Madison Area Lakes Data Summary and Draft Recommendations

The WDNR recently received access to the University of Wisconsin's long term ecological research program's data on the Yahara chain of lakes, as well as, beach closure and cyanotoxin data from Dane County. Central office summarized this data along with WDNR data to provide a more complete picture of the water quality in the Madison area lakes and draw preliminary recommendations. Please review the follow summaries, recommendations, and data sets and provide any corrections, recommendations, or suggestions.

Lake Mendota data summary - Total phosphorus (TP) and chlorophyll *a* (chl. *a*) data collected at the deep hole location by WDNR and/or UW's Long Term Ecological Research (LTER) program exceed the TP recreational impairment threshold and the chl. *a* recreational impairment threshold (Mendota attachment). Additionally, Dane County, which manages Lake Mendota's eight public beaches, reported 58 beach closures from 2007-2010 on Lake Mendota due to blue-green algae blooms, leading to 182 lost beach days (Beach closure attachment). Dane County also collected 43 cyanotoxin samples at Lake Mendota beaches during algal blooms and 23 of these samples exceed the World Health Organization's (WHO) high risk threshold for exposure to cyanotoxins. The WDNR also collected three chl. *a* samples from Lake Mendota beaches in 2004 and 2005 and two of these samples exceeded the WHO's high risk threshold for exposure to cyanotoxins (Mendota attachment)

Lake Monona data summary – Total phosphorus and chl. *a* samples collected from the deep hole station of Lake Monona were found to exceed the TP and chl. *a* recreational impairment thresholds and the TP and chl. *a* data collected from the center of Monona Bay exceeds both the recreational and Fish and Aquatic Life (FAL) impairment thresholds (Monona attachment). WDNR also collected chl. *a* data from Turville Bay and it also exceeded the chl. a recreational impairment threshold (Monona attachment).
Dane County reported 56 beach closures on Lake Monona due to blue-green algae blooms from 2007-2010 leading to 168 lost beach days (Beach closure attachment). Dane County collected 45 cyanotoxin samples at Lake Monona beaches during algal blooms in 2008 and 2009 and found 37 samples exceeded the WHO's high risk threshold for exposure to cyanotoxins.

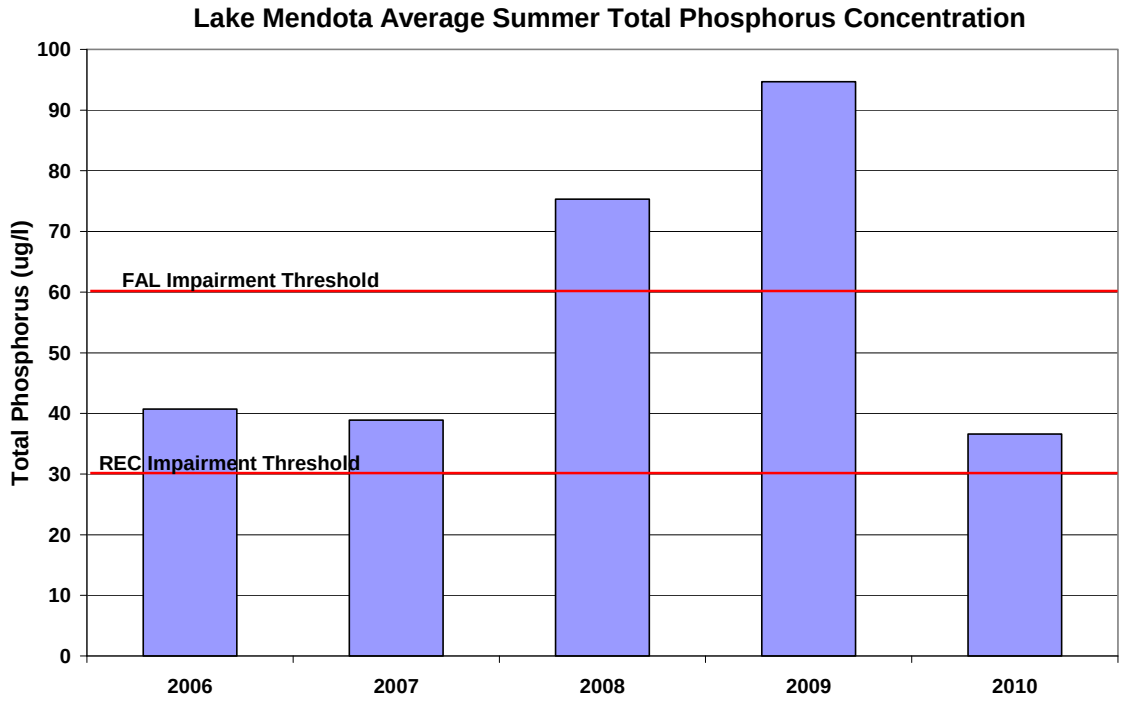
Lake Waubesa data summary – Total phosphorus data collected from the deep hole location exceeds the TP recreational impairment threshold every year for the last 10 years, however, the deep hole chl. *a* data only exceeds the chl. *a* recreational impairment threshold two of the past five years (Waubesa attachment). Blue green algae blooms led to Goodland Park beach at Lake Waubesa being closed four times in 2009 for a total of 19 lost beach days (Beach closure attachment). Dane county collected cyanotoxin samples seven times at Goodland beach and all seven samples exceeded the WHO's high risk threshold for exposure to cyanotoxins as did the two near shore chl. *a* samples collected in 2007 by the WDNR (Waubesa attachment)

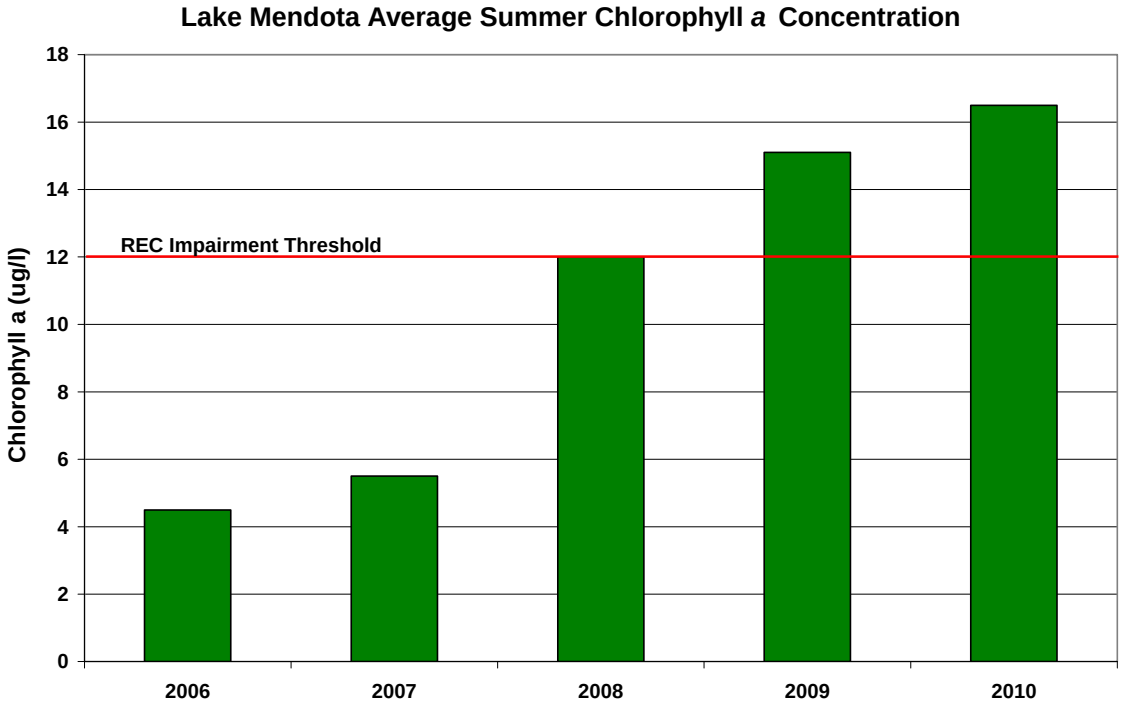
Lake Kegonsa data summary – Total phosphorus and chl. *a* samples collected from the deep hole station of Lake Kegonsa were found to exceed the TP and chl. *a* recreational impairment thresholds (Kegonsa attachment). Dane County also closed the beach at Lake Kegonsa State Park in 2007 because of blue-green algae blooms (Beach closure attachment). While no cyanotoxin samples have been collected at Lake Kegonsa beaches, WDNR collected near shore chl. *a* data seven times since 2005 and all seven samples exceeded the WHO's high risk threshold for exposure to cyanotoxins.

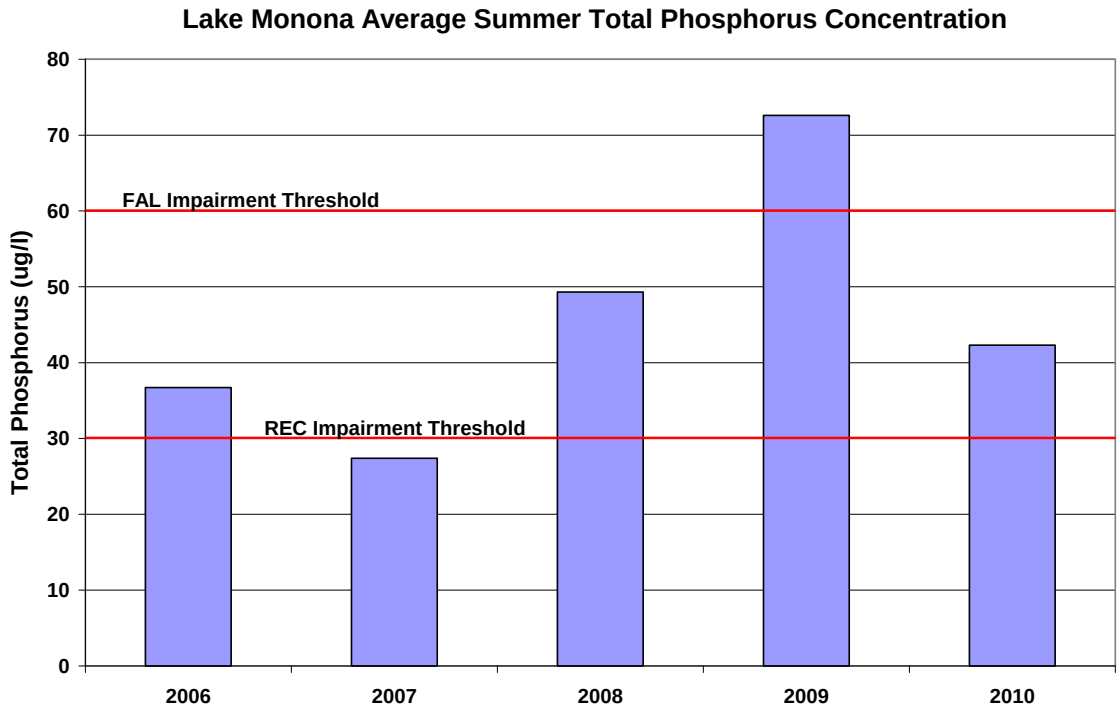
Lake Wingra data summary – Deep hole TP data from both the WDNR and LTER exceed the recreational TP threshold in Lake Wingra, but the deep hole chl. *a* data does not exceed the chl. *a* recreational impairment threshold (Wingra attachment). The most recent chl. *a* data collected from Villas Beach often exceeds the WHO's moderate risk threshold for exposure to cyanotoxins but never exceeds the WHO's high risk threshold (Wingra attachment). Dane County closed Villas Beach at Lake Wingra a total of 3 times due to blue-green algae blooms from 2007-2010 and only two of seven cyanotoxin samples collected exceeded the WHO's high risk threshold (Beach closure attachment).

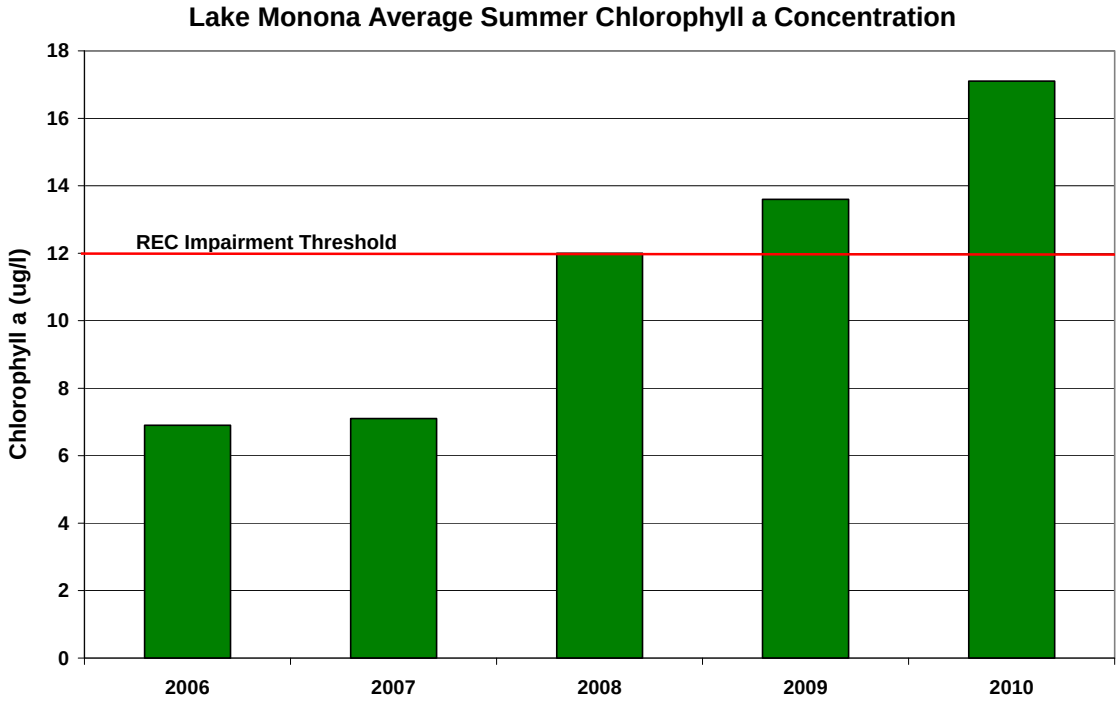
Recommendations – Our preliminary recommendation is to consider the recreational designated uses for Lakes Mendota, Monona, Waubesa, and Kegonsa as impaired with total phosphorus listed as the responsible pollutant. The numerous blue-green algae driven beach closures and elevated near shore chl. *a* and cyanotoxin values limit the recreational use of these lakes and are indicative of ongoing cultural eutrophication. Lakes Mendota, Monona, and Kegonsa exceed both the TP and the chl. a recreational impairment thresholds, meeting the listing criteria outlined in the 2012 WisCalm, and Waubesa clearly exceeds the TP impairment threshold and has violated the chl. a threshold for the last two years. The elevated levels of TP in these lakes, as demonstrated by the repeated exceedance of the recreational TP threshold, has been identified in several scientific studies as the cause of the excessive blue-green algal production (Lathrop, 1992a,b, Lathrop et al, 1997, Soranno et al 1997).

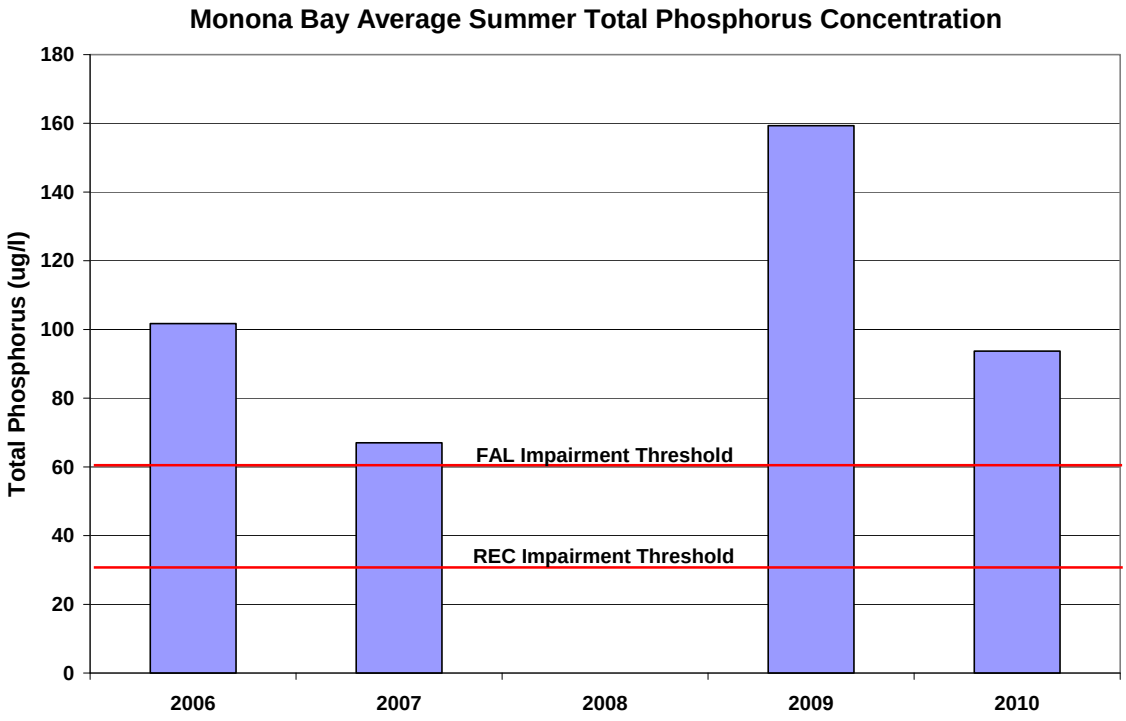
Finally, we recommend that Lake Wingra be considered a "watch water" and monitoring efforts continued. While the TP values for Lake Wingra exceed the recreational threshold, the available chl. *a* and beach closure data do not indicate an impairment of the recreational use.

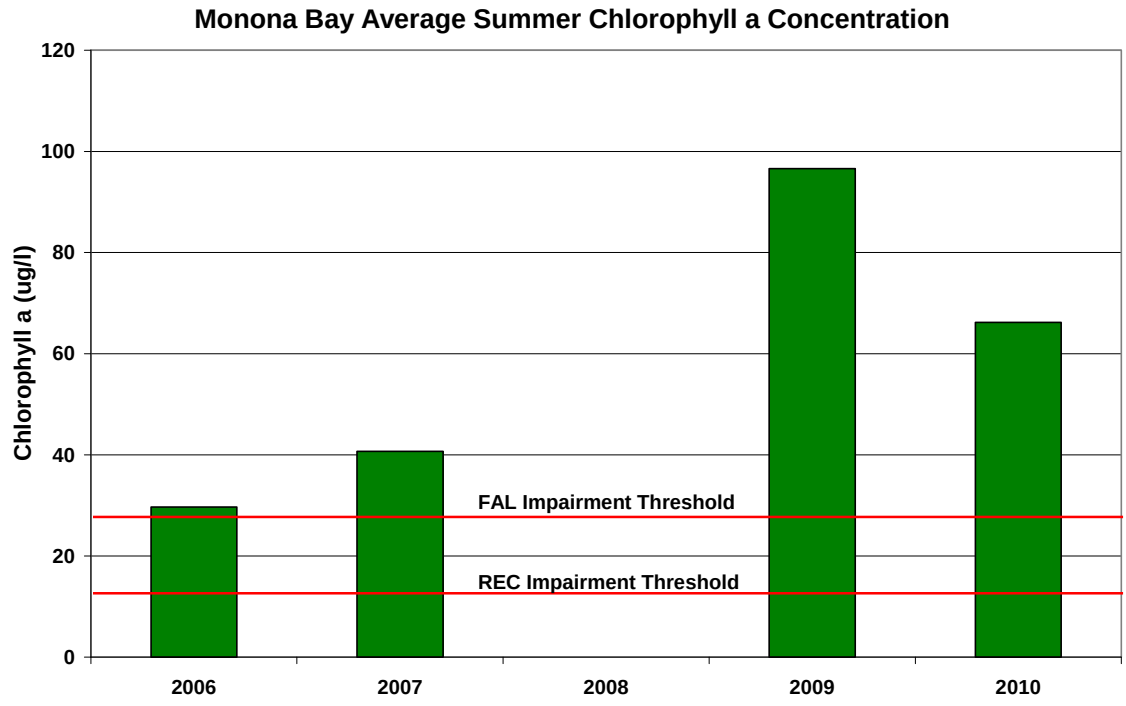

Lake Mendota Average Summer Total Phosphorus Concentration
Total Phosphorus (ug/l)
100
90
80
70
60
50
40
30
20
10
0
FAL Impairment Threshold
REC Impairment Threshold
2006
2007
2008
2009
2010

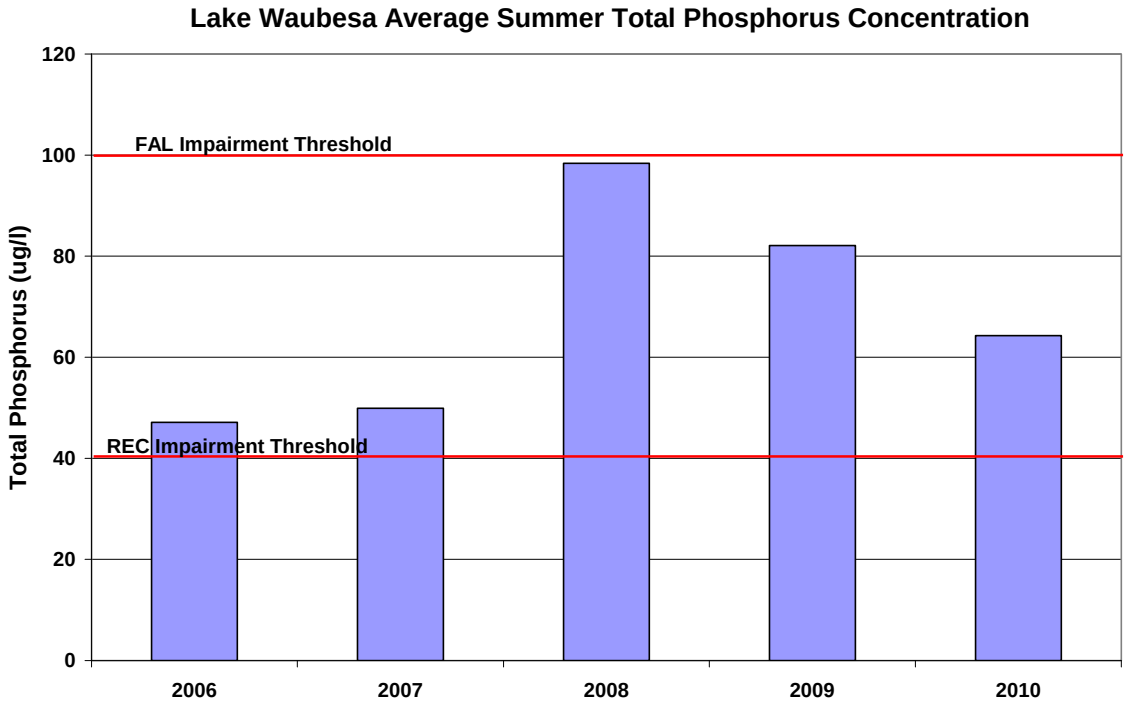

Lake Mendota Average Summer Chlorophyll a Concentration
Chlorophyll a (ug/l)
18
16
14
12
10
8
6
4
2
0
REC Impairment Threshold
2006
2007
2008
2009
2010

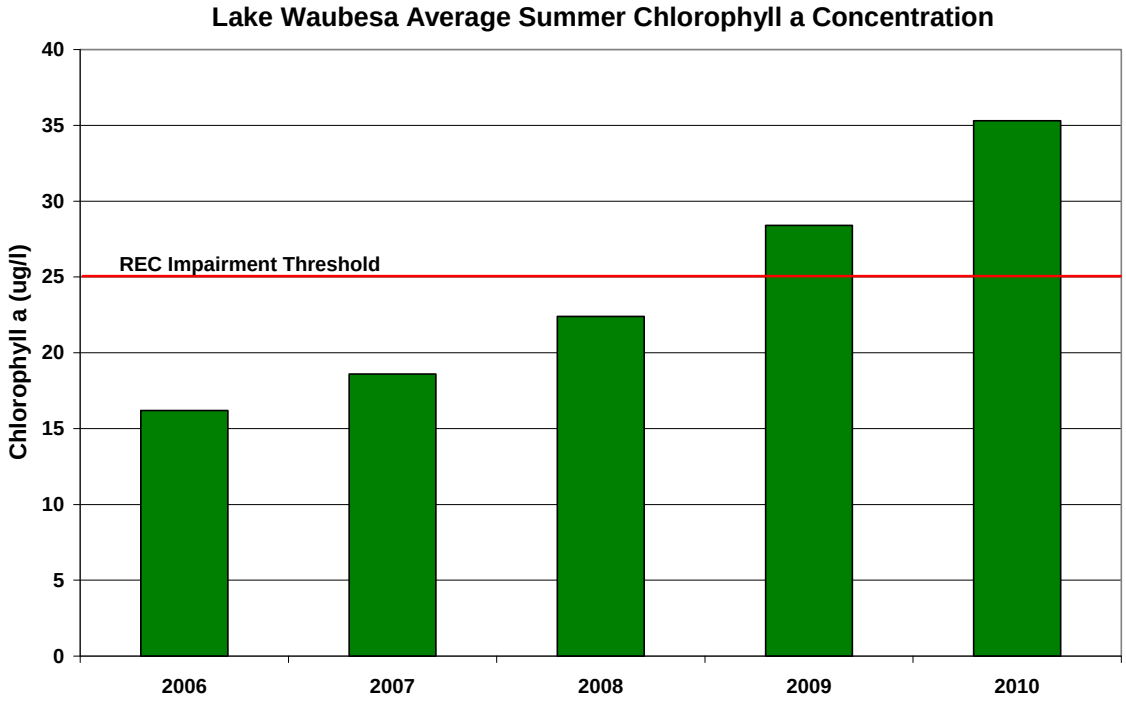

Lake Monona Average Summer Total Phosphorus Concentration
Total Phosphorus (ug/l)
80
70
60
50
40
30
20
10
0
FAL Impairment Threshold
REC Impairment Threshold
2006
2007
2008
2009
2010


Lake Monona Average Summer Chlorophyll a Concentration
Chlorophyll a (ug/l)
18
16
14
12
10
8
6
4
2
0
REC Impairment Threshold
2006
2007
2008
2009
2010

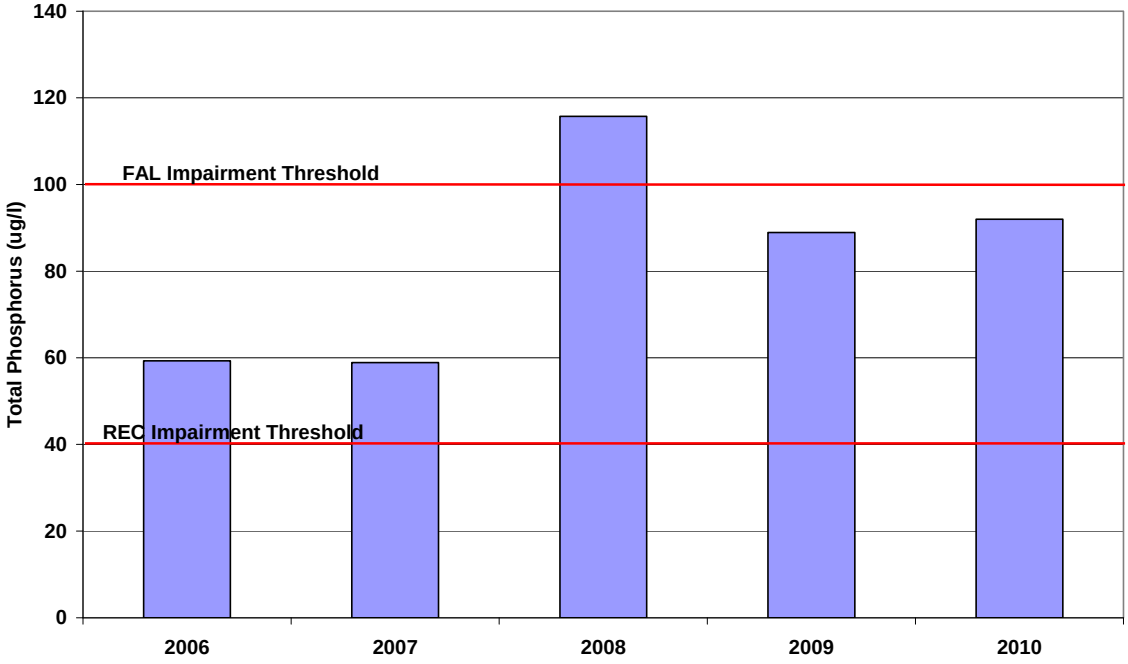

Monona Bay Average Summer Total Phosphorus Concentration
Total Phosphorus (ug/l)
180
160
140
120
100
80
60
40
20
0
FAL Impairment Threshold
REC Impairment Threshold
2006
2007
2008
2009
2010


Monona Bay Average Summer Chlorophyll a Concentration
Chlorophyll a (ug/l)
120
100
80
60
40
20
0
FAL Impairment Threshold
REC Impairment Threshold
2006
2007
2008
2009
2010

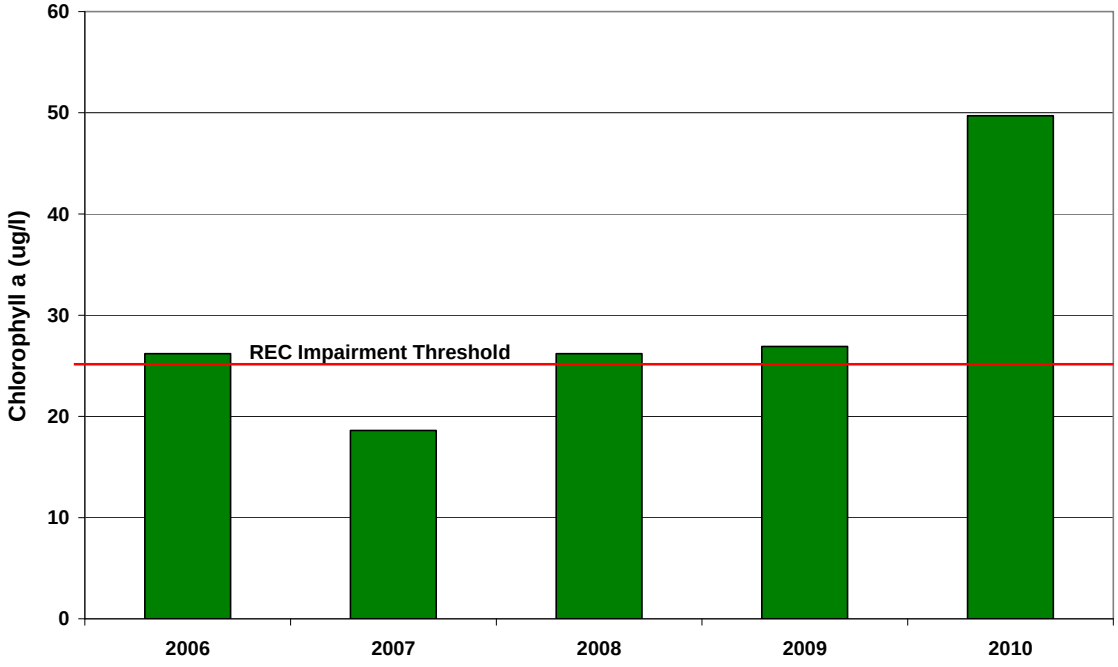

Lake Waubesa Average Summer Total Phosphorus Concentration
Total Phosphorus (ug/l)
120
100
80
60
40
20
0
FAL Impairment Threshold
REC Impairment Threshold
2006
2007
2008
2009
2010

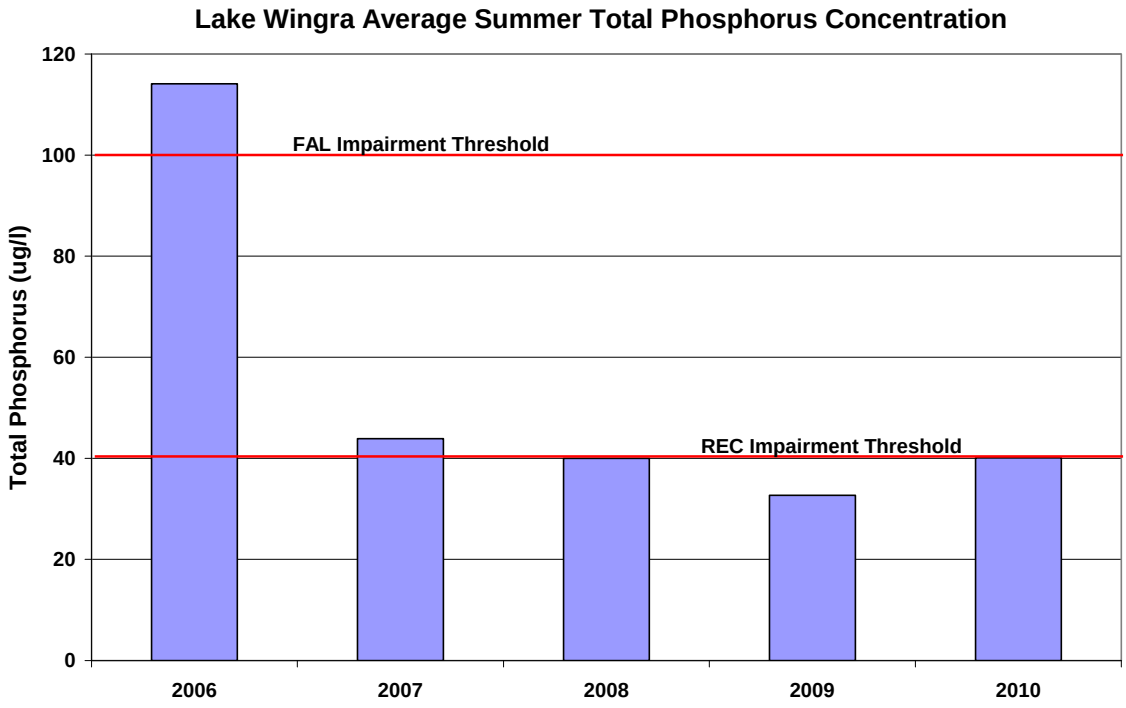

Lake Waubesa Average Summer Chlorophyll a Concentration
Chlorophyll a (ug/l)
40
35
30
25
20
15
10
5
0
REC Impairment Threshold
2006
2007
2008
2009
2010

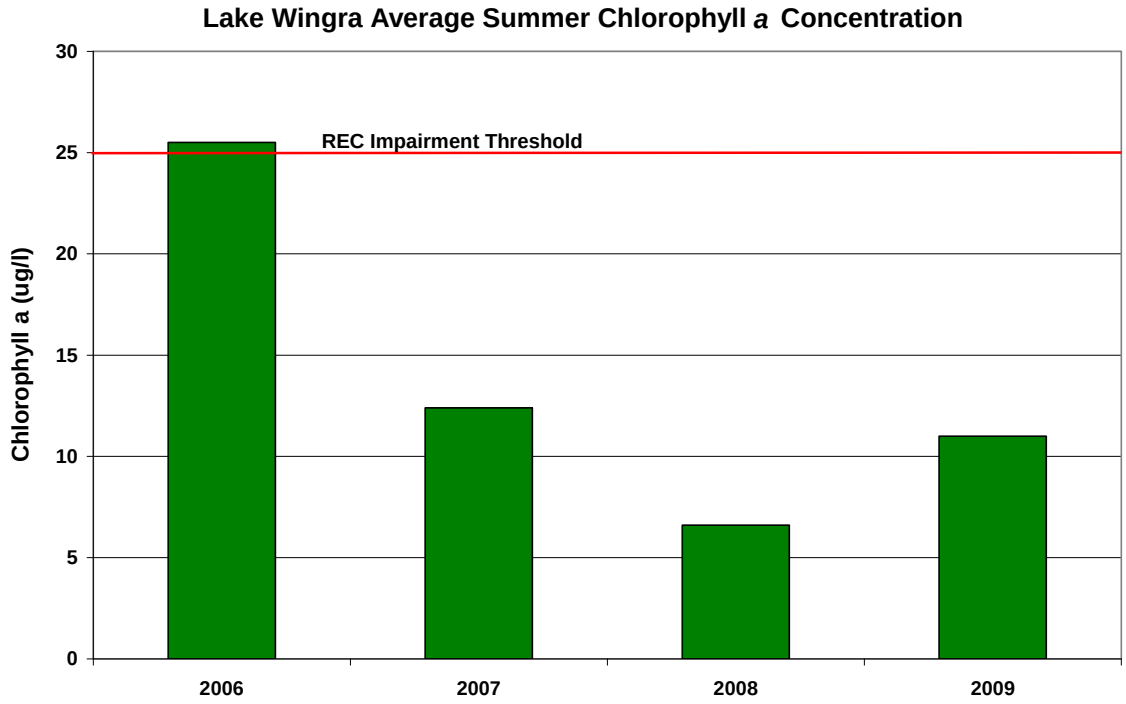
Lake Kegonsa Average Summer Total Phosphorus Concentration



Lake Kegonsa Average Summer Chlorophyll a Concentration




Lake Wingra Average Summer Total Phosphorus Concentration
Total Phosphorus (ug/l)
120
100
80
60
40
20
0
FAL Impairment Threshold
REC Impairment Threshold
2006
2007
2008
2009
2010


Lake Wingra Average Summer Chlorophyll a Concentration
Chlorophyll a (ug/l)
30
25
20
15
10
5
0
REC Impairment Threshold
2006
2007
2008
2009