Appendix F

Water Quality Analysis Methodology, Assumptions, and Data

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WATERSHED LOADING MODEL DESCRIPTION

General Model Description

The Hydrologic Simulation Program–FORTRAN (HSPF), a dynamic watershed model capable of simulating flows along with a wide range of water quality parameters, was selected to represent flows and nonpoint source pollutant contributions to the Greers Ferry Lake. HSPF is a tool that is an extension to the BASINS watershed modeling package developed for EPA. It solves for the flow and water quality concentrations out of a defined subwatershed given the basin area, relative pervious and impervious area, land use distribution, slopes, and characteristics of the receiving stream. BASINS provides the geographic information system (GIS) coverages, elevation data, reach file information (receiving water characteristics), and other hydrodynamic and water quality baseline information to the HSPF model. The Nonpoint Source Model (NPSM) also is a tool in BASINS and was used in this application for developing the model inputs into HSPF.

HSPF is a lumped land use model, which means that all of the land use types defined for a subbasin are grouped together and the associated runoff of both flow and water quality are loaded into the top of the reach within that subbasin. The watershed model was set up using standard hydrologic parameters that have been used in other watershed models and are considered representative of the Greers Ferry system, and the model results were examined for general agreement with loading conditions. The water quality parameters that were used to model fecal coliform (i.e., the build-up rate and maximum storage values) were typical values that also have been used in other watershed models. HSPF was therefore used to determine the relative impacts associated with a variety of loading scenarios.

Application to the Greers Ferry Lake Watershed

Many different modules that can be implemented in the NPSM interface. Table F-1 lists the modules used in this application. In the following parts the methodology of the model setup and model inputs will be described.

Table F-1
HSPF Modules Used in Greers Ferry Watershed Simulations

HSPF Module	Module Description
PERLAND = Pervious Land Simulation	
PWATER	Simulation of water movement for pervious land
PQUAL	Simulation of general water quality for pervious land
IMPLAND = Impervious Land Simulation	
IWATER	Simulation of water movement for impervious land
IQUAL	Simulation of quality constituent washoff
RCHRES = Simulation of a free-flowing reach or mixed reservoir	
HYDR	Simulation of hydraulic behavior
ADCALC	Simulation of longitudinal advection of constituents
GQUAL	Simulation of generalized quality constituent behavior

The Greers Ferry watershed is part of the Little Red watershed (HUC 11010014). For the Greers Ferry watershed, HSPF was used to simulate flows and various water quality constituents from three subwatersheds. The first subwatershed, which contained all of the area that drains to the Greers Ferry Lake tributaries that flow into the upper lake, is referred to as the Upper Watershed. The second subwatershed is the area that drains to the upper portion of Greers Ferry Lake and represents non-point loadings from lands immediately adjacent to the upper lake, and the third subwatershed is the area of the Greers Ferry watershed that drains to the lower portion of Greers Ferry Lake. These two subwatersheds were referred to as the Upper Greers Ferry Lake and the Lower Greers Ferry Lake watersheds. These three subwatersheds were chosen based on the loading analysis. These subwatersheds were delineated using digital elevation maps (DEM's) and BASINS GIS coverages (reach file version 1 and reach file version 3). Once the subwatersheds were delineated, area and land use distribution were determined using the NPSM tool within BASINS. The land use distribution for each subwatershed was determined by dividing the land into two (2) categories, impervious and pervious land. An area for each land use type was then determined by the NPSM. After information about the three subwatersheds was obtained, characteristics about the reach within each subwatershed were determined. These characteristics included the length of the reach, the average elevation of the reach, and the change in elevation along the reach. This information was determined using the BASINS digital elevation maps (DEM's) and 3-D TopoQuads software. Each reach also had associated with it a representative cross section for the entire reach. The representative cross sectional information was defined using the standard NPSM cross section. After all the pertinent information was compiled for each subwatershed and respective reach, the data were input into the NPSM. The connectivity of the subwatersheds was then correctly mapped within the NPSM. The connectivity of the three subwatersheds shows that the Upper Watershed flows into the Upper Greers Ferry Lake watershed, which in turn flows into the Lower Greers Ferry Lake watershed.

To run HSPF, each subwatershed needs an associated meteorological station. These stations are contained within a watershed data management (WDM) file. Each station in the WDM file has information about the precipitation, evaporation, potential evaporation, solar radiation, dew point temperature, air temperature, and cloud cover. In the BASINS database, WDM files have been created for each state, with approximately 10 meteorological stations in each file. The closest station to the Greers Ferry watershed within the Arkansas WDM is the Batesville Livestock station.

For each of the three subwatersheds an associated point source that represented the number of failing septic tanks located within that subwatershed was loaded into the top of each reach. The number of failing septic tanks for each of the 3 subwatersheds was determined in the following manner. First, the population of each subwatershed was determined. This information came from the BASINS database. Once the population was determined, it was assumed that there are 2.8 people per septic tank in each subwatershed. This is a typical ratio used in many septic tank calculations. It was then assumed that 20 percent of the septic tanks are failing in each subwatershed. From this information the number of failing septic tanks was calculated. To load the failing septic tanks as a point source in HSPF, a flow (in cubic feet per second) and a fecal concentration (in number per 100 milliliter) need to be attached to the failing septic tanks. To determine the flow of the failing septic tanks, the value for the number of failing tanks was multiplied by 2.8 to obtain the number of people served by the failing septic tanks. The flow rate was then assumed to be 70 gal/day/person on septic. The fecal concentration for the septic tanks was assumed to be 10,000/100 mL. Using this information the flow and fecal concentrations were

loaded into HSPF for each point source. Once all the data were input into the NPSM, the HSPF model was run to develop the baseline scenario.

For the various alternatives analyzed for the Greers Ferry EIS, only two things were changed. Those changes were the number of acres of forest that become residential and the changes in the number of failing septic tanks associated with additional development. The results from these model runs are presented in the main body of this report.

IN-LAKE RESPONSE MODEL FORMULATION

To calculate the in-lake response to pollutant loads, a simplified methodology that assumes that the Upper Lake and Lower Lake are completely mixed systems was used. The completely mixed assumption is justified on the basis of wind stresses on the water surface resulting in internal mixing. In addition, when the scale of the problem is sufficiently long, as from year to year, seasonal mixing processes can result in a completely mixed lake over the years. An assumption of this type should be recognized as a gross approximation of loadings to the actual lake because variations in concentrations of substances will exist throughout the lake (Thomann and Mueller, 1987).

Making the assumption of first-order decay for substances in the water column, a mass balance for the lake is defined using the equation

$$\frac{DVs}{dt} = W(t) - Qs-$$

where:

V = lake volume,
W = time-varient mass load input,
Q = net flow through the lake,
K = decay coefficient, and
s = concentration.

The in-lake response model provides a solution for this equation and calculates the time-variant rate of change for the in-lake concentration under specific loading conditions.

For the Greers Ferry application, the Upper Lake response calculation is made using the upper watershed loads and the Upper Lake watershed loads input directly to the model with the Upper Lake volume and annual average flow rate. Utilizing the annual average flow rate moving through the narrows, with the upper lake concentration as the load, the Lower Lake is then loaded with the mass passing through the Narrows along with the direct Lower Lake loads. This provides the in-lake response calculations. For all of the simulations, zero decay is assumed to provide a highly conservative estimate of in-lake concentration.

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Table F-2
USGS Flow Stations in the Little Red Watershed

USGS Gauge	Latitude	Longitude	Station Name
Stations Located Above Greers Ferry Lake			
USGS07074900	35.871	92.602	Trace C Tributary, near Mars
USGS07074950	35.858	92.440	Tick Creek, near Leslie
USGS07075000	35.653	92.319	Middle Fork of Little Red River
USGS07075300	35.590	92.460	South Fork of Little Red River
USGS07075500	35.570	92.380	South Fork of Little Red River NR C
USGS07075600	35.525	92.418	Choctaw Creek Tributary
USGS07075900	35.521	91.995	Greers Ferry Lake NR
USGS07075800	35.543	91.957	Peter Creek Tributary
Stations Located Below Greers Ferry Lake			
USGS07076000	35.517	91.997	Little Red River NR HE
USGS07076630	35.246	91.784	Key Branch, near Searcy

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Table F-3
Statistics on USGS Flow Stations[1]

Station	Dates of Analysis	Min	Max	Mean	Median	7Q10
07075000	3-1-1939 to 9-30-1984	0	75,000	466	122	0
07075300	10-2-1961 to 9-30-1994	0	41,600	238	81	0
07075500	3-1-1939 to 12-31-1961	0	29,400	579	170	0
07076000	1-1-1970 to 9-30-1984	22	7,940	1,843	1,240	47

[1]All flow values are in cubic feet per second (cfs).

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Table F-4
Water Quality Standards for the Greers Ferry Lake Watershed

Parameter	Units	State of Arkansas Water Quality Standard
Water Temperature	ºC	32 ºC
DO	mg/L	5 mg/L
pH	SU	6> and <9
Turbidity	Hach FTU	
Secchi Depth	Meters	
Color PT-CO	PT-CO	
Total Nitrogen	mg/L	
$NH_3 + NH_4$-N, Total	mg/L	
$NO_2 + NO_3$-N, Total	mg/L	
Organic Nitrogen	mg/L	
Phosphorus, Total	mg/L	0.05 mg/L (recommendation)
OrthoPhosphorus, Total	mg/L	
BOD5	mg/L	
Copper, Dissolved*	µg/L	8.86 µ/L
Iron, Dissolved	µg/L	
Lead, Dissolved*	µg/L	30.14 µg/L
Zinc, Dissolved*	µg/L	63.6 µ/L
Mercury, Dissolved	µg/L	2.04 µ/L
Fecal Coliform Bacteria	#/100 mL	200
Chlorophyll *a*	µg/L	

*Calculated at a hardness of 50 mg/L ($CACO_3$).

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Table F-5
Water Quality Statistics for Station 07075025 (Brush Creek)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	95	0.60	120.00	11.42	4.60	1
Secchi Depth	Meters	55	0.12	4.02	2.16	2.20	0
Color PT-CO	PT-CO	109	0	270.00	23.71	5.00	15
Total Nitrogen	mg/L	42	0.06	1.40	0.53	0.47	0
$NH_3 + NH_4$-N, Total	mg/L	66	0.01	0.87	0.10	0.04	9
$NO_2 + NO_3$-N, Total	mg/L	111	0	0.71	0.10	0.09	36
Organic Nitrogen	mg/L	44	0	0.70	0.32	0.33	0
Phosphorus, Total	mg/L	111	0	0.33	0.05	0.02	15
OrthoPhosphorus, Total	mg/L	36	0	1.00	0.19	0.09	1
BOD5	mg/L	109	0.20	18.00	1.52	1.40	9
Copper, Total	µg/L	30	0	11.00	3.27	3.00	2
Iron, Total	µg/L	52	30.00	8,600.00	1,040.58	345.00	0
Lead, Total	µg/L	30	0	45.00	4.90	3.00	2
Zinc, Total	µg/L	44	0	130.00	44.55	20.00	8
Mercury, Total	µg/L	44	0	0.80	0.21	0.10	30
Fecal Coliform Bacteria	#/100mL	57	0	1,800.00	58.49	1.00	6
Chlorophyll *a*	µg/L	36	0.10	7.40	2.10	1.85	2

Table F-6
Water Quality Statistics for Station 07075215 (Above Hill Creek)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	98	0.40	100.00	7.71	4.40	4
Secchi Depth	Meters	56	0.15	23.00	2.78	2.45	0
Color PT-CO	PT-CO	111	0	205.00	20.15	7.00	13
$NH_3 + NH_4$-N, Total	mg/L	15	0.01	0.38	0.12	0.02	4
$NO_2 + NO_3$-N, Total	mg/L	61	0.02	1.60	0.14	0.10	26
Phosphorus, Total	mg/L	62	0.01	0.20	0.03	0.02	17
OrthoPhosphorus, Total	mg/L	6	0.03	0.09	0.06	0.06	0
BOD5	mg/L	60	0.10	3.90	1.37	1.20	8
Fecal Coliform Bacteria	#/100mL	59	0	3,300.00	85.49	2.00	5
Chlorophyll *a*	µg/L	40	0.10	12.00	2.11	1.55	2

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Table F-7
Water Quality Statistics for Station 07075490 (Near Clinton)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	54	1.10	96.00	11.72	4.55	0
Secchi Depth	Meters	56	0.10	3.10	1.17	1.10	0
Color PT-CO	PT-CO	62	0	140.00	18.98	10.00	5
Total Nitrogen	mg/L	20	0.34	2.30	0.79	0.65	0
$NH_3 + NH_4$-N, Total	mg/L	38	0	0.54	0.08	0.04	4
$NO_2 + NO_3$-N, Total	mg/L	63	0	1.10	0.13	0.10	21
Organic Nitrogen	mg/L	22	0.16	2.10	0.54	0.39	0
Phosphorous, Total	mg/L	62	0.01	0.19	0.04	0.03	12
Ortho Phosphorous, Total	mg/L	17	0.03	0.18	0.10	0.12	0
BOD5	mg/L	62	0.30	5.50	1.81	1.80	8
Copper, Total	µg/L	14	1.00	20.00	4.36	3.00	2
Iron, Total	µg/L	26	220.00	5,300.00	820.77	465.00	0
Lead, Total	µg/L	14	0	16.00	5.43	3.50	0
Zinc, Total	µg/L	22	0	150.00	44.55	20.00	2
Mercury, Total	µg/L	22	0	0.50	0.20	0.10	16
Fecal Coliform Bacteria	#/100mL	58	0	3,100.00	274.33	14.50	4
Chlorophyll *a*	µg/L	37	0.10	20.00	4.29	0.90	2

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Table F-8
Water Quality Statistics for Station 07075602 (Near Choctaw)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	59	1.00	130.00	15.40	6.00	0
Secchi Depth	Meters	56	0.09	2.00	1.01	1.00	0
Color PT-CO	PT-CO	69	0	200.00	22.16	10.00	5
$NH_3 + NH_4$-N, Total	mg/L	11	0	0.50	0.06	0.01	2
$NO_2 + NO_3$-N, Total	mg/L	35	0.02	0.50	0.10	0.10	19
Phosphorus, Total	mg/L	36	0.01	0.12	0.04	0.02	9
OrthoPhosphorus, Total	mg/L	3	0.03	0.06	0.04	0.03	0
BOD5	mg/L	34	0.10	3.00	1.67	1.80	4
Fecal Coliform Bacteria	#/100mL	57	0	2,100.00	116.79	4.00	4
Chlorophyll *a*	µg/L	37	0.10	13.00	2.53	1.60	3

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Table F-9
Water Quality Statistics for Station 07075638 (Higden)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	132	0.30	100.00	7.07	3.00	2
Secchi Depth	Meters	55	0.15	6.10	3.02	2.60	0
Color PT-CO	PT-CO	180	0	170.00	10.74	5.00	14
Total Nitrogen	mg/L	42	0.07	3.30	0.48	0.41	0
$NH_3 + NH_4$-N, Total	mg/L	138	0.01	0.27	0.06	0.04	15
$NO_2 + NO_3$-N, Total	mg/L	158	0	0.90	0.12	0.10	25
Organic Nitrogen	mg/L	43	0	3.00	0.31	0.23	0
Phosphorus, Total	mg/L	212	0.01	0.14	0.02	0.02	66
Ortho Phosphorus, Total	mg/L	34	0.03	0.21	0.08	0.06	2
BOD5	mg/L	211	0	5.60	1.12	1.00	13
Copper, Total	µg/L	117	0	61.00	14.68	16.00	48
Iron, Total	µg/L	111	10.00	5,800.00	455.51	200.00	4
Lead, Total	µg/L	77	0	50.00	15.14	10.00	12
Zinc, Total	µg/L	129	0	120.00	36.23	24.00	38
Mercury, Total	µg/L	47	0	1.00	0.25	0.10	34
Fecal Coliform Bacteria	#/100mL	59	0	500.00	14.10	2.00	7
Chlorophyll *a*	µg/L	40	0	2.20	0.81	0.75	2

Table F-10
Water Quality Statistics for Station 07075660 (Near Eden Isle)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	98	0.40	29.00	2.77	1.30	4
Secchi Depth	Meters	56	0.55	7.60	3.47	3.40	0
Color PT-CO	PT-CO	112	0	45.00	5.96	5.00	20
$NH_3 + NH_4$-N, Total	mg/L	19	0.01	0.35	0.05	0.01	5
$NO_2 + NO_3$-N, Total	mg/L	63	0.02	0.23	0.11	0.10	18
Phosphorus, Total	mg/L	64	0.01	0.28	0.02	0.02	33
Ortho Phosphorus, Total	mg/L	2	0.03	0.03	0.03	0.03	0
BOD5	mg/L	61	0.20	3.50	1.15	1.00	11
Fecal Coliform Bacteria	#/100mL	57	0	190.00	6.79	1.00	5
Chlorophyll *a*	µg/L	37	0.10	5.00	0.74	0.50	1

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Table F-11
Water Quality Statistics for Station 07075900
(Lake station at Dam Site Near Heber Springs)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	62	0.20	20.00	2.19	1.10	2
Secchi Depth	Meters	116	0.98	8.10	4.33	4.32	0
Color PT-CO	PT-CO	83	0	50.00	6.01	4.00	7
Total Nitrogen	mg/L	41	0.10	1.40	0.43	0.35	0
NH_3 + NH_4-N, Total	mg/L	53	0	0.27	0.05	0.02	11
NO_2 + NO_3-N, Total	mg/L	90	0	1.20	0.15	0.10	22
Organic Nitrogen	mg/L	42	0	1.10	0.27	0.21	0
Phosphorus, Total	mg/L	99	0.01	0.10	0.02	0.01	36
Ortho Phosphorus, Total	mg/L	35	0.03	0.18	0.06	0.06	3
BOD5	mg/L	70	0	2.50	0.86	0.80	0
Copper, Total	µg/L	30	1.00	7.00	3.23	3.00	1
Iron, Total	µg/L	48	10.00	710.00	120.42	75.00	3
Lead, Total	µg/L	30	1.00	31.00	5.47	4.00	1
Zinc, Total	µg/L	42	0	200.00	46.43	20.00	10
Mercury, Total	µg/L	42	0	1.90	0.23	0.10	28
Fecal Coliform Bacteria	#/100mL	34	0	516.00	23.82	3.00	1
Chlorophyll *a*	µg/L	29	0.10	6.60	1.23	0.80	1

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Table F-12
Water Quality Statistics for Station 07076000
(Little Red River Near Heber Springs)

Parameter	Units	No. Obs.	Min	Max	Mean	Median	No. Obs. Below Detection
Turbidity	Hach FTU	53	0.40	16.00	2.39	1.40	0
Secchi Depth	Meters						
Color PT-CO	PT-CO	59	0	30.00	6.58	5.00	0
Total Nitrogen	mg/L	22	0.18	1.40	0.53	0.43	0
NH_3 + NH_4-N, Total	mg/L	39	0	0.28	0.06	0.03	0
NO_2 + NO_3-N, Total	mg/L	60	0.09	0.54	0.19	0.18	0
Organic Nitrogen	mg/L	21	0	1.10	0.28	0.22	0
Phosphorus, Total	mg/L	60	0.01	0.09	0.03	0.03	0
OrthoPhosphorus, Total	mg/L	60	0	0.09	0.02	0.01	0
BOD5	mg/L	60	0	3.10	1.42	1.40	0
Copper, Total	µg/L	27	0	7.00	2.50	2.00	0
Iron, Total	µg/L	38	40.00	730.00	158.66	105.00	0
Lead, Total	µg/L	28	1.00	32.00	4.61	2.00	0
Zinc, Total	µg/L	34	0	130.00	32.97	20.00	0
Mercury, Total	µg/L	34	0	5.00	0.32	0.10	0
Fecal Coliform Bacteria	#/100mL	55	0	510.00	28.11	4.00	0
Chlorophyll *a*	µg/L						

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Table F-13
Water Column Data Statistics for Station 07075025 (Brush Creek)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	^oC	59	6.00	30.50	20.71	22.50
DO	mg/L	59	5.90	13.50	8.86	8.50
pH	SU	59	6.10	8.48	7.25	7.24
Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	^oC	51	5.00	23.30	14.85	16.00
DO	mg/L	53	0.10	13.20	4.49	3.00
pH	SU	53	5.70	8.26	6.72	6.70

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Table F-14
Water Column Data Statistics for
Station 07075215 (Above Hill Creek)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	38	7.30	30.00	21.27	25.05
DO	mg/L	40	7.00	11.50	8.57	8.30
PH	SU	40	5.88	8.69	7.14	7.11

Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	69	3.50	23.50	12.97	12.50
DO	mg/L	69	0.10	12.70	4.50	2.80
PH	SU	69	5.80	7.70	6.64	6.60

Table F-15
Water Column Data Statistics for
Station 07075490 (Near Clinton)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	76	3.50	32.10	19.79	22.80
DO	mg/L	78	0.70	14.70	8.64	8.15
pH	SU	78	5.88	8.63	6.88	6.80
Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	0	0	0	0	0
DO	mg/L	0	0	0	0	0
pH	SU	0	0	0	0	0

Table F-16
Water Column Data Statistics for
Station 07075602 (Near Choctaw)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	82	4.50	32.00	20.19	21.25
DO	mg/L	83	3.50	13.80	8.79	8.20
PH	SU	84	5.70	8.99	6.80	6.70
Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	0	0	0	0	0
DO	mg/L	0	0	0	0	0
PH	SU	0	0	0	0	0

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Table F-17
Water Column Data Statistics for Station 07075638 (Higden)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	14	9.60	30.50	24.27	28.60
DO	mg/L	14	7.30	10.60	8.40	7.95
pH	SU	14	6.87	7.54	7.18	7.19
Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	200	3.00	32.00	14.37	11.85
DO	mg/L	202	0	12.50	7.67	8.70
pH	SU	198	5.89	8.32	6.85	6.98

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Table F-18
Water Column Data Statistics for
Station 07075660 (Near Eden Isle)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	32	0	31.60	21.28	25.00
DO	mg/L	33	7.10	10.50	8.48	8.30
PH	SU	33	5.93	8.42	7.18	7.11
Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	96	4.00	24.40	12.15	10.75
DO	mg/L	96	0.70	41.00	7.38	6.90
PH	SU	96	5.90	7.61	6.76	6.70

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Table F-19
Water Column Data Statistics for Station 07075900
(Lake station at Dam Site Near Heber Springs)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	349	4.50	32.50	18.48	19.50
DO	mg/L	351	6.30	14.40	9.12	8.80
pH	SU	344	6.10	9.30	7.31	7.30
Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	°C	2,335	4.00	25.00	10.35	9.00
DO	mg/L	2,314	0	14.00	7.89	8.25
pH	SU	2,272	5.20	8.89	6.86	6.80

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Table F-20
Water Column Data Statistics for Station 07076000
(Little Red River Near Heber Springs)

Top of Water Column (<15 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	^{o}C	0	0	0	0	0
DO	mg/L	0	0	0	0	0
PH	SU	0	0	0	0	0
Bottom of Water Column (>30 ft)						
Parameter	**Units**	**No. Obs.**	**Min**	**Max**	**Mean**	**Median**
Water Temperature	^{o}C	0	0	0	0	0
DO	mg/L	0	0	0	0	0
PH	SU	0	0	0	0	0

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Table F-21
Upper and Lower Lake Calculations

	Alternative 1: No Action	Alternative 2: 80 Percent Rezoning Criteria	Alternative 3: No Growth	Alternative 4: 90% Rezoning Criteria	Alternative 5: Maximum Modification	Alternative 6: Revised Preferred Alternative
UPPER LAKE						
Total Acre Change Calculation						
Number of existing docks	147	147	147	147	147	147
Number of potential docks	112	112	0	112	726	112
Number of rezoning request docks	0	50	0	26	0	27
Number of rezoning request docks with no structure	0	6	0	4	0	4
Total number of docks	259	309	147	285	873	286
Number of additional slips	426	615	0	524	2,758	528
Number of additional home sites	325	342	0	336	2,105	336
Acres per home	0.75	0.75	0.75	0.75	0.75	0.75
Total acres forested to residential	244	257	0	252	1,579	252
Relative Acre Change Calculation						
Acres in watershed altered	244	257	0	252	1,579	252
Marina acres altered	0	0	0	0	0	0
Septic Systems						
Additional septic systems	325	342	0	336	2,105	336
LOWER LAKE						
Total Acre Change Calculation						
Number of existing docks	148	148	148	148	148	148
Number of potential docks	58	58	0	58	372	58
Number of rezoning request docks	0	43	0	19	0	29
Number of rezoning request docks with no structure	0	13	0	5	0	7
Total number of docks	206	262	148	230	520	242
Total number of additional slips	220	384	0	293	1,414	331
Number of additional home sites	168	205	0	183	1,079	189
Acres per home	0.75	0.75	0.75	0.75	0.75	0.75
Total acres forested to residential	126	154	0	137	809	141
Relative Acre Change Calculation						
Acres in watershed altered	126	154	0	137	809	141
Marina acres altered	13	13	0	13	13	13
Septic Systems						
Additional septic systems	168	205	0	183	1,079	189
Total Number of Existing Docks	**295**	**295**	**295**	**295**	**295**	**295**
Total Number of Additional Docks	**170**	**263**	**0**	**215**	**1,098**	**226**
Total Number of Docks	**465**	**558**	**295**	**510**	**1,393**	**521**
Total Number of Additional Slips	**646**	**999**	**0**	**817**	**4,172**	**859**
Total Number of Additional Homes	**493**	**547**	**0**	**519**	**3,184**	**525**
Total Acres Forested to Residential	**370**	**411**	**0**	**389**	**2,388**	**393**

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Figure F-1. Greers Ferry Lake Turbidity

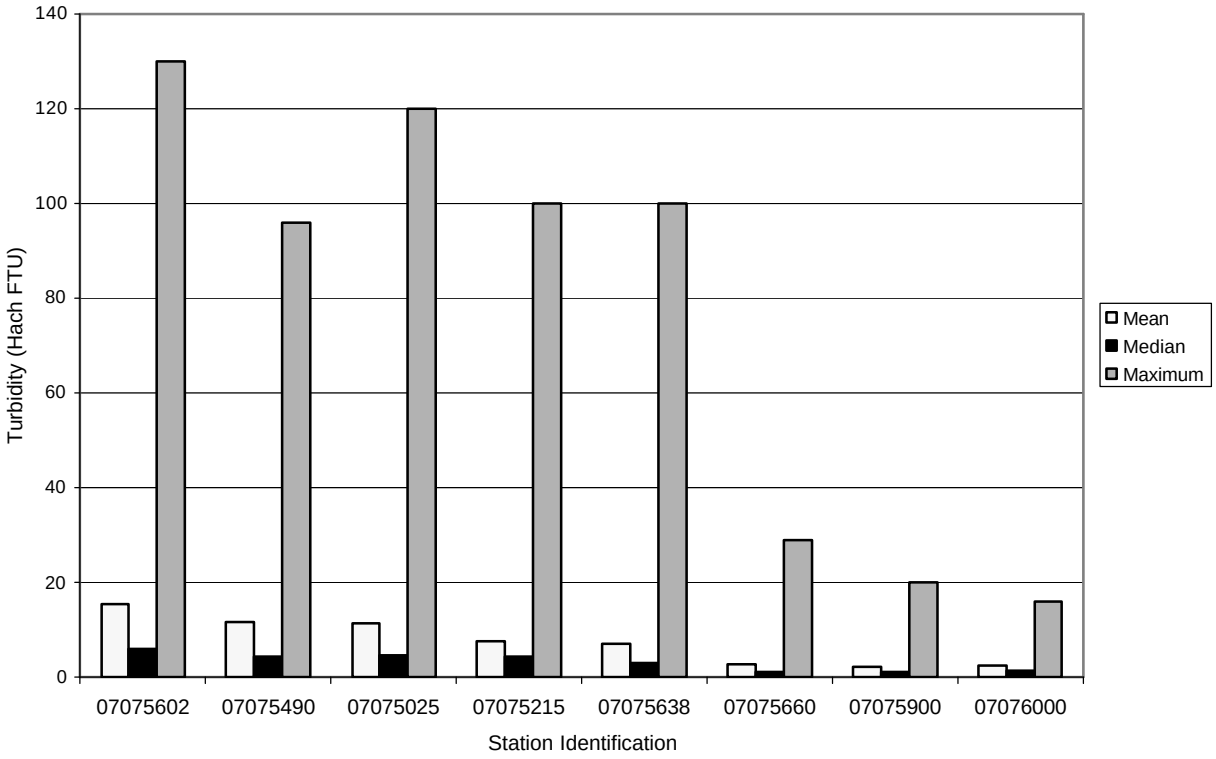

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Figure F-2. Greers Ferry Lake Color

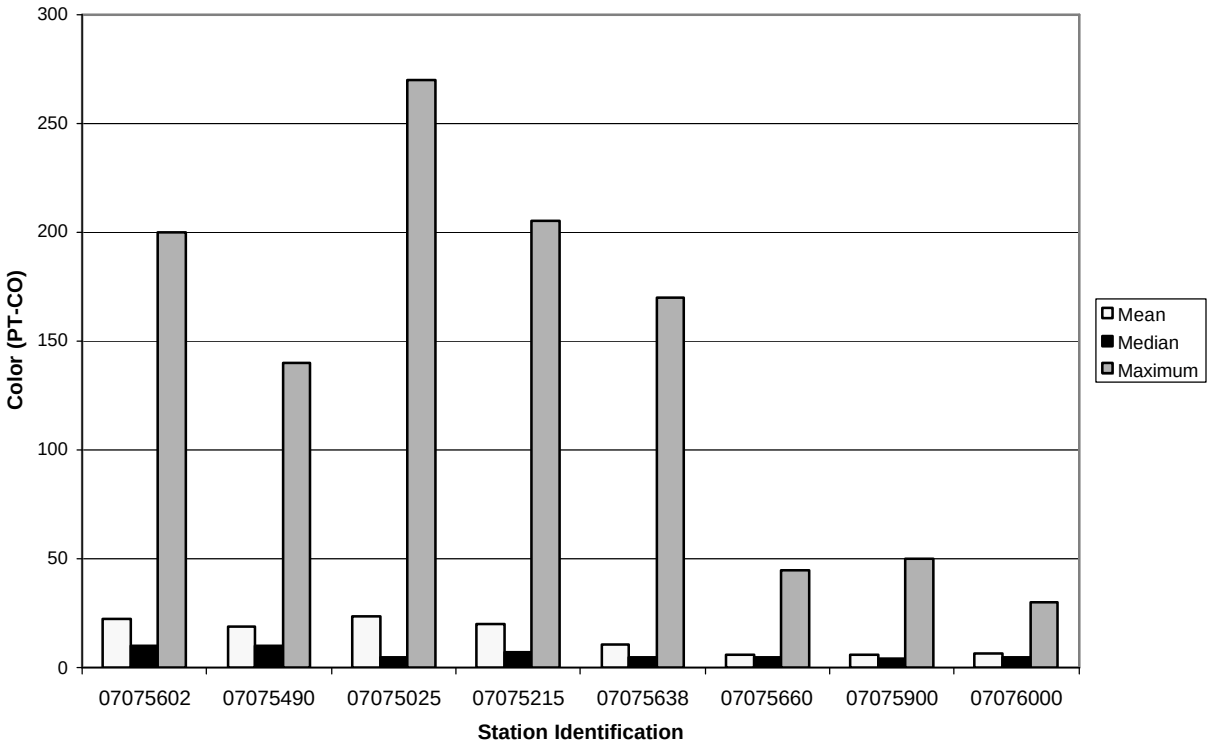

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Figure F-3. Greers Ferry Lake Total Phosphorus

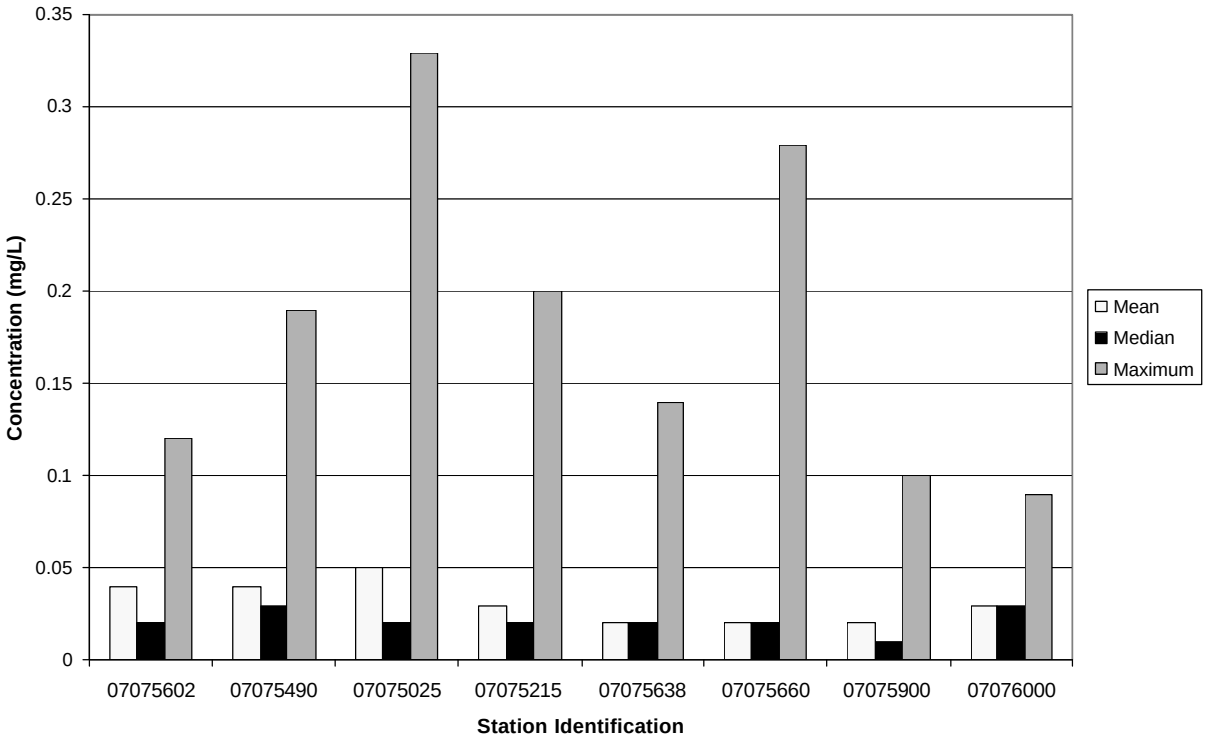

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Figure F-4. Greers Ferry Lake Chlorophyll a

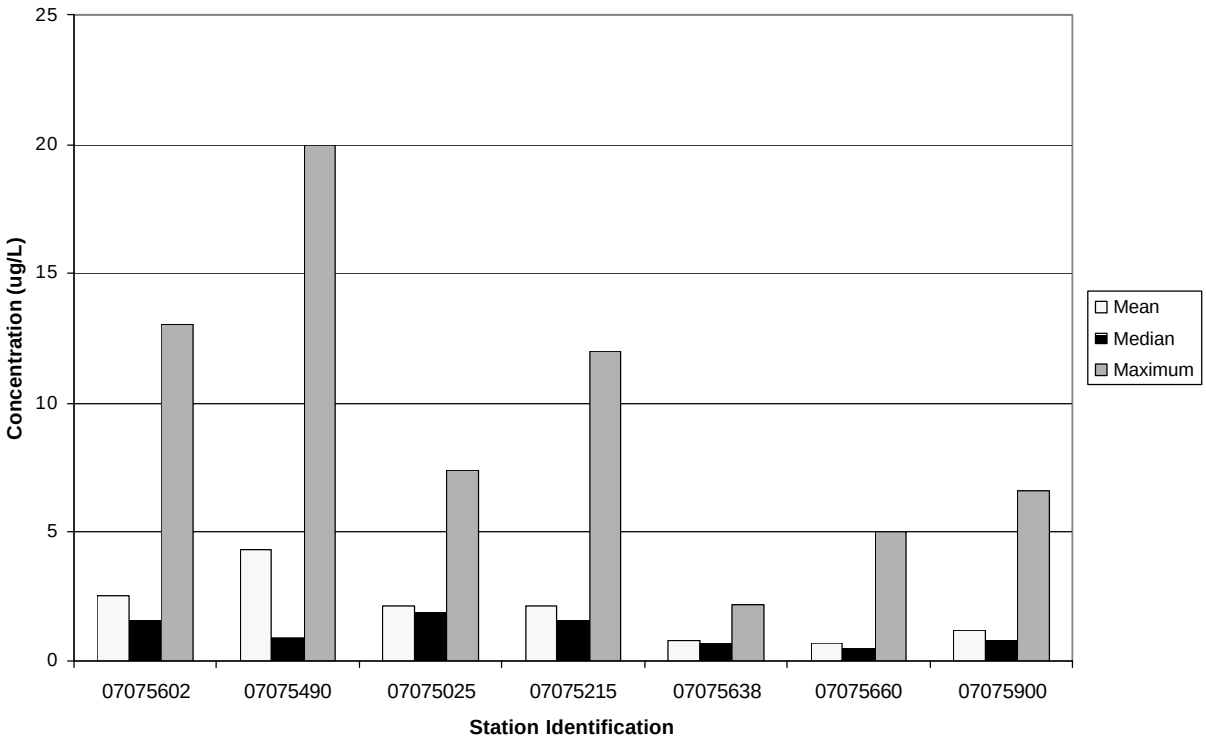

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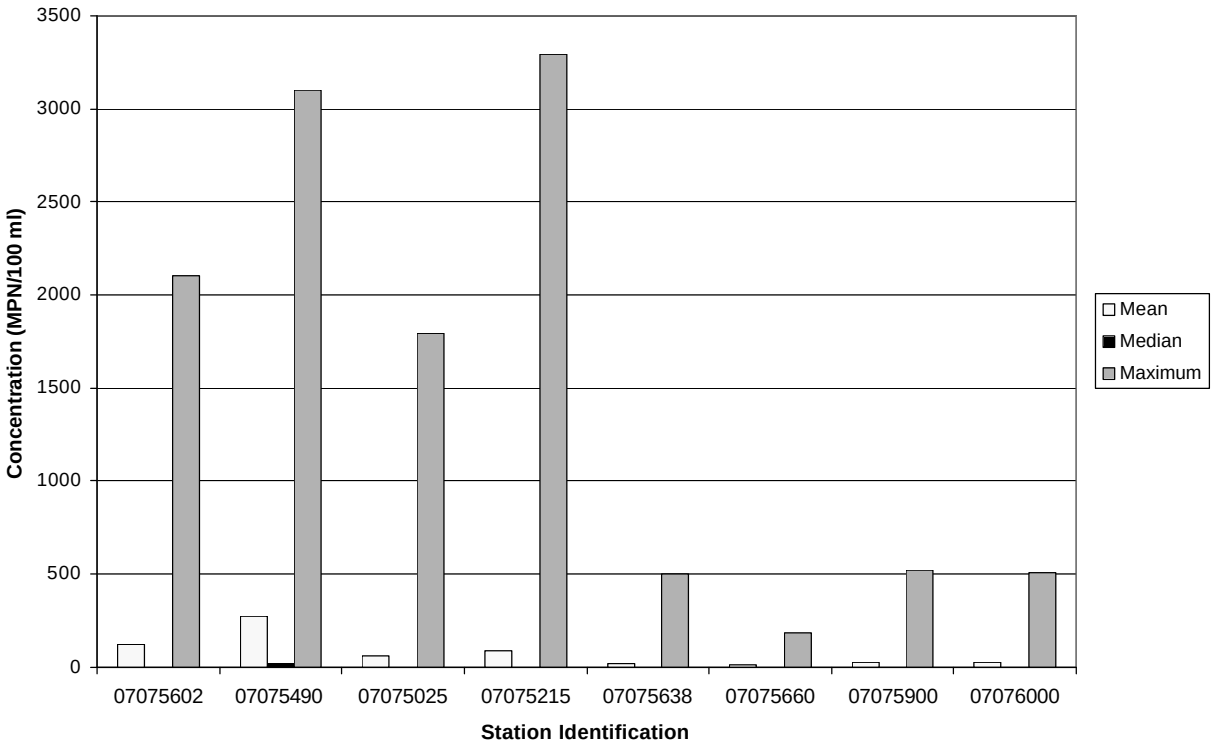
Figure F-5. Greers Ferry Lake Fecal Coliform



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