

Town Creek Embayment
Guntersville Reservoir
Intensive Basin Survey 2009

Tennessee River Basin

GUNM-7: Town Creek approximately 0.5 mi downstream of Hwy 227 bridge (Marshall Co 34.40582/-86.18318)

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 2009, ADEM monitored the Town 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 in the Town Ck embayment (GUNM-7) during the 2009 growing season (Apr-Oct). This is the second 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 2009 were compared to ADEM’s 2003 data and established criteria.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Town Creek is classified as a *Swimming/Fish & Wildlife (S/F&W)* stream located in the Plateau Escarpment ecoregion (68c). Based on the 2006 National Land Cover Dataset, land use within the 215 mi² watershed is predominantly agriculture [(Pasture/Hay 41%) (Crops 9%)] (Fig. 3). As of October 1, 2013, ADEM has issued a total of 17 NPDES permits within the watershed. No permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Town Ck embayment at GUNM-7 is located just west of Guntersville, AL. . It is a fairly large embayment, flowing into the Tennessee River near Guntersville State Park. Town Ck has a median bottom depth of 9.55 m (Table 2) at the sampling location.



Figure 1. Photo of Town Ck at GUNM-7

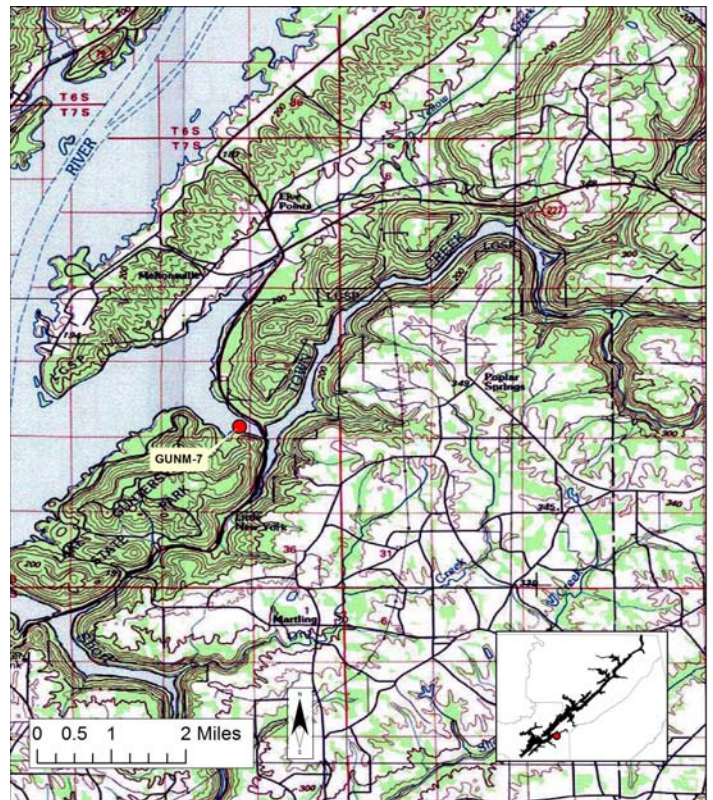


Figure 2. Map of Town Ck Embayment of Guntersville Reservoir. Though additional discharges may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

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 2009), Surface Water Quality Assurance Project Plan (ADEM 2008a), and Quality Management Plan (ADEM 2008b).

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 2009 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

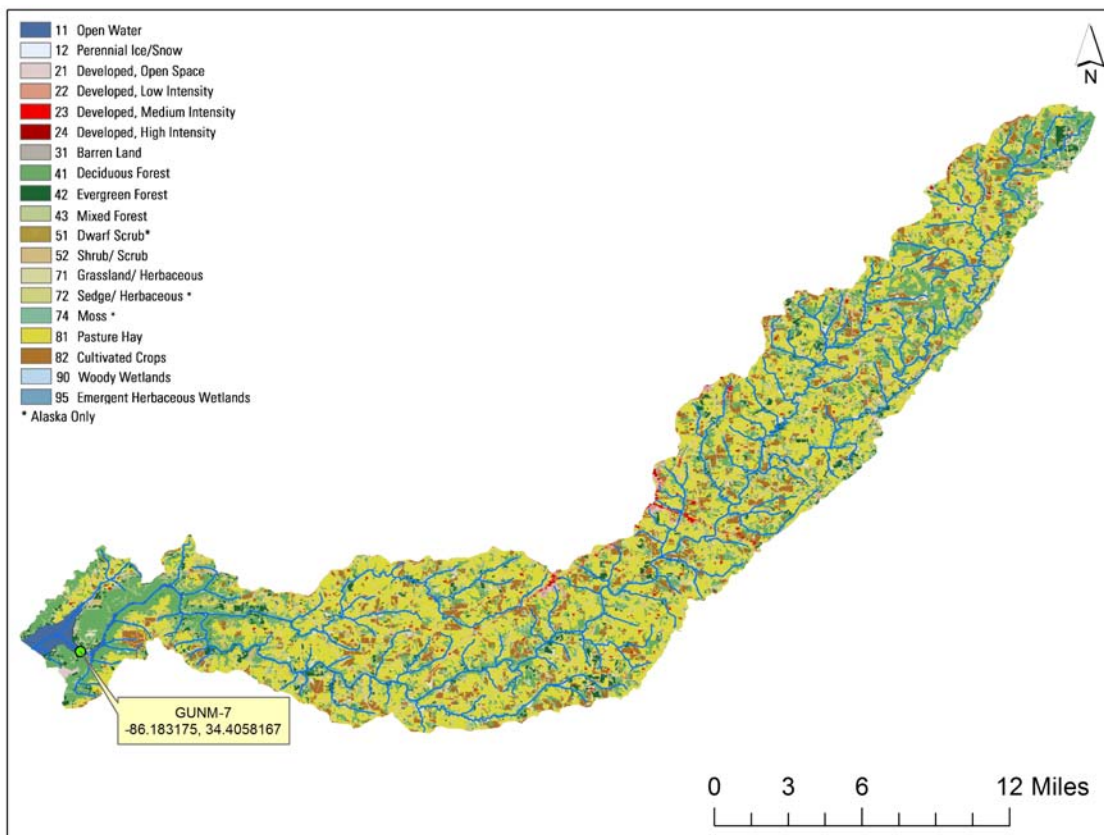


Figure 3. Landuse within the Town Creek watershed at GUNM-7.

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 of the graphs in Fig. 4 were set to maximum values reservoir wide so all embayment reports on the same reservoir could be compared.

The mean growing season TN value was higher in 2009 than in 2003 (Fig. 4). Monthly TN concentrations peaked in April and decreased through September, with a second peak in October.

Contrary to mean TN concentration, the mean growing season TP concentration was lower in 2009 (Fig. 4). The highest monthly TP concentration occurred in October, however, April-September concentrations were lower and similar.

In 2009, the growing season mean chl *a* value was lower than 2003 (Fig. 4). Monthly chl *a* concentrations peaked in July.

Mean TSI remained eutrophic in 2009. Monthly TSI in Town Ck started mesotrophic in April and increased to eutrophic conditions May-October (Fig. 4).

The mean growing season TSS value was lower in 2009 than 2003 (Fig. 5). Monthly TSS concentrations were at or below 5.0 mg/L April-October.

AGPT results show that GUNM-7 was nitrogen limited 2009 and co-limited in 2003 (Table 3). The mean maximum standing crop (MSC) value was 2.58 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 mean MSC in 2003 was over three times higher than the 2009 value.

The DO concentration in the GUNM-7 station was below the ADEM criteria limit of 5.0 mg/l at 5.0 ft (1.5 m) in July (ADEM Admin. Code R. 335-6-10-09) (Fig. 6).

Table 1: Summary of Watershed GUNM-7

Basin	Tennessee R
Drainage Area (mi ²)	215
Ecoregion ^a	68c
% Landuse	
Open Water	1%
Developed	Open Space 5%
	Low Intensity <1%
	Medium Intensity <1%
	High Intensity <1%
Barren Land	<1%
Forest	Deciduous Forest 22%
	Evergreen Forest 4%
	Mixed Forest 10%
	Shrub/Scrub 4%
	Herbaceous 2%
	Hay/Pasture 41%
	Cultivated Crops 9%
Wetlands	Woody 0%
	Emergent Herb. <1%
# NPDES Permits ^b	TOTAL 17
	401 Water Quality Certification 1
	Construction Stormwater 6
	Mining 3
	Industrial General 7

a. Plateau Es carpment

b. #NPDES permits do wnloaded from ADEM's NPDES Management Sys tem database, Oct 1, 2013.

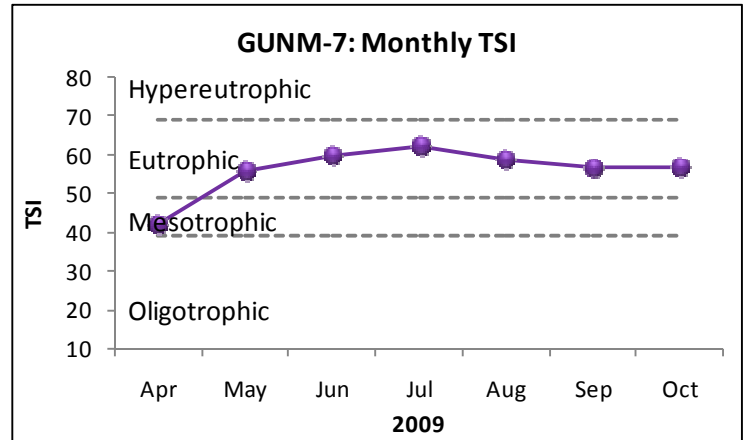
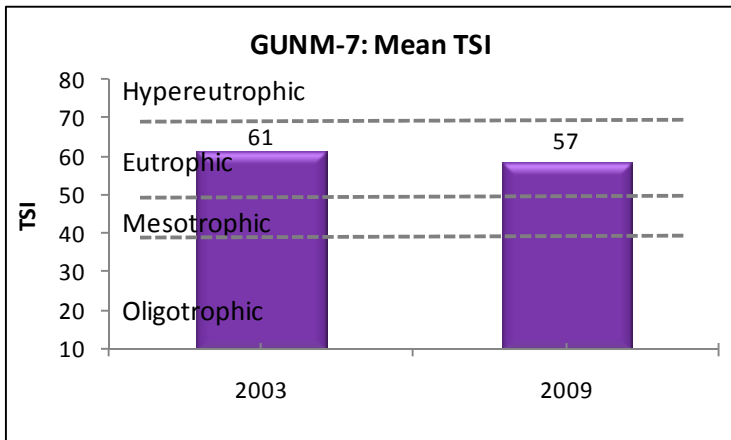
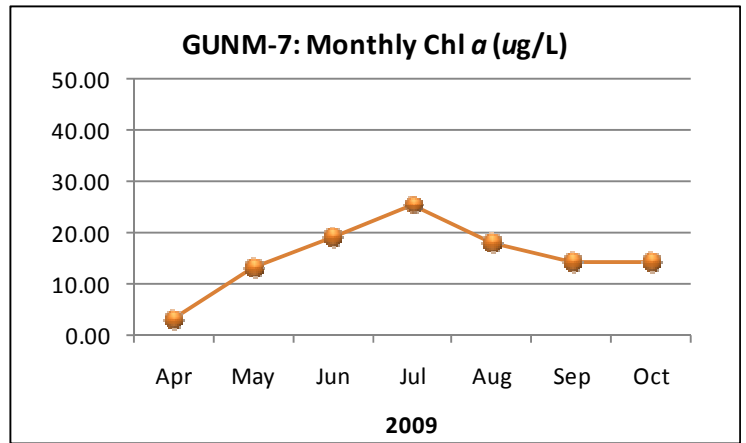
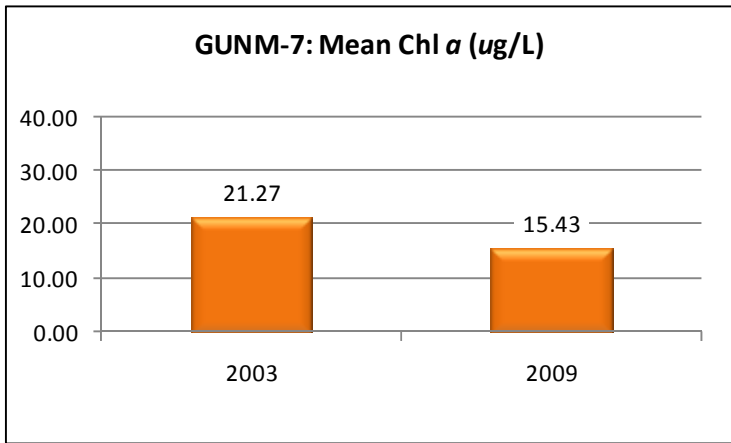
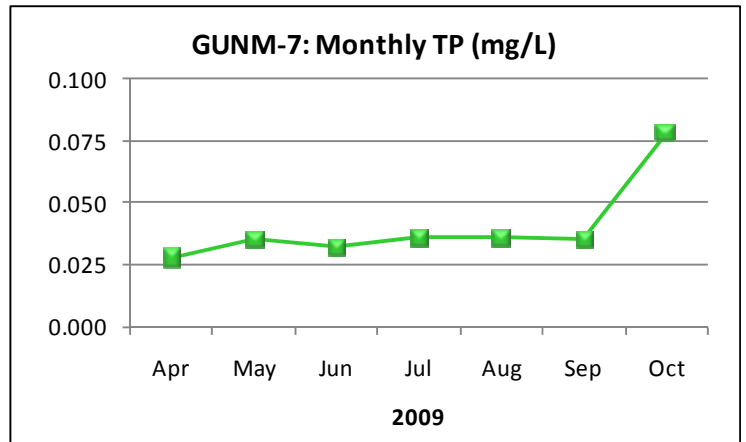
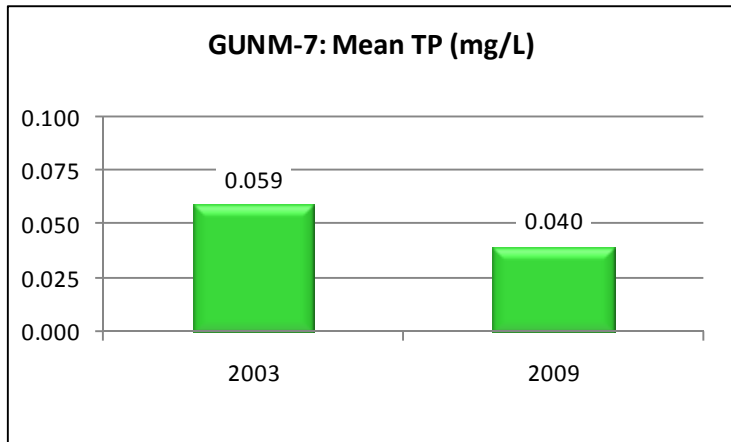
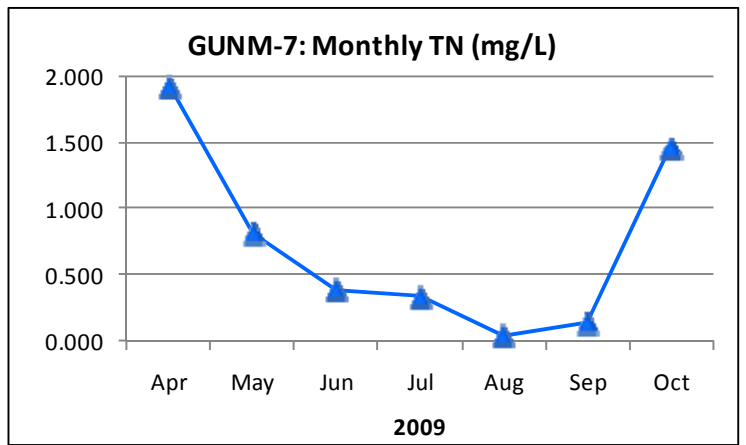
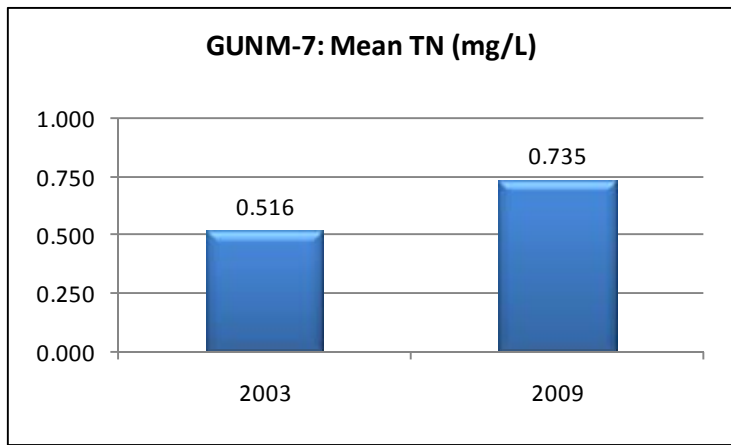


Figure 4. Mean growing season (2003-2009) and monthly (April-October, 2009) TN, TP, chl a and TSI measured in the Town Creek embayment of Guntersville Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

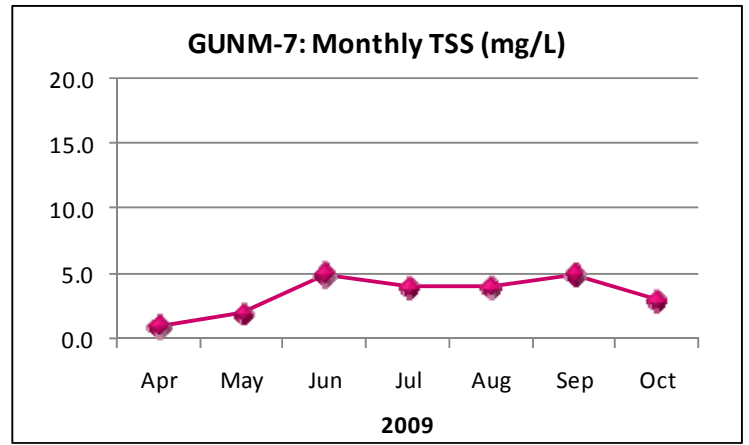
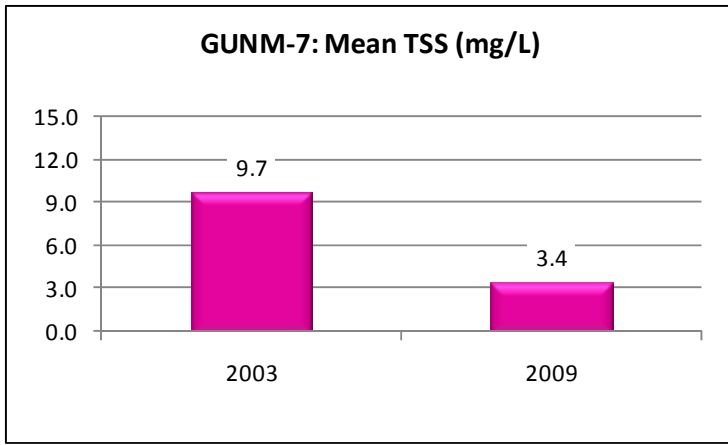


Figure 5. Mean growing season and monthly TSS measured in the Town Creek embayment of Guntersville Reservoir.

Table 2. Summary of water quality data collected April-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

GUNM-7	N	Min	Max	Med	Avg	SD
Physical						
Turbidity (NTU)	7	3.6	5.8	4.8	4.7	0.8
Total Dissolved Solids (mg/L) ^J	7	40.0	130.0	102.0	93.1	31.5
Total Suspended Solids (mg/L)	7	1.0	5.0	4.0	3.4	1.5
Hardness (mg/L)	3	45.0	76.5	70.6	64.0	16.8
Alkalinity (mg/L)	7	33.0	78.6	64.5	56.6	19.0
Photic Zone (m)	7	3.05	4.40	3.38	3.61	0.54
Secchi (m)	7	1.02	1.63	1.38	1.35	0.21
Bottom Depth (m)	8	9.00	10.20	9.55	9.61	0.34
Chemical						
Ammonia Nitrogen (mg/L)	7	< 0.006	0.027	0.007	0.009	0.008
Nitrate+Nitrite Nitrogen (mg/L) ^J	7	< 0.002	1.405	0.098	0.423	0.548
Total Kjeldahl Nitrogen (mg/L)	7	< 0.089	0.642	0.338	0.312	0.230
Total Nitrogen (mg/L) ^J	7	< 0.046	1.935	0.391	0.735	0.717
Dissolved Reactive Phosphorus (mg/L) ^J	7	< 0.004	0.034	0.007	0.010	0.011
Total Phosphorus (mg/L)	7	0.028	0.078	0.035	0.040	0.017
CBOD-5 (mg/L)	7	< 2.0	2.4	1.0	1.2	0.5
Chlorides (mg/L)	7	4.7	8.2	5.3	6.1	1.5
Biological						
Chlorophyll a (ug/L)	7	3.20	25.63	14.42	15.43	6.87
Fecal Coliform (col/100 mL) ^J	3	< 1	4	2	2	2

^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
8/20/2003	9.33	CO-LIMITING
8/17/2009	2.58	NITROGEN

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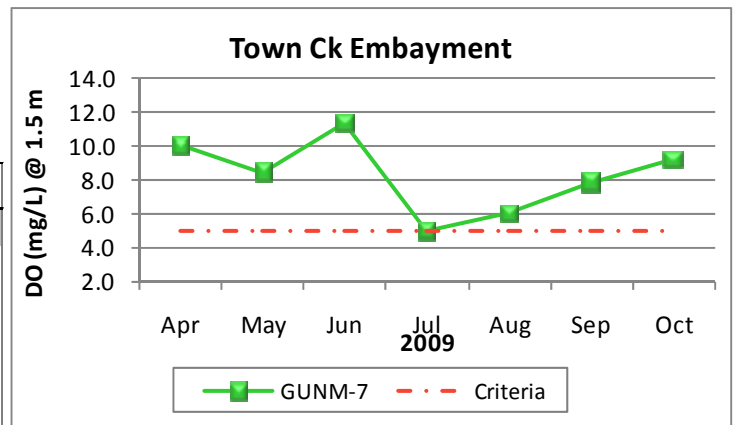


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Town Ck embayment station of Guntersville Reservoir collected April-October 2009. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

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