Alabama Department of Environmental Management

Tennessee River Basin

Rivers and Reservoirs Monitoring Program

Round Island Creek Embayment
Wheeler Reservoir
Intensive Basin Survey 2015

WHEL-8: Round Island Creek approx 1.5 mi upstream of confluence with TN R (Limestone Co 34.698/-

BACKGROUND

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM's 2012 Monitoring Strategy (ADEM 2012).

In 2015, ADEM monitored the Round Island Creek tributary embayment of Wheeler Reservoir as part of the basin assessment of the Tennessee River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in the Round Island Creek embayment (WHEL-8) during the 2015 growing season (Apr-Oct). This is the fourth basin assessment of the Tennessee River since ADEM began sampling. Monthly and/or mean concentrations of nutrients [total nitrogen (TN); total phosphorus (TP)], algal biomass/productivity [chlorophyll *a* (chl *a*); algal growth potential testing (AGPT)], sediment [total suspended solids (TSS)], and trophic state [Carlson's trophic state index (TSI)] from 2015 were compared to ADEM's historical data and established criteria.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Round Island Creek is classified as a *Fish & Wildlife (F&W)* stream located in the Eastern Highland Rim ecoregion (71g). Based on the 2006 National Land Cover Dataset, land use within the 52 mi^2 watershed is predominantly agriculture (63%) (Fig. 3). As of January 28, 2016, ADEM has issued a total of 9 NPDES permits within the watershed. Two of those permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Round Island Creek embayment at WHEL-8 is located just south of Athens, AL. It is a fairly wide and shallow embayment which flows into the Tennessee River near river mile 297. Round Island Creek has a mean bottom depth of 2.45 m (Table 2) at the sampling location.

Figure 1. Photo of Round Island Creek at WHEL-8.

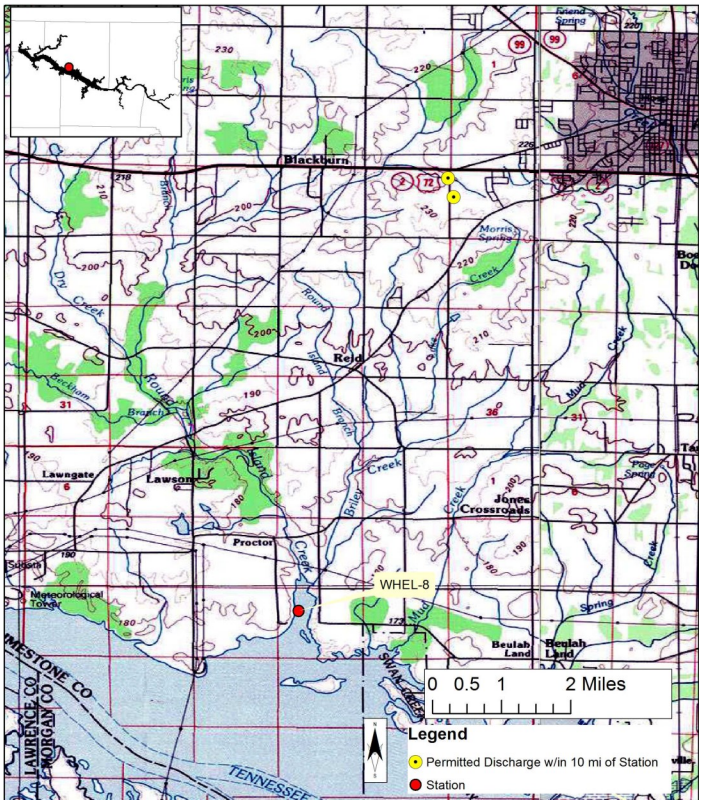


Figure 2. Map of Round Island Creek embayment of Wheeler Reservoir. Though additional permitted facilities may occur in the watershed (Table 1), only those within 10 miles upstream of the station are displayed on the map.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2015), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013).

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2015 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2. The axis ranges of the graphs in Figs. 4-6 were set to maximum values reservoir wide so all embayment reports on the same reservoir could be compared.

Table 1: Summary of Watershed **WHEL-8**

Basin		Tennessee R
Drainage Area (mi^2)		52
Ecoregion[a]		71g
% Land use		
Open Water		<1%
Developed	Open Space	5%
	Low Intensity	1%
	Medium Intensity	<1%
	High Intensity	<1%
Barren Land		<1%
Forest	Deciduous Forest	13%
	Evergreen Forest	2%
	Mixed Forest	1%
Shrub/Scrub		5%
Herbaceous		2%
Hay/Pasture		42%
Cultivated Crops		21%
Wetlands	Woody	7%
	Emergent	<1%
# NPDES outfalls[b]	TOTAL	9
Construction Stormwater		1
Small Mining		2
Industrial General		6

a. Eastern Highland Rim
b. #NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

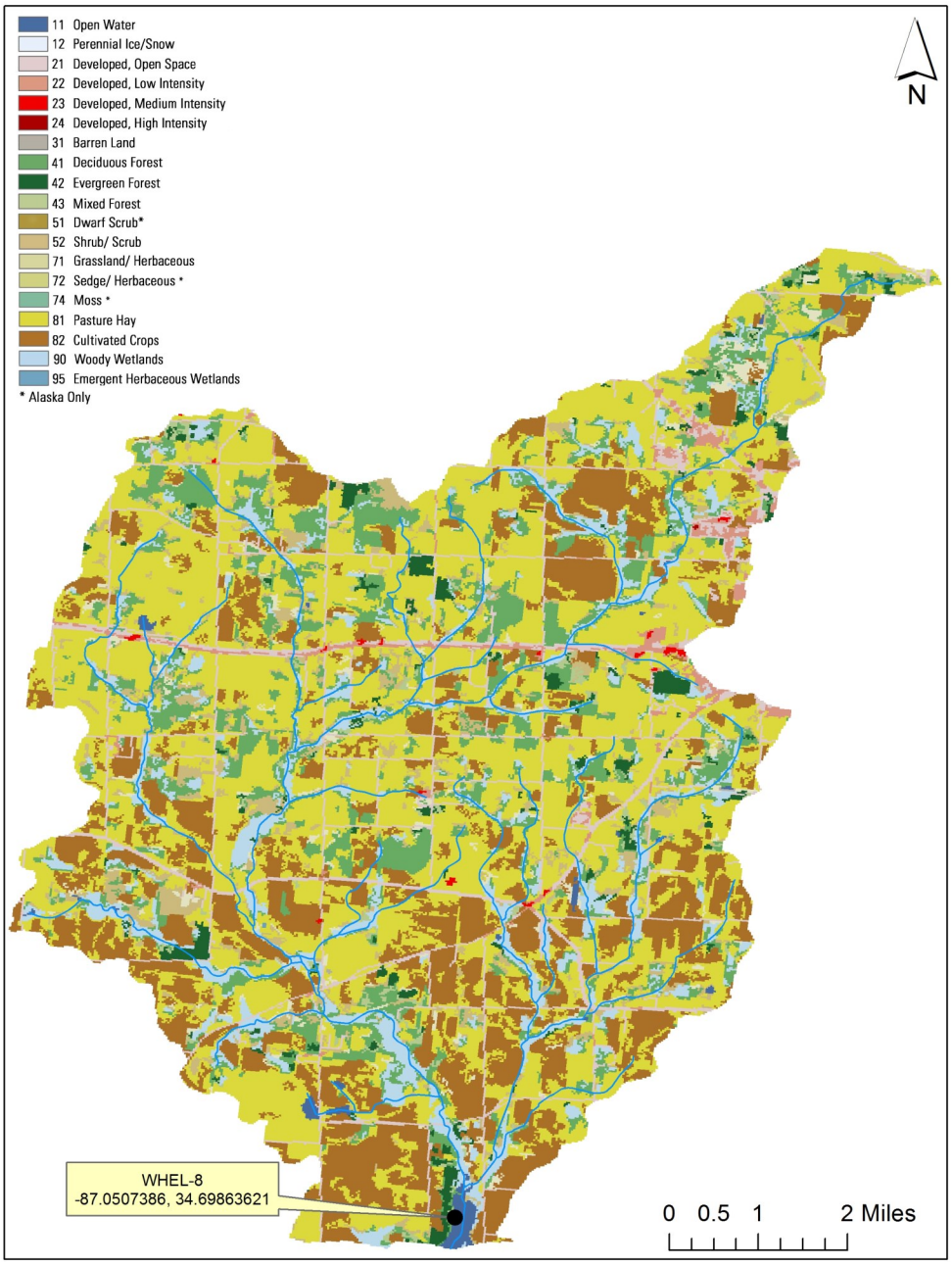


Figure 3. Land use within the Round Island Creek watershed at WHEL-8.

The mean growing season TN value increased 2003 through 2013 then declined in 2015 (Fig. 4). Monthly TN concentrations were highest in April and August.

The mean growing season TP concentration has steadily declined 2009 through 2015 (Fig. 4). Highest monthly TP concentrations were measured in April and August.

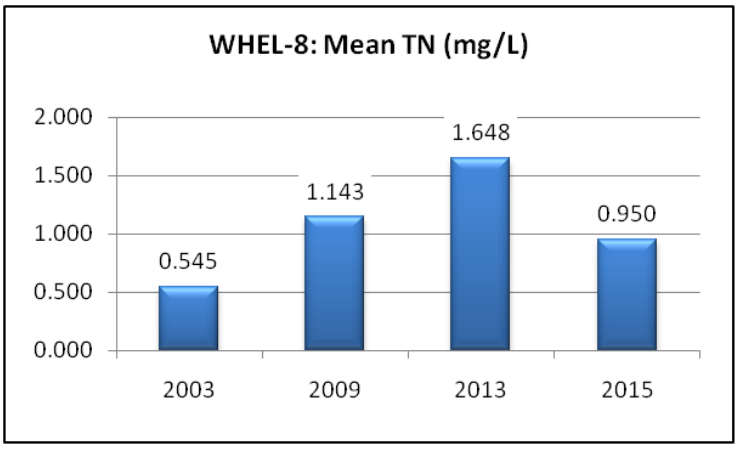
The mean growing season chl *a* value increased from 2003 through 2013 then declined in 2015 (Fig. 4). Monthly chl *a* concentrations were highest in August and September.

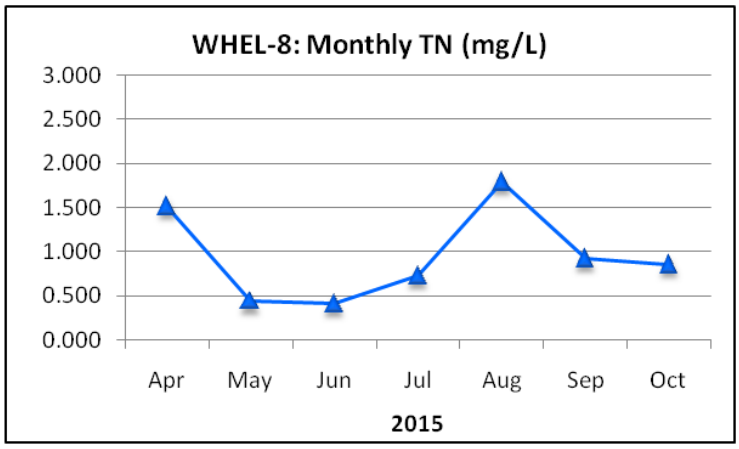
Mean TSI values have remained eutrophic all years monitored (Fig. 4). Monthly TSI in Round Island Creek was eutrophic July through October.

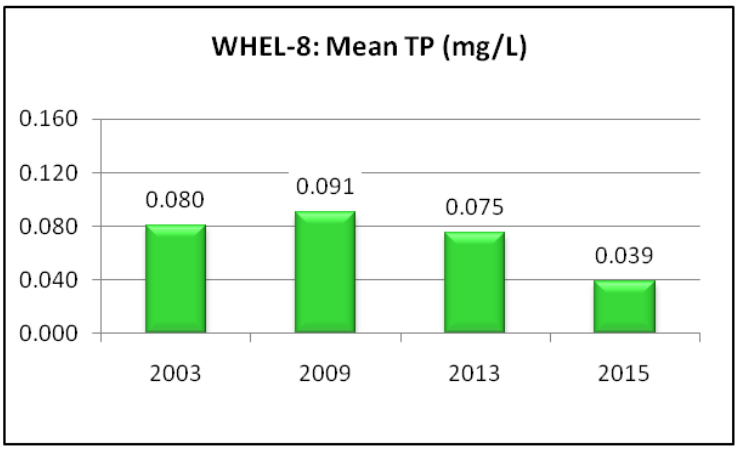
The mean growing season TSS value has declined 2003 through 2015 (Fig. 5). Monthly TSS concentrations were highest in May and August.

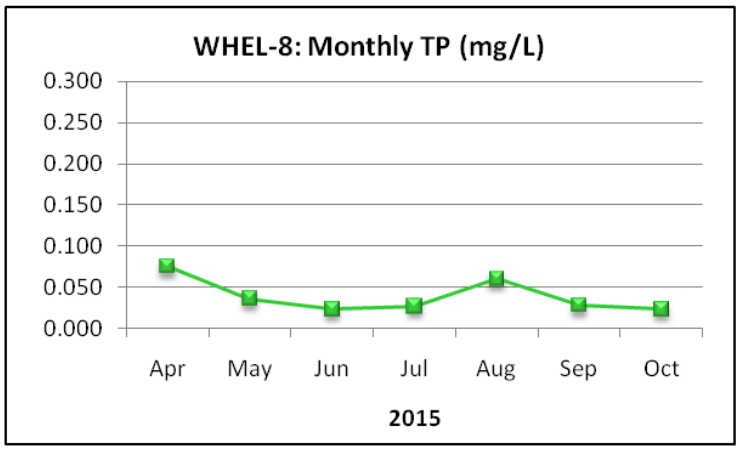
No AGPT sample was collected from Round Island Creek in 2015. Results from 2003 -2013 are shown in Table 3.

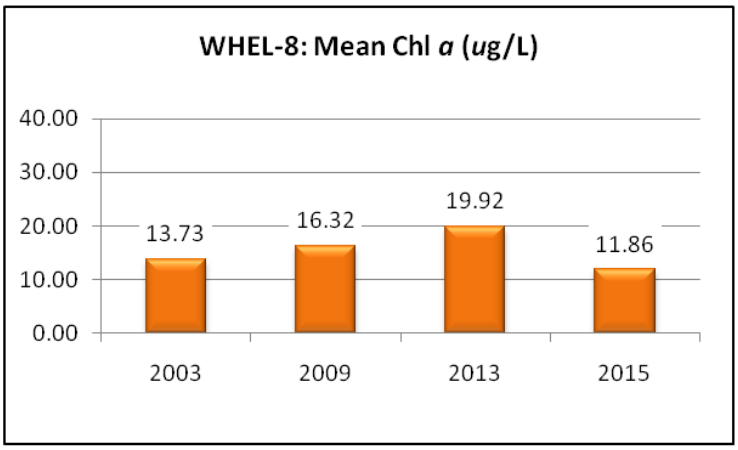
The DO concentration in the WHEL-8 station was below the ADEM criteria limit (ADEM Admin. Code R. 335-6-10-.09) of 5.0 mg/L at 5.0 ft (1.5 m) in July (Fig. 6).

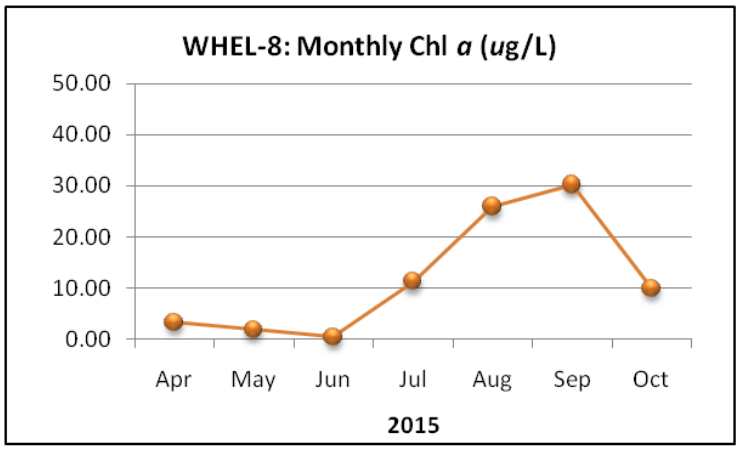


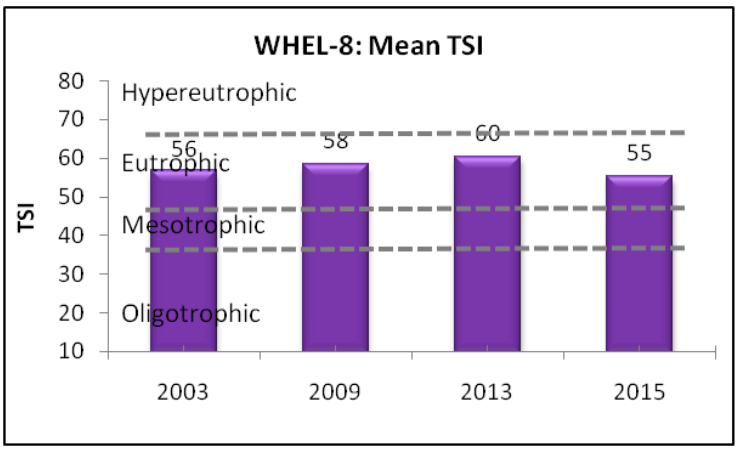












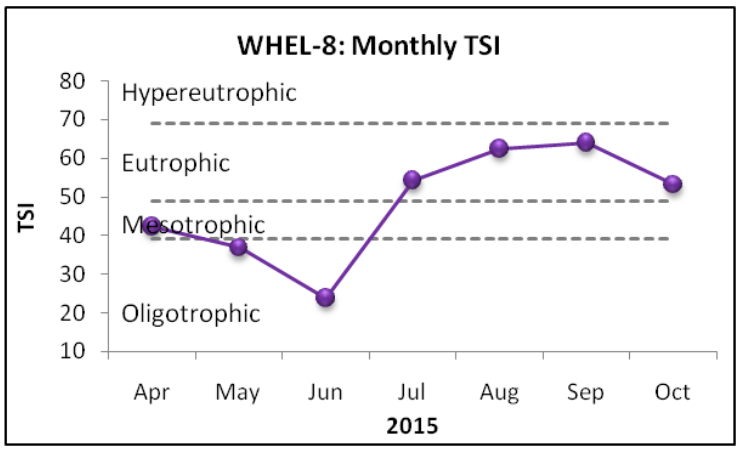
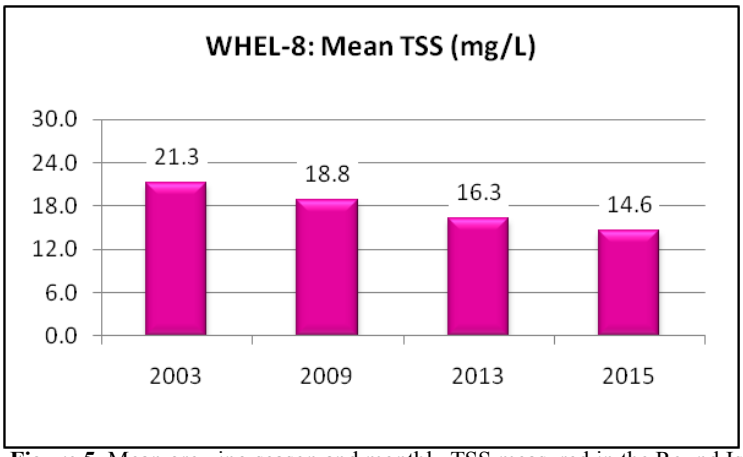


Figure 4. Mean growing season (2003-2015) and monthly (April-October, 2015) TN, TP, chl *a* and TSI measured in the Round Island Creek embayment of Wheeler Reservoir**.** Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.



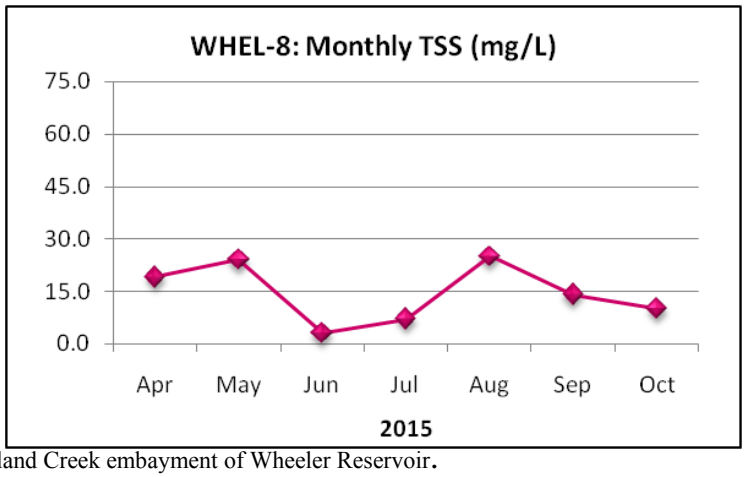


Figure 5. Mean growing season and monthly TSS measured in the Round Island Creek embayment of Wheeler Reservoir.

Table 2. Summary of water quality data collected April-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

WHEL-8	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	7	6.9	21.4	16.5	14.8	5.8
Total Dissolved Solids (mg/L)	7	81.0	101.0	93.0	92.6	6.9
Total Suspended Solids (mg/L)	7	3.0	25.0	14.0	14.6	8.5
Hardness (mg/L)	4	49.4	82.2	65.3	65.6	15.8
Alkalinity (mg/L)	7	44.7	74.3	64.8	60.7	10.5
Photic Zone (m)	7	1.60	2.70	1.80	2.00	0.48
Secchi (m)	7	0.53	0.95	0.66	0.71	0.16
Bottom Depth (m)	7	1.90	3.00	2.70	2.45	0.54
Chemical						
Ammonia Nitrogen (mg/L)	7	< 0.010	0.053	0.030	0.028	0.018
Nitrate+Nitrite Nitrogen (mg/L)[J]	7	0.011	0.702	0.075	0.186	0.242
Total Kjeldahl Nitrogen (mg/L)	7	0.193	1.620	0.813	0.764	0.462
Total Nitrogen (mg/L)[J]	7	0.407	1.790	0.855	0.950	0.523
Dissolved Reactive Phosphorus (mg/L)[J]	7	< 0.002	0.022	0.003	0.006	0.007
Total Phosphorus (mg/L)	7	0.023	0.075	0.028	0.039	0.020
CBOD-5 (mg/L)[J]	7	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)	7	4.8	9.0	6.8	6.9	1.6
Biological						
Chlorophyll a (ug/L)	7	< 1.00	30.30	10.00	11.86	11.83
E. coli (col/100mL)	3	1	82	6	30	45

J= one or more of the values is an estimate; N= # samples.

Table 3. Algal growth potential test results (expressed as mean MSC) dry weights of *Selenastrum capricornutum* in mg/L) and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes (Raschke and Schultz 1987).

WHEL-8	MSC	Limiting Nutrient
8/20/2003	5.2	NITROGEN
8/18/2009	7.95	NITROGEN
8/20/2013	8.52	PHOSPHORUS

FOR MORE INFORMATION, CONTACT:
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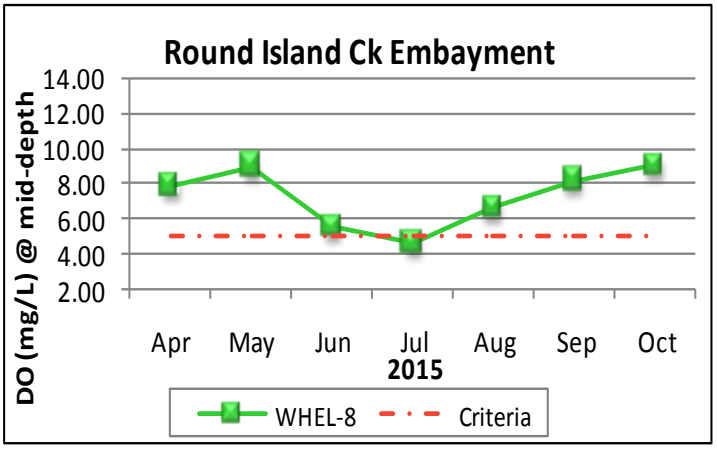

Figure 6. Monthly DO concentrations at mid-depth for Round Island Creek embayment station of Wheeler Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

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