

**South Sauty Creek Embayment  
Guntersville Reservoir  
Intensive Basin Survey 2013**

**GUNM-6:** South Sauty Creek immediately upstream of CR 67 bridge (Jackson Co 34.51917/-86.10389)

**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 2013, ADEM monitored the South Sauty Creek tributary embayment of Guntersville Reservoir as part of the intensive 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 at the South Sauty Ck embayment (GUNM-6) during the 2013 growing season (Apr-Oct). This is the third intensive basin assessment of the Tennessee River since ADEM began sampling on a basin rotation. 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 2013 were compared to ADEM’s historical data and established criteria.



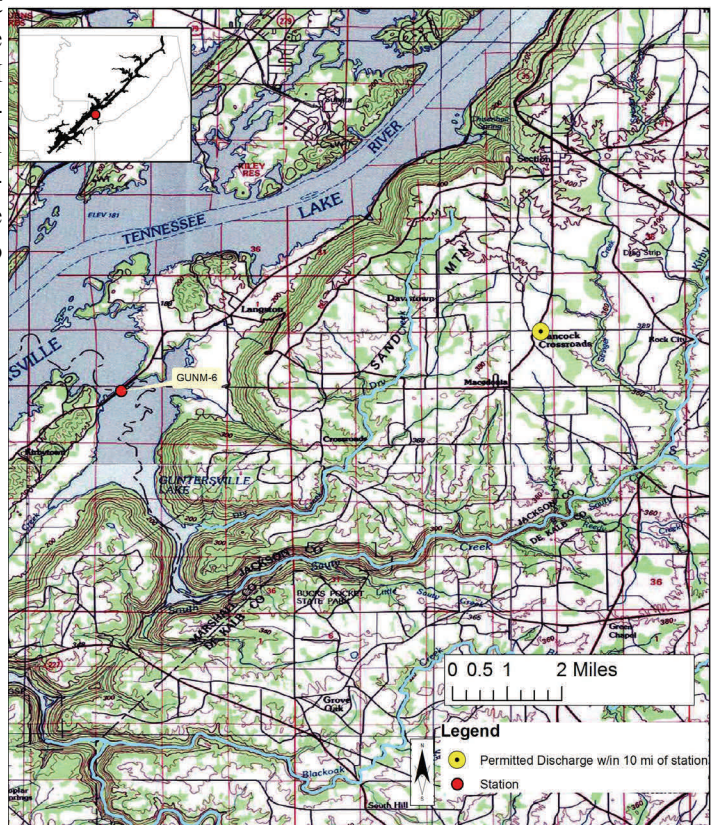
**Figure 1.** Photo of South Sauty Ck at GUNM-6.

**WATERSHED CHARACTERISTICS**

Watershed land uses are summarized in Table 1. South Sauty Ck is classified as a *Swimming/Fish & Wildlife (S/F&W)* stream located in the Sequatchie Valley ecoregion (68b). Based on the 2006 National Land Cover Dataset, land use within the 165 mi<sup>2</sup> watershed is predominantly agriculture [hay/pasture (38%) and cultivated crops (12%)](Fig. 3). As of October 1, 2013, ADEM has issued a total of 16 NPDES permits within the watershed. One of those permits is located within 10 mi upstream of the station (Fig. 2).

**SITE DESCRIPTION**

The South Sauty Ck embayment is located near Langston, AL. It has a mean bottom depth of 7.63 m (Table 2) at the sampling location. The headwaters of South Sauty originate near Henagar, Al and wind down through Bucks Pocket State Park before flowing into the Tennessee River at river mile 372.

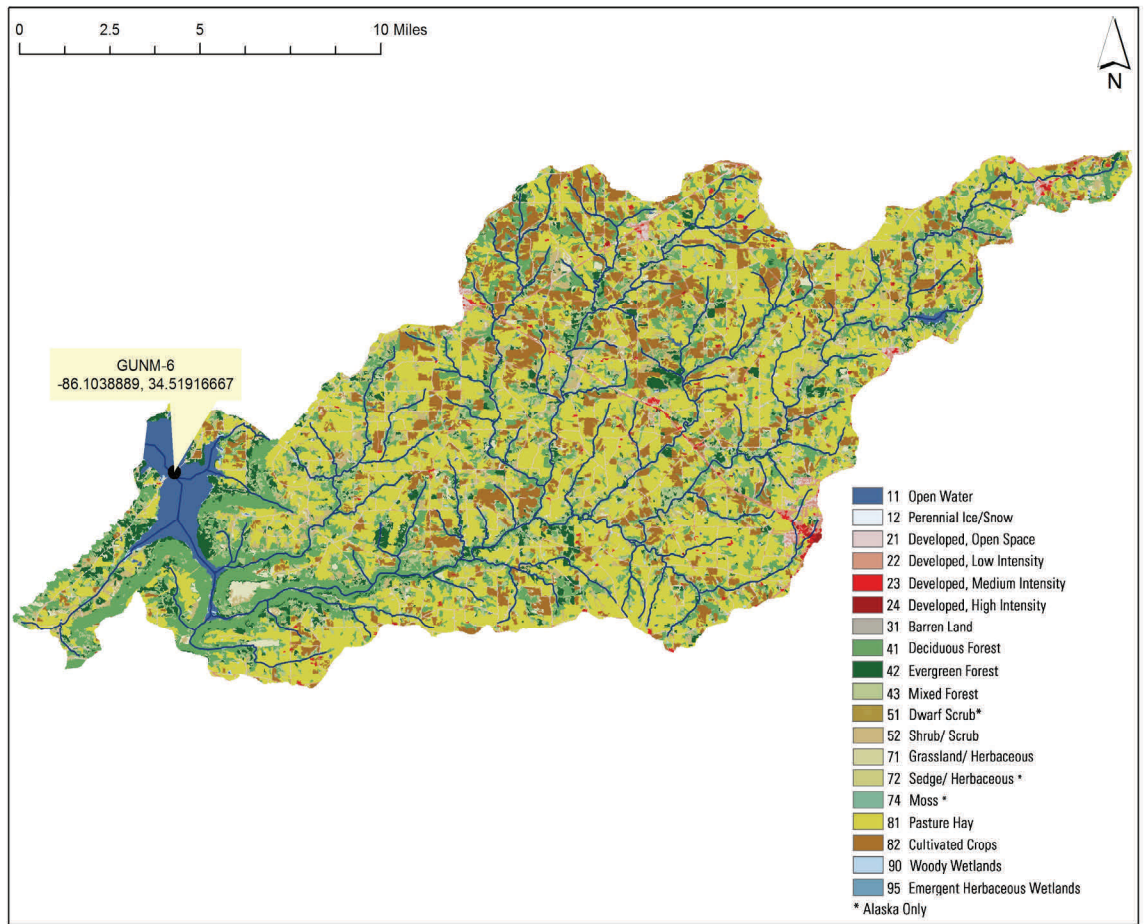


**Figure 2.** Map of South Sauty Ck embayment of Guntersville Reservoir. Though additional permits may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

**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 2013b), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013a).

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 2013 results. Carlson’s TSI was calculated from the corrected chl *a* concentrations.



**Figure 3.** Landuse within the South Sauty Creek watershed at GUNM-6.

**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.

The mean growing season TN values increased 2003-2013 (Fig. 4). The highest monthly TN concentration was measured in May.

The mean growing season TP concentration was the same as 2009 (Fig. 4). Monthly TP concentration was highest in May and September.

In 2013, the growing season mean chl *a* value decreased 2003-2013 (Fig. 4). Monthly chl *a* concentrations peaked in September and October.

Mean TSI remained eutrophic in 2013, though values have declined 2003-2013 (Fig. 4). Monthly TSI in South Sauty Ck varied from eutrophic to mesotrophic April through October.

In 2013, the mean growing season TSS value was slightly higher than 2009. However, the value was still lower compared to 2003 (Fig. 5). Monthly TSS concentration was highest in September.

AGPT results show that GUNM-6 was nitrogen limited in both 2009 and 2013 (Table 3). The mean maximum standing crop (MSC) value was 3.54 mg/L, which is below the 5.0 mg/L value that Raschke and Schultz (1987) defined as protective of reservoir and lake systems. The previous MSC values for South Sauty Ck at GUNM-6 were also below 5 mg/L.

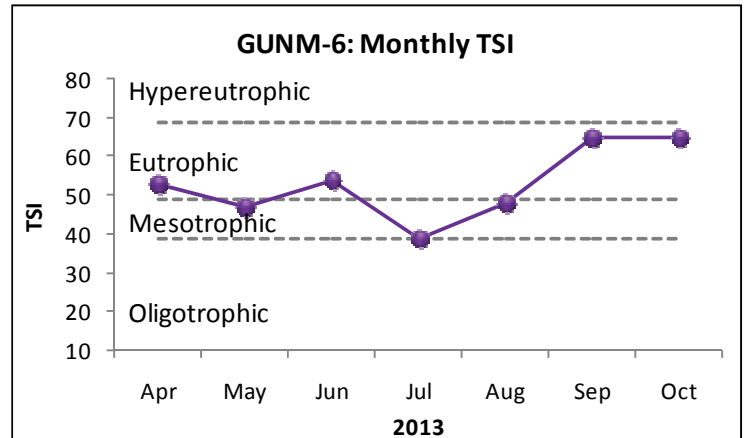
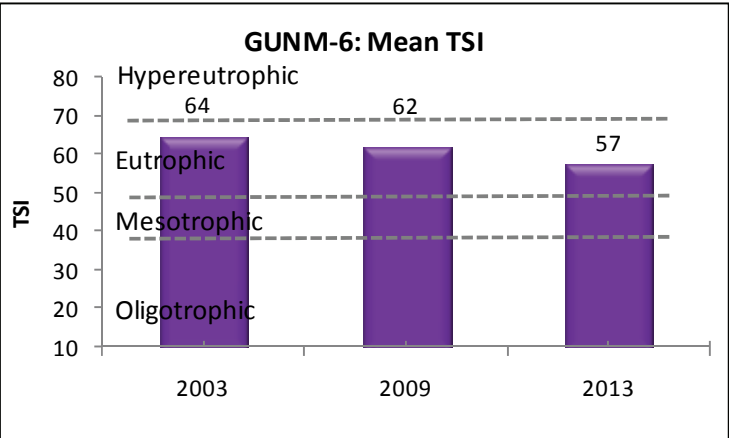
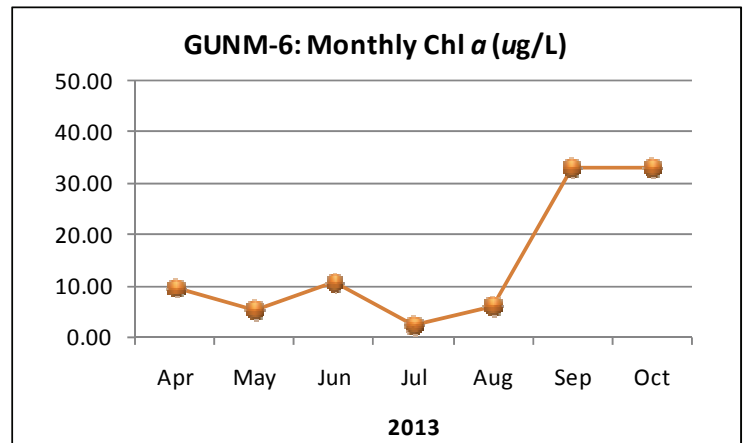
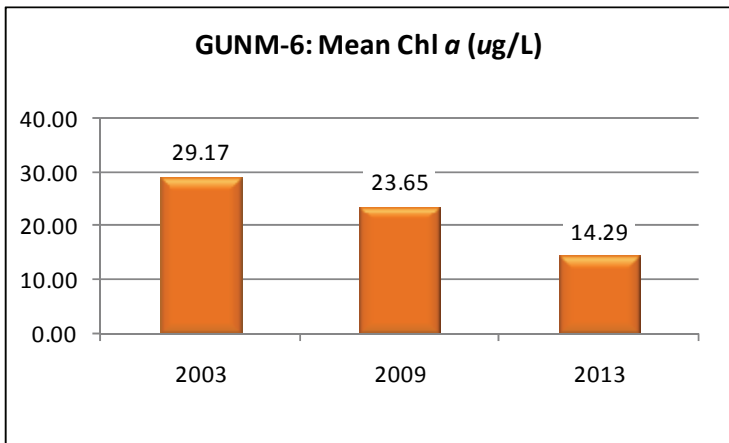
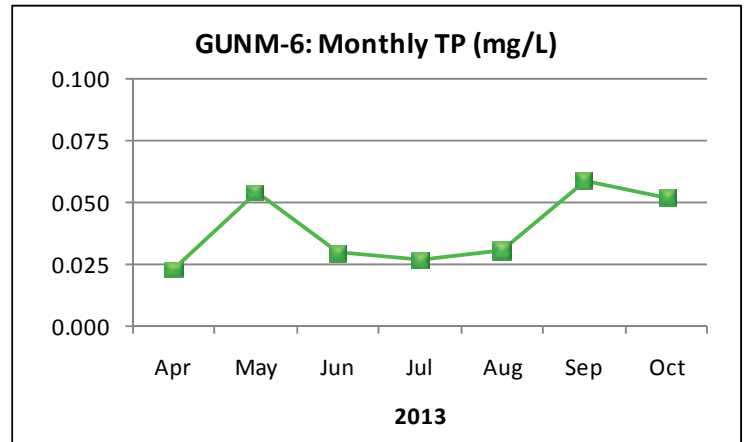
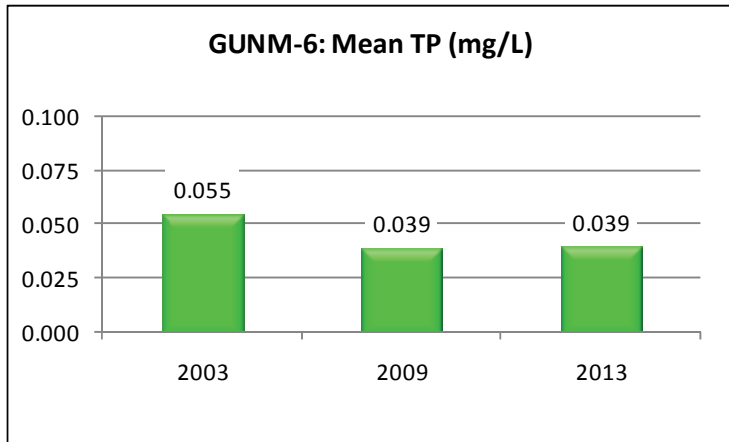
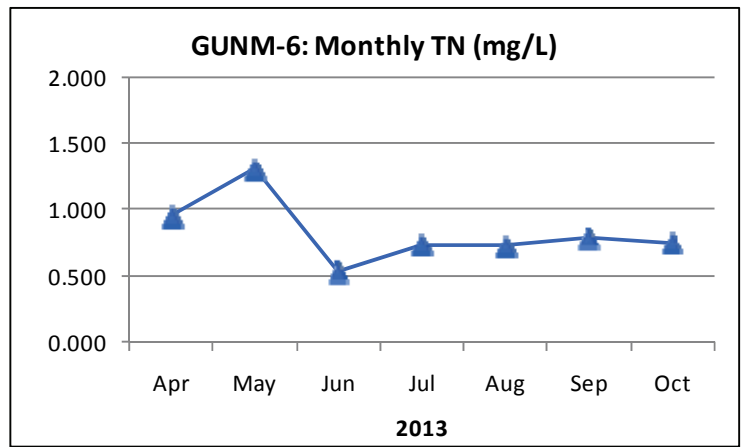
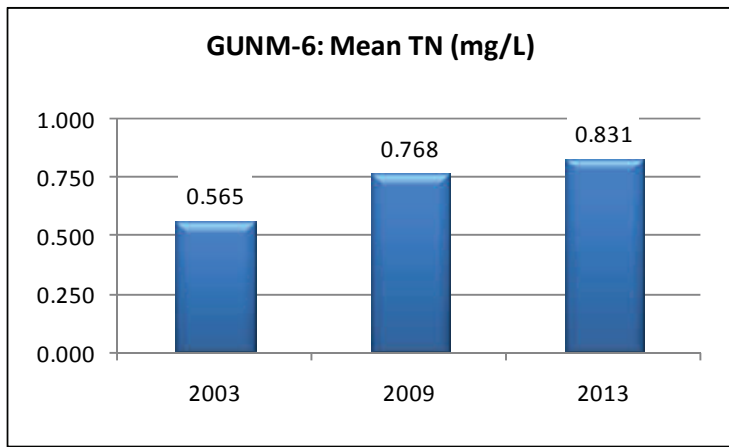
The DO concentrations in South Sauty Ck were above the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) in all months (ADEM Admin. Code R. 335-6-10-.09) (Fig. 6).

**Table 1: Summary of Watershed GUNM-6**

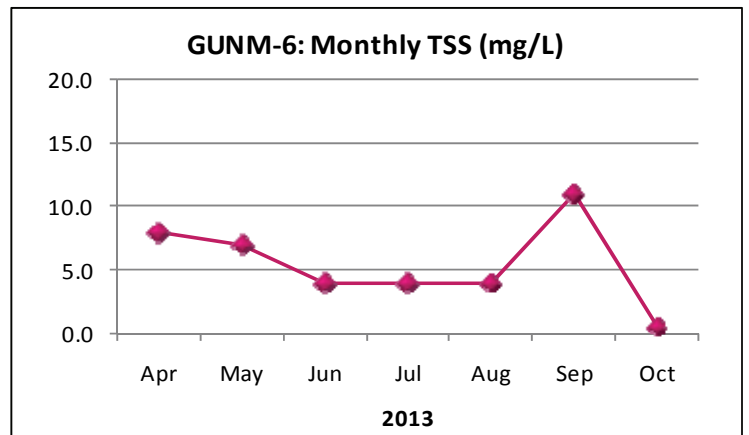
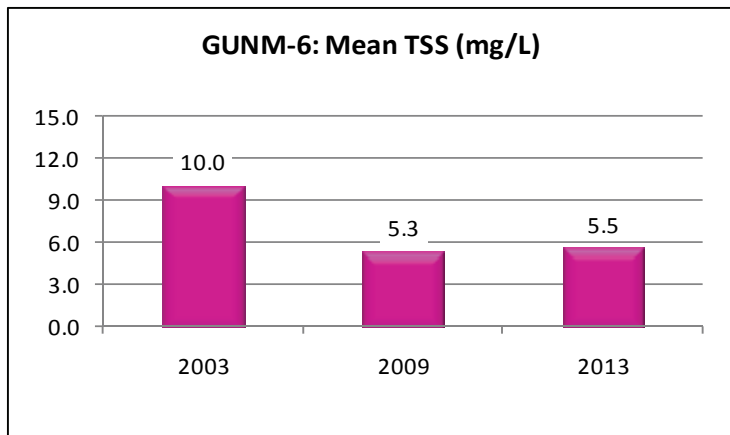
Basin	Tennessee R
Drainage Area (mi <sup>2</sup> )	165
Ecoregion <sup>a</sup>	68b
<b>% Landuse</b>	
Open Water	3%
Developed	Open Space
	Low Intensity
	Medium Intensity
	High Intensity
Barren Land	<1%
Forest	Deciduous Forest
	Evergreen Forest
	Mixed Forest
Shrub/Scrub	5%
Herbaceous	2%
Hay/Pasture	38%
Cultivated Crops	12%
Wetlands	Woody
	Emergent Herb.
	<1%
# NPDES Permits <sup>b</sup>	TOTAL
	16
Construction Stormwater	6
Industrial General	6
Industrial Individual	1
Municipal Individual	2
Underground Injection Control	1

a. Sequatchie Valley

b. #NPDES permits downloaded from ADEM's NPDES Management System database, Oct 1, 2013.



**Figure 4.** Mean growing season (2003-2013) and monthly (April-October, 2013) TN, TP, chl  $\alpha$  and TSI measured in the South Sauty Creek embayment of Guntersville 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 South Saaty Creek embayment of Guntersville Reservoir.

**Table 2.** Summary of water quality data collected April-October, 2013. 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.

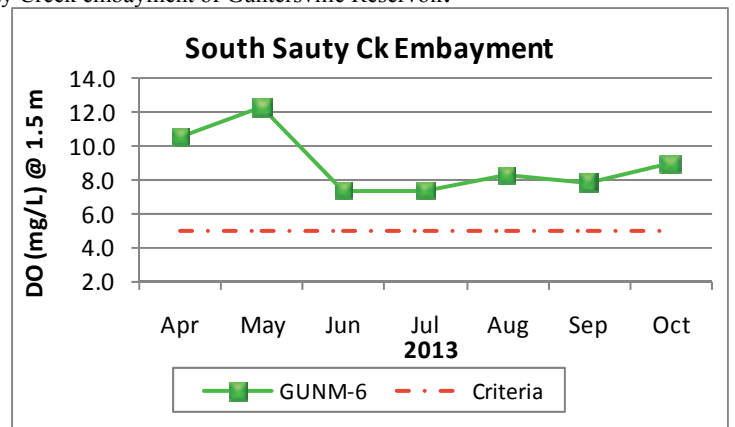
GUNM-6	N	Min	Max	Med	Mean	SD
<b>Physical</b>						
Turbidity (NTU)	7	4.0	7.9	6.1	6.1	1.4
Total Dissolved Solids (mg/L)	7	40.0	90.0	64.0	65.0	16.8
Total Suspended Solids (mg/L)	7	< 1.0	11.0	4.0	5.5	3.4
Hardness (mg/L)	4	26.0	56.4	45.7	43.4	13.8
Alkalinity (mg/L)	7	21.5	59.8	44.6	41.4	14.7
Photic Zone (m)	7	2.04	4.09	2.67	2.89	0.75
Secchi (m)	7	0.91	1.59	0.98	1.06	0.24
Bottom Depth (m)	7	6.90	9.40	7.20	7.63	1.11
<b>Chemical</b>						
Ammonia Nitrogen (mg/L)	7	< 0.004	0.018	0.009	0.007	0.003
Nitrate+Nitrite Nitrogen (mg/L) <sup>J</sup>	7	< 0.002	0.606	0.008	0.138	0.239
Total Kjeldahl Nitrogen (mg/L)	7	0.350	0.985	0.733	0.694	0.201
Total Nitrogen (mg/L) <sup>J</sup>	7	< 0.537	1.312	0.754	0.831	0.245
Dissolved Reactive Phosphorus (mg/L) <sup>J</sup>	7	< 0.003	0.006	0.004	0.004	0.002
Total Phosphorus (mg/L)	7	0.023	0.059	0.031	0.039	0.015
CBOD-5 (mg/L)	7	< 2.0	2.1	1.0	1.2	0.4
Chlorides (mg/L)	7	2.8	5.7	4.0	4.0	0.9
<b>Biological</b>						
Chlorophyll a (ug/L)	7	2.29	33.11	9.61	14.29	13.16
E. coli (col/100mL) <sup>J</sup>	3	< 1	1	1	1	0

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).

Year	Mean MSC	Limiting Nutrient
2003	2.93	CO-LIMITING
2009	3.20	NITROGEN
2013	3.54	NITROGEN

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**Figure 6.** Monthly DO concentrations at 1.5 m (5 ft) for the South Saaty Ck embayment station of Guntersville Reservoir collected April-October 2013. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

## REFERENCES

- ADEM. 2012. Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring in Alabama. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 78 pp.
- ADEM. 2013a. Quality Management Plan (QMP) for the Alabama Department of Environmental, Alabama Department of Environmental Management (ADEM), Montgomery, AL. 58 pp.
- ADEM. 2013b. Standard Operating Procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.
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