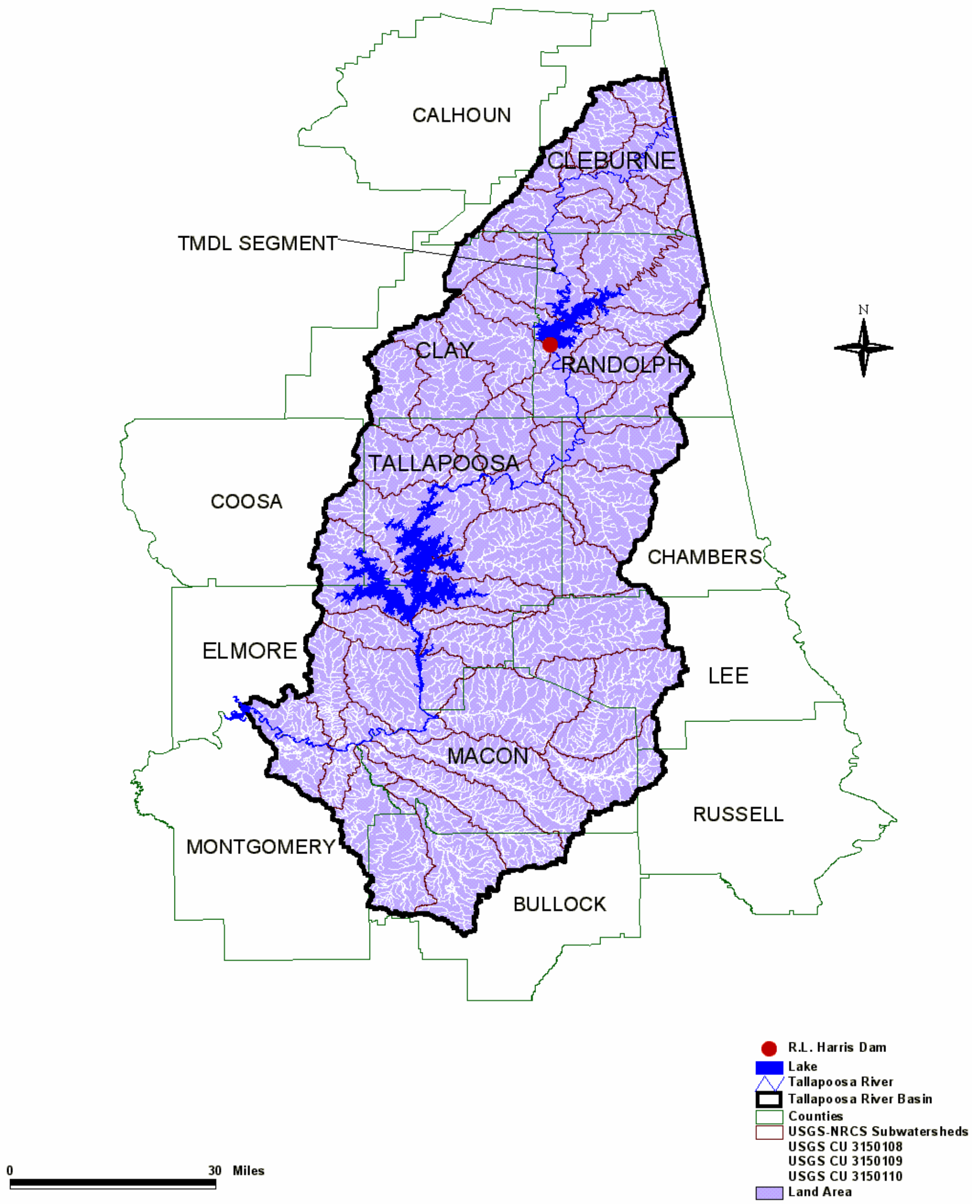
ADEM

Alabama Department of Environmental Management

Final TMDL Development for
Tallapoosa River, AL/Tallapoosa R_1
Low Dissolved Oxygen/Organic Loading

Water Quality Branch
Water Division
February 2002

Tallapoosa River Basin



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1.0 Executive Summary

This report contains one or more Total Maximum Daily Loads (TMDLs) for waterbody segments found on Alabama's 1996 and/or 1998 Section 303(d) List(s) of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The implementation of the TMDLs contained herein will be prioritized within Alabama's rotating basin approach.

The amount and quality of data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in land use within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Tallapoosa River, a part of the Tallapoosa River basin, is located in Cleburne County near Heflin, Alabama. It has been on the State of Alabama's §303(d) use impairment list since 1996 for organic enrichment/low dissolved oxygen (O.E./D.O.). Its use classification is Fish & Wildlife (F&W).

Water quality data or information collected in 1992 identified dissolved oxygen impairments for Tallapoosa River. The stream flows during periods of impairment were typically at, or below, the $7Q_{10}$ (the minimum 7-day average flow that occurs once in 10 years on average). Since the D.O. impairments were clearly driven by low flows and high temperatures, occurring during the summer months, a steady state modeling approach was adopted as appropriate for the TMDL analysis.

The following report addresses the results of the TMDL analysis for O.E./D.O. In accordance with ADEM water quality standards, the minimum dissolved oxygen concentration in a stream classified as Fish and Wildlife is 5.0 mg/l. For the purpose of this TMDL, a minimum dissolved oxygen level of 5.0 mg/l will be implemented allowing for an implicit margin of safety resulting from conservative assumptions used in the dissolved oxygen model.

A summary of the TMDL for the watershed is provided in the tables presented on the next page. The pollutants shown in the tables include ultimate carbonaceous biochemical oxygen demand ($CBOD_u$) and nitrogenous biochemical oxygen demand (NBOD), the principle causes for observed low dissolved oxygen concentrations. $CBOD_u$ is a measure of the total amount of oxygen required to degrade the carbonaceous portion of the organic matter present in the water. NBOD is the amount of oxygen utilized by bacteria as they convert ammonia to nitrate. Because organic nitrogen can be converted to ammonia, its potential oxygen demand is included in the NBOD component of the TMDL. The first table lists allowable pollutant loadings by source (point and non-point sources) for the summer season (May through November). The second table lists the allowable pollutant loadings for the winter season (December through April).

Table 1-1. Maximum Allowable Pollutant Loads by Source – Summer

Pollutant	Point Source Loads (lbs./day)	Non-point Source Loads (lbs./day)
$CBOD_u$	229.0	673.6
NBOD	98.1	186.2
Total	327.1	859.8

Table 1-2. Maximum Allowable Pollutant Loads by Source – Winter

Pollutant	Point Source Loads (lbs./day)	Non-point Source Loads (lbs./day)
$CBOD_u$	1,517.0	4,431.1
NBOD	1,182.2	3,694.1
Total	2,699.2	8,125.2

2.0 Basis for §303(d) Listing

2.1 Introduction

Section 303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)] require states to identify waterbodies which are not meeting water quality standards applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to implement the applicable water quality standards with seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants, or other quantifiable parameters for a waterbody, based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified Tallapoosa River as being impaired by organic loading (i.e., CBODu and NBOD) for a length of 4.3 miles, as reported on the 1996, 1998 and draft 2000 §303(d) list(s) of impaired waters. Tallapoosa River is prioritized as "medium" on the list(s). Tallapoosa River is located in Cleburne County and lies within the Tallapoosa River watershed of the Tallapoosa River basin.

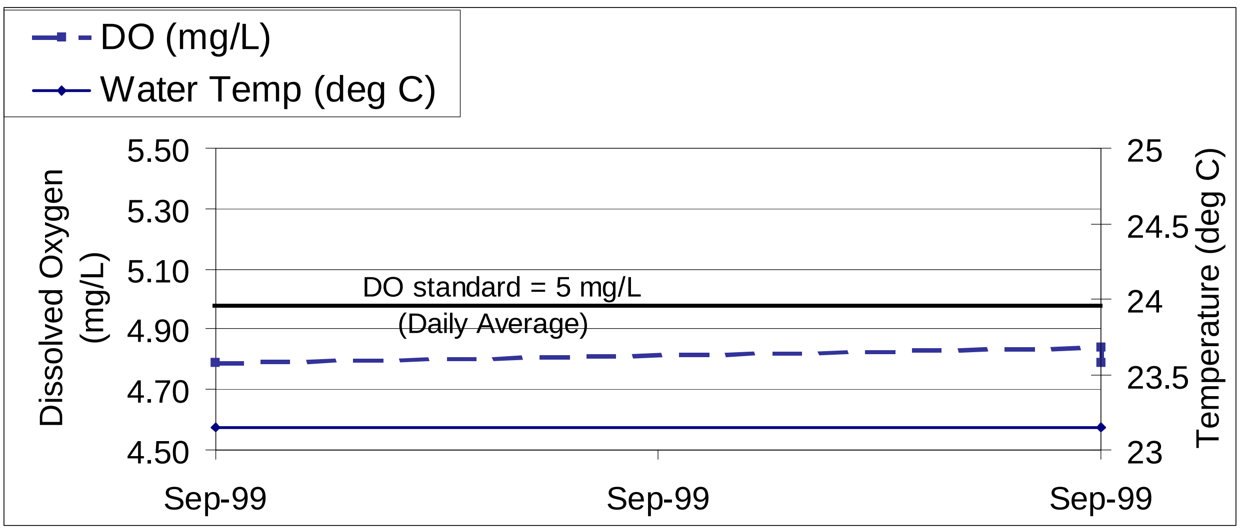
The TMDL developed for Tallapoosa River illustrates the steps that can be taken to address a waterbody impaired by low dissolved oxygen levels. The TMDL is consistent with a phased-approach: estimates are made of needed pollutant reductions, load reduction controls are implemented, and water quality is monitored for plan effectiveness. Flexibility is built into the plan so that load reduction targets and control actions can be reviewed if monitoring indicates continuing water quality problems.

2.2 Problem Definition

Tallapoosa River is a big headwater stream with a relatively large drainage area of 526 square miles. Dry weather flows for the watershed are relatively in significant. Water quality data collected for the watershed during 1992-2000, indicates that dissolved oxygen impairments occurred primarily during the summer months (May through November). Generally, depressed in-stream D.O. concentrations may be caused by several sources including the decay of oxygen demanding waste from both point and non-point sources, algal respiration, sediment oxygen demand or other sources.

Figure 2.1 below illustrates the dissolved oxygen versus temperature data available for Tallapoosa River at sampling station TALL-04.

Figure 2.1 Dissolved Oxygen vs. Temperature Data



Waterbody Impaired:	Tallapoosa River-from Dam-Cleb. Co. Rd. 36 to Cleburne Co. Rd. 19
Water Quality Standard Violation:	Dissolved Oxygen
Pollutant of Concern:	Organic Enrichment ($CBOD_u$/NBOD)
Water Use Classification:	Fish and Wildlife

The impaired stream segment, Tallapoosa River, is classified as Fish and Wildlife. Usage of waters in this classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d).

(a) Best usage of waters:

Fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food processing purposes.

(b) Conditions related to best usage:

The waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

(c) Other usage of waters:

It is recognized that the waters may be used for incidental water contact and recreation during June through September, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

(d) Conditions related to other usage:

The waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

Low D.O./Organic Loading Criteria:

Alabama's water quality criteria document (ADEM Admin. Code R. 335-6-10-.09-(5)(e)(4.)) states that for a diversified warm water biota, including game fish, daily dissolved oxygen concentrations shall not be less than 5 mg/l at all times; except under extreme conditions due to natural causes, it may range between 5 mg/l and 4 mg/l, provided that the water quality is favorable in all other parameters. The normal seasonal and daily fluctuations shall be maintained above these levels. In no event shall the dissolved oxygen level be less than 4 mg/l due to discharges from existing hydroelectric generation impoundments. All new hydroelectric generation impoundments, including addition of new hydroelectric generation units to existing impoundments, shall be designed so that the discharge will contain at least 5 mg/l dissolved oxygen where practicable and technologically possible. The Environmental Protection Agency, in cooperation with the State of Alabama and parties responsible for impoundments, shall develop a program to improve the design of existing facilities.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

The minimum dissolved oxygen concentration in a stream classified as Fish and Wildlife is 5.0 mg/l. For the purpose of this TMDL, a minimum dissolved oxygen level of 5.0 mg/l will be implemented allowing for an implicit margin of safety resulting from conservative assumptions used in the dissolved oxygen model. The target $CBOD_u$ and NBOD concentrations are concentrations that, in concert with the nitrification of ammonia, will not deplete the dissolved oxygen concentration below this level as a result of the decaying process.

3.2 Source Assessment

3.2.1. General Sources of $CBOD_u$ and NBOD

Both point and non-point sources may contribute $CBOD_u$ and NBOD (i.e., organic loading) to a given waterbody. Potential sources of organic loading are numerous and often occur in combination. In rural areas, storm runoff from row crops, livestock pastures, animal waste application sites, and feedlots can transport significant organic loading. Nationwide, poorly treated municipal sewage comprises a major source of organic compounds that are hydrolyzed to create additional organic loading. Urban storm water runoff, sanitary sewer overflows, and combined sewer overflows can be significant sources of organic loading.

All potential sources of organic loading in the watershed were identified based on an evaluation of current land use/cover information on watershed activities (e.g., agricultural management activities). The source assessment was used as the basis for development of the model and ultimate analysis of the TMDL allocations. The organic loading within the watershed included both point and non-point sources.

3.2.2. Point Sources in the Tallapoosa River Watershed

ADEM maintains a database of current NPDES permits and GIS files that locate each permitted outfall. This database includes municipal, semi-public/private, industrial, mining, industrial storm water, and concentrated animal feeding operations (CAFOs) permits. Table 3-1, below, shows the permitted point sources in the watershed that discharge into or upstream of the impaired segment. Table 3-2 contains the permit limitations for the significant point sources that were considered in the model development. Figure 3-1 shows the location of each facility considered a significant source relative to the impaired segment.

Table 3-1. Contributing Point Sources in the Tallapoosa River Watershed.

NPDES Permit	Type of Facility (e.g., CAFO, Industrial, Municipal, Semi-Public/Private, Mining, Industrial Storm Water)	Facility Name	Significant Contributor (Yes/No) [% $7Q_{10}$]
AL0056146	Municipal	Heflin WWTP	YES [2.1%]
AL0002810	Industrial	Tyson Poultry	YES [3.4%]

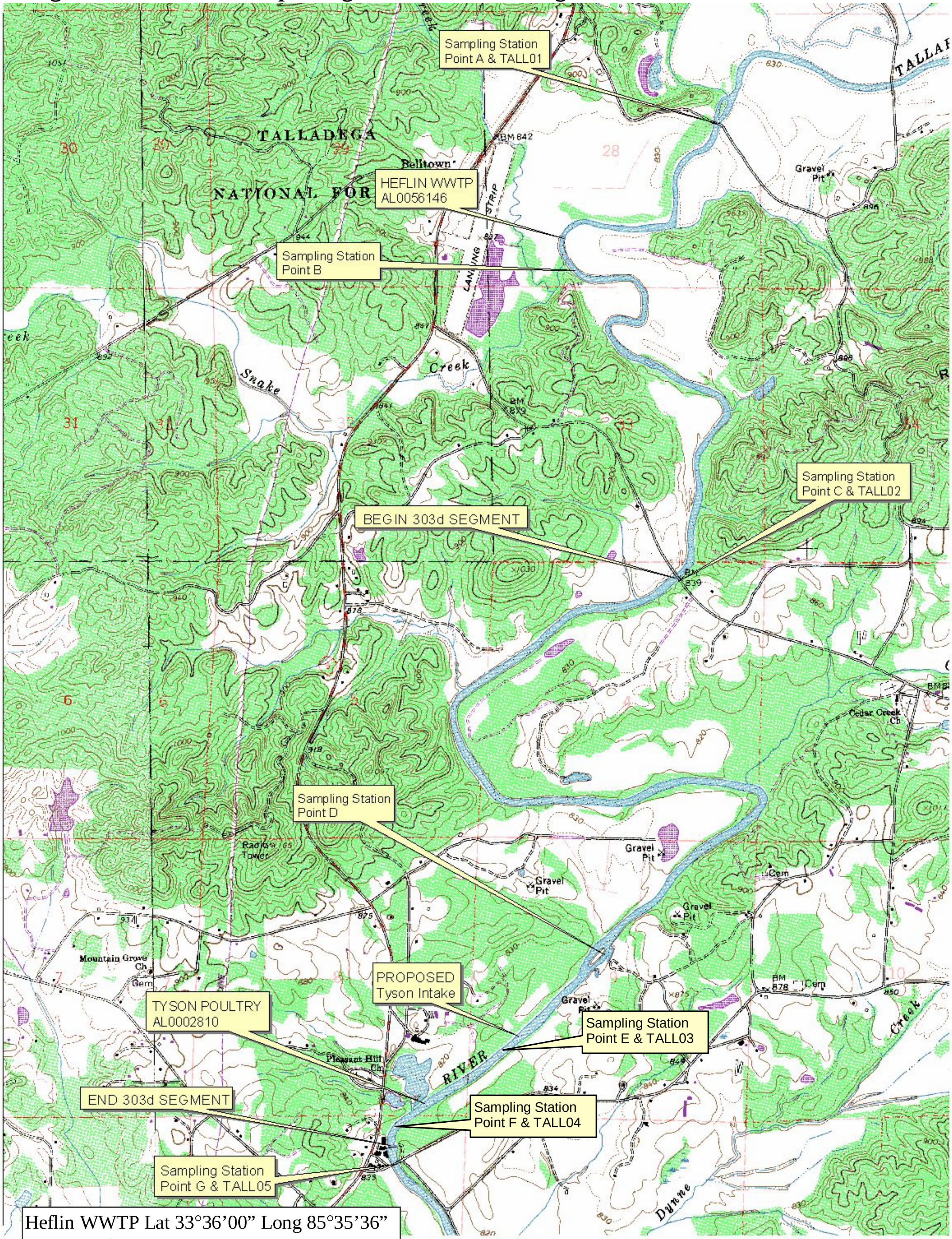
Note: Storm water discharges if listed in the above table were marked as not being significant contributors since the discharge would not occur during low flow conditions. Construction storm water discharges are not listed as these discharges do not occur during low flow and generally do not contribute directly to the organic loading.

Table 3-2. NPDES Permit Limits for Significant Contributing Point Sources

NPDES Permit	Facility Name	Permit Limtations - Summer							Permit Limtations - Winter						
		Flow (MGD)		BOD_5 (MG/L)		NH_3-N (MG/L)		DO (MG/L)	Flow (MGD)		BOD_5 (MG/L)		NH_3-N (MG/L)		DO (MG/L)
		Max	Avg	Max	Avg	Max	Avg	Min	Max	Avg	Max	Avg	Max	Avg	Min
AL0056146	Heflin WWTP	0.6	N/A	N/A	30	N/A	20*	2*	N/A	0.6	N/A	45	N/A	20*	2*
AL0002810	Tyson Poultry	1	N/A	N/A	29	N/A	2.44*	1	N/A	1	N/A	29	N/A	2.44*	1

* The number was assumed for modeling purposes.
Notes: N/A = not applicable

Figure 3-1. Location Map of Significant Contributing Point Sources



Heflin WWTP Lat 33°36’00” Long 85°35’36”
Tyson Poultry Lat 33°36’06” Long 85°36’23”

3.2.3. <u>Non-Point Sources in the Tallapoosa River Watershed</u>

Shown in Table 3-3, below, is a detailed summary of land usage in the Tallapoosa River watershed. A land use map of the watershed is presented in Figure 3-2. Shown below Figure 3-2 is a pie chart depicting principal land uses. The predominant land uses within the watershed are forest, pasture/hay, and row crops. Their respective percentages of the total watershed are 85%, 11%, and 4%. These perecentages were calculated by combining the smaller insignificant land uses (i.e., strip mine, quarry).

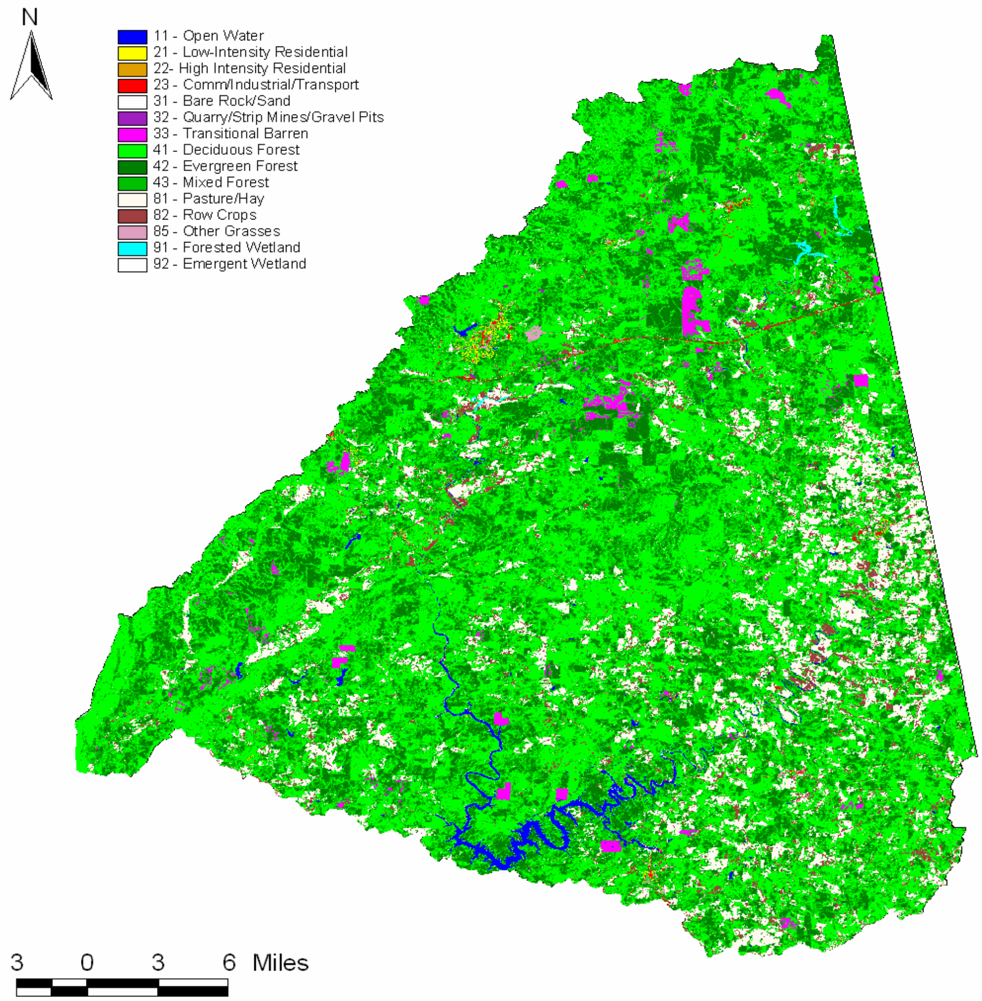
Table 3-3. Land Use in the Tallapoosa River Watershed.

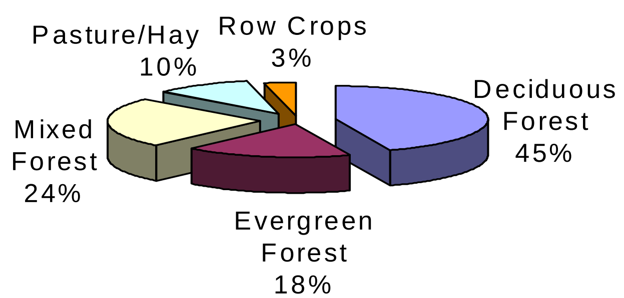
Land Use	Percentage of Watershed
Open Water	1.12%
Low-Intensity Industrial Residential	0.14%
High Intensity Residential	0.02%
Commercial/Industrial/Transport	0.24%
Quarry/Strip Mine/Gravel Pits	0.01%
Transitional Barren	1.24%
Deciduous Forest	42.87%
Evergreen Forest	17.18%
Mixed Forest	23.74%
Pasture/Hay	9.88%
Row Crops	3.27%
Other Grasses	0.16%
Forested Wetland	0.09%
Emergent Wetland	0.04%

The predominant land uses of forest, pasture/hay, and row crops make up 100% of the watershed. Each land use has the potential to contribute to the organic loading in the watershed due to organic material on the land surface that potentially can be washed off into the receiving waters of the watershed. Information on agricultural and management activities and watershed characteristics were obtained through coordination with the ADEM Mining and Non-Point Section, the Alabama Cooperative Extension System, and the USDA-Natural Resources Conservation Service (NRCS).

The major sources of organic enrichment from non-point sources within the Tallapoosa River watershed are the forest, pasture/hay, and row crops land uses. Compared to other land uses organic enrichment from forested land is normally considered to be small. This is because forested land tends to serve as a filter of pollution originating within its drainage areas. However, organic loading can originate from forested areas due to the presence of wild animals such as deer, raccoons, turkeys, waterfowl, etc. Control of these sources is usually limited to land management best management practices (BMPs) and may be impracticable in most cases. In contrast to forested land, agricultural land can be a major source of organic loading. Runoff from pastures, animal operations, improper land application of animal wastes, and animals with access to streams are all mechanisms that can introduce organic loading to waterbodies.

Figure 3-2. Land Use Map for the Tallapoosa River Watershed.





3.3 Loading Capacity – Linking Numeric Water Quality Targets and Pollutant Sources

EPA regulations define loading, or assimilative capacity, as the greatest amount of loading that a waterbody can receive without violating water quality standards (40 CFR Part 130.2(f)).

Alabama's water quality criteria document (ADEM Admin. Code R. 335-6-10-.09-(5)(e)(4.)) states that for a diversified warm water biota, including game fish, daily dissolved oxygen concentrations shall not be less than 5 mg/l at all times; except under extreme conditions due to natural causes, it may range between 5 mg/l and 4 mg/l, provided that the water quality is favorable in all other parameters. The normal seasonal and daily fluctuations shall be maintained above these levels.

Using the D.O. water quality criterion of 5.0 mg/l as the numerical target, a TMDL model analysis was performed at critical conditions (i.e., summer) to determine the loading capacity for the watershed. This was accomplished through a series of simulations aimed at meeting the dissolved oxygen target limit by varying source contributions. The final acceptable simulation represented the TMDL (and loading capacity of the waterbody). If point sources were identified in the watershed, an additional model analysis was performed for winter to determine the loading capacity during higher flow conditions.

In the TMDL model analysis, the pollutant concentrations from forestland were assumed to be at normal background concentrations. Specific values for background pollutant concentrations are as follows: 2 mg/l $CBOD_u$, 0.5 mg/l ammonia oxygen demand (NH_3OD_u), and 1 mg/l total organic nitrogen oxygen demand ($TONOD_u$). Pollutant concentrations for the other land uses in the watershed were assigned in proportion to measured concentrations and were set in the TMDL model at levels necessary to maintain dissolved oxygen concentrations greater than, or equal to, 5 mg/l. The model predictions for in-stream pollutant concentrations were then compared to actual field data. The model velocities and reaeration coefficients were adjusted in those cases where the field data indicated significant discrepancies from the model predictions.

3.4 Data Availability and Analysis

3.4.1. Watershed Characteristics

A. General Description: Tallapoosa River, located in Cleburne County, is a tributary to the Alabama River. The Tallapoosa River is a part of the Tallapoosa River basin. Tallapoosa River is a part of the USGS (United States Geological Survey) 03150108 cataloging unit and the NRCS (Natural Resources Conservation Service) 110 sub-watershed. Cataloging unit 03150108 includes the Tallapoosa River basin. NRCS sub-watershed number 110 represents the Upper Tallapoosa River watershed.

   The impaired portion of the Tallapoosa River begins approximately 2 miles south of Heflin, Alabama in section 28 T16S, R10E. It has a length of 4.3 miles and a total drainage area of 591.3 square miles. Tallapoosa River has a use classification of Fish & Wildlife (F&W).

B. Geological Description: The upper portion of the Tallpoosa River impaired segment consists of the rock type Greenstone, with a Hillabee Greenstone Formation. The lower portion of the Tallpoosa River impaired segment consists of the rock type Amphibolite, with a Ketchepedrakee Amphibolite.

C. Eco-region Description: The Tallapoosa River consists of the Southern Inner Piedmont of Alabama which is mostly higher in elevation with more relief than 45b, but has less elevation and relief and has different rocks and soils than 45d. Covering most of the Ashland Plateau, the rolling to hilly region is a moderately to well dissected upland with schist, gneiss, and granite bedrock. Madison soils are typical over the more micaceous saprolite and rocks, and these soils are more common in 45a than in 45b. This ecoregion is drained mostly by the Tallapoosa River, and in the west, by tributaries to the lower Coosa River. The region is mostly forested, with major forest types of oak-pine and oak-hickory. Native pines include loblolly, short leaf, and some longleaf. Open areas are mostly in pasture, although there are some small areas of cropland. Hay, cattle, and poultry are the main agricultural products.

The northern boundary generally coincides with the beginning of the Lay Dam geologic formation of 45d in the east, and the Ridge and Valley boundary (67) to the west. The southwest boundary is the Fall Line transition zone to the Coastal Plain of ecoregion 65. The southeastern boundary with 45b is similar to the southern boundary of the Northern Piedmont Upland physiographic region (Sapp and Emplaincourt 1975), and to the Opelika Plateau forest habitat region northern boundary (Hodgkins et al. 1976).

D. Other Notable Characteristics: A dam is located in reach 7 at river mile 1.105.

3.4.2 Available Water Quality and Biological Data

Water Quality and biological data for the Tallapoosa River is available for the period of 1992 through 2000. The data was collected by the Alabama Department of Environmental Management. A complete listing of the available data can be found in the appendix of this report.

A map indicating the location of sampling points relative to applicable point source discharges is presented in Figure 3-1.

3.4.3. Flow data

For the purpose of this TMDL, annual $7Q_{10}$ stream flows for the summer season and annual $7Q_2$ stream flows for the winter season are employed. These flows represent worst-case scenarios for seasonal model evaluations. The use of worst-case conditions, in turn, creates a margin of safety in the final results.

The $7Q_{10}$ flow represents the minimum 7-day flow that occurs, on average, over a 10-year recurrence interval. Likewise, the $7Q_2$ is the minimum 7-day flow that occurs, on average, over a 2-year period.

Both flows (i.e., $7Q_{10}$ and $7Q_2$) can be calculated for the model using gage data from the United States Geological Survey (USGS) or by using the Bingham Equation. The USGS continuous-record station (02412000) on the Tallapoosa River near Heflin, Alabama can be found on page 64 of a publication from the USGS entitled, Low-Flow and Flow-Duration Characteristics of Alabama Streams, Report 93-4186. The Bingham Equation can be found on page 3 of a publication from the Geological Survey of Alabama entitled, Low-Flow Characteristics of Alabama Streams, Bulletin 117.

The equations used to calculate the $7Q_{10}$ and $7Q_2$ flows based on continuous USGS gaging records for the stream and any associated tributaries are as follows:

$$7Q_{10}\,(\text{cfs}) = \frac{(7Q_{10}\ @\ \text{USGS Station (cfs)})}{(\text{Drainage Area @ USGS Station (mi}^2))} * (\text{Watershed Drainage Area (mi}^2))$$

$$7Q_{10} = \frac{(38)}{(448)} * (526)$$

$$7Q_{10} = 44.6 \text{ cfs}$$

$$7Q_2\,(\text{cfs}) = \frac{(7Q_2\ @\ \text{USGS Station (cfs)})}{(\text{Drainage Area @ USGS Station (mi}^2))} * (\text{Watershed Drainage Area (mi}^2))$$

$$7Q_{10} = \frac{(96)}{(448)} * (526)$$

$$7Q_{10} = 112.7 \text{ cfs}$$

The calculated flows were distributed over the Tallapoosa River in the form of tributary flow or incremental inflow (identified on the modeled reach schematic as IF). The IF was distributed in proportion to the length of each segment. The $7Q_{10}$ and $7Q_2$ flows for the tributaries can be found in Figure 4-1.

3.5 Critical Conditions

Summer months (May – November) are generally considered critical conditions for dissolved oxygen in streams. This can be explained by the nature of storm events in the summer versus the winter. Periods of low precipitation allow for slower in-stream velocity, which increases the organic loading residence time and decreases stream re-aeration rates. This increased time permits more decay to occur which depletes the stream's dissolved oxygen supply. Reaction rates for $CBOD_u$ and NBOD (i.e., organic loading) are temperature dependent and high summertime temperatures increase the decay process, which depletes the dissolved oxygen even further.

In winter, frequent low intensity rain events are more typical and do not allow for the build-up of organic loading on the land surface, resulting in a more uniform loading rate. Higher flows and lower temperatures create less residence time and lower decay rates. This pattern is evidenced in the output data of the model where the highest allowable loading achieved was for winter stream flows.

3.6 Margin of Safety (MOS)

There are two basic methods of incorporating the MOS (USEPA, 1991): 1) implicitly, using conservative model assumptions, or 2) explicitly specifying a portion of the TMDL as the MOS.

The MOS is implicit in this TMDL process through the use of conservative model input parameters (**temperature, flow and D.O. concentrations**). Conservative temperature values are employed through the use of the highest average maximum temperature that would normally occur under critical stream flow conditions. The $7Q_{10}$ and $7Q_2$ stream flows employed for summer and winter, respectively, reflect the lowest flows that would normally occur under critical conditions. Finally, the D.O. concentration for incremental flow was set at 70% of the saturation concentration at the given temperature, which is 15% lower than the 85% normally assumed in a typical waste load allocation.

4.0 Water Quality Model Development

4.1 Water Quality Model Selection and Setup

Since the impairment noted by the available data occurred during periods of low flows, a steady-state modeling approach was adopted as appropriate to represent the relevant conditions in the impaired waterbody. The steady state TMDL spreadsheet water quality model (SWQM) developed by the ADEM was selected for the following reasons:

- It is a simplified approach without unnecessary complexity.
- It conforms to ADEM standard practices for developing wasteload allocations.
- It lends itself to being developed with limited data, which is the present situation for this waterbody.
- It has the ability to handle tributary inputs and both point and non-point source inputs.

The TMDL spreadsheet model also provides a complete spatial view of a stream, upstream to downstream, giving differences in stream behavior at various locations along the model reach. The model computes dissolved oxygen using a modified form of the Streeter-Phelps equation. The modified Streeter-Phelps equation takes into account the oxygen demand due to carbonaceous decay plus the oxygen demand generated from the nitrification process (ammonia decay). Each stream reach is divided into twenty elements, with each element assumed to be the functional equivalent of a completely mixed reactor.

The following assumptions were used in the spreadsheet TMDL model***:***

- D.O. concentrations for incremental flow were assumed @ 70% of the saturated value at the given temperature. **(MOS)**
- Incremental and tributary loading were apportioned to correlate with the land usage of the drainage basin.
- Ratios for $CBOD_u/NH_3OD_u$ and $CBOD_u/TONOD_u$ were calculated using water quality data for the waterbody. These ratios were assigned in the estimation of loading parameters for incremental flow and tributaries for all land uses, except forest and open water.
- $CBOD_u/BOD_5$ ratio used for Heflin WWTP was 6.
- $CBOD_u/BOD_5$ ratio used for Tyson Poultry was 4.
- $CBOD_u/BOD_5$ ratio used for nonpoint sources was 1.5.
- NH_3OD_u is equal to 4.57 times the ammonia nitrogen concentration.
- $TONOD_u$ is equal to 4.57 times the organic nitrogen concentration.
- Background conditions were assumed for forest incremental flow.
  Background conditions are typically the following ranges: 2-3 mg/l $CBOD_u$, 0.2-1 mg/l NH_3OD_u, 1-2 mg/l $TONOD_u$.

The vertical profile of DO measured on September 16, 1999 ranged from 4.83 to 4.68 mg/L surface to bottom, respectively. This profile represents a well-mixed water column with a vertically integrated concentration of 4.8 mg/L. The spreadsheet modeling approach represents a vertically integrated concentration because it assumes the system is completely mixed from the surface to the bottom. Therefore, the model calibrated to the vertically integrated value of 4.8 mg/L versus the 1.5-meter compliance point with a concentration of 4.79 mg/L. In this particular situation there would be no difference in the model: however, typically there would be a larger discrepancy when there is more stratification in the DO profile. In the case where stratification did exist, the more conservative modeling approach would be to calibrate to a vertically integrated concentration instead of the 1.5-meter compliance point.

The profile on September 16, 1999 was measured at 8:40 am representing an early morning DO condition. Algal respiration occurs in the late evening to dawn hours and photosynthesis occurs with available light and is at its maximum at early afternoon hours. This particular profile at the early morning hour is a direct representation of the low-end of the DO diurnal activity. Therefore, by using this data as the calibration point, in conjunction with it being located in the critical area upstream of the dam at TALL-04, it shows that the model can account for diurnal activity and its impact on the allocation. The Hydrolab data from September 2000 shows a diurnal swing of approximately 0.5 mg/L. Therefore, assuming that this is a typical swing in the concentrations over the day, there is an implicit margin of safety in the modeling analysis.

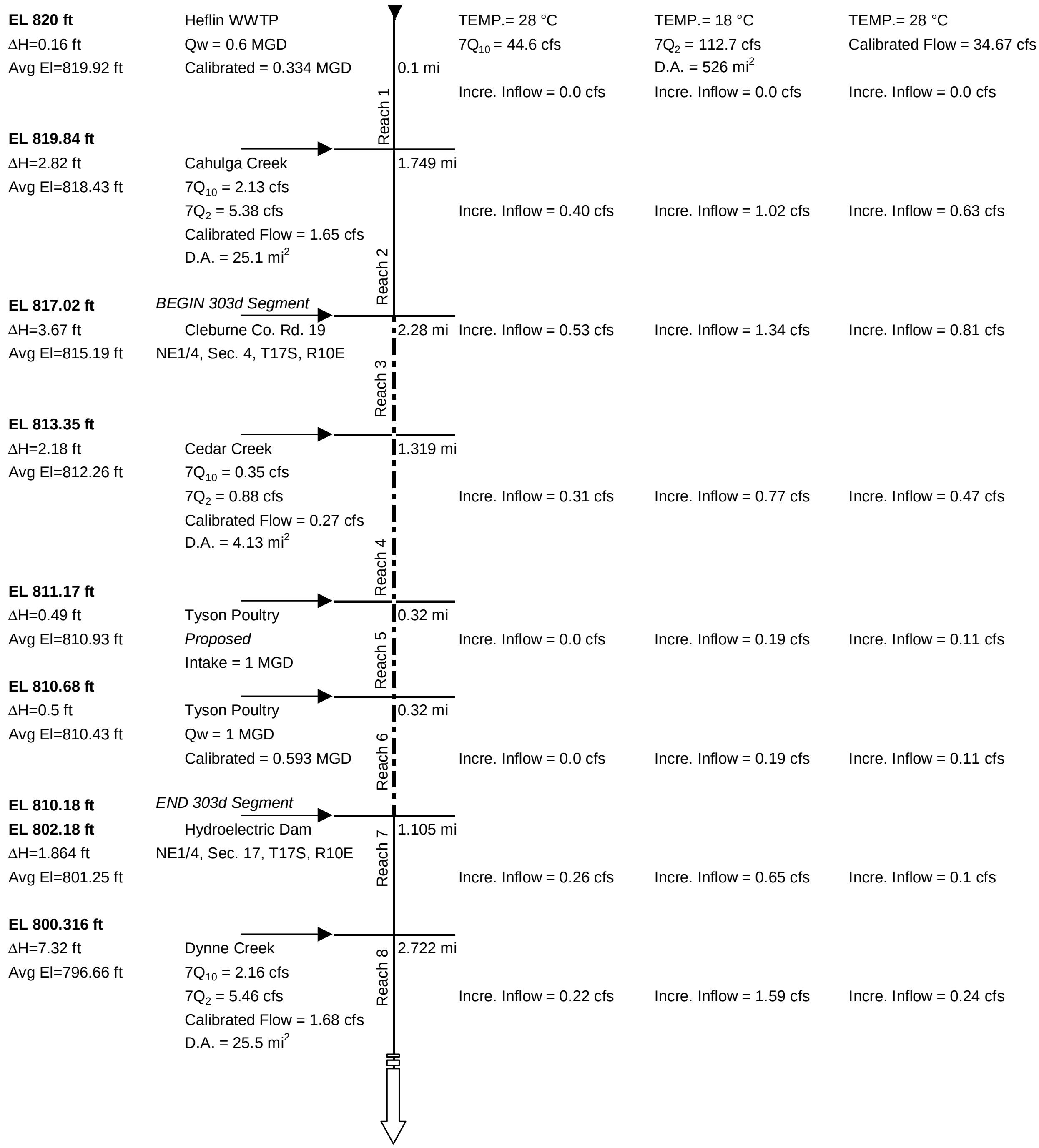
4.1.1. <u>SOD Representation</u>: Sediment oxygen demand (SOD) can be an important part of the oxygen demand budget in shallow streams. However, for shallow streams with sand and silt, the SOD component is generally small. These hydrogeological conditions are representative of the Tallapoosa River. It is believed, therefore, that the SOD for this stream is minimal. In the absence of available field SOD measurements for the waterbody, SOD data was obtained from EPA Region IV's SOD database. The EPA SOD database represents mixed land uses and varying degrees of point source activity. Various SOD values ranging from 0.025 to 0.055 gm-O2/ft2/day were applied to the Tallapoosa River model. The numbers were determined from the EPA SOD database for a stream with a sand and gravel bottom, which is similar to the characteristics in the Tallapoosa River.

4.1.2. <u>Calibration Data:</u> The model calibration period was determined from an examination of the available field data (ref: Appendix) during the period of September 16, 1999. The combination of the lowest, steady flow period with the lowest dissolved oxygen defined the critical modeling period. The stream conditions (i.e., D.O., temperature) during this period were incorporated into the calibrated model TMDL spreadsheet.

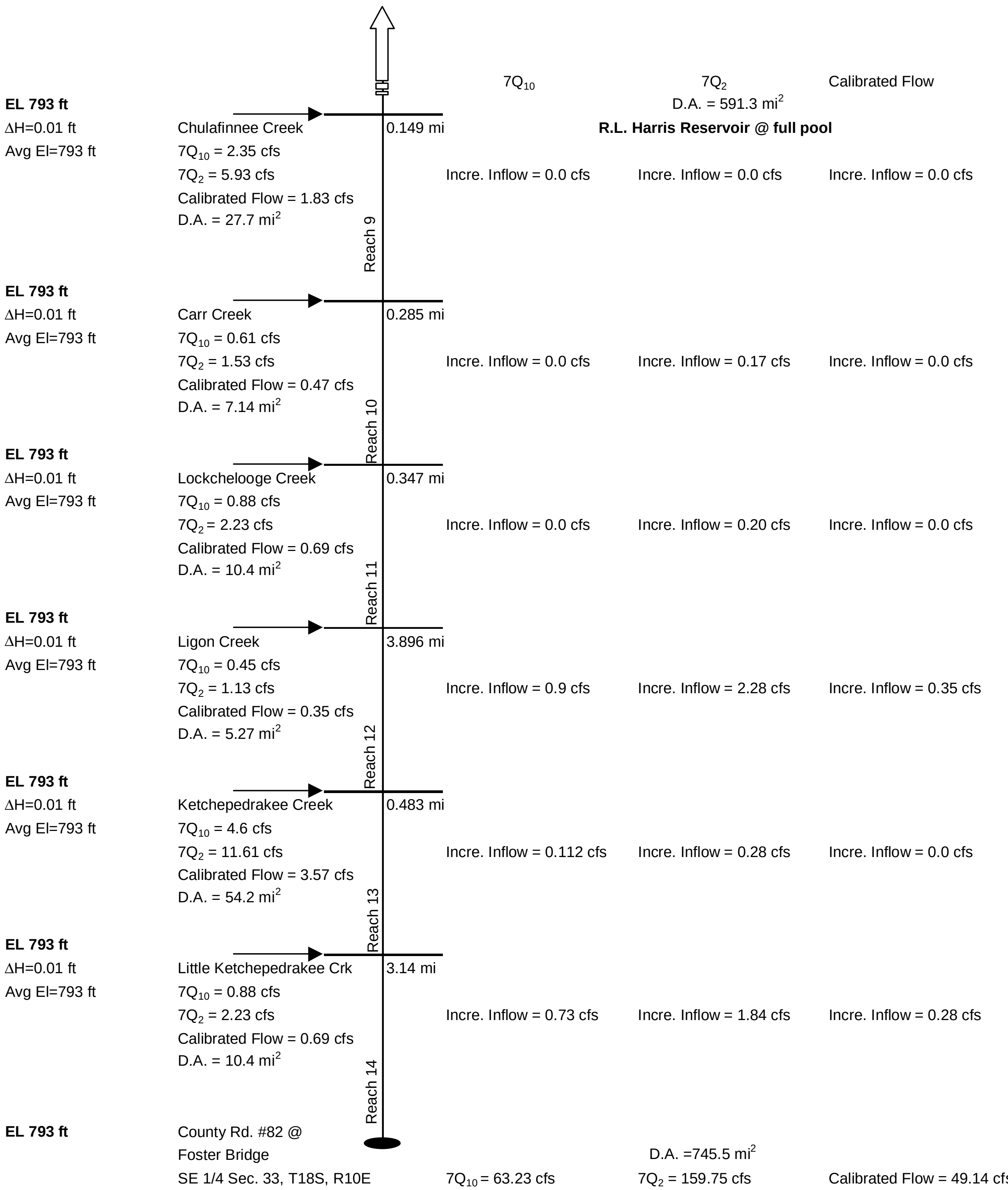
4.2 Water Quality Model Summary

The model reach used for each season was longer than the impaired. The summer model reach consisted of 14 segments. The impaired portion of the summer model reach consists of segments 3, 4, 5, and 6. The length of the impaired portion is 4.3 miles. Total distance of the summer model reach is 18.2 miles. The winter model reach consisted of 14 segments. The impaired portion of the winter model reach consists of segments 3, 4, 5, and 6. The length of the impaired portion is the same as that for summer. Total distance of the winter model reach is 18.2 miles. A schematic diagram of the model is presented in Figure 4-1. Assumed in-stream seasonal temperatures are based on historical model development. A guide for use of ADEM's TMDL water quality model can be found in the appendix. The guide also explains the theoretical basis for the physical/chemical mechanisms and principles that form the foundation of the model.

Figure 4-1. Schematic of the Modeled Reach.



Schematic of the Modeled Reach continued.



4.2.1. Summer (May – November) Model

Summer Stream Flow Parameters

Description	Flow (cfs)	DO (mg/l)	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	Temp (^oC)
Headwater	44.6	6.897	2.0000	0.0437	0.0740	26.0
Heflin WWTP	0.928	0.928	24.000	1	1	26.0
Cahulga Creek	2.13	6.897	2.0000	0.0466	0.0825	26.0
Cedar Creek	0.35	6.897	2.0000	0.0466	0.0825	26.0
Tyson Poultry	1.547	6.500	16.000	0.5	1	26.0
Dynne Creek	2.16	6.897	2.0000	0.0466	0.0825	26.0
Chulafinnee Creek	2.35	6.897	2.0000	0.0466	0.0825	26.0
Carr Creek	0.61	6.897	2.0000	0.0466	0.0825	26.0
Lockchelooge Creek	0.88	6.897	2.0000	0.0466	0.0825	26.0
Ligon Creek	0.45	6.897	2.0000	0.0466	0.0825	26.0
Ketchepedrakee Creek	4.60	6.897	2.0000	0.0466	0.0825	26.0
Little Ketchepedrakee Creek	0.88	6.897	2.0000	0.0466	0.0825	26.0
Conditions @ Lowest D.O.	49.2482	5.0097	1.8870	0.0554	0.0837	26.0
Flow @ End of Model	63.4002	6.7855	0.3091	0.0104	0.0134	26.0

Summer Incremental Flow Parameters

Sections	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	DO (mg/l)	Total Flow (cfs)	Temp. (^oC)
1	0.0000	0.0000	0.0000	0.0000	0.00	26.0
2	2.0000	0.0466	0.0825	5.6800	0.40	26.0
3	2.0000	0.0466	0.0825	5.6800	0.53	26.0
4	2.0000	0.0466	0.0825	5.6800	0.31	26.0
5	0.0000	0.0000	0.0000	0.0000	0.00	26.0
6	0.0000	0.0000	0.0000	0.0000	0.00	26.0
7	2.0000	0.0466	0.0825	5.6800	0.26	26.0
8	2.0000	0.0466	0.0825	5.6800	0.22	26.0
9	0.0000	0.0000	0.0000	0.0000	0.00	26.0
10	0.0000	0.0000	0.0000	0.0000	0.00	26.0
11	0.0000	0.0000	0.0000	0.0000	0.00	26.0
12	2.0000	0.0466	0.0825	5.6800	0.90	26.0
13	2.0000	0.0466	0.0825	5.6800	0.11	26.0
14	2.0000	0.0466	0.0825	5.6800	0.73	26.0

4.2.2 Winter (December – April) Model

Winter Stream Flow Parameters

Description	Flow (cfs)	DO (mg/l)	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	Temp (°C)
Headwater	112.7	8.05	5.1500	0.3176	0.6239	18.0
Heflin WWTP	0.928	8.05	150.000	10	10	18.0
Cahulga Creek	5.38	8.05	5.1500	0.3140	0.6205	18.0
Cedar Creek	0.88	8.05	5.1500	0.3140	0.6205	18.0
Tyson Poultry	1.547	8.05	100.000	10	10	18.0
Dynne Creek	5.46	8.05	5.1500	0.3140	0.6205	18.0
Chulafinnee Creek	5.93	8.05	5.1500	0.3140	0.6205	18.0
Carr Creek	1.53	8.05	5.1500	0.3140	0.6205	18.0
Lockchelooge Creek	2.23	8.05	5.1500	0.3140	0.6205	18.0
Ligon Creek	1.13	8.05	5.1500	0.3140	0.6205	18.0
Ketchepedrakee Creek	11.61	8.05	5.1500	0.3140	0.6205	18.0
Little Ketchepedrakee Creek	2.23	8.05	5.1500	0.3140	0.6205	18.0
Conditions @ Lowest D.O.	123.3982	8.05	5.5861	0.4726	0.6118	18.0
Flow @ End of Model	160.5282	8.05	1.5322	0.1760	0.1722	18.0

Winter Incremental Flow Parameters

Sections	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	DO (mg/l)	Total Flow (cfs)	Temp. (°C)
1	0.00	0.0000	0.0000	0.00	0.00	18.0
2	5.1500	0.3140	0.6205	6.6300	1.02	18.0
3	5.1500	0.3140	0.6205	6.6300	1.34	18.0
4	5.1500	0.3140	0.6205	6.6300	0.77	18.0
5	5.1500	0.3140	0.6205	6.6300	0.19	18.0
6	5.1500	0.3140	0.6205	6.6300	0.19	18.0
7	5.1500	0.3140	0.6205	6.6300	0.65	18.0
8	5.1500	0.3140	0.6205	6.6300	1.59	18.0
9	0.00	0.0000	0.0000	0.00	0.00	18.0
10	5.1500	0.3140	0.6205	6.6300	0.17	18.0
11	5.1500	0.3140	0.6205	6.6300	0.20	18.0
12	5.1500	0.3140	0.6205	6.6300	2.28	18.0
13	5.1500	0.3140	0.6205	6.6300	0.28	18.0
14	5.1500	0.3140	0.6205	6.6300	1.84	18.0

4.3 Summer and Winter Models Predictions and Graphics

Figure 4-2. Summer Model Predictions.

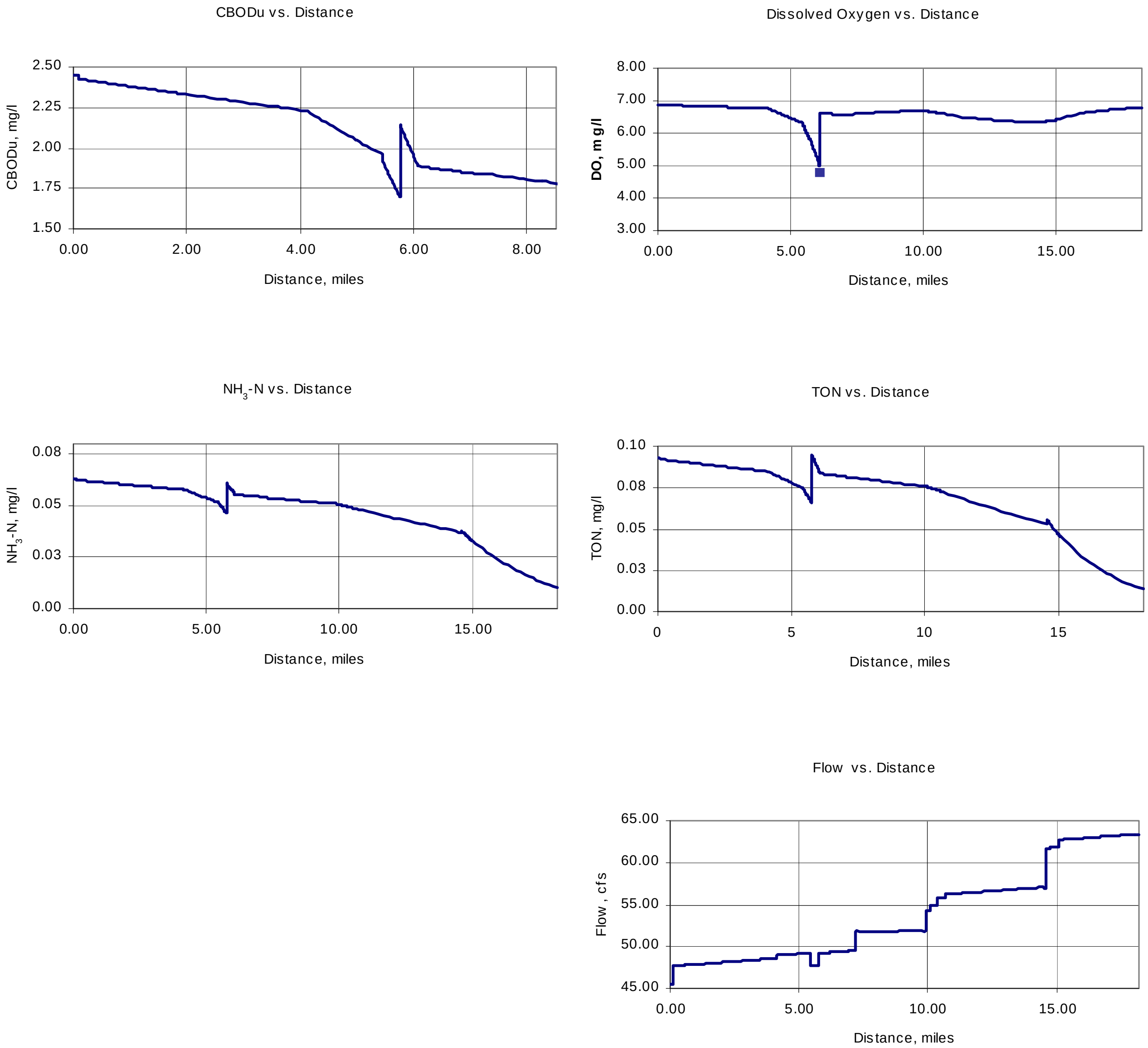
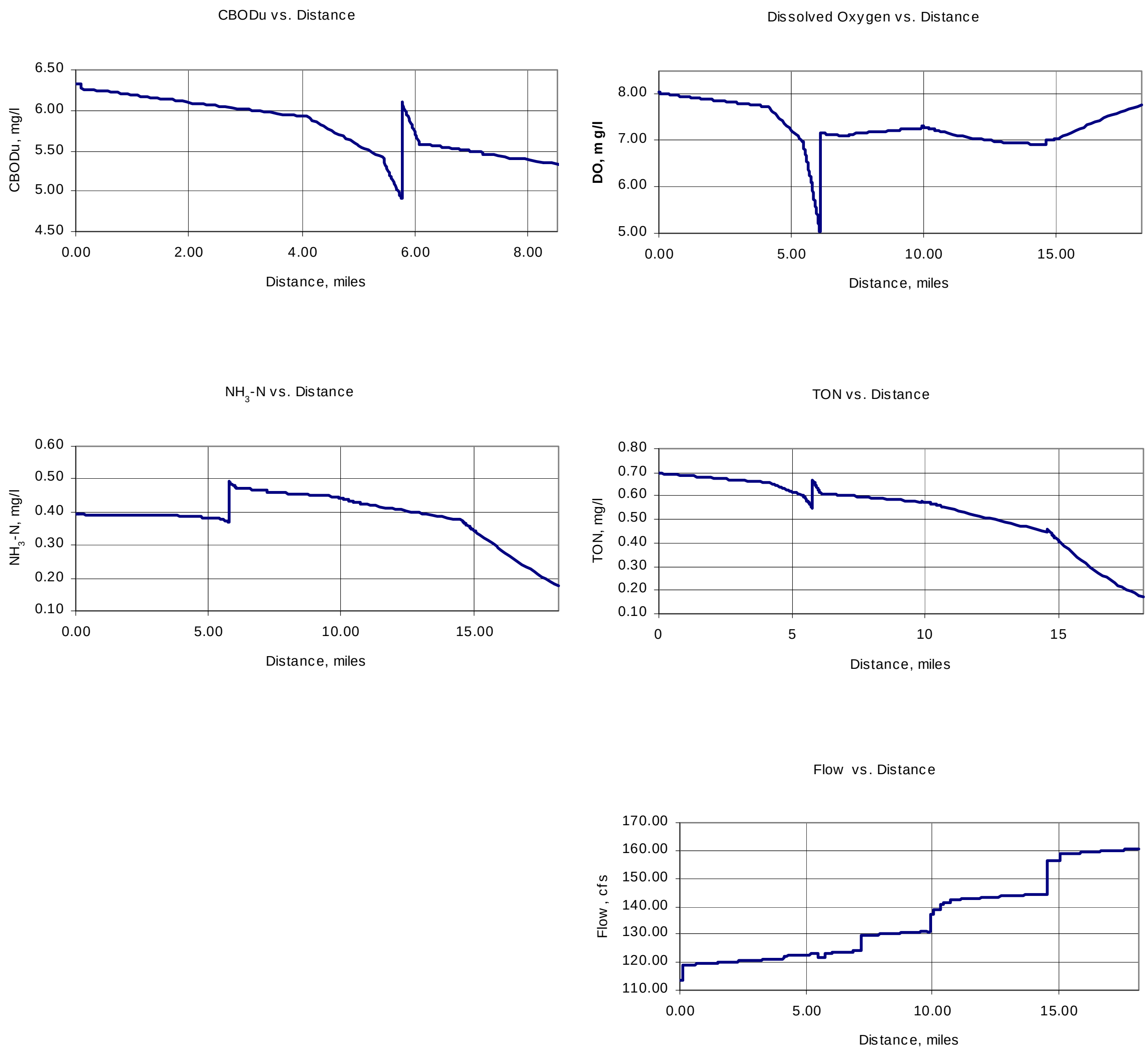


Figure 4-3. Winter Model Predictions.



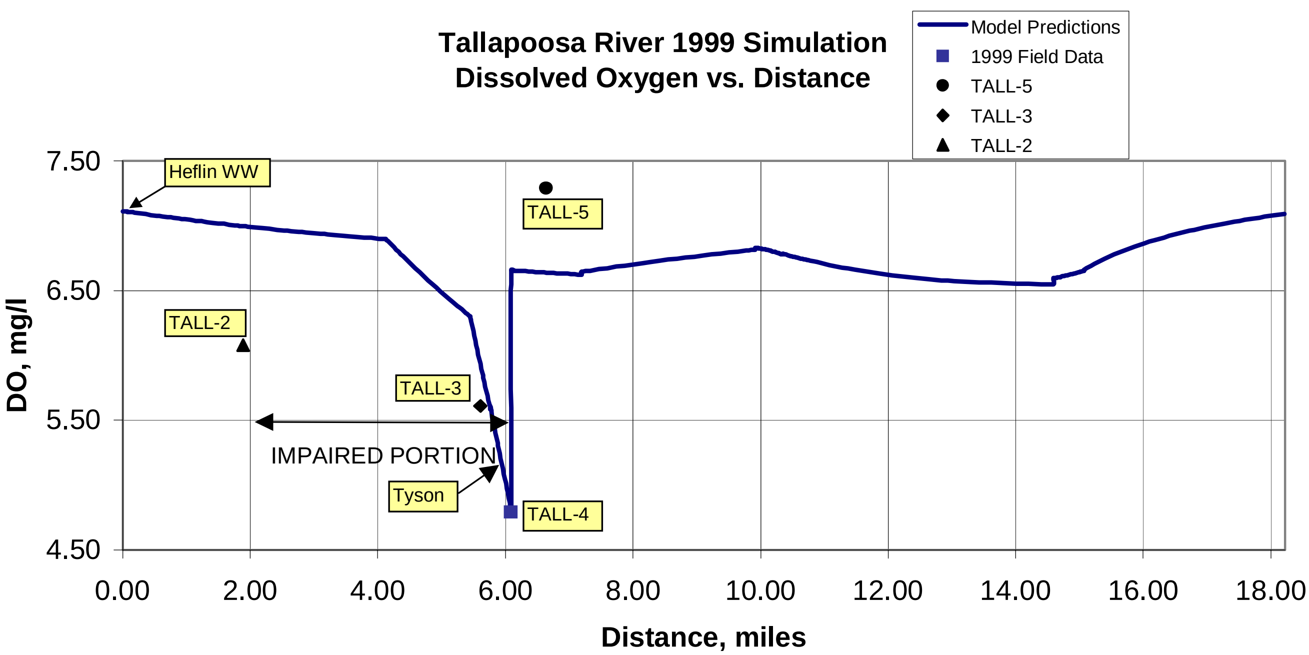
4.4 Loading Reduction Analysis

4.4.1. Calibrated Model

The only D.O. violation from available field data occurred at TALL-4. The lowest observed D.O. value occurred during the September 9, 1999, sampling event. The measured concentration was 4.79 mg/l. Field data from the sampling event was used as input into the summer TMDL model to perform a third simulation referred to as the calibrated model (the first and second simulations are the summer and winter models, respectively). Non-point source loading was adjusted so that model predictions simulated the measured D.O. value as closely as possible at TALL-4, while still providing a reasonable representation of water quality in the stream at the time of the sampling event.

Shown in Figure 4-4, below, is a plot of D.O. calibrated model predictions vs. actual D.O. field data.

Figure 4-4. Calibrated Model D.O. Predictions vs. Actual D.O. Field Data.



Calibrated Model Flow Parameters

Description	Flow (cfs)	DO (mg/l)	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	Temp (°C)
Headwater	34.67	7.16	2.75	0.0437	0.0740	24.0
Heflin WWTP	0.517	4	66.0	10	5	24.0
Cahulga Creek	1.65	7.16	2.75	0.0466	0.0825	24.0
Cedar Creek	0.27	7.16	2.75	0.0466	0.0825	24.0
Tyson Poultry	0.941	6.4	12.0	0.05	0.79	24.0
Dynne Creek	1.68	7.16	2.75	0.0466	0.0825	24.0
Chulafinnee Creek	1.83	7.16	2.75	0.0466	0.0825	24.0
Carr Creek	0.47	7.16	2.75	0.0466	0.0825	24.0
Lockchelooge Creek	0.69	7.16	2.75	0.0466	0.0825	24.0
Ligon Creek	0.35	7.16	2.75	0.0466	0.0825	24.0
Ketchepedrakee Creek	3.57	7.16	2.75	0.0466	0.0825	24.0
Little Ketchepedrakee Creek	0.69	7.16	2.75	0.0466	0.0825	24.0
Conditions @ Lowest D.O.	40.1773	6.6564	2.5449	0.1013	0.1059	24.0
Flow @ End of Model	50.4273	7.0905	0.4810	0.0160	0.0185	24.0

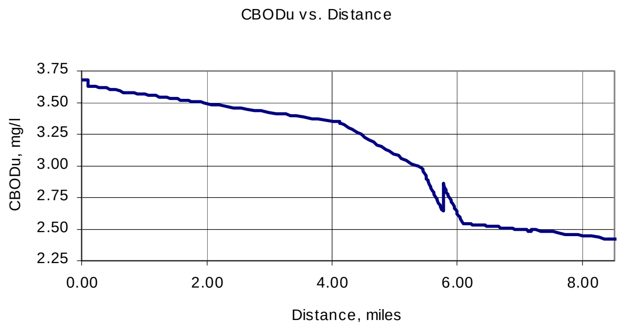
Calibrated Model Incremental Flow Parameters

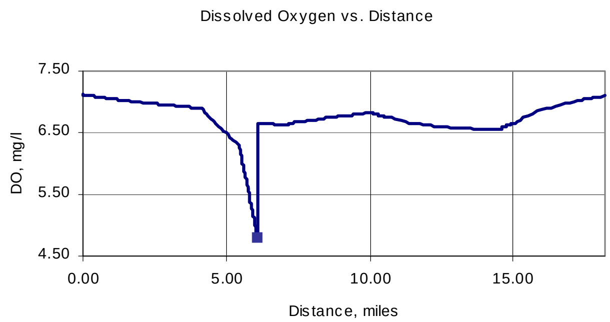
Sections	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	DO (mg/l)	Total Flow (cfs)	Temp. (°C)
1	0.00	0.0466	0.0825	0.00	0.00	24.0
2	2.7500	0.0466	0.0825	5.8900	0.63	24.0
3	2.7500	0.0466	0.0825	5.8900	0.81	24.0
4	2.7500	0.0466	0.0825	5.8900	0.47	24.0
5	2.7500	0.0466	0.0825	5.8900	0.11	24.0
6	2.7500	0.0466	0.0825	5.8900	0.11	24.0
7	2.7500	0.0466	0.0825	5.8900	0.10	24.0
8	2.7500	0.0466	0.0825	5.8900	0.24	24.0
9	0.00	0.0000	0.0000	0.00	0.00	24.0
10	0.00	0.0000	0.0000	0.00	0.00	24.0
11	0.00	0.0000	0.0000	0.00	0.00	24.0
12	2.7500	0.0466	0.0825	5.8900	0.35	24.0
13	2.7500	0.0000	0.0000	5.8900	0.00	24.0
14	2.7500	0.0466	0.0825	5.8900	0.28	24.0

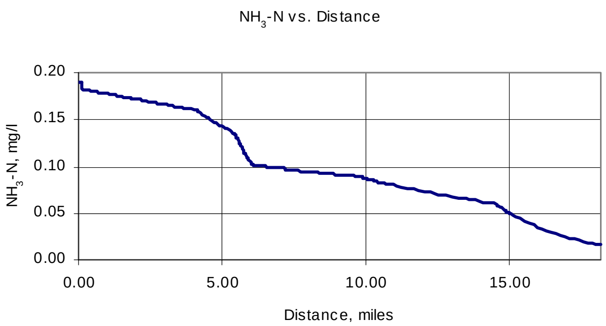
Comparison of Calibrated Model Flow Parameters to Actual Data

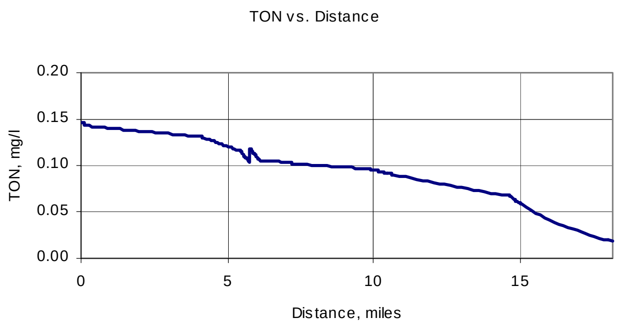
Description	Flow (cfs)	DO (mg/l)	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	Temp (°C)
Actual Conditions @ Low D.O.	40.1	4.79	3.6	0.015	0.135	24.0
Cal. Conditions @ Low D.O.	40.1773	4.8208	2.5449	0.1013	0.1059	24.0

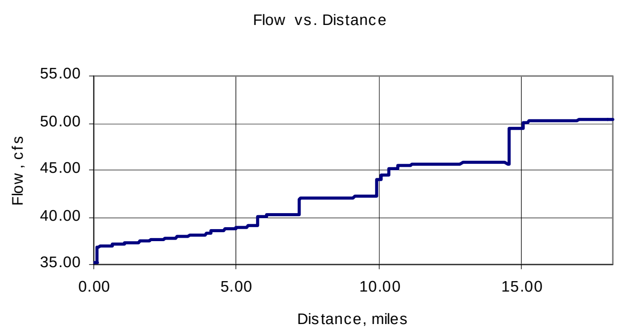
Figure 4-4. Calibrated Model Predictions and Graphics.











4.4.2. Load Reduction Model

The fourth simulation is referred to as the load reduction model. In this simulation, non-point and point source loadings in the calibrated model were adjusted to bring the waterbody into compliance with the 5 mg/l D.O. Fish & Wildlife water quality standard.

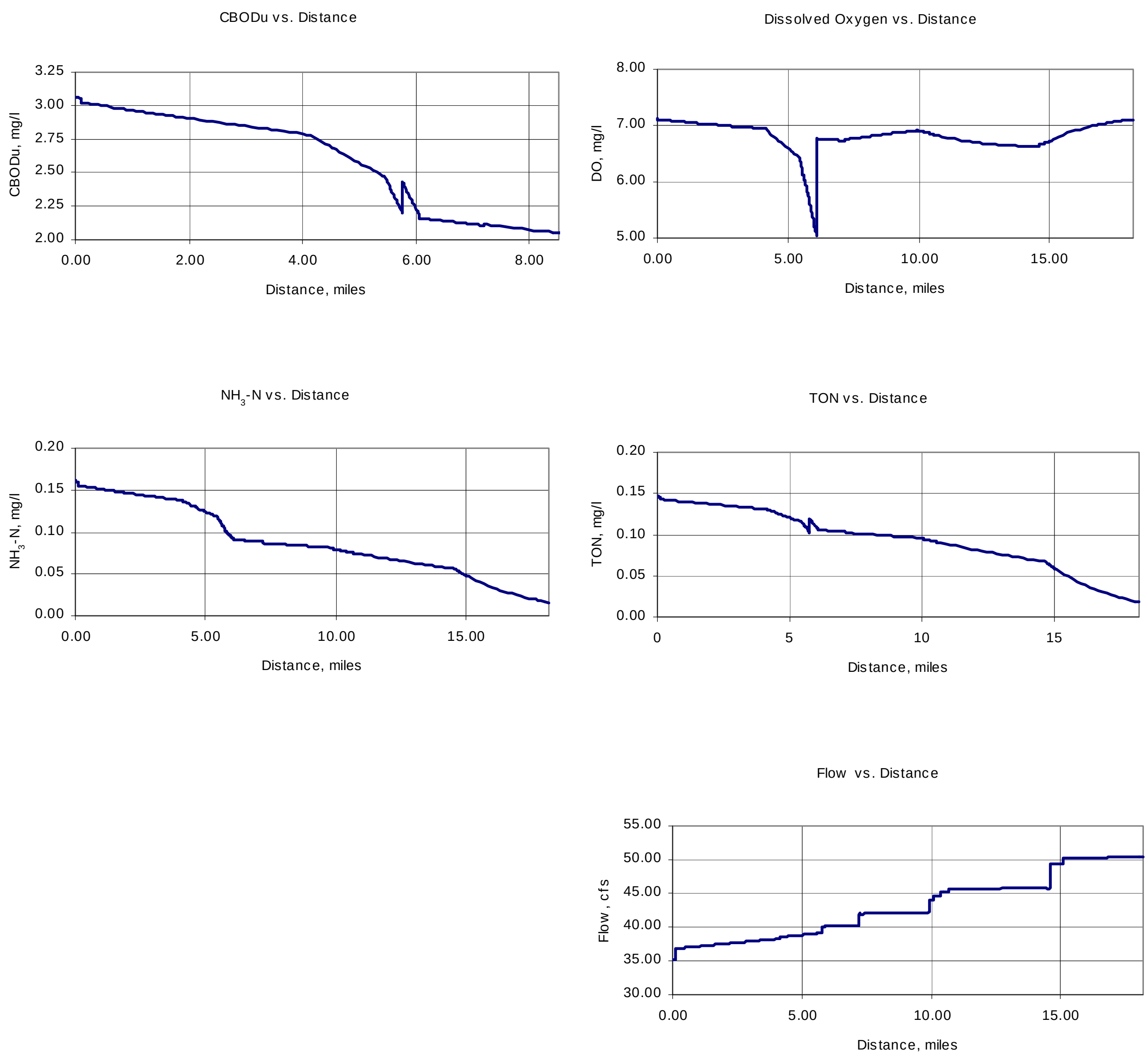
Load Reduction Model Flow Parameters

Description	Flow (cfs)	DO (mg/l)	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	Temp (^oC)
Headwater	34.67	7.16	2.30	0.0437	0.0740	24.0
Heflin WWTP	0.517	4	54.0	8	5	24.0
Cahulga Creek	1.65	7.16	2.30	0.0466	0.0825	24.0
Cedar Creek	0.27	7.16	2.30	0.0466	0.0825	24.0
Tyson Poultry	0.941	6.4	12.0	0.05	0.79	24.0
Dynne Creek	1.68	7.16	2.30	0.0466	0.0825	24.0
Chulafinnee Creek	1.83	7.16	2.30	0.0466	0.0825	24.0
Carr Creek	0.47	7.16	2.30	0.0466	0.0825	24.0
Lockchelooge Creek	0.69	7.16	2.30	0.0466	0.0825	24.0
Ligon Creek	0.35	7.16	2.30	0.0466	0.0825	24.0
Ketchepedrakee Creek	3.57	7.16	2.30	0.0466	0.0825	24.0
Little Ketchepedrakee Creek	0.69	7.16	2.30	0.0466	0.0825	24.0
Conditions @ Lowest D.O.	40.1773	5.0601	2.1592	0.0907	0.1059	24.0
Flow @ End of Model	50.4273	7.1119	0.4066	0.0158	0.0185	24.0

Load Reduction Model Incremental Flow Parameters

Sections	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	DO (mg/l)	Total Flow (cfs)	Temp. (^oC)
1	0.00	0.0466	0.0825	0.00	0.00	24.0
2	2.3000	0.0466	0.0825	5.8900	0.63	24.0
3	2.3000	0.0466	0.0825	5.8900	0.81	24.0
4	2.3000	0.0466	0.0825	5.8900	0.47	24.0
5	2.3000	0.0466	0.0825	5.8900	0.11	24.0
6	2.3000	0.0466	0.0825	5.8900	0.11	24.0
7	2.3000	0.0466	0.0825	5.8900	0.10	24.0
8	2.3000	0.0466	0.0825	5.8900	0.24	24.0
9	0.00	0.0000	0.0000	0.00	0.00	24.0
10	0.00	0.0000	0.0000	0.00	0.00	24.0
11	0.00	0.0000	0.0000	0.00	0.00	24.0
12	2.3000	0.0466	0.0825	5.8900	0.35	24.0
13	0.0000	0.0000	0.0000	5.8900	0.00	24.0
14	2.3000	0.0466	0.0825	5.8900	0.28	24.0

Figure 4-5. Load Reduction Model Predictions and Graphics.



4.4.3. Required Reductions

Total organic loading (i.e., CBODu and NBOD) was calculated at TALL-4 for both the calibrated model and the load reduction model. The total organic loading for the calibrated model was 1,327.1 lbs./day. For the load reduction model, the total organic loading loading was 1,149.5 lbs./day. However the summer TMDL model simulation indicates a loading of 1,186.9 lbs./day. Therefore, the summer TMDL would require a theoretical total organic loading reduction of 89.9% for point source loads and 66.7% reduction for non-point source loads, excluding forest, to bring the Tallapoosa River into compliance with the Fish & Wildlife D.O. water quality standard of 5.0 mg/l. The summer TMDL non-point source loads were compared to the current model non-point source loads in Table 4-2. The summer TMDL analysis indicates that the reductions indicated in table 4-3 below would be needed from point sources during the critical period. The summer TMDL reductions were based on the current loadings model. A summary of suggested revised permit limitations for point sources is presented in Table 5-2. Also a summary of the required reductions for point and non-point source loads is presented in Table 4-1.

Table 4-1. Estimated Load Reductions for Point and Non-Point Sources, during the Calibration Period.

Existing Point Source Load[1]	Existing Non-Point Source Load[1,2]	Total Existing Load [1,2]	Reduced Load[1,2]	% Reduction (Calibration)	% Reduction (Calibration)
(lbs./day)	(lbs./day)	(lbs./day)	(lbs./day)	Point Sources	Non-Point Sources[2]
455.1	872	1,327.1	1,149.5	12.9%	13.6%

Notes: 1 = $CBOD_u$ + NBOD
Notes: 2 = Includes loads from all land uses
Notes: 3 = Excludes forest land uses since no load reductions are assigned to forest land uses

Table 4-2. Required Load Reductions for Non-point Sources during Critical Period.

Existing Non-forest Non-Point Source Load[1,2]	Non-forest Reduced Load[1,2]	Non-forest Reduction
(lbs./day)	(lbs./day)	%
409.2	136.3	66.7%

Notes: 1 = $CBOD_u$ + NBOD
Notes: 2 = Excludes forest land uses since no load reductions are assigned to forest land uses

Table 4-3. Required Load Reductions for Point Sources during Critical Period.

Facility	$CBOD_5$ (mg/L)	NH_3-N (mg/L)	TKN (mg/L)
Heflin WW	87%	95%	95%
Tyson Poultry	86%	80%	90%

% Reduction from Current Permit loads

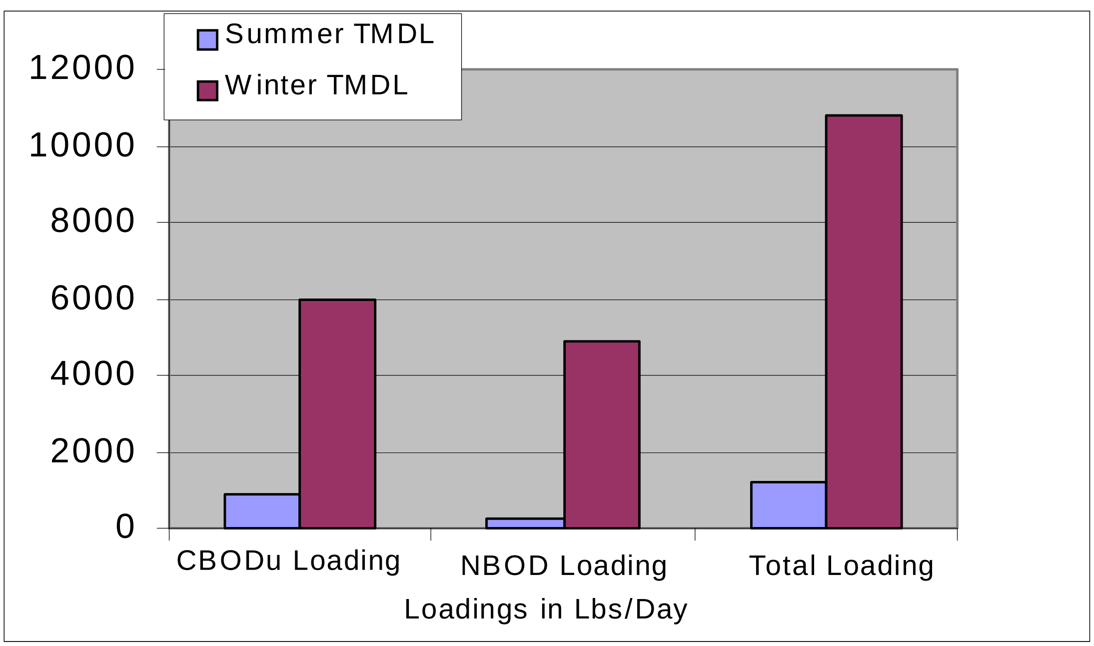
The required reductions will be sought through NPDES Permit Program and the TMDL implementation with follow up monitoring to determine the effectiveness of implementation. Follow up monitoring as discussed further in this document will be conducted according to basin rotation.

4.5 Seasonal Variation

The regulations require that a TMDL be established with consideration of seasonal variations. Since impairments occurred only during the summer months and not during other times of the year, a seasonal variation in the TMDL was not necessary. However, since there were point source loads identified, both summer and winter TMDLs were calculated for the purposes of determination of applicable point source permit limitations year round.

As discussed previously, TMDLs have been estimated for the summer and winter. Figure 4-6, below, illustrates the effect that seasonal temperatures and stream flows have on CBODu, NBOD and total organic loading at the mouth of the Tallapoosa River.

Figure 4-6. Seasonal Temperature and Stream Effects on the TMDLs



5.0 Conclusions

A summary of the TMDL for both summer and winter is presented in Table 5-1.

Table 5-1. Summer and Winter TMDLs Summary

	TMDL	
	Summer	**Winter**
$CBOD_u$ Loading (lbs./day)	902.6	5,948.1
NBOD Loading (lbs./day)	284.3	4,876.3
Total Loading (lbs./day)	1,186.9	10,824.4

Within the impaired segment, the point source allocations used in development of the summer and winter TMDLs will be addressed by the NPDES permit program during permit renewals and modifications. Based on the summer and winter TMDL analyses the revised NPDES permit limitations presented in Table 5-2 are necessary.

An alternative method to the Tallapoosa Rivewr TMDL is the relocation of Tyson Poultry's outfall to below the dam. The reloaction of the Tyson Poultry's outfall will allow less strigent limits for Tyson Poultry and Heflin WWTP. The Table 5-2 below illustrates the increase in allocation for Tyson Poultry and Heflin WWTP.

Table 5-2. Suggested Revised NPDES Permit Limits for Significant Contributing Point Sources and results of alternate relocation of Tyson Poultry's outfall.

NPDES Permit	Facility Name	Permit Limitations - Summer							Permit Limitations - Winter						
		Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)		Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)
		Max	Max	Avg	Max	Avg	Min		Max	Max	Avg	Max	Avg	Min
AL0056146	Heflin WWTP	0.6	N/A	4	N/A	1	6		0.6	N/A	25	N/A	10	6
AL0002810	Tyson Poultry	1	N/A	4	N/A	0.5	6.5		1	N/A	25	N/A	10	6
AL0056146*	Heflin WWTP	0.6	N/A	10	N/A	1	5		0.6	N/A	25	N/A	20	5
AL0002810*	Tyson Poultry	1	N/A	25	N/A	20	5		1	N/A	25	N/A	20	5

Notes: n/a = not applicable
* = alternative method (i.e. Tyson Poultry outfall relocated to below the dam.)

6.0 TMDL Implementation

6.1 Non-Point Source Approach

Tallapoosa River is impaired partially by nonpoint sources. For 303(d) listed waters impaired solely or primarily by nonpoint source (NPS) pollutants, necessary reductions will be sought during TMDL implementation using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired water. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. Therefore, TMDL implementation activities will be coordinated through interaction with local entities in conjunction with Clean Water Partnership efforts.

The primary TMDL implementation mechanism used will employ concurrent education and outreach, training, technology transfer, and technical assistance with incentive-based pollutant management measures. The ADEM Office of Education and Outreach (OEO) will assist in the implementation of TMDLs in cooperation with public and private stakeholders. Planning and oversight will be provided by or coordinated with the Alabama Department of Environmental Management's (ADEM) Section 319 nonpoint source grant program in conjunction with other local, state, and federal resource management and protection programs and authorities. The CWA Section 319 grant program may provide limited funding to specifically ascertain NPS pollution sources and causes, identify and coordinate management programs and resources, present education and outreach opportunities, promote pollution prevention, and implement needed management measures to restore impaired waters.

Depending on the pollutant of concern, resources for corrective actions may be provided, as applicable, by the Alabama Cooperative Extension System (education and outreach); the USDA-Natural Resources Conservation Service (NRCS) (technical assistance) and Farm Services Agency (FSA) (federal cost-share funding); and the Alabama Soil and Water Conservation Committee (state agricultural cost share funding and management measure implementation assistance) through local Soil and Water Conservation Districts, or Resource Conservation and Development Councils (funding, project implementation, and coordination). Additional assistance from such agencies as the Alabama Department of Public Health (septic systems), Alabama Department of Agriculture and Industries (pesticides), and the Alabama Department of Industrial Relations and Dept of Interior - Office of Surface Mining (abandoned minelands), Natural Heritage Program and US Fish and Wildlife Service (threatened and endangered species), may also provide practical TMDL implementation delivery systems, programs, and information. Land use and urban sprawl issues will be addressed through the Nonpoint Source for Municipal

Officials (NEMO) education and outreach program. Memorandums of Agreements (MOAs) may be used as a tool to formally define roles and responsibilities.

Additional public/private assistance is available through the Alabama Clean Water Partnership Program (CWP). The CWP program uses a local citizen-based environmental protection approach to coordinate efforts to restore and protect the state's resources in accordance with the goals of the Clean Water Act. Interaction with the state or river basin specific CWP will facilitate TMDL implementation by providing improved and timely communication and information exchange between community-based groups, units of government, industry, special interest groups, and individuals. The CWP can assist local entities to plan, develop, and coordinate restoration strategies that holistically meet multiple needs, eliminate duplication of efforts, and allow for effective and efficient use of available resources to restore the impaired waterbody or watershed.

Other mechanisms that are available and may be used during implementation of this TMDL include local regulations or ordinances related to zoning, land use, or storm water runoff controls. Local governments can provide funding assistance through general revenues, bond issuance, special taxes, utility fees, and impact fees. If applicable, reductions from point sources will be addressed by the NPDES permit program. The Alabama Water Pollution Control Act empowers ADEM to monitor water quality, issue permits, conduct inspections, and pursue enforcement of discharge activities and conditions that threaten water quality. In addition to traditional "end-of-pipe" discharges, the ADEM NPDES permit program addresses animal feeding operations and land application of animal wastes. For certain water quality improvement projects, the State Clean Water Revolving Fund (SRF) can provide low interest loans to local governments.

Long-term physical, chemical, and biological improvements in water quality will be used to measure TMDL implementation success. As may be indicated by further evaluation of stream water quality, the effectiveness of implemented management measures may necessitate revisions of this TMDL. The ADEM will continue to monitor water quality according to the rotational river basin monitoring schedule as allowed by resources. In addition, assessments may include local citizen-volunteer monitoring through the Alabama Water Watch Program and/or data collected by agencies, universities, or other entities using standardized monitoring and assessment methodologies. Core management measures will include, but not be limited to water quality improvements and designated use support, preserving and enhancing public health, enhancing ecosystems, pollution prevention and load reductions, implementation of NPS controls, and public awareness and attitude/behavior changes.

6.2 Point Source Approach

The reductions from point sources will be addressed by the NPDES permit program.

7.0 Follow Up Monitoring

ADEM has adopted a basin approach to water quality management; an approach that divides Alabama's fourteen major river basins into five groups. Each year, the ADEM water quality monitoring resources are concentrated in one of the basin groups. One goal is to continue to monitor §303(d) listed waters. This monitoring will occur in each basin according to the following schedule:

River Basin Group	Schedule
Cahaba / Black Warrior	2002
Tennessee	2003
Choctawhatchee / Chipola / Perdido-Escambia / Chattahoochee	2004
Tallapoosa / Alabama / Coosa	2005
Escatawpa / Upper Tombigbee / Lower Tombigbee / Mobile	2006

Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed.

8.0 Public Participation

A thirty-day public notice will be provided for this TMDL. During this time, the availability of the TMDL will be public noticed, a copy of the TMDL will be provided as requested, and the public will be invited to provide comments on the TMDL.

9.0 Appendices

9.1 References

Adkins, J.B., Pearman, J.L.. 1994. Low-Flow and Flow-Duration Characteristics of Alabama Streams. Water-Resources Investigations Report 93-4186.

Nelson, George H., Jr.. 1984. Maps to Estimate Average Streamflow and Headwater Limits for Streams in the U.S. Army Corps of Engineers, Mobile District, Alabama and Adjacent States. Water-Resources Investigations Report 84-4274.

United States Environmental Protection Agency. 1991. Guidance for Water Quality-Based Decisions: The TMDL Process, Office of Water, EPA 440/4-91-001.

9.2 Water Quality Data

Tallapoosa River, near Heflin, AL

Points		Location of Points		Latitude		Longitude
A		NE 1/4, Sec 28, T16S, R10E		33°36'23"		85°35'17"
B		SW 1/4, Sec 28, T16S, R10E		33°35'52"		85°35'44"
C		NE 1/4, Sec 4, T17S, R10E		33°34'55"		85°35'29"
D		NW 1/4, Sec 9, T17S, R10E		33°35'43"		85°35'46"
E		SW 1/4, Sec 9, T17S, R10E		33°33'26		85°36'10"
F		NE 1/4, Sec 17, T17S, R10E		33°33'12"		85°36'34"
G		NE 1/4, Sec 17, T17S, R10E		33°33'03"		85°36'35"
H		NE 1/4, Sec 29, T17S, R10E		33°31'17"		85°36'49"
I		SW 1/4, Sec 29, T17S, R10E		33°30'48"		85°37'13"
J		NW 1/4, Sec 5, T18S, R10E		33°29'41"		85°37'23"
K		NE 1/4, Sec 8, T18S, R10E		33°28'28"		85°36'49"
L		SE 1/4, Sec 20, T18S, R10E		33°26'16"		85°36'39"

Station	Location
TALL01	Tallapoosa River at abandoned bridge at end of dirt road in NE ¼, Sec. 28, T16S, R10E.
TALL02	Tallapoosa River at Cleburne County Road 19 in NE ¼, Sec. 4, T17S, R10E.
TALL03 Note: A canoe is needed to sample this station.	Tallapoosa River approximately 200 feet upstream of Tyson Poultry discharge in SW ¼, Sec. 9, T17S, R10E.
TALL04 Note: A canoe is needed to sample this station.	Tallapoosa River approximately 100 feet upstream of mill dam in NE ¼, Sec. 17, T17S, R10E.
TALL05	Tallapoosa River at Cleburne County Road 36 approximately 100 feet downstream of mill dam in NE ¼, Sec. 17, T17S, R10E.

Tallapoosa River Water Quality Study 9/15/99-9/16/99

Field Parameters

Station	Date	Time	Depth (m)	Air Temp (°C)	Water Temp (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (umhos)	Turbidity (ntu)	Flow (cfs)
TALL-1	990915	15:50	0.6092	30	24.67	7.78	6.67	42	13	27.7
TALL-2	990915	15:20	0.1524	32.5	23.23	7.06	6.54	70	17	----
TALL-3	990915	12:47	0.1	33.5	24.29	7.48	6.95	63		----
			0.5		23.84	9.38	7.08	64		
			1		23.38	6.75	6.77	65		
			1.5		23.31	6.37	6.65	65	17	
			2		23.29	6.01	6.59	66		
			2.5		23.26	4.99	6.52	66		
			3		23.27	4.19	6.46	66		
			3.5		23.28	3.96	6.42	66		
TALL-4	990915	14:00	0.1	35	25.41	8.01	6.68	101		----
			0.5		23.78	6.65	6.59	102		
			1		23.58	5.62	6.53	99		
			1.5		23.47	5.07	6.49	92	15	
			2		23.41	4.44	6.45	87		
			2.5		23.38	3.53	6.43	78		
			3		23.4	3.1	6.4	81		
			3.5		23.4	2.78	6.37	80		
			4		23.4	2.74	6.36	80		
TALL-5	990915	11:30	0.1524	27	23.96	7.52	6.48	93	18	40.2
TALL-1	990916	10:00	0.4572	20.5	21.58	6.98	6.87	43	13	----
TALL-2	990916	9:30	0.1524	21.5	21.26	6.08	6.77	89	16	----
TALL-3	990916	7:51	0.1	16	22.95	5.81	6.96	62		----
			0.5		22.99	5.74	6.68	61		
			1		22.99	5.53	6.75	61		
			1.5		22.99	5.61	6.68	61	19	
			2		22.99	5.65	6.57	61		
			2.5		22.98	5.68	6.57	61		
			3		22.98	5.78	6.57	61		
			3.5		22.98	5.78	6.56	61		
TALL-4	990916	8:40	0.1	19.5	23.12	4.83	6.59	79		----
			0.5		23.15	4.84	6.46	79		
			1		23.15	4.84	6.43	79		

Tallapoosa River Water Quality Study 9/15/99-9/16/99 Continued

Field Parameters										
Station	*Date*	*Time*	*Depth (m)*	*Air Temp (° C)*	*Water Temp (° C)*	*Dissolved Oxygen (mg/L)*	*pH*	*Conductivity (umhos)*	*Turbidity (ntu)*	*Flow (cfs)*
TALL-4	990916		1.5		23.15	4.79	6.41	79	28	
			2		23.15	4.8	6.41	80		
			2.5		23.15	4.78	6.41	80		
			3		23.13	4.82	6.42	82		
			3.5		23.11	4.76	6.43	82		
TALL-5	990916	7:15	0.1524	11	22.94	7.29	6.85	80	23	----

Tallapoosa River Water Quality Report 9/15/99-9/16/99
Chemical Results

Station	*Date*	*Time*	*TDS mg/L*	*TSS mg/L*	*NH3-N mg/L*	*TKN mg/L*	*NO3/NO2 mg/L*	*Total-P mg/L*	*BOD5 mg/L*	*TOC mg/L*	*Fecal Coliform colonies/100 mL*
TALL-1	990915	15:50	61	18	<0.015	<0.15	0.16	0.07	0.7	2.24	----
TALL-2	990915	15:20	69	24	<0.015	<0.15	0.14	0.2	0.6	2.54	----
TALL-3	990915	12:47	75	26	<0.015	0.35	0.14	0.15	6.6	4.7	----
TALL-4	990915	14:00	108	21	0.09	0.39	1.41	0.42	4	5.35	----
TALL-5	990915	11:30	90	24	<0.015	<0.15	0.75	0.23	1.2	2.76	----
TALL-1	990916	10:00	77	20	<0.015	<0.15	0.15	0.08	1.9	2.22	31
TALL-2	990916	9:30	73	28	<0.015	0.17	0.15	0.27	0.5	2.93	73
TALL-3	990916	7:51	55	18	0.03	0.34	0.13	0.12	0.3	3.58	26
TALL-4	990916	8:40	59	7	<0.015	<0.15	0.83	0.31	2.4	3.04	32
TALL-5	990916	7:15	89	43	<0.015	<0.15	1.07	0.38	0.8	3.06	40

Tallapoosa River Water Quality Study 1992-1993

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
A	7/28/92	1845								202.8
A	7/29/92	740	22.5	0.8	0.4	25.1	6.92	5.84	40	212.6
A	7/29/92	1334	27.0	1.0	0.5	26.1	7.09	6.51	39	
A	7/30/92	835	24.0	0.4	0.2	25.2	6.80	6.21	40	193.8
A	7/30/92	1415		0.4	0.2	27.0	7.17	6.33	39	191.2
A	7/31/92	845								183.2
A	8/31/93	1325	29.5	1.4	0.7	26.9	7.63	6.26	41	
A	8/31/93	1540								87.6
A	9/1/93	645	17.0	0.2	0.1	24.8	6.75	5.92	40	
A	9/1/93	1030								79.3
A	9/1/93	1300	30.0	0.2	0.1	26.7	6.98	6.34	40	
A	9/1/93	1459								81.3
A	9/2/93	655	22.0	0.3	0.2	25.5	6.62	5.79	40	
A	9/2/93	945								76.2
A	9/2/93	1240	28.5	0.2	0.1	26.6	6.80	6.11	40	
A	9/3/93	946								68.9
C	7/29/92	804	25.0	0.8	0.4	25.1	6.78	6.20	45	
C	7/29/92	1357	35.0	0.8	0.4	26.2	7.06	6.58	46	
C	7/30/92	855	25.0	0.8	0.4	25.1	6.72	6.18	45	
C	7/30/92	1445		0.9	0.5	26.9	7.13	6.42	47	
C	8/31/93	1340	36.0	0.4	0.2	26.8	7.17	6.21	45	
C	9/1/93	710	18.0	0.6	0.3	24.9	6.62	5.82	48	
C	9/1/93	1312	30.0	0.4	0.2	26.4	6.95	6.34	45	
C	9/2/93	705	22.0	0.5	0.3	25.6	6.42	5.94	53	
C	9/2/93	1255	33.5	0.4	0.2	26.3	6.67	6.16	48	
D	7/28/92	2000	24.0	1.5	0.7	26.6	6.25	3.95	43	
D	7/30/92	1345		1.5	0.7	26.9	6.29	6.20	48	
E	7/28/92	1852	25.0	0.7	0.3	27.2	5.94	6.34	45	
E	7/29/92	840	29.5	3.4	1.7	26.1	5.95	6.19	45	
E	7/29/92	1413	31.0	3.4	1.5	26.4	6.08	6.41	48	
E	7/30/92	915	25.5	3.5	1.5	25.9	6.15	6.08	45	
E	7/30/92	1515		3.0	1.5	26.4	6.17	6.23	48	
E	8/31/93	1400	31.0	3.5	0.0	31.0	6.47	6.29	45	
E	8/31/93	1400	31.0	3.5	0.5	27.8	6.24	6.27	45	
E	8/31/93	1400	31.0	3.5	1.0	26.9	5.57	6.23	46	
E	8/31/93	1400	31.0	3.5	1.5	26.8	5.37	6.23	46	
E	8/31/93	1400	31.0	3.5	2.0	26.8	5.33	6.22	46	
E	8/31/93	1400	31.0	3.5	2.5	26.7	5.28	6.22	46	
E	8/31/93	1400	31.0	3.5	3.0	26.7	5.22	6.21	46	
E	8/31/93	1400	31.0	3.5	3.5	26.8	5.15	6.22	46	
E	9/1/93	740	20.0	3.6	0.0	26.4	5.64	6.13	46	
E	9/1/93	740	20.0	3.6	0.5	26.4	5.60	6.13	46	
E	9/1/93	740	20.0	3.6	1.0	26.4	5.65	6.12	46	
E	9/1/93	740	20.0	3.6	1.5	26.3	5.61	6.11	46	
E	9/1/93	740	20.0	3.6	2.0	26.3	5.69	6.10	46	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
E	9/1/93	740	20.0	3.6	2.5	26.3	5.71	6.08	45	
E	9/1/93	740	20.0	3.6	3.0	26.3	5.72	6.07	45	
E	9/1/93	740	20.0	3.6	3.5	26.2	5.28	5.97	46	
E	9/1/93	1335	30.0	3.6	0.0	31.0	6.54	6.36	46	
E	9/1/93	1335	30.0	3.6	0.5	27.1	5.78	6.38	46	
E	9/1/93	1335	30.0	3.6	1.0	26.7	5.52	6.34	46	
E	9/1/93	1335	30.0	3.6	1.5	26.5	5.45	6.31	46	
E	9/1/93	1335	30.0	3.6	2.0	26.5	5.43	6.30	46	
E	9/1/93	1335	30.0	3.6	2.5	26.5	5.36	6.25	46	
E	9/1/93	1335	30.0	3.6	3.0	26.5	5.13	6.25	46	
E	9/1/93	1335	30.0	3.6	3.5	26.4	5.14	6.24	46	
E	9/2/93	735	26.0	3.5	0.0	26.7	6.57	6.03	38	
E	9/2/93	735	26.0	3.5	0.5	26.8	6.54	6.16	46	
E	9/2/93	735	26.0	3.5	1.0	26.8	6.51	6.18	46	
E	9/2/93	735	26.0	3.5	1.5	26.5	5.27	6.13	46	
E	9/2/93	735	26.0	3.5	2.0	26.3	5.01	6.11	47	
E	9/2/93	735	26.0	3.5	2.5	26.2	4.81	6.09	47	
E	9/2/93	735	26.0	3.5	3.0	26.1	4.67	6.06	47	
E	9/2/93	735	26.0	3.5	3.5	26.1	4.59	6.08	47	
E	9/2/93	1315	31.0	3.4	0.0	28.3	7.47	6.34	46	
E	9/2/93	1315	31.0	3.4	0.5	27.2	6.64	6.36	46	
E	9/2/93	1315	31.0	3.4	1.0	26.8	5.97	6.31	46	
E	9/2/93	1315	31.0	3.4	1.5	26.6	5.43	6.28	46	
E	9/2/93	1315	31.0	3.4	2.0	26.4	5.09	6.21	47	
E	9/2/93	1315	31.0	3.4	2.5	26.4	4.66	6.17	47	
E	9/2/93	1315	31.0	3.4	3.0	26.2	4.34	6.11	48	
E	9/2/93	1315	31.0	3.4	3.4	26.2	4.26	6.14	48	
F	7/28/92	1825	28.0	2.0	1.0	27.2	5.81	6.22	47	
F	7/29/92	1015	32.0	3.7	0.0	26.6	5.64	6.22	49	
F	7/29/92	1015	32.0	3.7	0.5	26.4	5.73	6.20	49	
F	7/29/92	1015	32.0	3.7	1.0	26.4	5.75	6.20	48	
F	7/29/92	1015	32.0	3.7	1.5	26.3	5.70	6.17	48	
F	7/29/92	1015	32.0	3.7	2.0	26.3	5.68	6.19	48	
F	7/29/92	1015	32.0	3.7	2.5	26.3	5.66	6.18	48	
F	7/29/92	1015	32.0	3.7	3.0	26.3	5.66	6.17	48	
F	7/29/92	1015	32.0	3.7	3.5	26.3	5.57	6.17	48	
F	7/29/92	1505	32.0	3.8	0.0	27.4	6.23	6.44	53	
F	7/29/92	1505	32.0	3.8	0.5	27.1	6.12	6.40	49	
F	7/29/92	1505	32.0	3.8	1.0	26.5	5.91	6.35	51	
F	7/29/92	1505	32.0	3.8	1.5	26.4	5.83	6.31	51	
F	7/29/92	1505	32.0	3.8	2.0	26.4	5.79	6.29	50	
F	7/29/92	1505	32.0	3.8	2.5	26.4	5.75	6.28	50	
F	7/29/92	1505	32.0	3.8	3.0	26.3	5.78	6.27	50	
F	7/29/92	1505	32.0	3.8	3.5	26.3	5.62	6.27	50	
F	7/30/92	945	29.5	4.0	0.0	26.1	5.93	6.24	48	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
F	7/30/92	945	29.5	4.0	0.5	25.9	5.89	6.14	48	
F	7/30/92	945	29.5	4.0	1.0	25.9	5.89	6.13	48	
F	7/30/92	945	29.5	4.0	1.5	25.8	5.87	6.13	49	
F	7/30/92	945	29.5	4.0	2.0	25.9	5.84	6.13	49	
F	7/30/92	945	29.5	4.0	2.5	25.9	5.87	6.13	49	
F	7/30/92	945	29.5	4.0	3.0	25.9	5.84	6.14	49	
F	7/30/92	945	29.5	4.0	3.5	25.9	5.82	6.13	49	
F	7/30/92	945	29.5	4.0	4.0	25.9	5.73	6.14	49	
F	7/30/92	1545		4.0	0.0	29.0	6.12	6.36	51	
F	7/30/92	1545		4.0	0.5	27.8	6.26	6.30	53	
F	7/30/92	1545		4.0	1.0	26.6	6.07	6.26	50	
F	7/30/92	1545		4.0	1.5	26.3	6.03	6.22	50	
F	7/30/92	1545		4.0	2.0	26.3	5.99	6.21	50	
F	7/30/92	1545		4.0	2.5	26.3	5.95	6.19	50	
F	7/30/92	1545		4.0	3.0	26.2	5.97	6.18	50	
F	7/30/92	1545		4.0	3.5	26.2	5.92	6.19	50	
F	7/30/92	1545		4.0	4.0	26.2	5.86	6.16	50	
F	8/31/93		31.0	3.5	0.0	29.9	7.25	6.29	57	
F	8/31/93		31.0	3.5	0.5	27.5	5.87	6.37	54	
F	8/31/93		31.0	3.5	1.0	27.0	5.40	6.33	54	
F	8/31/93		31.0	3.5	1.5	26.9	5.24	6.31	53	
F	8/31/93		31.0	3.5	2.0	26.9	4.88	6.27	53	
F	8/31/93		31.0	3.5	2.5	26.8	4.38	6.22	50	
F	8/31/93		31.0	3.5	3.0	26.8	3.83	6.16	50	
F	8/31/93		31.0	3.5	3.5	26.7	2.56	6.15	51	
F	9/1/93	805	20.0	3.5	0.0	26.5	5.51	6.15	56	
F	9/1/93	805	20.0	3.5	0.5	26.5	5.48	6.15	56	
F	9/1/93	805	20.0	3.5	1.0	26.5	5.38	6.13	56	
F	9/1/93	805	20.0	3.5	1.5	26.5	5.26	6.13	58	
F	9/1/93	805	20.0	3.5	2.0	26.5	5.24	6.14	59	
F	9/1/93	805	20.0	3.5	2.5	26.5	5.32	6.16	62	
F	9/1/93	805	20.0	3.5	3.0	26.2	5.32	6.14	61	
F	9/1/93	805	20.0	3.5	3.5	26.5	1.06	6.08	54	
F	9/1/93	1405	30.0	3.3	0.0	29.3	7.49	6.47	55	
F	9/1/93	1405	30.0	3.3	0.5	27.0	6.05	6.42	54	
F	9/1/93	1405	30.0	3.3	1.0	26.8	5.29	6.35	54	
F	9/1/93	1405	30.0	3.3	1.5	26.7	5.35	6.30	52	
F	9/1/93	1405	30.0	3.3	2.0	26.6	5.09	6.27	52	
F	9/1/93	1405	30.0	3.3	2.5	26.6	4.83	6.24	53	
F	9/1/93	1405	30.0	3.3	3.0	26.6	4.51	6.19	51	
F	9/1/93	1405	30.0	3.3	3.3	26.6	4.08	6.18	51	
F	9/2/93	800	26.0	3.8	0.0	27.0	6.55	6.24	68	
F	9/2/93	800	26.0	3.8	0.5	27.0	6.41	6.27	70	
F	9/2/93	800	26.0	3.8	1.0	26.7	5.37	6.21	59	
F	9/2/93	800	26.0	3.8	1.5	26.4	4.79	6.17	47	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
F	9/2/93	800	26.0	3.8	2.0	26.3	4.54	6.12	47	
F	9/2/93	800	26.0	3.8	2.5	26.3	4.47	6.10	47	
F	9/2/93	800	26.0	3.8	3.0	26.3	4.30	6.06	47	
F	9/2/93	800	26.0	3.8	3.5	26.3	3.72	6.07	47	
F	9/2/93	800	26.0	3.8	3.8	26.2	2.57	6.03	49	
F	9/2/93	1340	31.0	3.5	0.0	28.0	7.98	6.53	67	
F	9/2/93	1340	31.0	3.5	0.5	27.4	6.65	6.54	64	
F	9/2/93	1340	31.0	3.5	1.0	26.8	5.56	6.33	75	
F	9/2/93	1340	31.0	3.5	1.5	26.5	4.38	6.19	54	
F	9/2/93	1340	31.0	3.5	2.0	26.4	4.19	6.13	48	
F	9/2/93	1340	31.0	3.5	2.5	26.3	4.18	6.13	48	
F	9/2/93	1340	31.0	3.5	3.0	26.3	4.05	6.12	48	
F	9/2/93	1340	31.0	3.5	3.5	26.3	3.75	6.12	48	
G	7/28/92	1745	28.5	1.0	0.5	27.2	6.40	6.28	48	
G	7/29/92	940	28.5	0.5	0.3	26.4	7.34	6.23	47	
G	7/29/92	1300								227.3
G	7/29/92	1532	30.0	1.0	0.5	26.7	7.37	6.67	48	
G	7/30/92	1025	28.0	0.8	0.4	26.0	7.40	6.23	48	
G	7/30/92	1615		0.8	0.4	26.8	6.31	6.26	48	
G	7/31/92	850								184.8
G	8/31/93	1030								87.4
G	8/31/93	1520	35.0	0.1	0.1	27.4	6.88	6.48	53	
G	9/1/93	840	24.0	0.2	0.1	26.4	5.84	6.15	56	84.6
G	9/1/93	1440	34.0	0.2	0.1	27.0	5.89	6.30	53	
G	9/2/93	715								83.7
G	9/2/93	830	27.0	0.1	0.1	26.6	5.79	6.03	56	
G	9/2/93	1420	32.0	0.2	0.1	26.9	6.05	6.29	59	
G	9/3/93	750								76.3
H	7/28/92	1725	28.0	1.0	0.5	27.1	6.93	6.44	48	
H	7/29/92	1056	30.0	1.0	0.5	26.6	6.95	6.27	49	
H	7/29/92	1600	31.5	1.0	0.5	27.4	7.15	6.61	47	
H	7/30/92	1055	28.0	1	0.5	26.0	6.94	6.23	50	
H	8/31/93	1535	35.0	0.6	0.3	28.1	6.95	6.42	52	
H	9/1/93	855	27.0	0.7	0.3	24.9	6.15	6.14	53	
H	9/1/93	1450	33.5	0.7	0.3	27.2	6.70	6.42	52	
H	9/2/93	850	26.0	0.6	0.3	25.9	6.07	6.12	53	
H	9/2/93	1430	32.5	0.6	0.3	27.3	6.46	6.31	55	
I	7/28/92	1646	28.5	1.0	0.5	27.2	6.86	6.39	48	
I	7/29/92	1117	31.0	1.1	0.6	26.4	6.62	6.45	48	
I	7/29/92	1619	28.5	1.0	0.5	27.6	7.05	6.57	49	
I	7/30/92	1120	29.5	1	0.5	26.1	6.82	6.40	52	
I	7/30/92	1700		1.1	0.5	27.9	7.20	6.48	48	
I	8/31/93	1553	32.5	0.4	0.2	27.6	6.74	6.36	54	
I	9/1/93	915	26.0	0.7	0.3	25.4	6.23	6.07	53	
I	9/1/93	1510	32.0	0.6	0.3	26.7	6.43	6.41	55	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
I	9/2/93	926	26.0	0.4	0.2	26.3	6.08	5.98	53	
I	9/2/93	1455	30.0	0.4	0.2	27.1	6.38	6.38	54	
J	7/28/92	1559	29.0	0.9	0.45	26.9	6.24	6.32	48	
J	7/29/92	1141	30.0	1.0	0.5	26.1	6.38	6.48	48	
J	7/29/92	1635	31.0	1.0	0.5	27.3	6.77	6.53	47	
J	7/30/92	1135	29.5	1.1	0.5	26.1	6.70	6.30	51	
J	7/30/92	1715		0.9	0.5	27.8	6.86	6.37	50	
J	8/31/93	1600	32.5	0.4	0.2	27.8	6.98	6.50	50	
J	9/1/93	925	27.0	0.5	0.2	26.2	6.68	6.34	51	
J	9/1/93	1520	31.5	0.4	0.2	27.5	6.96	6.49	51	
J	9/2/93	940	25.0	0.3	0.2	26.6	6.51	6.16	51	
J	9/2/93	1505	28.5	0.3	0.2	27.5	6.75	6.44	51	
K	7/28/92	1506	26.5	2.2	1.1	26.7	6.33	6.31	47	
L	7/28/92	1352	31.5	5.0	1.5	29.2	8.20	6.50	42	
L	7/29/92	1203	32.0	4.5	2.3	28.1	6.93	6.68	43	
L	7/29/92	1704	30.0	4.8	1.5	28.8	8.53	7.08	42	
L	7/29/92	1704	30.0	4.8	2.4	27.6	6.40	6.56	45	
L	7/30/92	1225	32.0	5.2	1.5	29.3	8.57	7.50	41	
L	7/30/92	1225	32.0	5.2	2.6	27.8	6.73	6.70	45	
L	7/30/92	1745		5.0	1.5	28.5	8.26	6.92	43	
L	7/30/92	1745		5.0	2.5	28.4	7.72	6.74	43	
L	8/31/93	1645	35.0	3.2	1.6	29.8	8.75	7.35	42	
L	9/1/93	950	30.0	3.3	1.6	28.4	7.51	6.48	43	
L	9/1/93	1545	30.0	3.4	1.7	29.6	8.40	7.15	43	
L	9/2/93	1005	27.0	3.2	1.6	28.7	7.41	6.33	42	
L	9/2/93	1530	33.0	3.1	1.5	29.3	8.05	6.79	43	

9.3 Water Quality Model Input and Output Files

9.4 Spreadsheet Water Quality Model (SWQM) User Guide