Lake Koshkonong Water Quality Modeling
For the
Lake Level Change Environmental Assessment

Conducted by

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Attachment 8. Water Quality Modeling for Lake Koshkong

Introduction

The following water quality modeling analysis is being conducted to assess the environmental impact of a proposal submitted by the Rock Koshkonong Lake District to: a) eliminate the winter draw down and b) raise the winter and summer pools 7.2 inches above the current summer pool elevation for Lake Koshkonong. The following nutrient loading modeling analysis focuses on the water column total phosphorus (TP) concentration before and after the proposed level change. Modeling was conducted using the Wisconsin Lake Modeling Suite (WiLMS) model. WiLMS is a Windows based planning level modeling system that couples 13 empirical lake response models with an export coefficient based watershed and point source loading module (Panuska and Kreider, 2002).

Method of Analysis

The time period used for the model study was October 1998 through September 1999. The 1998-99 period was chosen because the USGS monitored flow and total phosphorus loading in the Rock River and the water column TP in Lake Koshkonong concurrently during that time. This period was used to represent a base line condition against which the water column TP concentration associated with the proposed change in water level was compared. Additional information not included in Tables 1 and 2 is contained Appendix A. The empirical model selected from WiLMS for use in the analysis was the Vollenweider 1982, Combined OECD which was found to fit the parameters for the Lake Koshkonong system.

Information provided by the applicant for the proposed surface area and elevation change was used to calculate the lake volume for the proposed condition. The net internal loading for the proposed condition was estimates by extrapolating the existing areal internal loading using the proposed increase in lake surface area. The analysis assumed that the land uses within the direct tributary area did not change as a result of the proposed conditions. The surface area and volume used in the analysis were calculated at a point assumed to be located half way between the proposed target level of 776.8 MSL and the maximum level of 777.0 MSL. This condition was selected because it is assumed that the lake level will be within this range the majority of the time. In addition, due to lack of specific data this analysis was not able to consider the impact of changes in boating activity.

Model Inputs

Table 1 below summarizes the WiLMS model inputs and data sources used in the analysis.

Table 1

A Summary of WiLMS Model Inputs

Parameter	Value	Data Source
Net Precipitation	3.0 In.	Regional Maps
Rock R. TP Load	4.72×10^5 Kg	USGS Water Data 1998-99
Rock R.. Flow	1.53×10^9 m^3	USGS Water Data 1998-99
Direct Area Loading	45,540 Kg	Land use export values
Direct Area Flow	92,240 AF	WiLMS default runoff 7.2 In.

Results and Discussion

Table 2 below summarizes the output from WiLMS for both the base line and proposed conditions.

Table 2

A summary of WiLMS Output

Parameter	Baseline Value	Proposed Value	Change
Lake Surface Area	10,460 Ac	10,513 Ac.	53 Ac
Lake Volume	55,793 AF	63,133 AF	7,340 AF
Internal Loading	740,000 LB	743,780 LB	3,780 LB
Water Residence Time	15.6 Days	17.5 Days	1.9 Days
Ave. Annual Water Column TP	312 ug/l	310 ug/l	1 ug/l

WiLMS predicts a 70% confidence range (170-520 ug/l) around the predicted mean TP of 310 ug/l. Given this range of prediction uncertainty, a change of -2 ug/l is essentially insignificant.

Conclusion

Review of the results summarized in Table 2 indicates a realistically insignificant change in water residence time and water column TP. It therefore appears reasonable to conclude that the proposed change in water level would not result in a measurable change in the average annual water column TP concentration and the associated trophic state indicators. It is important to note however that due to lack of data this analysis did not consider the impact of changes in boating activity.

References

Panuska, J.C., and Kreider, J.C., 2002, Wisconsin lake modeling suite program documentation and user's manual, Version 3.3 for Windows: Wisconsin Department of Natural Resources PUBL-WR-363-94, 32 p. [Available online through the Wisconsin Lakes Partnership: accessed March 16, 2004, at URL http://www.dnr.state.wi.us/org/water/fhp/lakes/laketool.htm]

Appendix A

WiLMS Model Printouts