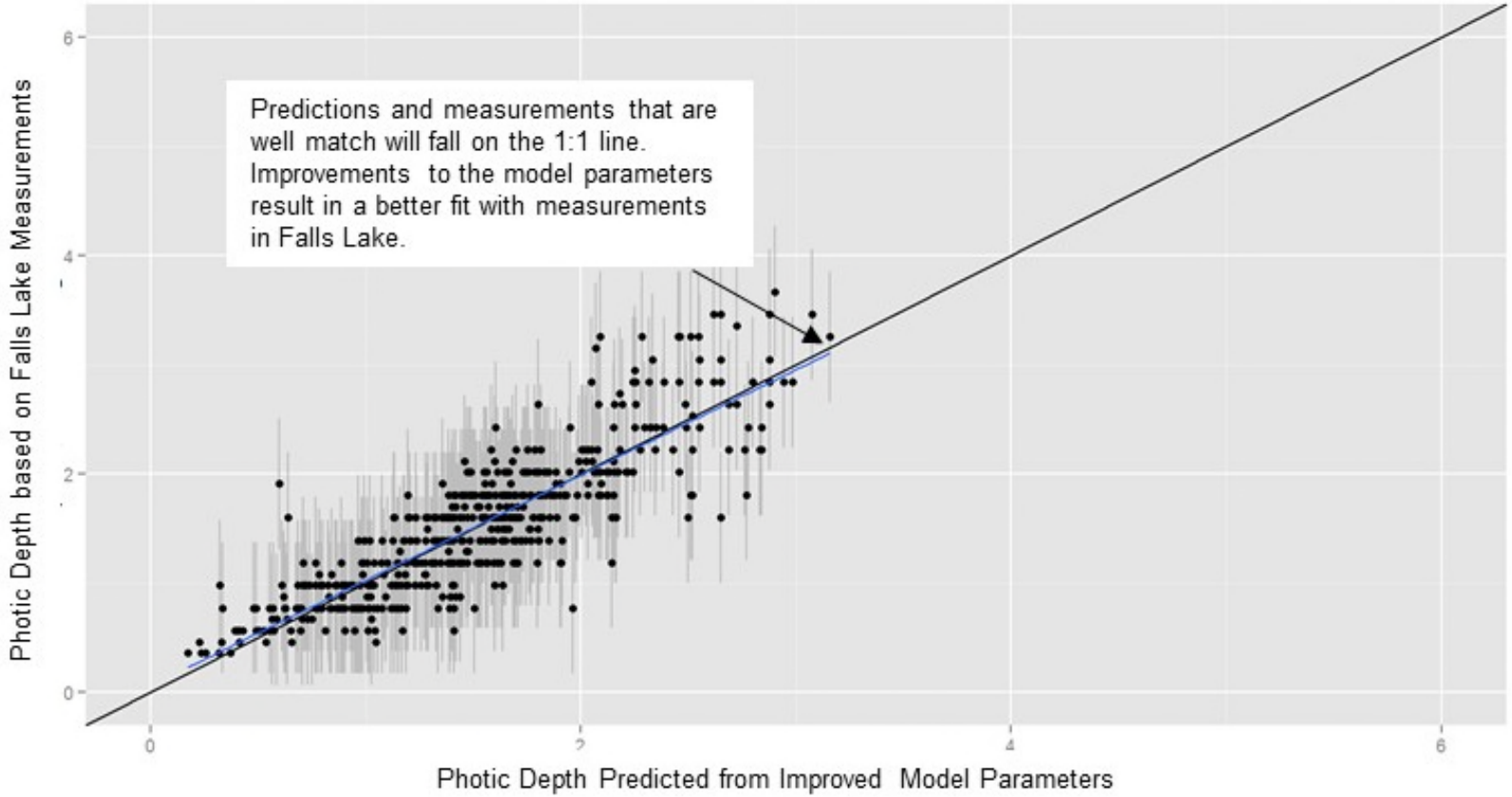

NEU013B
NEU018E
NEU020D
TOC (mg/L)
12
10
8
6
0
100
200
300
Day of year, 2006
Scenario
5% POC, 25% Labile
5% POC, 50% Labile
5% POC, 75% Labile
50% POC, 50% Labile


NEU013B
NEU018E
NEU020D
75
50
25
Chl-a (ug/L)
0
100
200
300
Day of year, 2006
Scenario
5% POC, 25% Labile
5% POC, 50% Labile
5% POC, 75% Labile
50% POC, 50% Labile


NEU013B
NEU018E
NEU020D
75
50
25
Chl-a (ug/L)
0
100
200
300
Day of year, 2006
Scenario
Baseline
Revised


Predictions and measurements that are well matched will fall on the 1:1 line. Here, the data plot below the 1:1 line because the predictions are approximately twice as high as the measurements.
Photic Depth based on Falls Lake Measurements
Photic Depth Predicted from DWR Model Parameters
0
2
4
6


Predictions and measurements that are well match will fall on the 1:1 line. Improvements to the model parameters result in a better fit with measurements in Falls Lake.
Photic Depth based on Falls Lake Measurements
Photic Depth Predicted from Improved Model Parameters
0
2
4
6


10/18/2009
Image USDA Farm Service Agency

Framework to Link Management Strategies and Lake Water Quality to Designated Uses in Falls Lake