

Dry Branch Embayment
Wheeler Reservoir
Intensive Basin Survey 2009

Tennessee River Basin

WHEL-7: Dry Branch immediately downstream stream of Alt. Hwy 72 bridge (Morgan Co 34.62081/-87.00064)

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 Dry Branch tributary embayment of Wheeler Reservoir as part of the intensive basin assessment of the Tennessee River under the RRMP. The purpose of this report is to summarize data collected at WHEL-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 [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. Dry Branch 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 very small 10 mi² watershed is predominantly developed (83%) (Fig. 3). As of October 1, 2013, ADEM has issued a total of 16 NPDES permits within the watershed. All of those permits are located within 10 mi upstream of the station (Fig. 2).

SITE DESCRIPTION

Draining into Wheeler Reservoir near river mile 303, the Dry Branch embayment is located near the center of downtown Decatur, AL. Nearly the entire watershed is contained within it’s city limits. It is a shallow embayment with a mean bottom depth of 1.72 m (Table 2) at the sampling location. There is no aquatic vegetation present in this embayment.



Figure 1. Photo of Dry Branch at WHEL-7

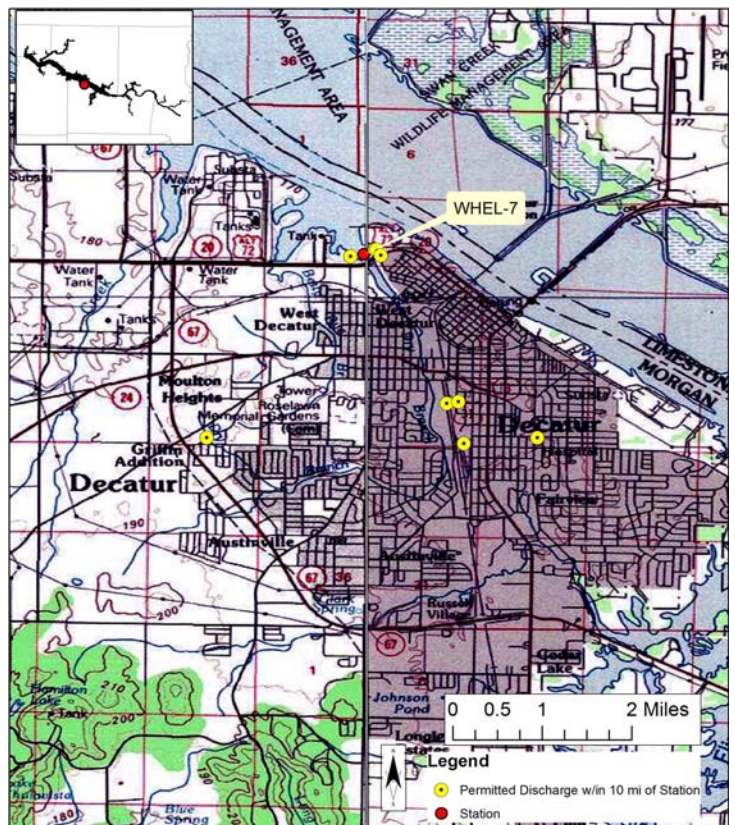


Figure 2. Map of Dry Branch embayment of Wheeler Reservoir. Though additional discharges may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. Sites were selected using historical data and previous assessments. 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.

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 value was higher in 2009 than in 2003 (Fig. 4). The highest monthly TN concentration was measured in October though concentrations generally declined April through September.

Contrary to mean TN concentration, the mean growing season TP concentration was lower in 2009 (Fig. 4). Monthly TP concentrations were similar April through October.

In 2009, the growing season mean chl *a* value was lower than 2003 (Fig. 4). Monthly chl *a* concentrations were variable with the highest concentration measured in May.

Mean TSI remained eutrophic in 2009. Monthly TSI in Dry Branch was eutrophic April through October, reaching near hypereutrophic conditions in May (Fig. 4).

The mean growing season TSS value was lower in 2009 than 2003 (Fig. 5). Monthly TSS concentrations were generally low April-October.

AGPT results show that Dry Branch was nitrogen limited in both 2009 and 2003 (Table 3). Though higher in 2003, the mean maximum standing crop (MSC) value was 3.32 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 DO concentration at the Dry Branch station generally decreased May-September, but remained above the ADEM criteria limit throughout the growing season (1.5 m or mid depth)(ADEM Admin. Code R. 335-6-10-.09) (Fig. 6).

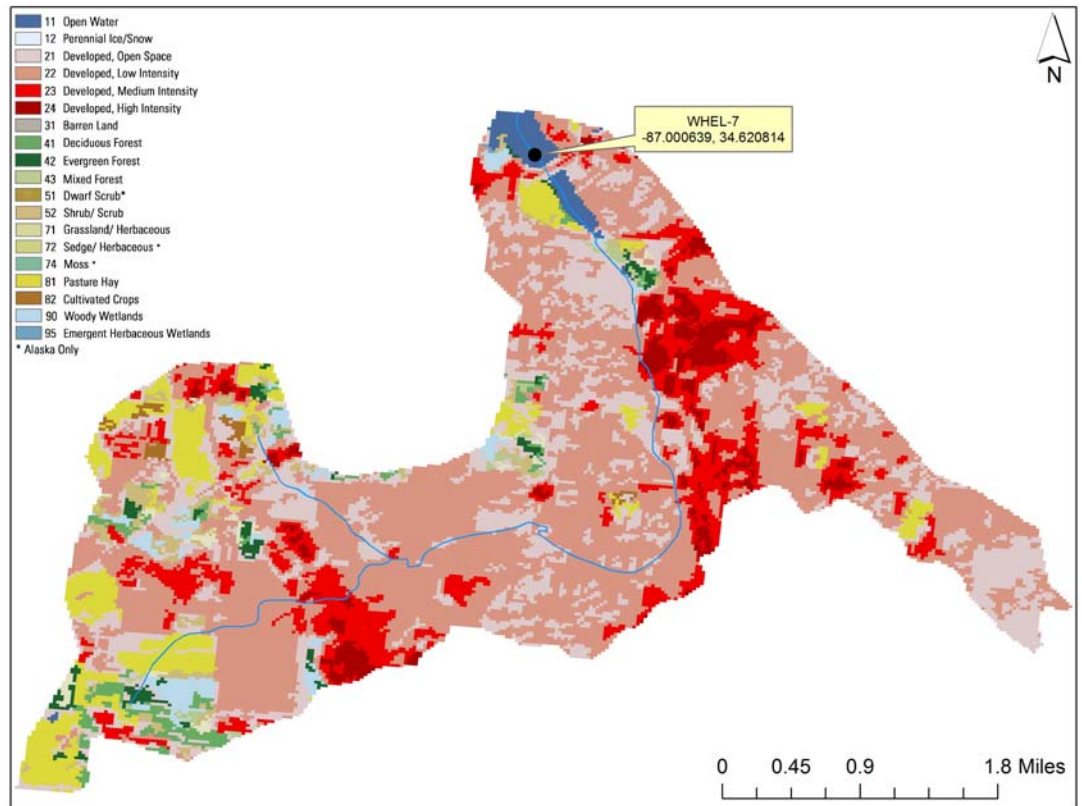


Figure 3. Land use within the Dry Branch watershed at WHEL-7.

Table 1: Summary of Watershed **WHEL-7**

Basin		Tennessee R
Drainage Area (mi ²)		10
Ecoregion ^a		71g
% Land use		
Open Water		1%
Developed	Open Space	21%
	Low Intensity	46%
	Medium Intensity	12%
	High Intensity	4%
Barren Land		<1%
Forest	Deciduous Forest	2%
	Evergreen Forest	1%
	Mixed Forest	<1%
Shrub/Scrub		2%
Herbaceous		1%
Hay/Pasture		7%
Cultivated Crops		1%
Wetlands	Woody	2%
	Emergent Herb.	<1%
#NPDES Permits ^b		TOTAL
401 Water Quality Certification		1
Construction Stormwater		7
Industrial General		7
Underground Injection Control		1

a. Eastern Highland Rim

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

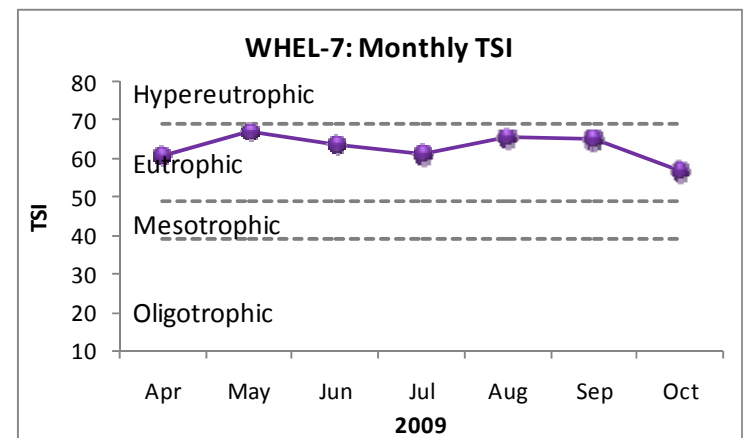
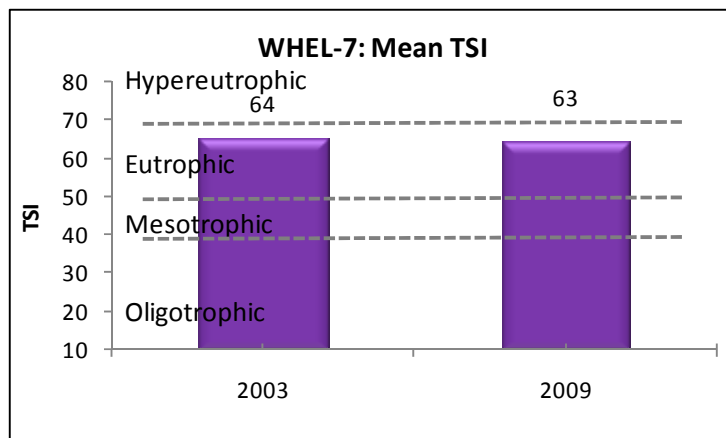
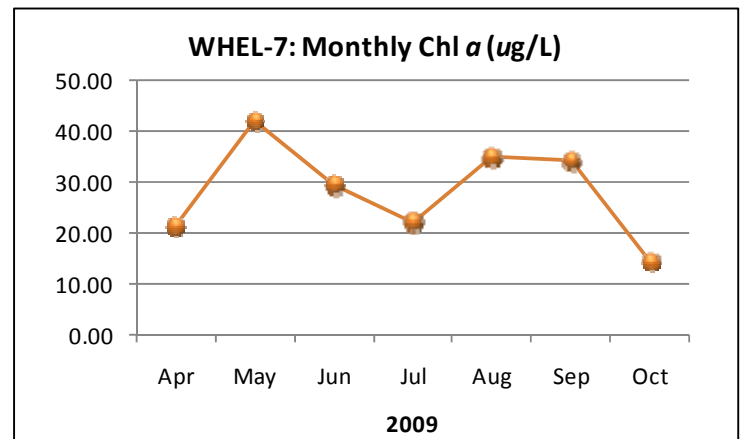
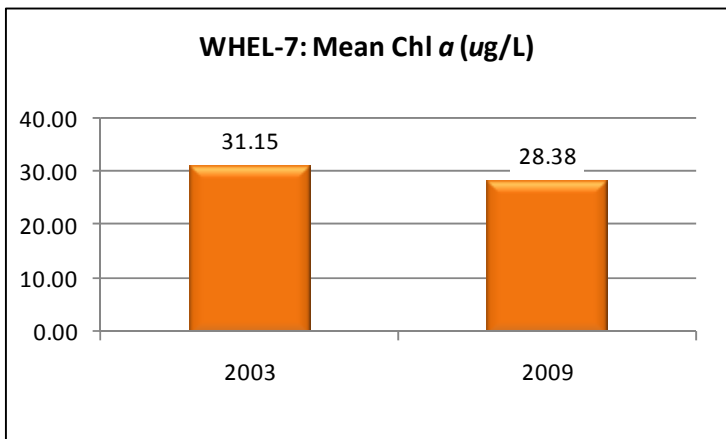
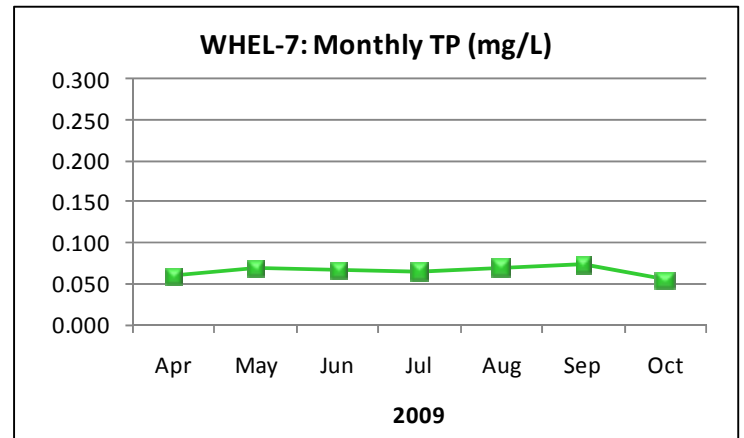
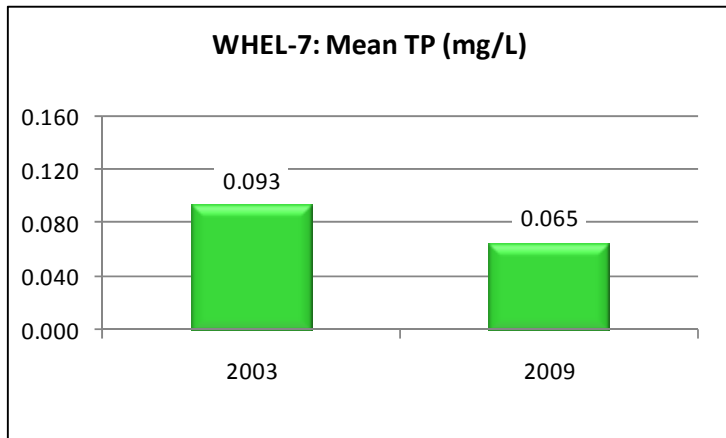
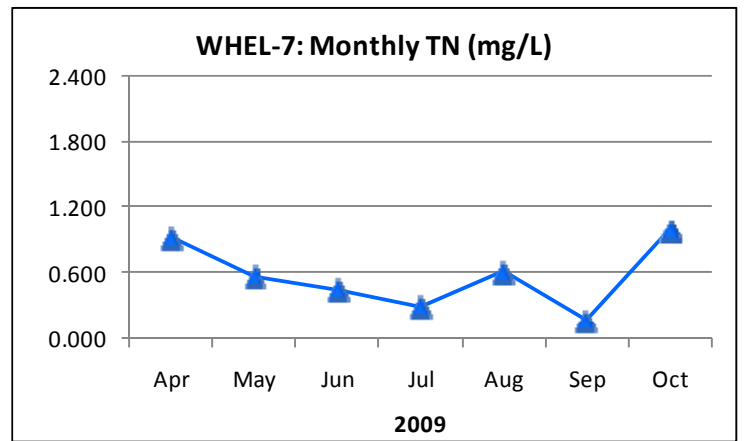
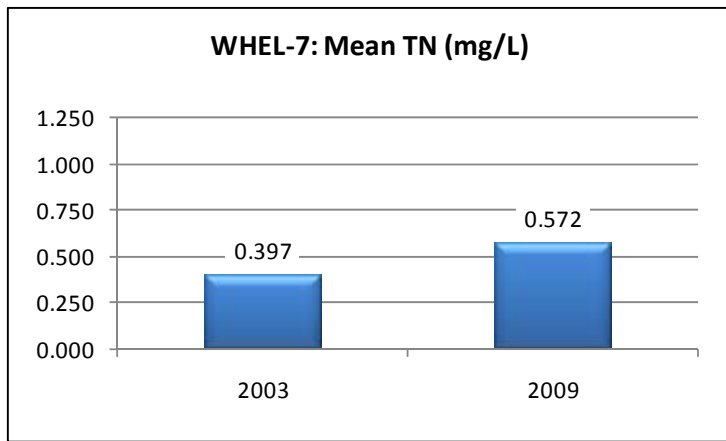


Figure 4. Mean growing season (2003-2009) and monthly (April-October, 2009) TN, TP, chl a and TSI measured in the Dry Branch embayment of Wheeler Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

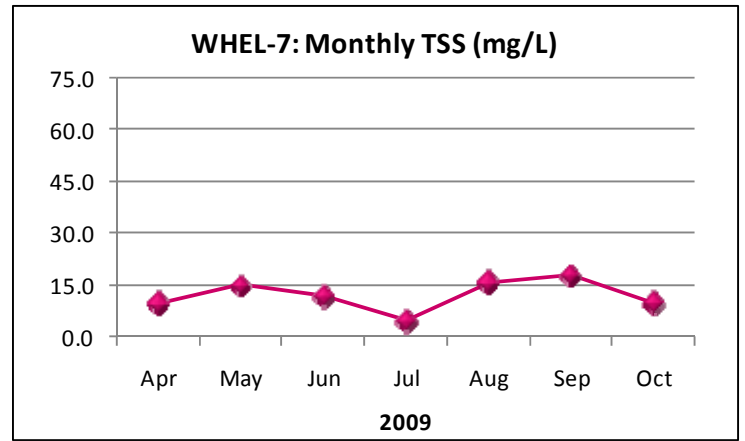
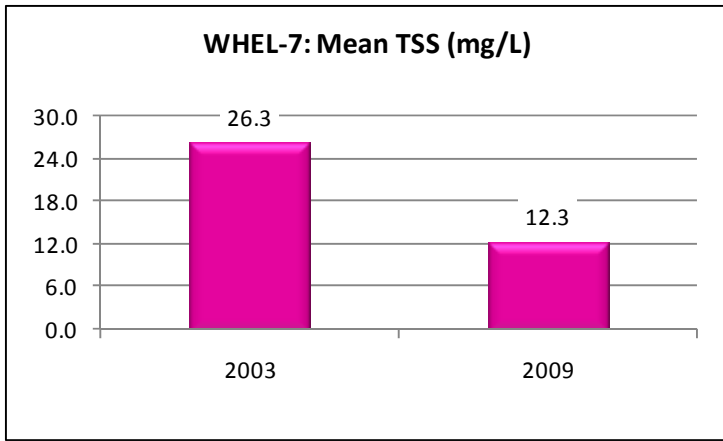


Figure 5. Mean growing season and monthly TSS measured in the Dry Branch embayment of Wheeler Reservoir.

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

WHEL-7	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	7	11.0	18.4	13.5	14.3	2.8
Total Dissolved Solids (mg/L) ^J	7	56.0	152.0	92.0	104.0	35.6
Total Suspended Solids (mg/L) ^J	7	5.0	18.0	12.0	12.3	4.4
Hardness (mg/L)	3	64.8	71.0	70.8	68.9	3.5
Alkalinity (mg/L)	7	37.3	79.3	68.4	64.9	13.3
Photic Zone (m)	7	1.40	1.92	1.83	1.72	0.23
Secchi (m)	7	0.57	0.95	0.62	0.67	0.13
Bottom Depth (m)	7	1.00	1.92	1.83	1.72	0.23
Chemical						
Ammonia Nitrogen (mg/L)	7	< 0.006	0.025	0.007	0.008	0.008
Nitrate+Nitrite Nitrogen (mg/L) ^J	7	< 0.002	0.387	0.070	0.117	0.146
Total Kjeldahl Nitrogen (mg/L)	7	< 0.089	0.690	0.500	0.456	0.223
Total Nitrogen (mg/L) ^J	7	< 0.162	0.996	0.570	0.572	0.307
Dissolved Reactive Phosphorus (mg/L) ^J	7	0.004	0.020	0.006	0.008	0.006
Total Phosphorus (mg/L)	7	0.055	0.073	0.066	0.065	0.006
CBOD-5 (mg/L)	7	< 2.0	3.8	1.0	1.4	1.1
Chlorides (mg/L)	7	4.7	8.2	4.9	5.6	1.3
Biological						
Chlorophyll a (ug/L)	7	14.42	41.96	29.37	28.38	9.54
Fecal Coliform (col/100 mL) ^J	3	< 1	320	100	140	163

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	5.52	NITROGEN
8/19/2009	3.32	NITROGEN

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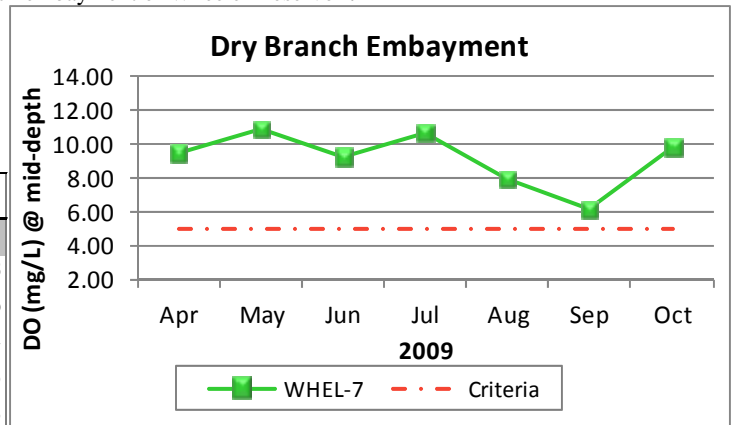


Figure 6. Monthly DO concentrations at mid-depth for Dry Branch embayment station of Wheeler Reservoir collected April-October 2009. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

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