TARRANT REGIONAL WATER DISTRICT
Environmental Services
Memorandum

Date: **August 13, 2009**

To: **North Central Texas Water Quality Group**

From: **Mark Ernst**

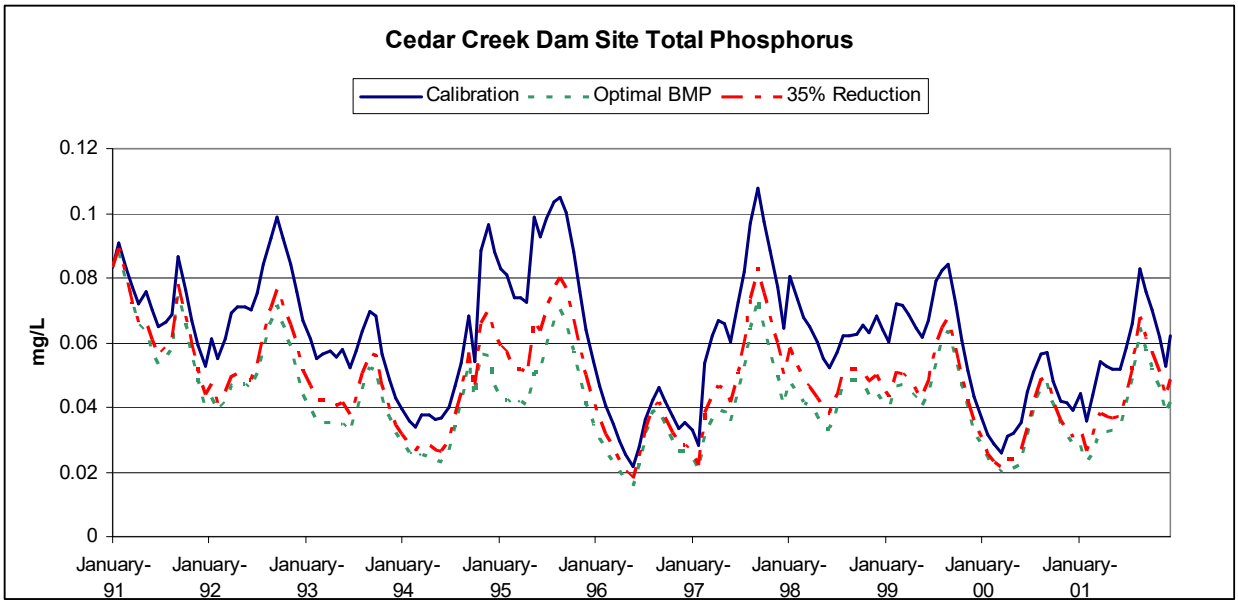
Subject: **Simulation of Optimal Cedar Creek BMP analysis in WASP**

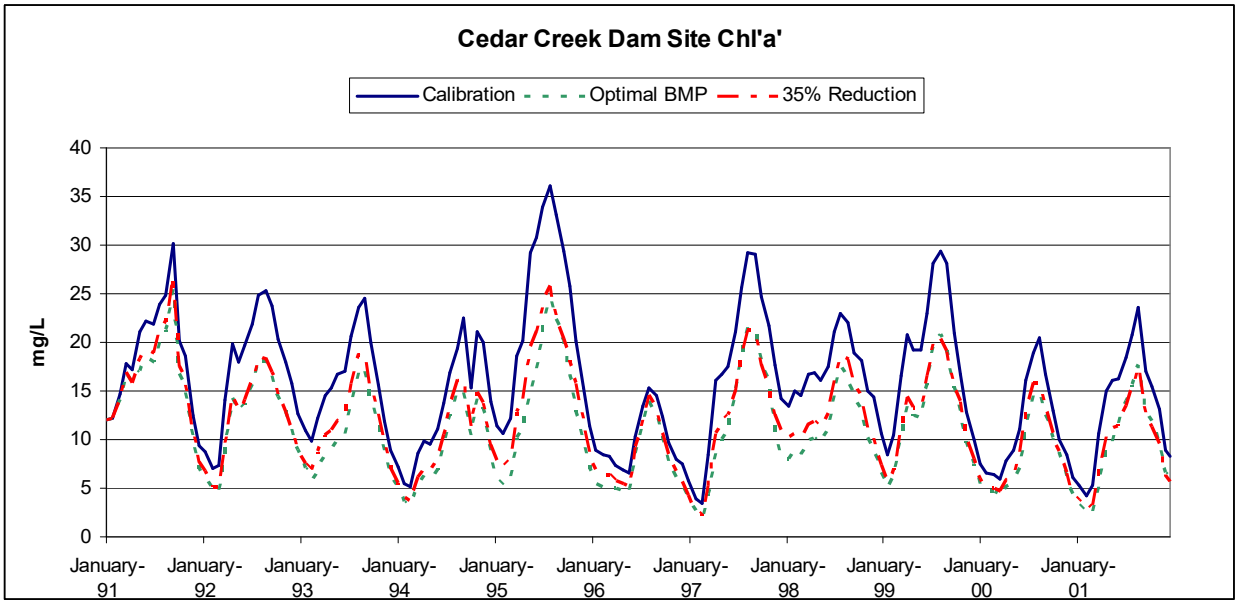
The 11-year WASP model was initially used in the Cedar Creek Project to provide direction on the degree of phosphorus reduction that would be necessary to translate into a reduction in Chl'a' that was meaningful. The daily watershed loading file (nps file generated by SWAT) was systematically reduced by a scaling factor from 15% to 65% to determine when Chl'a' was significantly ($p<0.05$) less than the calibration results at two sites in the main pool of the reservoir. This exercise determined at 30-35% reduction was necessary to see a statistically significant reduction in Chl'a' at the Dam and Intake areas of Cedar Creek Reservoir. The stakeholders on the project adopted a 35% total phosphorus reduction goal for the project.

It must be emphasized that the WASP simulation was done with a scalar on the NPS file that reduced the daily load by a set amount. Subsequent analysis by SWAT and the Economic Model used the target of 35% reduction to guide their efforts, however they were focused on 35% of the average annual load as a target. There has been some question as to whether implementing the Optimal solution based on a 35% total phosphorus reduction will actually result in the desire impacts in Cedar Creek Reservoir. This exercise is aimed at looking at that question.

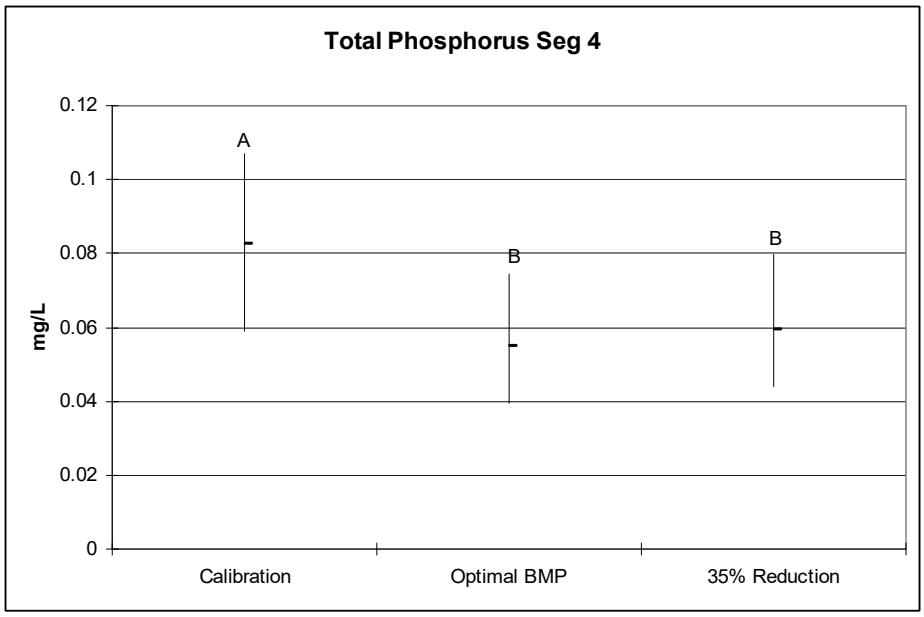
The Economic Model has selected an optimal solution of 8 BMP's that reduces the phosphorus loading by the target goal of 35%. This solution was given back to the SWAT modelers who implemented the suite of BMP's. A new NPS file was generated and run in the WASP model.

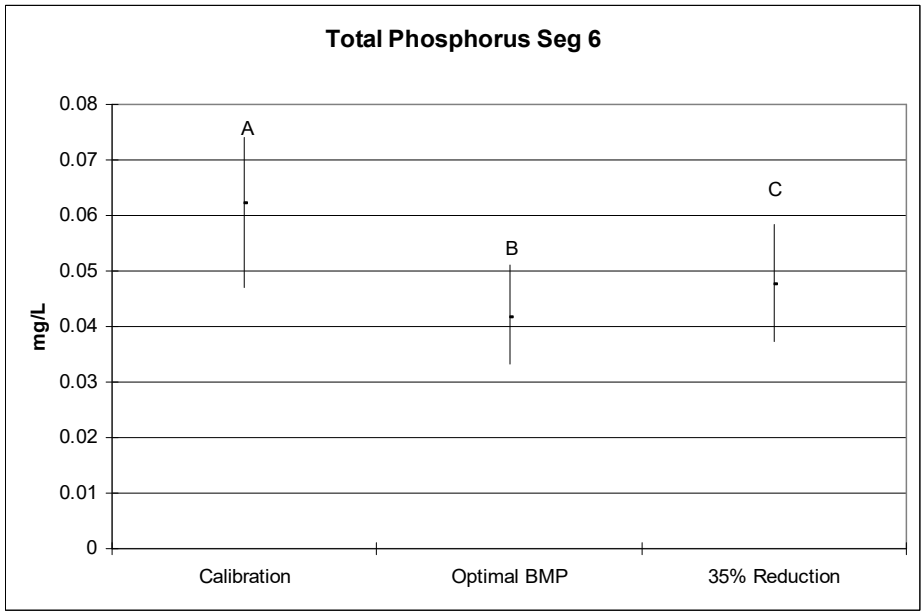
Figure 1 and 2 show time series plots of the TP and Chl'a' at the dam (Seg 6) for three scenarios: calibrated model, Optimal solution with 8 BMP's and the systematic reduction of 35%. Both parameters show a reduction from the calibrated model and indicate similar results for the Optimal solution and 35% reduction scenario.





The following figures compare the three scenarios by calculating the overall median and 75th and 25th percentiles. These medians were tested to see if they were statistically different from the calibration median ($p<0.05$) with a Kruskal-Wallis nonparametic multiple range test. This was the same technique employed to test the systematic reductions at the beginning of this project. The results here show that at the intake (Seg 4) and dam (Seg 6) the Optimal Solution was significantly lower than the calibration median. The Optimal Solution was even a bit lower than the 35% reduction scenario, but these differences are only statistically less for total phosphorus at the dam site (Seg 6).


Total Phosphorus Seg 4
0.12
0.1
0.08
0.06
0.04
0.02
0
mg/L
A
B
B
Calibration
Optimal BMP
35% Reduction


Total Phosphorus Seg 6
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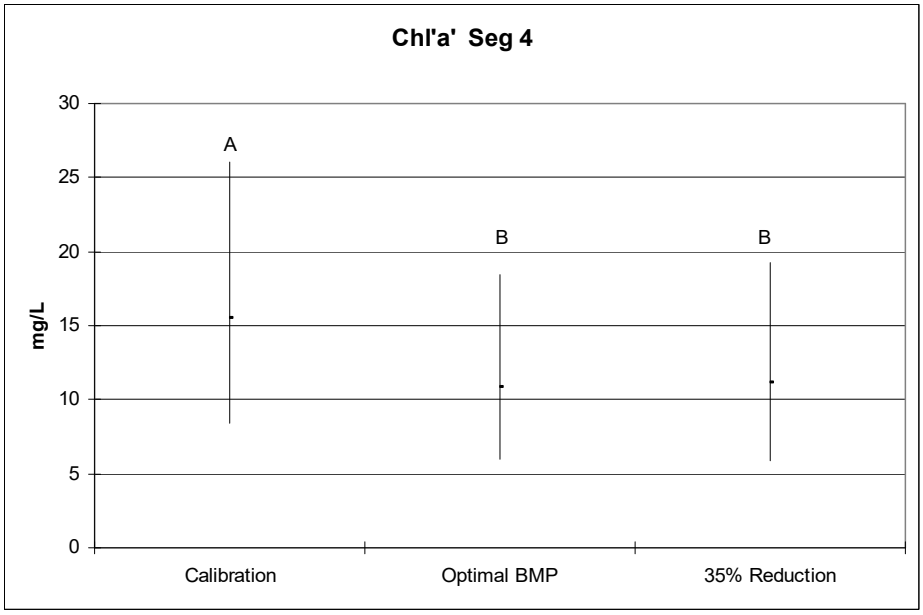
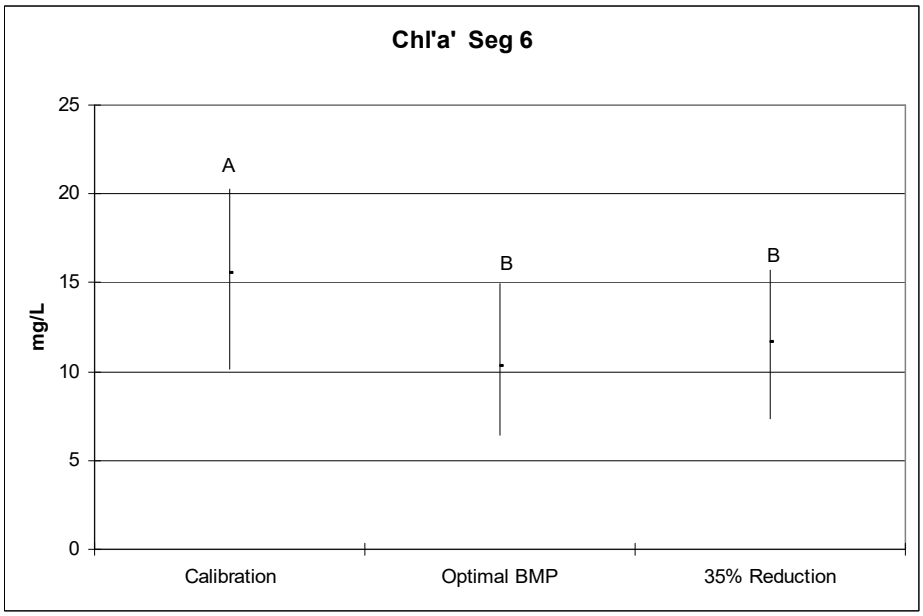
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
mg/L
A
B
C
Calibration
Optimal BMP
35% Reduction





In conclusion, the WASP modeling suggests that the Optimal Solution BMP's scenario will reduce the phosphorus loading to a sufficient level to result in significant reductions in Chl'a' that were targeted by this project.

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