

# **WDNR Response to Comments on Wisconsin River TMDL Models, including: Draft Petenwell and Castle Rock Reservoir Models, Draft Big Eau Pleine Reservoir Model, and Draft SWAT Model**

May 31, 2016

*All statements in this document are responses to comments and questions on a draft models. Draft models are a work in progress, a snapshot in time. As such, the approach and models referenced herein are continuously evolving and subject to change.*

## **Petenwell and Castle Rock Reservoir Modeling (Final Water Quality Calibration)**

*Technical Memorandum documenting CE-QUAL-W2 final water quality calibration (Task 4) modeling of Petenwell and Castle Rock reservoirs, LimnoTech, April 12, 2016*

1. **WRDG** – The WRDG appreciates the invitation to participate in the workshop held on April 20, 2016. We understand concerns with the model are being investigated and encourage the Department to fully resolve the calibration issues before proceeding to the allocation phase and provide an update on resolution of the model calibration challenges as they are addressed.

**NCWSC** - Petenwell/Castle Rock Reservoir Modeling – It is requested that WDNR fully resolve the calibration challenges related to the total phosphorus and chlorophyll-a described in April 12, 2016 memorandum from Limno Tech and discussion at the April 20, 2016 stakeholder meeting. It is requested that these efforts be fully documented and available for review.

*WDNR plans to further calibrate the CE QUAL W2 model, and will fully document the revised calibration. The results of this effort will be available for public review.*

2. WRDG - Total phosphorus (TP) loading from SWAT was used as input to the CE-QUAL model. How did the SWAT TP compare to the observed data? Were the SWAT model bias corrections described in the SWAT update applied to this data?

*In October of 2015, we released the draft calibrated model that included measures of accuracy for streamflow, TSS, and TP with a short memo to aid with interpretation (readme.docx). The draft model is archived and can be accessed from the WR TMDL Dropbox account:*

[https://dl.dropboxusercontent.com/u/117469377/WRB\\_TMDL/wrb\\_swat\\_model\\_draft\\_release.zip](https://dl.dropboxusercontent.com/u/117469377/WRB_TMDL/wrb_swat_model_draft_release.zip)

Since the release of the above draft calibrated model, we have improved the TP fit at most sites:

Site	R <sup>2</sup>	NSE	PBIAS
Mill Creek - PP	0.8	0.74	-39.1
Muskellunge Cr-Muskellunge L Outlet	0.19	0	8.3
Yellow River Babcock	0.51	0.38	35.5
Big Roche a Cri Creek	0.77	0.76	-4.5
Tenmile Creek	0.77	0.31	-15.7
Plover River	0.74	0.7	3
Little Eau Pleine River	0.61	0.61	5.9
Freeman Creek	0.83	0.74	16.3
Big Eau Pleine River	0.42	0.42	8.5
Eau Claire River	0.9	0.84	-28.8
Big Rib River	0.75	0.7	6.2
Wis River - Merrill	0.75	0.74	5
Prairie River	0.84	0.69	33.3
Spirit River - Spirit Falls	0.9	0.72	25.8
Baraboo River - Reedsburg	0.71	0.05	-7.1
Lemonweir River	0.75	0.62	11.9
Yellow River- Necedah	0.7	0.64	-14.3
Link Creek	0	-0.92	-0.1
Pine River	0.82	0.76	-40.6
Fenwood Creek	0.43	0.38	-26.7

The majority of loads coming into Lake Petenwell used for CE-QUAL-W2 modeling were estimated using FLUXMASTER, with daily flows and bi-weekly concentration samples at Nekoosa. The remaining loads into Petenwell were estimated in SWAT before the bias correction was completed, account for less than 3% of its overall load.

The Yellow River arm of Castle Rock Lake is the only segment of the CE-QUAL-W2 models where a significant fraction of the load was estimated using SWAT. The October 2015 draft SWAT model loads at the Yellow River—Necedah gage site that were provided to LimnoTech were biased 14.3% overall, however, the majority of this bias was associated with the error in predicting a single (or set of) large event(s). We are confident that the SWAT loads from the Yellow River into Castle Rock adequately inform the CE-QUAL-W2 model at this location.

## Big Eau Pleine Reservoir Modeling

*Steady-State Modeling Analysis of Big Eau Pleine Reservoir, Wisconsin River System, UW-Stout, William F. James, November 20, 2015*

3. **WRDG** - If 60% of TP is being retained in the reservoir, will TP reductions upstream have much impact on the Big Eau Pleine Reservoir water quality because of historical TP re-suspension and release during lake turn-over or future high flow events, for example?

*While there is a moderate buildup of phosphorus in the hypolimnion during the summer months under current conditions, it does not appear that this phosphorus is being transported downstream during fall overturn. Sampling at the outlet of the reservoir indicates that during fall overturn the phosphorus concentration leaving the reservoir is generally lower than it is during the summer growing season. Physical re-suspension due to high flow events is extremely unlikely given the long hydraulic residence time of the reservoir.*

4. **WRDG** - How do SWAT loads compare to incoming observed gauged TP loads to Big Eau Pleine Reservoir?

**NCWSC** - Provide a description on how SWAT load compare to incoming observed gauged TP loads to Big Eau Pleine Reservoir

*See response to question 2.*

5. **WRDG** - The Department has indicated the water quality criterion (WQC) for the reservoir is 0.03 mg/L. Figure 16 in the report suggests about 85% reduction in TP is needed to reach the WQC. Is this interpretation correct, and is that load reduction (and WQC) attainable? How long would it take to attain the WQC, and is the timeframe reasonable?

**NCWSC** - Given that BEP Reservoir has a target of 0.03 mg/L (statewide phosphorus criteria for stratified reservoirs per NR 102.06), Figure 16 appears to indicate that an approximate 85 percent TP load reduction would be needed to achieve the 0.03 mg/L TP concentration in the reservoir. It is requested that the report more clearly indicate than an approximate reduction in incoming TP loads of 85 percent are required in order for the reservoir to meet its criteria.

*This modeling report is intended to describe the empirical lake response model used to simulate the Big Eau Pleine Reservoir's response to phosphorus loadings; it is not intended as a vehicle for determining the loading capacity of the Big Eau Pleine Reservoir. The former task will be completed in a subsequent step of the TMDL development process.*

*Given the current state of water quality in the reservoir, it is clear that widespread implementation of best management practices will be required to achieve water quality*

*standards. The time required to achieve this will depend on the rate of adoption and implementation of practices on the landscape.*

*Water quality criteria are set to protect the designated uses of a waterbody. TMDL allocations are set to achieve water quality criteria. Preliminary calculations suggest that the total phosphorus export rates from agricultural lands needed to achieve water quality criteria in the Big Eau Pleine can be achieved and have been in other watersheds. If, at some point in the future, attainment of water criterion is found to be infeasible, it may be appropriate to conduct a Use Attainability Analysis.*

6. **WRDG** - It appears the annual reservoir-wide, area-weighted mean is the value that is used for comparison to the WQC. Is this correct? Should the growing season median be used instead?

*The TP criterion for lakes and reservoirs is based on the geometric mean during June 1 - Sept 15 (<http://dnr.wi.gov/topic/surfacewater/documents/2014/2014wiscalm.pdf>, page 26). Load reduction scenarios will be evaluated at each sample station used for waterbody assessment (upper middle, lower middle, and lower in BEP), and if any of these stations are exceeding the criterion, the lake will remain impaired (pages 20-22).*

7. **WRDG** - The sample locations were not displayed on the map in the report.

**NCWSC** - Include a watershed map to the BEP Reservoir in the report including subwatersheds for the BEP River, Freeman Creek and Fenwood Creek. Include sampling location points in Figure 1.

*The final report(s) will include figures depicting monitoring stations.*

8. **WRDG** - Earlier documentation indicated that Spirit Lake Flowage, Dexter Lake, and the Tri Lakes, would also be modeled in addition to those already completed. What is the status of the modeling effort?

*The existing models for Spirit River Flowage and Tri Lakes are being reviewed for their suitability in determining appropriate in-lake phosphorus goals and their ability to describe phosphorus transport through these systems. Similarly, analysis of Dexter Lake water quality data is ongoing.*

## Wisconsin River SWAT Model

*Wisconsin River SWAT Model: Draft Calibrated Model and Next Steps, Aaron Ruesch and Andrew Radecki, WDNR, May 2016.*

9. **NCWSC** - NCWSC supports WDNR's efforts to refine the SWAT modeling using empirical methods to adjust loads at gauging stations and to adjust the model to simulate within-channel phosphorus, routing and release. It is requested that these efforts be fully documented and available for review.

*Draft methods memo:*

<https://onedrive.live.com/redir?resid=762B3F11A30B9F73!118&authkey=!AGBznYBwJYe67h0&ithint=file%2cdocx>

*Draft diagnostic plots*

<https://www.dropbox.com/sh/uiy4k0k5xvpw31c/AACLtWjsHRUIZxzjYMNfHiC8a?dl=0>

10. **NCWSC** - Provide information on how TSS wasteload allocations will be developed. It is our understanding that a number of tributaries of the Baraboo River are impaired for TSS and the remainder of the Wisconsin River Basin watershed is not TSS impaired.

*TSS allocations will be developed for tributaries with TSS impairments. The specific TSS allocation methodology is still under development.*

11. **WRDG** - Could the discussions of the bias correction in slides 24 and 25 be explained further? How are these adjustment being made? Is the bias adjustment described on slide 24 going to be made at locations without gauging station data as well?

*Draft methods memo:*

<https://onedrive.live.com/redir?resid=762B3F11A30B9F73!118&authkey=!AGBznYBwJYe67h0&ithint=file%2cdocx>

*Draft diagnostic plots*

<https://www.dropbox.com/sh/uiy4k0k5xvpw31c/AACLtWjsHRUIZxzjYMNfHiC8a?dl=0>

12. **WRDG** - Slide 26 shows an example adjusted data set for TP. Will the bias corrected calibration data for other parameters and locations be provided for review also? WRDG comments were provided in October 2015 regarding sediment and TP plots provided at that time and comparison to more recent plots may be helpful.

*Draft methods memo:*

<https://onedrive.live.com/redirect?resid=762B3F11A30B9F73!118&authkey=!AGBznYBwJYe67h0&ithint=file%2cdocx>

*Draft diagnostic plots*

<https://www.dropbox.com/sh/uiy4k0k5xvpw31c/AACltWjsHRUIZxzjYMNfHiC8a?dl=0>

## **Modeling Integration Database**

13. **NCWSC** - It is requested that WDNR provide a summary of how CE-QUAL-W2, BATHTUB, and SWAT modeling will be integrated into each other, including the status of each of the reservoir models.

*This information will be presented at our next technical stakeholder meeting. At that meeting we will provide a summary of how all the model outputs are being used among the different models and for the development of allocations. In addition, WDNR will present the proposed allocation methodology. This meeting will likely be an online meeting and will occur towards the end of summer 2016, prior to the release of the draft allocations.*