TMDLS FOR TURBIDITY FOR BAYOU DEVIEW AND CACHE RIVER, AR

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Prepared for

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standards for that pollutant. Through a TMDL, pollutant loads can be allocated to point sources and nonpoint sources discharging to the waterbody.

The study area for this project is the Bayou DeView and Cache River watersheds in northeastern Arkansas. The study area is part of the Arkansas Department of Environmental Quality (ADEQ) Planning Segment 4B and is located within the Delta ecoregion. Land use in the study area is about 77% cropland and 17% forest.

Five reaches on Bayou DeView and 11 reaches of the Cache River are included on the draft 2004 Arkansas 303(d) list as not supporting the aquatic life use due to exceedances of numeric criteria for turbidity. In Arkansas Regulation No. 2, Bayou DeView and the Cache River are specified as “channel-altered” streams. The applicable numeric criteria for turbidity for these streams are 75 NTU (“primary” value) and 250 NTU (“storm-flow” value).

ADEQ historical water quality data were available for six locations in the study area. These data were analyzed for long term trends, seasonal patterns, relationships between concentration and stream flow, and relationships between turbidity and total suspended solids (TSS). The seasonal analysis showed that the highest values of turbidity and TSS tended to occur during the winter and spring, although some exceedence of the turbidity standards occurred throughout the year. There were no noticeable relationships between concentration and flow. Most of the data showed some correlation between turbidity and TSS, with higher turbidity levels tending to correspond with higher TSS values.

These TMDLs were expressed using TSS as a surrogate for turbidity because turbidity cannot be expressed as a mass load. Two regressions between TSS and turbidity were developed for each ADEQ water quality monitoring station, one for base flow conditions and one for storm-flow conditions. The base flow regressions were used to develop target TSS

concentrations corresponding to the primary turbidity criterion of 75 NTU. The storm-flow regressions were used to develop target TSS concentrations corresponding to the storm-flow turbidity criterion of 250 NTU.

The TMDLs in this report were developed using the load duration curve methodology. This method illustrates allowable loading at a wide range of stream flow conditions. The steps for applying this methodology for the TMDLs in this report were:

1. Developing a flow duration curve,
2. Converting the flow duration curve to a load duration curve,
3. Plotting observed loads with the load duration curve,
4. Calculating the TMDL components, and
5. Calculating percent reductions.

The load duration curve was developed using multiple target TSS concentrations because Arkansas has different turbidity criteria for different flow conditions. Each target TSS concentration corresponding to the primary turbidity criterion was applied between the 100% exceedence of stream flow and the 60% exceedence of stream flow. Each target TSS concentration corresponding to the storm-flow turbidity criterion was applied between the 60% exceedence of stream flow and the 0% exceedence of stream flow.

The wasteload allocations (WLAs) for point source contributions were set to not applicable (NA) ~~zero~~ because TSS in these TMDLs was considered to represent inorganic suspended solids (i.e., soil and sediment particles from erosion or sediment resuspension). The suspended solids discharged by point sources such as domestic wastewater or filter backwash in the study area are assumed to consist primarily of organic solids rather than inorganic solids. Discharges of organic suspended solids from point sources are already addressed by ADEQ through their permitting of point sources to maintain water quality standards for dissolved oxygen. The WLAs to support these TMDLs will not require any changes to the permits concerning inorganic suspended solids. Therefore, future growth for these permits or new permits would not be restricted by these turbidity TMDLs.

An implicit margin of safety (MOS) was incorporated through the use of conservative assumptions. The primary conservative assumption was calculating the TMDLs assuming that TSS is a conservative parameter and does not settle out of the water column.

The percent reductions shown in Table ES.1 were calculated using methodology that is slightly different than the assessment criteria used by ADEQ to develop the 2004 draft 303(d) list. These differences caused the assessment for the 2004 draft 303(d) list to indicate 16 stream reaches in the Bayou DeView and Cache River watersheds are impaired and the TMDL analysis to indicate that two of those reaches (08020302-007 and -009) are not impaired. The 2004 draft 303(d) list is still being reviewed by EPA and has not been finalized yet.

Table ES.1. Summary of turbidity TMDLs.

Reach ID	Stream Name	Flow Category	Loads (tons/day of TSS)				Percent Reduction Needed
			WLA	LA	MOS	TMDL	
08020302-004	Bayou DeView	Base flow	0NA	15.2	0Implicit	15.2	35%
		Storm-flow	0 NA	181	0Implicit	181	0%
08020302-005	Bayou DeView	Base flow	0 NA	12.2	0 Implicit	12.2	35%
		Storm-flow	0 NA	146	0 Implicit	146	0%
08020302-006	Bayou DeView	Base flow	0 NA	10.8	0 Implicit	10.8	35%
		Storm-flow	0NA	129	0 Implicit	129	0%
08020302-007	Bayou DeView	Base flow	0NA	3.04	0 Implicit	3.04	0%
		Storm-flow	0NA	112	0 Implicit	112	0%
08020302-009	Bayou DeView	Base flow	0NA	1.88	0 Implicit	1.88	0%
		Storm-flow	0NA	69.2	0 Implicit	69.2	0%
08020302-016	Cache River	Base flow	0NA	21.3	0 Implicit	21.3	35%
		Storm-flow	0NA	225	0 Implicit	225	0%
08020302-017	Cache River	Base flow	0NA	19.4	0 Implicit	19.4	35%
		Storm-flow	0NA	205	0 Implicit	205	0%
08020302-018	Cache River	Base flow	0NA	19.1	0 Implicit	19.1	35%
		Storm-flow	0NA	202	0 Implicit	202	0%
08020302-019	Cache River	Base flow	0NA	16.7	0 Implicit	16.7	35%
		Storm-flow	0NA	176.9	0 Implicit	176.9	0%
08020302-020	Cache River	Base flow	0NA	19.3	0 Implicit	19.3	0%
		Storm-flow	0NA	347	0 Implicit	347	17%
08020302-021	Cache River	Base flow	0NA	17.3	0 Implicit	17.3	0%
		Storm-flow	0NA	311	0 Implicit	311	17%
08020302-027	Cache River	Base flow	0NA	10.5	0 Implicit	10.5	13%
		Storm-flow	0NA	304	0 Implicit	304	0%
08020302-028	Cache River	Base flow	0NA	9.22	0 Implicit	9.22	13%
		Storm-flow	NA	267	0 Implicit	267	0%
08020302-029	Cache River	Base flow	0NA	8.22	0 Implicit	8.22	13%
		Storm-flow	0NA	238	0 Implicit	238	0%
08020302-031	Cache River	Base flow	0NA	7.47	0 Implicit	7.47	13%
		Storm-flow	0NA	216	0 Implicit	216	0%
08020302-032	Cache River	Base flow	0NA	6.43	0 Implicit	6.43	13%
		Storm-flow	0NA	186	0 Implicit	186	0%

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1.0 INTRODUCTION

This report presents total maximum daily loads (TMDLs) for siltation/turbidity for 5 reaches of Bayou DeView and 11 reaches of the Cache River in northeastern Arkansas. These stream reaches were included on the Arkansas Department of Environmental Quality (ADEQ) draft 2004 Arkansas 303(d) list (ADEQ 2005) as not supporting their designated use of aquatic life. The sources of contamination and causes of impairment from the 303(d) listing are shown below in Table 1.1. The TMDLs in this report were developed in accordance with Section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency's (EPA) regulations in 40 CFR 130.7.

The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standards for that pollutant and to establish the load reduction that is necessary to meet the standard in a waterbody. The TMDL is the sum of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The WLA is the load allocated to point sources of the pollutant of concern. The LA is the load allocated to nonpoint sources, including natural background. The MOS is a percentage of the TMDL that takes into account any lack of knowledge concerning the relationship between pollutant loadings and water quality.

Table 1.1. 303(d) listing for stream reaches in this task order.

Reach No.	Stream Name	Sources	Causes	Category	Priority
08020302-004	Bayou DeView	Agriculture	Siltation/Turbidity	5b	Low
08020302-005	Bayou DeView	Agriculture	Siltation/Turbidity	5b	Low
08020302-006	Bayou DeView	Agriculture	Siltation/Turbidity	5b	Low
08020302-007	Bayou DeView	Agriculture	Siltation/Turbidity	5b	Low
08020302-009	Bayou DeView	Agriculture	Siltation/Turbidity	5b	Low
08020302-016	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-017	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-018	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-019	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-020	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-021	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-027	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-028	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-029	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-031	Cache River	Agriculture	Siltation/Turbidity	5b	Low
08020302-032	Cache River	Agriculture	Siltation/Turbidity	5b	Low

2.0 BACKGROUND INFORMATION

2.1 General Information

The study area for this project is the Bayou DeView and Cache River watersheds in northeastern Arkansas (see Figure A.1 in Appendix A). The Bayou DeView and Cache River watersheds are in the Delta ecoregion and in ADEQ Planning Segment 4B. Bayou DeView and the Cache River are also in United States Geological Survey (USGS) Hydrologic Unit 08020302. The study area covers 1,785 square miles and includes parts of Clay, Greene, Lawrence, Craighead, Jackson, Poinsett, Woodruff, Cross, Prairie, and Monroe Counties.

2.2 Soils and Topography

The soils and topography information was obtained from soil surveys for Clay, Greene, Lawrence, Craighead, Jackson, Cross, and Monroe Counties (United States Department of Agriculture (USDA) 1969, 1978a, 1978b, 1979, 1974, 1968, 1978c). Most of the study area is characterized by loamy and clayey soils and flat topography. The exception to this is Crowley's Ridge, which is a hilly area with more silty soils along the eastern edge of the Cache River watershed north of Jonesboro. The topography of Crowley's Ridge forms a sharp contrast to the remainder of the study area.

2.3 Land Use

Land use data for the study area were obtained from the GEOSTOR database, which is maintained by the Center for Advanced Spatial Technology (CAST) at the University of Arkansas in Fayetteville. These data were based on satellite imagery from 1999. The spatial distribution of these land use is shown on Figure A.2 (located in Appendix A) and land use percentages are shown in Table 2.1. These data indicate that the study area is about 77% cropland and 17% forest. Most of the forest occurs along Crowley's Ridge and in the floodplains along some of the lower reaches of Bayou DeView and the Cache River.

Table 2.1. Land use percentages for the study area.

Land use	Percentage of study area
Urban	0.5%
Water	1.3%
Forest (all types)	17.0%
Soybeans	48.5%
Rice	24.0%
Cotton	0.6%
Corn	4.4%
Pasture	3.7%
Total	100.0%

2.4 Description of Hydrology

Average precipitation for the study area is about 47-50 inches per year (USGS 1985). There are two USGS flow gages in the study area; information for these gages is summarized in Table 2.2. Flow data for each gage were used to characterize different portions of the study area.

Table 2.2. Information for USGS stream flow gaging stations (USGS 2005).

Gage name:	Cache River near Cotton Plant	Cache River at Egypt
Gage number:	07077555	07077380
Descriptive location:	Bridge on county road, 4.2 miles northwest of Cotton Plant	Bridge at State Highway 91, 1.0 mile southeast of Egypt
Period of record:	May 1987 – September 2004	October 1964 – September 2004
Drainage area:	1,172 square miles	701 square miles
Mean daily flow:	1,376 cfs	868 cfs
Median daily flow:	800 cfs	328 cfs

2.5 Water Quality Standards

Water quality standards for Arkansas waterbodies are listed by ecoregion in Regulation No. 2 (Arkansas Pollution Control and Ecology Commission (APCEC) 2004a). Designated uses for Bayou DeView and the Cache River include primary and secondary contact recreation; public, industrial, and agricultural water supply; and perennial Delta fishery (where the drainage area is 10 square miles or more). In addition, a portion of the Cache River above Cache Bayou is designated as an Extraordinary Resource Water (ERW). The portion of the Cache River to which

the ERW designation applies includes nearly all of reach 08020302-018. This designation does not affect the narrative or numeric turbidity criteria for this reach.

Section 2.503 of Regulation No. 2 provides both a narrative criterion and numeric criteria that apply to siltation/turbidity. The general narrative criterion is: "There shall be no distinctly visible increase in turbidity of receiving waters attributable to municipal, industrial, agricultural, other waste discharges or instream activities." For the Delta ecoregion, there are different numeric criteria for turbidity for "least-altered" and "channel-altered" streams. Appendix A of Regulation No. 2 specifies Bayou DeView and Cache River as channel-altered streams. The numeric turbidity criteria for channel-altered streams in the Delta ecoregion are 75 NTU ("primary" value) and 250 NTU ("storm-flow" value). The regulation also states that "the non-point source runoff shall not result in the exceedance of the in stream storm-flow values in more than 20% of the ADEQ ambient monitoring network samples taken in not less than 24 monthly samples."

As specified in EPA's regulations at 40 CFR 130.7(b)(2), applicable water quality standards include antidegradation requirements. Arkansas' antidegradation policy is listed in Sections 2.201 through 2.204 of Regulation No. 2. These sections impose the following requirements:

- Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.
- Water quality that exceeds standards shall be maintained and protected unless allowing lower water quality is necessary to accommodate important economic or social development, although water quality must still be adequate to fully protect existing uses.
- For outstanding state or national resource waters, those uses and water quality for which the outstanding waterbody was designated shall be protected.
- For potential water quality impairments associated with a thermal discharge, the antidegradation policy and implementing method shall be consistent with Section 316 of the Clean Water Act.

2.6 Nonpoint Sources

In the draft 2004 303(d) list, the source of turbidity for Bayou DeView and Cache River is listed as agriculture. As shown in Table 2.1, over 77% of the study area is cropland, which typically has greater soil erosion than other land uses such as forest or pasture.

2.7 Point Sources

Information for point source discharges in the study area was obtained by searching the Permit Compliance System on the EPA web site (PCS 2005). The search yielded 37 facilities with point source discharges. Search results, including flow rate and permit limits for total suspended solids (TSS) and turbidity, are included in Tables 2.3a and 2.3b. Locations of the permitted facilities are shown on Figure A.3 in Appendix A.

Table 2.3a. Inventory of point source discharges in Bayou DeView watershed.

NPDES Permit No.	Facility Name	Receiving Water	Flow Rate (MGD)	Monthly Average TSS Limits (mg/L)
AR0020354	City of Weiner	Trib, Bayou DeView	0.60	20
AR0022446	City of Fisher	Trib, Bayou DeView	0.08	20
AR0037834	Riceland - Waldenburg	Ditch, Bayou DeView	0.005	20
AR0037907	Jonesboro – West	Trib, Big Creek, B. DeView	3.00	20
AR0041629	Westside Consol	Trib, Big Creek, B. DeView	0.03	15
AR0042188	Northern Mobile	Trib, Big Creek, B. DeView	0.01	15
AR0044211	Holy Angels Conv	Lost Crk, Big Crk, B. DeView	0.01	30
AR0046981	Hedger Aggregate	Mud Cr., Big Cr., B. DeView	0.71	20
AR0048402	LMJ Trailer Park	Trib, Big Creek, B. DeView	0.02	20

Table 2.3b. Inventory of point source discharges in Cache River watershed.

NPDES Permit No.	Facility Name	Receiving Water	Flow Rate (MGD)	Monthly Average TSS Limits (mg/L)
AR0020699	City of Bono	Trib/Whaley Slough, Cache R	0.25	20
AR0034614	City of Grubbs	Cache River	0.09	90
AR0035947	Crowley's Ridge State Prk	Ditch, Big Ditch, Cache R.	0.04	15
AR0042552	Tri-County Sand & Gravel	Dort Creek, Cache River	0.27	20
AR0042781	McDougal WWTF	Ditch, Cache River	0.10	0 / 90
AR0043290	Knobel WWTF	Trib, Cache River	0.05	15
AR0043443	City of Sedgwick	W Cache R. Ditch, Cache R.	0.05	0 / 90
AR0043486	Tri-City Utilities, Inc.	Trib, Beaver Dam Ditch	0.05	15 / 20
AR0043524	Egypt Sewer System	W Cache R. Ditch, Cache R.	0.03	90
AR0044954	City of McCrory	Cache River	0.39	30
AR0045284	City of Cash	Trib, Cache River	0.02	15
AR0045489	City of Pollard	Pollard Creek, Ditch #2, #1	0.03	20
AR0046604	City of Amagon	Trib, Cache River	0.02	20
AR0048909	Town of Lafe	Big Creek, Cache River	0.05	20
AR0049603	City of Beedeville	Cache River	0.02	90
ARG160019	Jackson County Landfill	Ditch, Brewer Lake, Cache R.	0.005	--
ARG160033	Jackson County Landfill	Trib, Brewer Creek, Cache R.	0.03	--

3.0 EXISTING WATER QUALITY FOR TURBIDITY AND TSS

3.1 General Description of Data

Turbidity and TSS data have been collected by ADEQ at six sites in the study area. The locations of these sampling sites are shown on Figure A.4 (located in Appendix A). TSS data are discussed here because TSS is needed as a surrogate parameter for expressing the siltation/turbidity TMDLs. These turbidity and TSS data were obtained from the ADEQ web site (ADEQ 2005) and are summarized in Table 3.1. The individual data are listed in Tables B.1-B.6 and shown graphically as time series plots on Figures B.1-B.12 (located in Appendix B). The data for the sampling stations starting with "BDV" or "CHR" are stored in the ADEQ database under slightly different station names than those used in this report (e.g. "UWBDV02" is used in the ADEQ database instead of "BDV0002"). The station names used in this report are the names most commonly used for these stations.

Table 3.1. Summary of ADEQ data for turbidity and TSS.

Station	Description	Parameter	Count	Min.	Median	Average	Max.
BDV0002	Bayou DeView at Hwy. 64, 4 mi. E. of McCrory, AR	Turbidity	20	4.0	83.2	101.3	458
		TSS	20	11	48.5	56.4	170
WHI0026	Bayou DeView west of Gibson, AR	Turbidity	164	1.1	52.8	81.3	760
		TSS	154	1.0	29.1	71.5	1358
WHI0032	Cache River near Brasfield, AR	Turbidity	20	23.0	65.5	81.8	198
		TSS	20	10.3	24.2	25.2	50
CHR0002	Cache River at Hwy. 64 at Patterson, AR	Turbidity	20	18.0	91.0	125.5	410
		TSS	20	7.3	33.5	36.3	89
CHR0003	Cache River at Hwy. 18 near Grubbs, AR	Turbidity	20	2.8	75.6	138.3	410
		TSS	20	35.3	65.2	102.6	322
CHR0004	Cache River at Hwy, 412, 6 1/2 mi. E. of Walnut Ridge, AR	Turbidity	20	17.0	80.5	142.0	469
		TSS	20	5.3	73.3	100.2	480

Tables B.1-B.6 include comparisons between the observed turbidity data and the numeric water quality criteria. These comparisons required the observed data to be separated into base flow data (to be compared with the "primary" criterion) and storm-flow data (to be compared with the "storm-flow" criterion). It was assumed here that the lowest 40% of stream flow values

represent flow conditions without significant influence from storm runoff and that stream flow values above the 40th percentile would have some influence from storm runoff. The turbidity data were considered to be base flow data when the flow on the sampling day was 554 cfs or less at the USGS gage on the Cache River near Cotton Plant or 189 cfs or less at the USGS gage on the Cache River near Egypt. These flows (554 cfs and 189 cfs) are the 40th percentile flows, or the flows that were exceeded 60% of the time. The turbidity data were considered to be storm-flow data when the flow on the sampling day was more than 554 cfs at the USGS gage on the Cache River near Cotton Plant or more than 189 cfs at the USGS gage on the Cache River near Egypt. Table 3.2 summarizes the percentages of the observed data for each station that exceeded the primary and storm-flow criteria over the period of record.

Table 3.2. Percentage of observed data exceeding primary and storm-flow criteria.

Sampling Station	Period of Record	Percent Exceeding Primary Criterion	Percent Exceeding Storm-flow Criterion
BDV0002	1994-2003	67%	0%
WHI0026	1990-2005	13%	8%
WHI0032	1994-2003	22%	0%
CHR0002	1994-2003	50%	21%
CHR0003	1994-2003	30%	30%
CHR0004	1994-2003	40%	40%

3.2 Seasonal Patterns

Seasonal plots of turbidity and TSS are shown on Figures C.1-C.12 (located in Appendix C). Most of these plots showed that the highest values of turbidity and TSS occurred during the winter and spring, which is usually the period of the year when many cropland fields are bare and stream flows are higher. At station WHI0026, exceedances of water quality criteria for turbidity occurred throughout the year. Exceedances of turbidity criteria throughout the year might have been detected at other sampling stations if more data had been collected.

3.3 Relationships Between Concentration and Flow

Plots of turbidity and TSS versus stream flow were also developed to examine any correlation between these two parameters (Figures D.1-D.12, located in Appendix D). These plots showed no noticeable relationship between concentration and flow.

3.4 Relationships Between TSS and Turbidity

Plots and regression analyses were used to examine relationships between TSS and turbidity. The regressions were performed using the natural logarithms of the data (rather than the raw data values) because most data such as turbidity and TSS fit a lognormal distribution better than a normal distribution.

Separate plots and regression analyses were developed for base flow conditions and storm-flow conditions to be consistent with the numeric criteria for turbidity. The plots and linear regressions for base flow conditions (Figures E.1, E.3, E.5, E.7, E.9, and E.11) use only the base flow data. The plots and linear regressions for storm-flow conditions (Figures E.2, E.4, E.6, E.8, E.10, and E.12) use all of the data regardless of flow on the sampling day. The data collected under base flow conditions were included in the storm-flow regression in order to maximize the accuracy of the lower end of the regression lines that correspond to turbidity values near the numeric criteria.

Noticeable correlations are evident in most of these plots, with higher turbidity levels tending to correspond with higher TSS concentrations. The results of the linear regression analyses are summarized in Table 3.2.

The strength of the linear relationship is measured by the coefficient of determination (R^2) calculated during the regression analysis (Zar 1996). The R^2 value is the percentage of the total variation in ln TSS that is explained or accounted for by the fitted regression (ln turbidity). For example, in the storm-flow regression for BDV0002 in Table 3.2, 66% of the variation in TSS is accounted for by turbidity and the remaining 34% of variation in TSS is unexplained. The unexplained portion is attributed to factors other than the measured value of turbidity.

Table 3.2. Results of regressions between TSS and turbidity.

Sampling Station	Category	Regression Equation	Number of Data	R^2	Significance Level (P value)
BDV0002	Base flow	ln TSS = 0.697 * ln Turbidity + 1.06	5	0.76	0.055
	Storm-flow	ln TSS = 0.546 * ln Turbidity + 1.53	19	0.66	2.3×10^{-5}
WHI0026	Base flow	ln TSS = 0.674 * ln Turbidity + 0.704	59	0.47	2.3×10^{-9}
	Storm-flow	ln TSS = 0.757 * ln Turbidity + 0.616	153	0.52	1.4×10^{-25}
WHI0032	Base flow	ln TSS = 0.292 * ln Turbidity + 2.07	6	0.43	0.157
	Storm-flow	ln TSS = 0.024 * ln Turbidity + 3.07	19	0.002	0.872
CHR0002	Base flow	ln TSS = 0.891 * ln Turbidity – 0.646	5	0.53	0.165
	Storm-flow	ln TSS = 0.452 * ln Turbidity + 1.33	19	0.30	0.014
CHR0003	Base flow	ln TSS = 0.351 * ln Turbidity + 2.80	9	0.57	0.18
	Storm-flow	ln TSS = 0.350 * ln Turbidity + 2.86	19	0.43	0.002
CHR0004	Base flow	ln TSS = 1.024 * ln Turbidity - 0.314	9	060	0.015
	Storm-flow	ln TSS = 0.796 * ln Turbidity + 0.662	19	0.62	6.3×10^{-5}

Note: Regression results in shaded rows were not used to develop TMDLs.

Most of these regressions show a majority of the measurement of the turbidity (NTU) is explained by the measured concentration of TSS. The perfect explanation of the measurement of turbidity to the measurement of TSS would require collecting and analyzing a large amount of data. A number of the items effecting this perfect explanation of the relationship would need to be known. A partial list of the items effecting the relationship follows:

- Velocity of the water at the time of sampling;
- Carbonaceous biochemical oxygen demand (CBOD) concentration;
- Ammonia concentration;
- Nitrate concentration;
- Phosphorus concentration;
- Algal mass in the water column;
- Bacteria mass in the water;
- Measured color of the water;
- Mass of the organic component of the TSS;
- Mass of the material passing through the filter during the TSS analysis;
- Grain size distribution of the inorganic portion of the TSS;
- Specific gravity of the different sizes of inorganic solids particles;
- Hydrograph for the stream;
- Position on the hydrograph (i.e., rising limb, falling limb) at the time of sampling;
- Number of overlapping rainfall events represented by this sample day;
- Magnitude of each of the rainfall events represented by this sample day; and

- Lags of the overlapping rainfall events represented by this sample day.

The collection of the above data would not change the fact that inorganic particles represented in the TSS measurements is the major contributor to the turbidity reading and is the major constituent reduced when sediment BMPs are applied to nonpoint sources. The BMPs used on nonpoint sources for sediment also reduce the load of many of the unexplained contributors in the regression. The effort to have a perfect explanation of turbidity may not result in a better selection of BMPs. The regressions presented above between TSS and turbidity are adequate for the preparation of this TMDL. A stakeholder group of knowledgeable persons from the watershed may need additional information to set a plan of action for this TMDL.

The correlations between turbidity and TSS for Bayou DeView and Cache River ranged from good to very poor. Except for WHI0032, the R^2 values for these regressions were within the range of R^2 values for turbidity and TSS from other approved TMDLs in Arkansas (FTN 2001, FTN 2003, FTN 2005).

The statistical significance of the regression was evaluated by computing the "P value" for the slope of the regression line. The P value is essentially the probability that the slope of the regression line is really zero. Thus, a low P value indicates that a non-zero slope calculated from the regression analysis is statistically significant. For these regressions, the P values ranged from very good (1.4×10^{-25}) to very poor (0.872).

Because some of the regressions had poor correlation and/or poor statistical significance, not all of the regressions were used in development of these TMDLs (see Section 4.2).

4.0 TMDL DEVELOPMENT

4.1 Seasonality and Critical Conditions

EPA's regulations at 40 CFR 130.7 require the determination of TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. Also, both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to consider seasonal variations for meeting water quality standards. The historical data analysis in Section 3.0 showed that some exceedances of turbidity criteria occurred throughout the year and there was no noticeable correlation between streamflow and turbidity or TSS. Therefore, there is not a critical season or a single critical flow for these TMDLs. The methodology used to develop these TMDLs (load duration curve) addresses allowable loading for a wide range of flow conditions.

4.2 Water Quality Targets

Turbidity is an expression of the optical properties in a water sample that cause light to be scattered or absorbed and may be caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms (Standard Methods 1999). Turbidity cannot be expressed as a load as preferred for TMDLs. To achieve a load based value, turbidity is often correlated with a surrogate parameter such as TSS that may be expressed as a load. In general, activities that generate varying amounts of suspended sediment will proportionally change or affect turbidity (EPA 1991). Research by Relyea et. al. (2000) states, "increased turbidity by sediments can reduce stream primary production by reducing photosynthesis, physically abrading algae and other plants, and preventing attachment of autotrophs to substrate surfaces".

For the turbidity TMDLs in this report, target TSS concentrations (i.e., numeric endpoints for the TMDLs) were developed using some of the relationships between turbidity and TSS presented in Table 3.2. Some of the regression results in Table 3.2 were not used because the statistical significance (and in some cases the correlation, too) was poor. The four regression equations that were not used were the base flow regression for BDV0002, the base flow

regression for WHI0032, the storm-flow regression for WHI0032, and the base flow regression for CHR0002.

Two target TSS concentrations were developed for each water quality monitoring station, except WHI0032. A base flow target was developed using the base flow regression and the primary turbidity criterion, and a storm-flow target was developed using the storm-flow regression and the storm-flow turbidity criterion. The exceptions to this were for BDV0002 and CHR0002, where the base flow targets were estimated using the storm-flow regression and the primary turbidity standard. For impaired reaches in the study area that do not have water quality monitoring stations, target TSS concentrations from the nearest water quality monitoring station were assigned to those reaches. The target TSS concentrations are shown in Table 4.1. The discussion in Section 3.1 associating the primary turbidity criterion with the base flow portion of the duration curve is the basis for using the descriptor "base flow" in this document for the conditions when the primary turbidity criterion should apply.

Table 4.1. TSS targets for Bayou DeView and Cache River TMDLs.

Water Quality Station	Regression	Turbidity Criterion	Target TSS	Reaches to Which Targets Were Applied
BDV0002	Base flow	75 NTU	49 mg/L	08020302-004, -005, -006
	Storm-flow	250 NTU	94 mg/L	
WHI0026	Base flow	75 NTU	37 mg/L	08020302-007, -009
	Storm-flow	250 NTU	121 mg/L	
CHR0002	Base flow	75 NTU	27 mg/L	08020302-016, -017, -018, -019
	Storm-flow	250 NTU	46 mg/L	
CHR0003	Base flow	75 NTU	75 mg/L	08020302-020, -021
	Storm-flow	250 NTU	121 mg/L	
CHR0004	Base flow	75 NTU	61 mg/L	08020302-027, -028, -029, -031, -032
	Storm-flow	250 NTU	157 mg/L	

4.3 Methodology for TMDL Calculations

The methodology used for the TMDLs in this report is the load duration curve. Because loading capacity varies as a function of the flow present in the stream, these TMDLs represent a continuum of desired loads over all flow conditions, rather than fixed at a single value. The basic elements of this procedure are documented on the Kansas Department of Health and

Environment web site (KDHE 2005). This method was used to illustrate allowable loading at a wide range of flows. The steps for how this methodology was applied for the TMDLs in this report can be summarized as follows:

1. Develop a flow duration curve (Section 4.4);
2. Convert the flow duration curve to load duration curves (Section 4.5);
3. Plot observed loads with load duration curves (Section 4.6);
4. Calculate TMDL, MOS, WLA, and LA (Sections 4.7-4.9); and
5. Calculate percent reductions (Section 4.10).

4.4 Flow Duration Curve

A flow per unit area duration curve was developed for the study area (see Table F.1 in Appendix F for details). Daily streamflow measurements from Cache River near Cotton Plant (USGS Gage No. 07077555) and Cache River at Egypt (USGS Gage No. 07077380) were sorted in increasing order and the percent exceedance of each flow was calculated. Each flow was then divided by the drainage area of the gage to get a flow per square mile. The flow per unit area duration curves are shown on Figures F.1 and F.2 in Appendix F.

4.5 Load Duration Curves

Each flow per unit area from the flow duration curve was multiplied by the appropriate TSS target concentration to develop plots of allowable load versus flow exceedence (Load duration curves). The water quality standards for Arkansas (APCEC 2004a) do not specify a range of flows or flow exceedances for which each of the turbidity criteria (primary and storm-flow) is applicable. As discussed in Section 3.1, it was assumed here that the lowest 40% of stream flow values represent flow conditions without significant influence from storm runoff and that stream flow values above the 40^{th} percentile would have some influence from storm runoff. Therefore, each TSS target corresponding to the primary turbidity criterion was applied to the lowest 40% of flows (from 100% exceedence of stream flow to 60% exceedence of stream flow) and each TSS target corresponding to the storm-flow turbidity criterion was applied from 60% exceedence of stream flow to 0% exceedence of stream flow. The load duration curves for storm-flow conditions and base flow conditions are shown on Figures F.3-F.12 (in Appendix F).

4.6 Observed Loads

The observed loads per unit of drainage area for each of the water quality monitoring stations except WH10032 were calculated for each sampling day. Each observed load per unit of drainage area was calculated by simply multiplying the observed TSS concentration times the flow per unit of drainage area on the sampling day (with a conversion factor incorporated).

The load duration plots (Figures F.3-F.12) provide visual comparisons between observed and allowable loads under different flow conditions. Observed loads that are plotted above the load duration curve represent conditions where observed water quality concentrations exceed the target concentrations. Observed loads below the load duration curve represent conditions where observed water quality concentrations were less than target concentrations (i.e., not exceeding water quality criteria).

4.7 TMDL and MOS

The allowable loads per unit area for storm-flow conditions were calculated as the appropriate TSS target for storm-flow conditions (see Table 4.1) multiplied times the flow per unit area at the 30% flow exceedance. The 30% flow exceedance was used because it is considered to represent a typical flow value for storm-flow conditions (it is the midpoint along the flow duration curve between 0% and 60%). The allowable loads per unit area for base flow conditions were calculated as the appropriate TSS target for base flow conditions (see Table 4.1) multiplied times the flow per unit area at the 80% flow exceedance. The 80% flow exceedance was used because it is considered to represent a typical flow value for base flow conditions (it is the midpoint along the flow duration curve between 60% and 100%). The TMDLs were calculated as the allowable loads per unit area multiplied times the total drainage area at the downstream end of each reach. These calculations are shown at the bottom of Tables F.1-F.5.

Both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to include a MOS to account for uncertainty in available data or in the actual effect that controls will have on the loading reductions and receiving water quality. The MOS may be expressed explicitly as unallocated assimilative capacity or implicitly through conservative

assumptions used in establishing the TMDL. For these TMDLs, an implicit MOS was incorporated through the use of conservative assumptions. The primary conservative assumption was calculating the TMDLs assuming that TSS is a conservative parameter and does not settle out of the water column.

4.8 Point Source Loads

The WLAs for the point sources were set to NA ~~zero~~ because the surrogate being used for turbidity (TSS) is considered to represent inorganic suspended solids (i.e., soil and sediment particles from erosion or sediment resuspension). The suspended solids discharged by point sources in the Cache River and Bayou DeView watershed are assumed to consist primarily of organic solids rather than inorganic solids. Discharges of organic suspended solids from point sources are already addressed by ADEQ through their permitting of point sources to maintain water quality standards for dissolved oxygen. The WLAs to support these TMDLs will not require any changes to the permits concerning inorganic suspended solids. Therefore, future growth for these permits or new permits would not be restricted by these turbidity TMDLs.

4.9 Nonpoint Source Loads

The LAs for nonpoint sources, including natural background, result in being equal to the TMDLs because the WLAs were NA ~~zero~~ and the MOS was implicit.

4.10 Percent Reductions

In addition to calculating allowable loads, estimates were made for percent reductions of nonpoint source loads that are needed. For each station where the number of observed TSS loads exceeded the allowable loads was above an acceptable number (i.e., each observed TSS load above the allowable load curve in Figures F.3-F.12), a uniform percent reduction was applied to the observed loads in the plot until the number of TSS loads exceeding the allowable loads was less than or equal to an acceptable number. For storm-flow conditions, the acceptable number of exceedances was 20% of the number of storm-flow data. This percentage (20%) was based on the Arkansas water quality standards, which state that “the non-point source runoff shall not

result in the exceedance of the in stream storm-flow values in more than 20% of the ADEQ ambient monitoring network samples taken in not less than 24 monthly samples." (APCEC 2004a). For base flow conditions, the acceptable number of exceedances was 25% of the number of base flow data. This percentage (25%) was based on the ADEQ assessment criteria for turbidity (ADEQ 2002, ADEQ 2005a). For both storm-flow and base flow conditions, whenever the appropriate percentage multiplied by the number of observed values yielded a fractional number (e.g., 25% x 38 = 9.5), the allowable number of exceedances was rounded up to the next whole number (e.g., 9.5 rounded up to 10) in accordance with the ADEQ assessment criteria (ADEQ 2002, ADEQ 2005a). The calculations for percent reductions are shown in Tables F.6-F.15.

For the impaired reaches without water quality monitoring data, percent reductions were assumed to be the same as the nearest reach with observed water quality data (i.e., in a similar manner as done for the target TSS concentrations). These percent reductions and the results of the TMDL calculations are summarized in Table 4.2. These calculations indicated that 14 of the 16 impaired reaches required some reductions.

The percent reductions in Table 4.2 were calculated using methodology that is slightly different than the assessment criteria used by ADEQ to develop the 2004 303(d) list. The ADEQ assessment was performed using turbidity data that were categorized as either base flow or storm-flow values based on the month of the year in which the values were measured. The percent reductions in Table 4.2 were calculated using TSS data that were categorized as either base flow or storm-flow values based on streamflow data on each sampling day. These differences caused the assessment for the 2004 draft 303(d) list to indicate that 16 stream reaches in the Bayou DeView and Cache River watersheds are impaired and the TMDL analysis to indicate that two of those reaches (08020302-007 and -009) are not impaired. The 2004 draft 303(d) list is still being reviewed by EPA and has not been finalized yet.

Table 4.2. Summary of turbidity TMDLs.

Reach ID	Stream Name	Flow Category	Loads (tons/day of TSS)				Percent Reduction Needed
			WLA	L	MOS	TMDL	
08020302-004	Bayou DeView	Base flow	0NA	15.2	0Implicit	15.2	35%
		Storm-flow	0NA	181	0Implicit	181	0%
08020302-005	Bayou DeView	Base flow	0NA	12.2	0 Implicit	12.2	35%
		Storm-flow	0NA	146	0 Implicit	146	0%
08020302-006	Bayou DeView	Base flow	0NA	10.8	0 Implicit	10.8	35%
		Storm-flow	0NA	129	0 Implicit	129	0%
08020302-007	Bayou DeView	Base flow	0NA	3.04	0 Implicit	3.04	0%
		Storm-flow	0NA	112	0 Implicit	112	0%
08020302-009	Bayou DeView	Base flow	0NA	1.88	0 Implicit	1.88	0%
		Storm-flow	0NA	69.2	0 Implicit	69.2	0%
08020302-016	Cache River	Base flow	0NA	21.3	0 Implicit	21.3	35%
		Storm-flow	0NA	225	0 Implicit	225	0%
08020302-017	Cache River	Base flow	0NA	19.4	0 Implicit	19.4	35%
		Storm-flow	0NA	205	0 Implicit	205	0%
08020302-018	Cache River	Base flow	0NA	19.1	0 Implicit	19.1	35%
		Storm-flow	0NA	202	0 Implicit	202	0%
08020302-019	Cache River	Base flow	0NA	16.7	0 Implicit	16.7	35%
		Storm-flow	0NA	176.9	0 Implicit	176.9	0%
08020302-020	Cache River	Base flow	0NA	19.3	0 Implicit	19.3	0%
		Storm-flow	0NA	347	0 Implicit	347	17%
08020302-021	Cache River	Base flow	0NA	17.3	0 Implicit	17.3	0%
		Storm-flow	0NA	311	0 Implicit	311	17%
08020302-027	Cache River	Base flow	0NA	10.5	0 Implicit	10.5	13%
		Storm-flow	0NA	304	0 Implicit	304	0%
08020302-028	Cache River	Base flow	0NA	9.22	0 Implicit	9.22	13%
		Storm-flow	0NA	267	0 Implicit	267	0%
08020302-029	Cache River	Base flow	0NA	8.22	0 Implicit	8.22	13%
		Storm-flow	0NA	238	0 Implicit	238	0%
08020302-031	Cache River	Base flow	0NA	7.47	0 Implicit	7.47	13%
		Storm-flow	0NA	216	0 Implicit	216	0%
08020302-032	Cache River	Base flow	0NA	6.43	0 Implicit	6.43	13%
		Storm-flow	0NA	186	0 Implicit	186	0%

4.11 Future Growth

As mentioned in Section 4.8, future growth of existing or new point source discharges would not be restricted by these TMDLs.

5.0 OTHER RELEVANT INFORMATION

In accordance with Section 106 of the federal Clean Water Act and under its own authority, ADEQ has established a comprehensive program for monitoring the quality of the State's surface waters. ADEQ collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for long term trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters, which are issued as a single document titled Arkansas Integrated Water Quality Monitoring and Assessment Report.

6.0 PUBLIC PARTICIPATION

When EPA establishes a TMDL, federal regulations require EPA to publicly notice and seek comment concerning the TMDL. Pursuant to a May 2000 consent decree, these TMDLs were prepared under contract to EPA. After development of the draft version of these TMDLs, EPA prepared a notice seeking comments, information, and data from the general public and affected public. No comments, data, or information were submitted during the public comment period. EPA has transmitted the final TMDLs to ADEQ for implementation and for incorporation into ADEQ's current water quality management plan.

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APPENDIX A

Maps

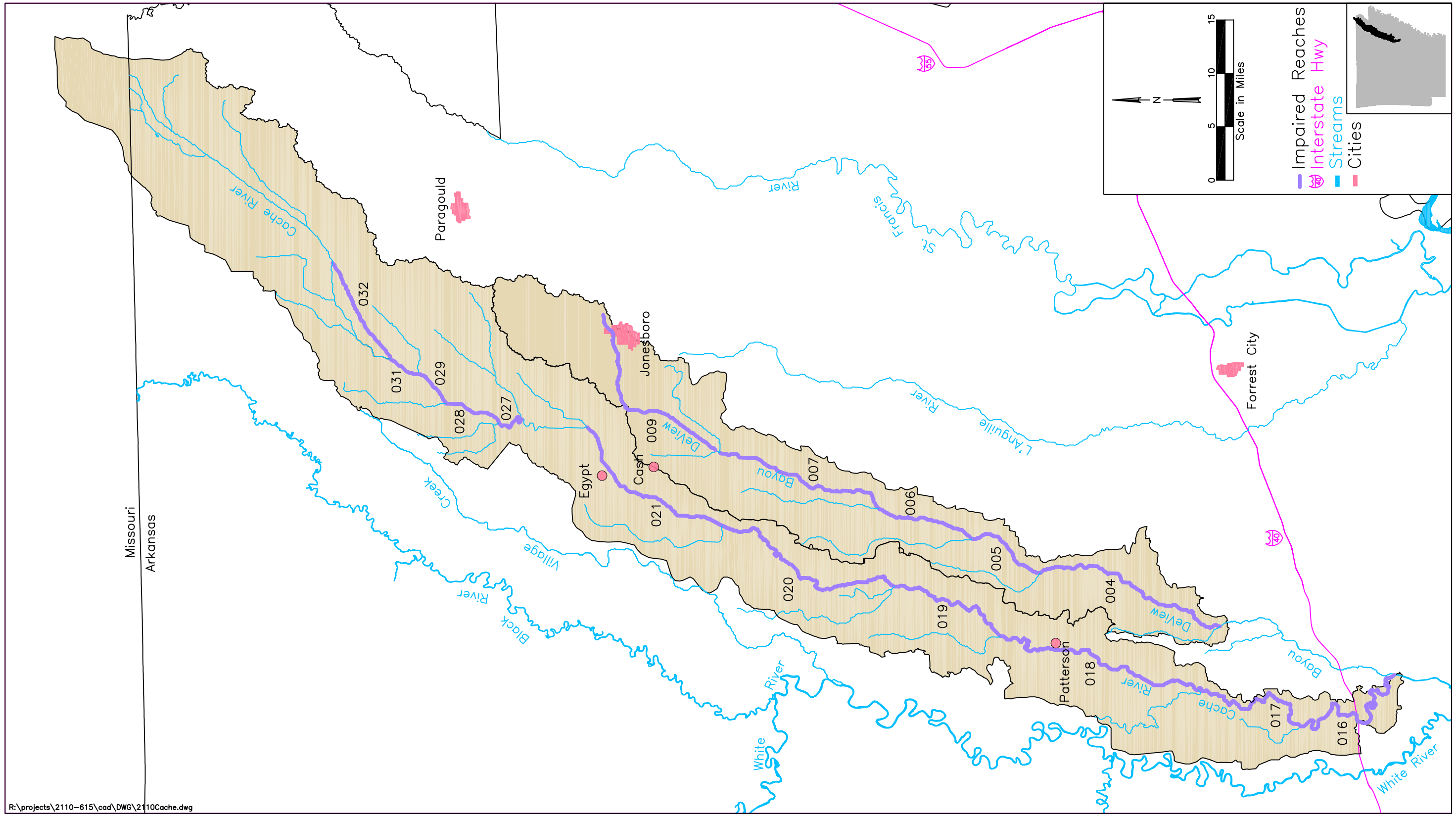

Figure A.1. Map of study area

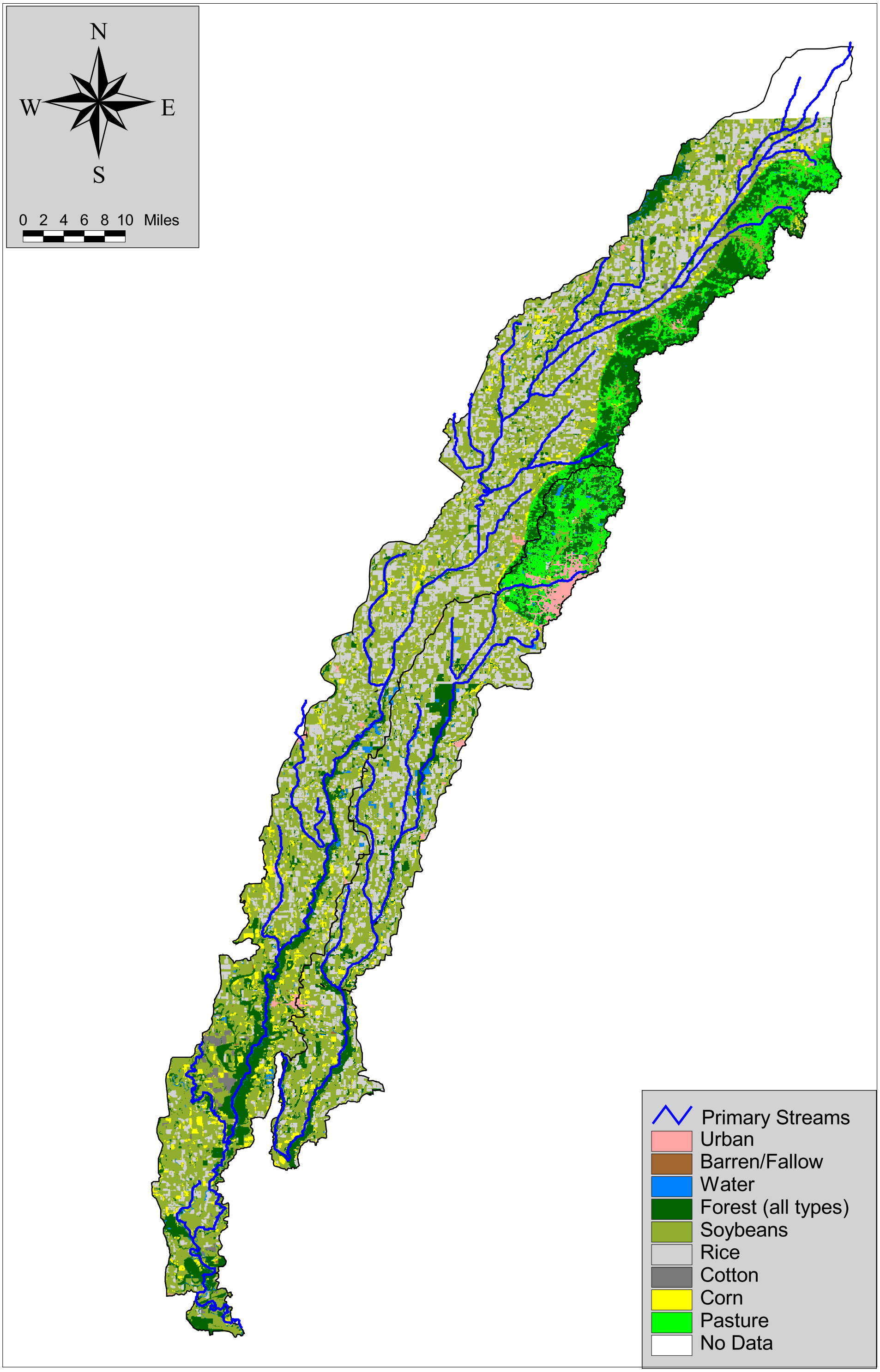

Figure A.2. Land use for Bayou DeView and Cache River study area.

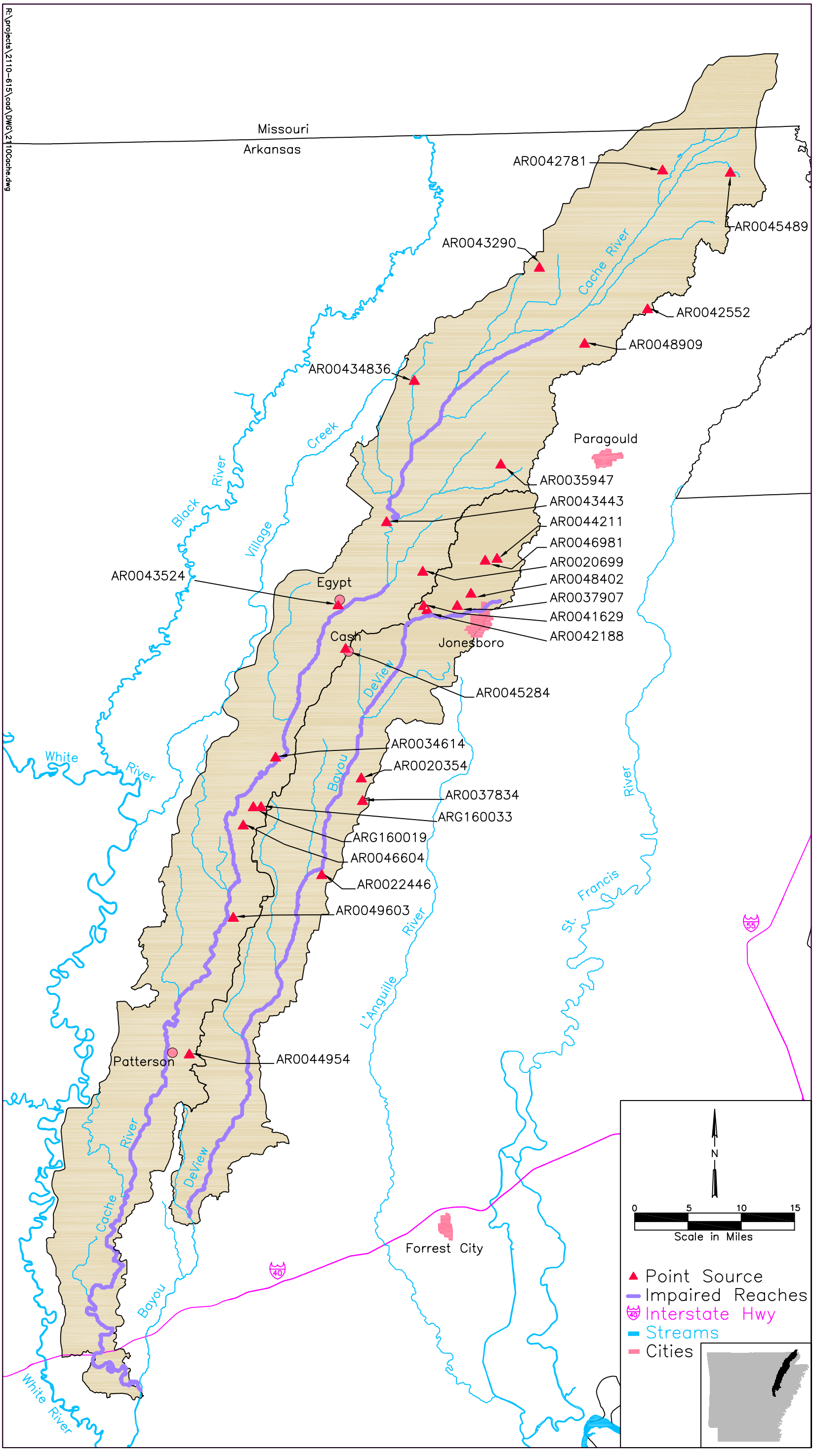

Figure A.3. Map of point sources in the study area

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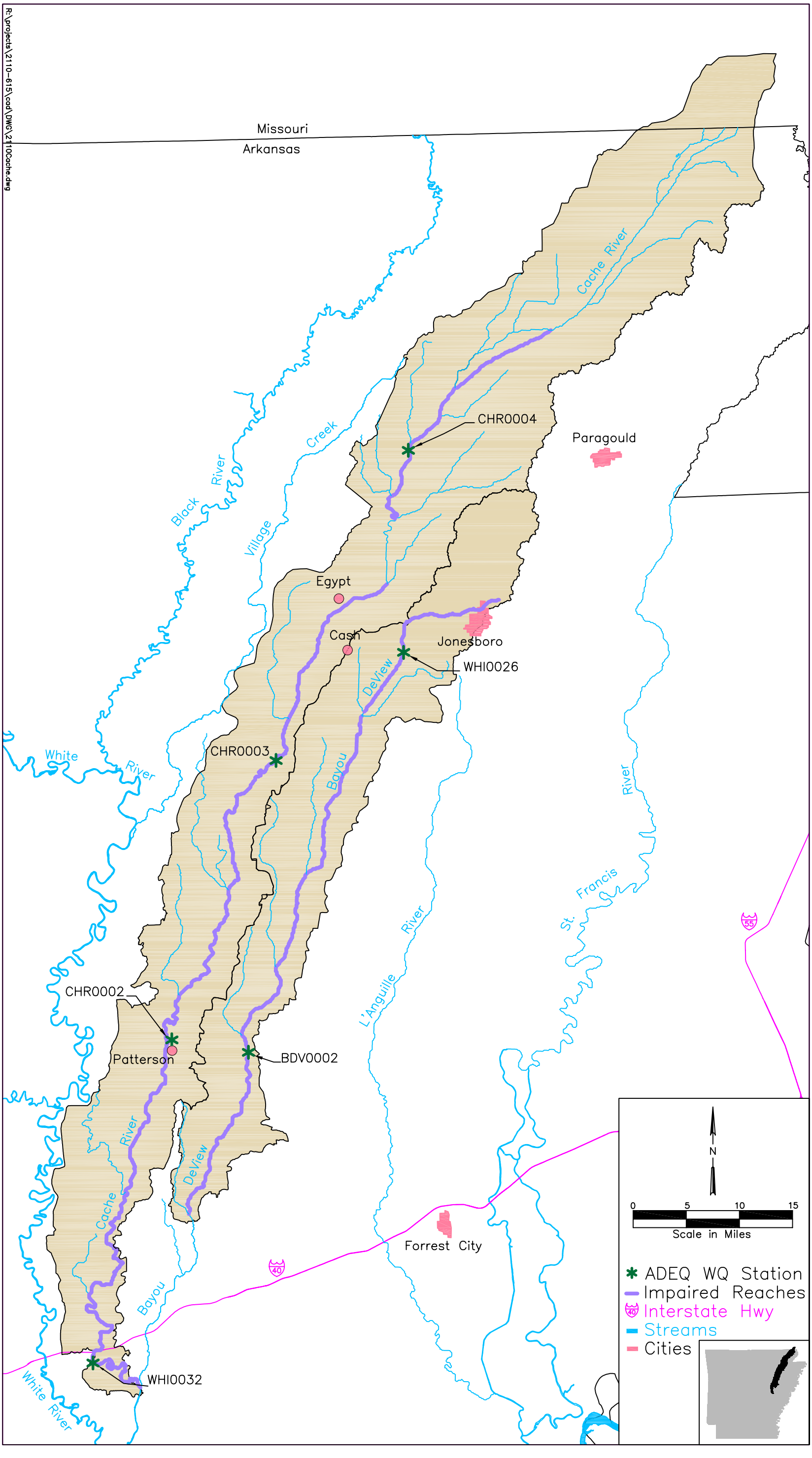

Figure A.4. Map of water quality stations in the study area

APPENDIX B

Long Term Plots of Turbidity and TSS

Table B.1. Observed Turbidity and TSS Data for Bayou DeView at BDV0002.

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
4/10/1995	88	75	145	0.12	5.00E+01	90.17%	Base flow	75	No	
11/4/2002	37.8	20	179	0.15	1.65E+01	87.22%	Base flow	75	Yes	
2/19/1996	105		207	0.18	0.00E+00	84.87%	Base flow	75	No	
4/28/2003	458	170	312	0.27	2.44E+02	75.85%	Base flow	75	No	
8/25/2003	80.3	98.6	470	0.40	2.13E+02	64.77%	Base flow	75	No	
10/2/1995	36	41	511	0.44	9.64E+01	62.43%	Base flow	75	Yes	
9/12/1994	38	48	592	0.51	1.31E+02	58.03%	Storm-flow	250		Yes
9/23/2002	20	13.8	738	0.63	4.69E+01	51.52%	Storm-flow	250		Yes
1/16/1995	180	159.5	783	0.67	5.75E+02	50.22%	Storm-flow	250		Yes
10/7/1996	36	40.5	1020	0.87	1.90E+02	43.69%	Storm-flow	250		Yes
10/22/2001	6.8	13	1050	0.90	6.28E+01	43.06%	Storm-flow	250		Yes
6/23/2003	62.4	50	1060	0.90	2.44E+02	42.88%	Storm-flow	250		Yes
5/6/1996	128	49	1120	0.96	2.53E+02	41.41%	Storm-flow	250		Yes
6/13/1994	86	65	1250	1.07	3.74E+02	38.25%	Storm-flow	250		Yes
7/17/1995	33	33	1370	1.17	2.08E+02	35.82%	Storm-flow	250		Yes
5/21/2002	160	66	1690	1.44	5.13E+02	29.62%	Storm-flow	250		Yes
1/28/2002	170	58.5	2240	1.91	6.03E+02	20.89%	Storm-flow	250		Yes
7/29/2002	4	11	2480	2.12	1.26E+02	18.23%	Storm-flow	250		Yes
1/7/2003	126	19	2800	2.39	2.45E+02	15.37%	Storm-flow	250		Yes
3/25/2002		42	3490	2.98	6.74E+02	9.57%	Storm-flow	250		
3/10/2003	171	56	3940	3.36	1.02E+03	6.74%	Storm-flow	250		Yes
							Number exceeding applicable water quality standard for turbidity =		4	0
							Total number of observations in each category =		6	14
							Percent exceeding applicable water quality standard for turbidity =		67%	0%

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Table B.2. Observed Turbidity and TSS Data for Bayou DeView at WHI0026.

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
10/23/1995	14	16.0	0.001	0.00	1.23E-04	99.68	Base flow	75	Yes	
10/17/2000	26	27.0	0.001	0.00	2.08E-04	99.68	Base flow	75	Yes	
11/13/2001	9	7.0	0.44	0.00	2.37E-02	99.25	Base flow	75	Yes	
10/5/2004	6	3.2	1.7	0.00	4.19E-02	99.05	Base flow	75	Yes	
11/2/1999	18	20.0	6	0.01	9.23E-01	98.33	Base flow	75	Yes	
10/18/1994	48	30.5	7	0.01	1.64E+00	98.20	Base flow	75	Yes	
6/12/2001	6	14.3	11	0.02	1.21E+00	97.26	Base flow	75	Yes	
11/6/1990	36		13	0.02	0.00E+00	96.98	Base flow	75	Yes	
10/27/1992	96	62.0	14	0.02	6.68E+00	96.81	Base flow	75	No	
11/9/1998	55	11.5	18	0.03	1.59E+00	95.95	Base flow	75	Yes	
10/8/2002	22	12.2	20	0.03	1.88E+00	95.33	Base flow	75	Yes	
4/22/2003	18	19.5	20	0.03	3.00E+00	95.33	Base flow	75	Yes	
5/20/1997	13	25.0	23	0.03	4.42E+00	94.10	Base flow	75	Yes	
3/12/1991	25	22.0	25	0.04	4.23E+00	93.21	Base flow	75	Yes	
9/21/1999	17	23.5	29	0.04	5.24E+00	92.03	Base flow	75	Yes	
11/9/1993	25	10.0	30	0.04	2.31E+00	91.79	Base flow	75	Yes	
9/19/2000	28	34.0	32	0.05	8.37E+00	91.31	Base flow	75	Yes	
12/15/1998	88	31.5	37	0.05	8.97E+00	89.97	Base flow	75	No	
10/1/1991	22	27.0	41	0.06	8.52E+00	88.68	Base flow	75	Yes	
3/14/2000	20	10.0	41	0.06	3.15E+00	88.68	Base flow	75	Yes	
6/24/2003	75	41.5	41	0.06	1.31E+01	88.68	Base flow	75	Yes	
6/11/1991	26	27.0	45	0.06	9.35E+00	87.94	Base flow	75	Yes	
9/23/1997	13	14.0	49	0.07	5.28E+00	87.09	Base flow	75	Yes	
9/30/2003	7	5.5	49	0.07	2.07E+00	87.09	Base flow	75	Yes	
12/7/1999	6	8.0	54	0.08	3.32E+00	85.91	Base flow	75	Yes	
5/21/1996	37	30.0	55	0.08	1.27E+01	85.64	Base flow	75	Yes	
4/18/1995	29	35.0	59	0.08	1.59E+01	84.67	Base flow	75	Yes	
4/6/2004	21	20.0	62	0.09	9.54E+00	84.05	Base flow	75	Yes	
9/26/1995	47	19.5	65	0.09	9.75E+00	83.17	Base flow	75	Yes	
10/14/1997	160	102.5	66	0.09	5.20E+01	82.91	Base flow	75	No	

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
9/20/1994	35	45.0	67	0.10	2.32E+01	82.65	Base flow	75	Yes	
2/23/1999	24	7.0	68	0.10	3.66E+00	82.38	Base flow	75	Yes	
5/11/1999	52	26.5	70	0.10	1.43E+01	81.79	Base flow	75	Yes	
3/25/2003	50	31.8	74	0.11	1.81E+01	80.86	Base flow	75	Yes	
2/1/2000	1	1.0	76	0.11	5.85E-01	80.29	Base flow	75	Yes	
12/9/1997	73	7.0	77	0.11	4.15E+00	80.00	Base flow	75	Yes	
4/11/2000	15	13.0	78	0.11	7.80E+00	79.73	Base flow	75	Yes	
3/21/1995	110	25.5	81	0.12	1.59E+01	78.88	Base flow	75	No	
6/20/1995	30	37.0	87	0.12	2.48E+01	77.64	Base flow	75	Yes	
7/9/1991	30	30.0	90	0.13	2.08E+01	76.95	Base flow	75	Yes	
5/12/1992	18	37.0	91	0.13	2.59E+01	76.71	Base flow	75	Yes	
6/24/1997	34	31.0	96	0.14	2.29E+01	75.58	Base flow	75	Yes	
11/12/1997	32	17.0	100	0.14	1.31E+01	74.56	Base flow	75	Yes	
9/17/2002	210	162.0	100	0.14	1.25E+02	74.56	Base flow	75	No	
1/21/2003	56	3.8	103	0.15	3.01E+00	73.88	Base flow	75	Yes	
11/20/1995	47	9.0	105	0.15	7.27E+00	73.45	Base flow	75	Yes	
6/25/2002	11		107	0.15	0.00E+00	73.06	Base flow	75	Yes	
2/20/1996	205	154.0	110	0.16	1.30E+02	72.42	Base flow	75	No	
3/26/1996	160	140.0	110	0.16	1.18E+02	72.42	Base flow	75	No	
4/10/2001	18	18.5	115	0.16	1.64E+01	71.45	Base flow	75	Yes	
7/17/2001	5	9.5	125	0.18	9.14E+00	69.75	Base flow	75	Yes	
5/9/2000	44	36.5	126	0.18	3.54E+01	69.57	Base flow	75	Yes	
2/3/1998	36	13.0	128	0.18	1.28E+01	69.13	Base flow	75	Yes	
1/3/1995	51	3.0	129	0.18	2.98E+00	68.92	Base flow	75	Yes	
2/12/1991	33	20.0	138	0.20	2.12E+01	67.26	Base flow	75	Yes	
7/6/1993	25	63.0	140	0.20	6.79E+01	67.02	Base flow	75	Yes	
2/6/1995	53	10.0	153	0.22	1.18E+01	65.03	Base flow	75	Yes	
8/7/2001	7	5.8	162	0.23	7.17E+00	63.71	Base flow	75	Yes	
12/10/2002	40	8.8	179	0.26	1.21E+01	61.40	Base flow	75	Yes	
3/17/1992	14	20.0	182	0.26	2.80E+01	60.91	Base flow	75	Yes	
3/17/1992	270	177.0	182	0.26	2.48E+02	60.91	Base flow	75	No	
8/6/1996		47.0	221	0.32	7.99E+01	56.47	Storm-flow	250		

Table B.2.
Turbidity and TSS data WHI0026

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
3/22/1994	48	24.0	229	0.33	4.23E+01	55.66	Storm-flow	250		Yes
8/3/2004	32	22.2	244	0.35	4.17E+01	54.37	Storm-flow	250		Yes
1/21/1992	36	18.0	248	0.35	3.43E+01	53.88	Storm-flow	250		Yes
8/16/1994	28	37.5	262	0.37	7.56E+01	52.80	Storm-flow	250		Yes
10/21/2003	53	18.5	272	0.39	3.87E+01	52.09	Storm-flow	250		Yes
8/29/1995	08	12.0	274	0.39	2.53E+01	51.92	Storm-flow	250		Yes
3/23/1999	63	19.0	304	0.43	4.44E+01	49.63	Storm-flow	250		Yes
2/13/2001	54	21.0	307	0.44	4.96E+01	49.42	Storm-flow	250		Yes
9/3/1996	41	56.0	308	0.44	1.33E+02	49.33	Storm-flow	250		Yes
8/1/1995	76	72.5	324	0.46	1.81E+02	48.22	Storm-flow	250		Yes
8/19/2003	32	22.2	326	0.47	5.57E+01	48.08	Storm-flow	250		Yes
7/20/1999	05	22.0	328	0.47	5.55E+01	47.95	Storm-flow	250		Yes
7/18/2000	13	25.0	332	0.47	6.39E+01	47.72	Storm-flow	250		Yes
8/13/1991	180	117.0	334	0.48	3.01E+02	47.61	Storm-flow	250		Yes
6/1/1993	25	22.0	340	0.49	5.75E+01	47.23	Storm-flow	250		Yes
6/9/1992	109	110.0	342	0.49	2.89E+02	47.05	Storm-flow	250		Yes
10/1/1996	86	27.5	353	0.50	7.47E+01	46.23	Storm-flow	250		Yes
3/22/2005	266	290.0	354	0.50	7.90E+02	46.19	Storm-flow	250		No
9/11/1990	52	94.0	361	0.51	2.61E+02	45.68	Storm-flow	250		Yes
7/23/2002	30	26.5	374	0.53	7.62E+01	45.04	Storm-flow	250		Yes
4/9/1991	64	50.0	375	0.53	1.44E+02	44.99	Storm-flow	250		Yes
11/12/2002	28	10.0	392	0.56	3.02E+01	43.96	Storm-flow	250		Yes
3/16/1993	440	1358.0	400	0.57	4.18E+03	43.58	Storm-flow	250		No
7/16/1996	05	100.0	416	0.59	3.20E+02	42.76	Storm-flow	250		Yes
7/16/1996	41	23.0	416	0.59	7.36E+01	42.76	Storm-flow	250		Yes
8/24/1999	28	22.0	426	0.61	7.21E+01	42.26	Storm-flow	250		Yes
5/27/2003	51	41.5	428	0.61	1.37E+02	42.15	Storm-flow	250		Yes
2/19/2002	70	33.5	459	0.65	1.18E+02	40.86	Storm-flow	250		Yes
1/6/2004	89	22.8	486	0.69	8.52E+01	39.96	Storm-flow	250		Yes
1/23/2001	56	24.0	492	0.70	9.08E+01	39.67	Storm-flow	250		Yes
6/11/1996	97	72.5	520	0.74	2.90E+02	38.79	Storm-flow	250		Yes
3/2/2004	89	30.5	586	0.84	1.37E+02	36.76	Storm-flow	250		Yes

Table B.2.
Turbidity and TSS data WHI0026

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
10/12/1999	310	206.5	600	0.86	9.53E+02	36.33	Storm-flow	250		No
2/3/2004	115	49.2	647	0.92	2.45E+02	34.96	Storm-flow	250		Yes
1/6/1998	61	85.0	656	0.94	4.29E+02	34.82	Storm-flow	250		Yes
5/28/2002	47	27.0	686	0.98	1.42E+02	33.95	Storm-flow	250		Yes
9/18/2001	26	18.5	691	0.99	9.83E+01	33.86	Storm-flow	250		Yes
5/8/2001	09	17.5	695	0.99	9.36E+01	33.77	Storm-flow	250		Yes
2/23/1993	49	24.0	703	1.00	1.30E+02	33.59	Storm-flow	250		Yes
9/10/1991	42	48.0	711	1.01	2.63E+02	33.35	Storm-flow	250		Yes
8/4/1992	07	70.0	715	1.02	3.85E+02	33.29	Storm-flow	250		Yes
8/10/1993	47	45.0	720	1.03	2.49E+02	33.21	Storm-flow	250		Yes
12/2/2003	70	24.5	731	1.04	1.38E+02	32.92	Storm-flow	250		Yes
9/21/1993	60	6.0	750	1.07	3.46E+01	32.45	Storm-flow	250		Yes
7/22/2003	91	60.6	773	1.10	3.60E+02	31.98	Storm-flow	250		Yes
9/1/1992	46	34.0	802	1.14	2.10E+02	31.26	Storm-flow	250		Yes
5/10/1994	75	18.5	880	1.26	1.25E+02	29.79	Storm-flow	250		Yes
4/13/1993	51	34.0	900	1.28	2.35E+02	29.39	Storm-flow	250		Yes
4/16/2002	37	28.2	904	1.29	1.96E+02	29.31	Storm-flow	250		Yes
1/23/1996	65	14.0	985	1.41	1.06E+02	27.64	Storm-flow	250		Yes
11/18/2003	339	419.0	1020	1.46	3.29E+03	27.09	Storm-flow	250		No
8/27/2002	15	21.8	1050	1.50	1.76E+02	26.64	Storm-flow	250		Yes
5/11/1993	89		1100	1.57	0.00E+00	25.94	Storm-flow	250		Yes
1/19/1999	180		1120	1.60	0.00E+00	25.61	Storm-flow	250		Yes
2/11/1997	58	30.0	1180	1.68	2.72E+02	24.88	Storm-flow	250		Yes
7/6/2004	66	42.0	1270	1.81	4.10E+02	23.90	Storm-flow	250		Yes
4/23/1996	150		1280	1.83	0.00E+00	23.75	Storm-flow	250		Yes
9/22/1992	22	142.0	1410	2.01	1.54E+03	22.14	Storm-flow	250		Yes
1/8/2002	05	21.3	1420	2.03	2.33E+02	22.03	Storm-flow	250		Yes
1/21/1997	91	99.0	1490	2.13	1.13E+03	21.26	Storm-flow	250		Yes
12/19/1995	200	59.0	1500	2.14	6.81E+02	21.09	Storm-flow	250		Yes
5/7/1991	04	4.0	1550	2.21	4.77E+01	20.58	Storm-flow	250		Yes
10/25/1993	87	30.0	1610	2.30	3.72E+02	19.99	Storm-flow	250		Yes
1/26/1993	73	46.0	1750	2.50	6.19E+02	18.59	Storm-flow	250		Yes

Table B.2.
Turbidity and TSS data WHI0026

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
3/4/2003	77	24.0	1770	2.52	3.27E+02	18.36	Storm-flow	250		Yes
11/15/1994	130	46.5	1800	2.57	6.44E+02	18.09	Storm-flow	250		Yes
6/15/1999	110		1810	2.58	0.00E+00	18.00	Storm-flow	250		Yes
2/25/1992	120	107.0	1920	2.74	1.58E+03	16.88	Storm-flow	250		Yes
1/25/1994	110	177.0	2000	2.85	2.72E+03	16.11	Storm-flow	250		Yes
2/22/1994	760	936.0	2000	2.85	1.44E+04	16.11	Storm-flow	250		No
3/12/2002	235	441.0	2040	2.91	6.92E+03	15.66	Storm-flow	250		Yes
11/14/2000	49	32.0	2150	3.07	5.29E+02	14.68	Storm-flow	250		Yes
7/7/1992	150	183.0	2320	3.31	3.27E+03	13.40	Storm-flow	250		Yes
8/18/1998			2320	3.31	0.00E+00	13.40	Storm-flow	250		
4/21/1992	110	126.0	2360	3.37	2.29E+03	13.10	Storm-flow	250		Yes
2/8/2005	118	78.0	2360	3.37	1.42E+03	13.14	Storm-flow	250		Yes
5/9/1995	250		2450	3.50	0.00E+00	12.44	Storm-flow	250		Yes
10/16/2001	62	25.0	2680	3.82	5.15E+02	10.78	Storm-flow	250		Yes
11/5/1996	89	27.5	2890	4.12	6.11E+02	9.20	Storm-flow	250		Yes
7/5/1994	80	38.0	2910	4.15	8.51E+02	9.02	Storm-flow	250		Yes
4/12/1994	200	334.0	2920	4.17	7.50E+03	8.94	Storm-flow	250		Yes
12/18/1990	210	313.0	2930	4.18	7.06E+03	8.86	Storm-flow	250		Yes
11/9/2004	455	176.0	3060	4.37	4.14E+03	8.01	Storm-flow	250		No
4/6/1999	210	324.5	3100	4.42	7.74E+03	7.71	Storm-flow	250		Yes
6/7/1994	330	450.0	3120	4.45	1.08E+04	7.55	Storm-flow	250		No
1/4/2000	260	142.0	3170	4.52	3.46E+03	7.18	Storm-flow	250		No
10/9/1990	45	59.0	3200	4.56	1.45E+03	6.96	Storm-flow	250		Yes
11/23/1992	91	90.0	3240	4.62	2.24E+03	6.63	Storm-flow	250		Yes
10/20/1998	85		3300	4.71	0.00E+00	6.27	Storm-flow	250		Yes
5/4/2004	54	23.8	3380	4.82	6.19E+02	5.71	Storm-flow	250		Yes
11/5/1991	75	33.0	3420	4.88	8.68E+02	5.38	Storm-flow	250		Yes
1/18/2005	60	17.2	3420	4.88	4.53E+02	5.43	Storm-flow	250		Yes
4/15/1997	55	36.0	3430	4.89	9.50E+02	5.30	Storm-flow	250		Yes
3/10/1998	64	30.5	3530	5.04	8.28E+02	4.64	Storm-flow	250		Yes
5/12/1998	77	57.0	3530	5.04	1.55E+03	4.64	Storm-flow	250		Yes
12/7/2004	163	98.7	3720	5.31	2.82E+03	3.83	Storm-flow	250		Yes

Table B.2.
Turbidity and TSS data WHI0026

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
12/11/2001	58	14.0	3950	5.63	4.25E+02	2.95	Storm-flow	250		Yes
3/6/2001	74	33.0	3960	5.65	1.01E+03	2.92	Storm-flow	250		Yes
12/13/1994	74	23.5	4110	5.86	7.43E+02	2.40	Storm-flow	250		Yes
4/30/1991	140		4160	5.93	0.00E+00	2.28	Storm-flow	250		Yes
12/7/1993	80	82.0	4260	6.08	2.69E+03	2.07	Storm-flow	250		Yes
12/3/1996	57	24.5	4290	6.12	8.09E+02	1.99	Storm-flow	250		Yes
3/4/1997	180		5090	7.26	0.00E+00	0.78	Storm-flow	250		Yes
1/15/1991	105	210.0	5130	7.32	8.29E+03	0.75	Storm-flow	250		Yes
								Number exceeding applicable water quality standard for turbidity =	8	8
								Total number of observations in each category =	61	103
								Percent exceeding applicable water quality standard for turbidity =	13%	8%

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Table B.2.
Turbidity and TSS data WHI0026

Table B.3. Observed Turbidity and TSS Data for Cache River at WHI0032.

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
7/29/2002	23	14.5	53	4.52E-02	3.54	99.38%	Base flow	75	Yes	
1/28/2002	56	24.5	56	4.78E-02	6.31	96.13%	Base flow	75	Yes	
4/10/1995	74	28	145	1.24E-01	18.68	90.17%	Base flow	75	Yes	
11/4/2002	44.4	16.8	179	1.53E-01	13.84	87.22%	Base flow	75	Yes	
6/7/1994	74		212	1.81E-01		84.49%	Base flow	75	Yes	
4/28/2003	152	39	312	2.66E-01	55.99	75.85%	Base flow	75	No	
2/26/1996	105	28.5	414	3.53E-01	54.29	68.27%	Base flow	75	No	
8/25/2003	30.2	26.3	470	4.01E-01	56.88	64.77%	Base flow	75	Yes	
10/2/1995	45	27.5	511	4.36E-01	64.66	62.43%	Base flow	75	Yes	
9/13/1994	36	50	586	5.00E-01	134.82	58.30%	Storm-flow	250		Yes
9/23/2002	31	23.4	738	6.30E-01	79.46	51.52%	Storm-flow	250		Yes
1/16/1995	81	11.5	783	6.68E-01	41.43	50.22%	Storm-flow	250		Yes
9/30/1996	35	21.5	965	8.23E-01	95.47	45.13%	Storm-flow	250		Yes
10/22/2001	26	17	1050	8.96E-01	82.14	43.06%	Storm-flow	250		Yes
6/23/2003	71	31.5	1060	9.04E-01	153.64	42.88%	Storm-flow	250		Yes
5/6/1996	198	31.5	1120	9.56E-01	162.34	41.41%	Storm-flow	250		Yes
7/17/1995	60	24	1370	1.17E+00	151.30	35.82%	Storm-flow	250		Yes
5/21/2002	103	50	1690	1.44E+00	388.82	29.62%	Storm-flow	250		Yes
1/7/2003	196	10.3	2800	2.39E+00	132.71	15.37%	Storm-flow	250		Yes
3/25/2002		10.5	3490	2.98E+00	168.62	9.57%	Storm-flow	250		
3/10/2003	196	17.2	3940	3.36E+00	311.83	6.74%	Storm-flow	250		Yes

Number exceeding applicable water quality standard for turbidity =	2	0
Total number of observations in each category =	9	11
Percent exceeding applicable water quality standard for turbidity =	22%	0%

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Table B.4. Observed Turbidity and TSS Data for Cache River at CHR0002.

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
4/10/1995	110	41.5	145	0.12	2.77E+01	90.17%	Base flow	75	No	
11/4/2002	49.9	11	179	0.15	9.06E+00	87.22%	Base flow	75	Yes	
2/19/1996	165		207	0.18		84.87%	Base flow	75	No	
4/28/2003	303	60.8	312	0.27	8.73E+01	75.85%	Base flow	75	No	
8/25/2003	40.3	8.5	470	0.40	1.84E+01	64.77%	Base flow	75	Yes	
10/2/1995	69	69	511	0.44	1.62E+02	62.43%	Base flow	75	Yes	
9/12/1994	45	41.5	592	0.51	1.13E+02	58.03%	Storm-flow	250		Yes
9/23/2002	24	20.1	738	0.63	6.83E+01	51.52%	Storm-flow	250		Yes
1/16/1995	90	12.5	783	0.67	4.50E+01	50.22%	Storm-flow	250		Yes
10/7/1996	56	29.5	1020	0.87	1.38E+02	43.69%	Storm-flow	250		Yes
10/22/2001	18	7.3	1050	0.90	3.53E+01	43.06%	Storm-flow	250		Yes
6/23/2003	70.5	47.5	1060	0.90	2.32E+02	42.88%	Storm-flow	250		Yes
5/6/1996	410	80	1120	0.96	4.12E+02	41.41%	Storm-flow	250		No
6/13/1994	130	26.5	1250	1.07	1.52E+02	38.25%	Storm-flow	250		Yes
7/17/1995	92	89	1370	1.17	5.61E+02	35.82%	Storm-flow	250		Yes
5/21/2002	170	39	1690	1.44	3.03E+02	29.62%	Storm-flow	250		Yes
1/28/2002	130	37.5	2240	1.91	3.87E+02	20.89%	Storm-flow	250		Yes
7/29/2002	22	16	2480	2.12	1.83E+02	18.23%	Storm-flow	250		Yes
1/7/2003	253	19.8	2800	2.39	2.55E+02	15.37%	Storm-flow	250		No
3/25/2002		44	3490	2.98	7.07E+02	9.57%	Storm-flow	250		
3/10/2003	262	24.8	3940	3.36	4.50E+02	6.74%	Storm-flow	250		No
							Number exceeding applicable water quality standard for turbidity =		3	3
							Total number of observations in each category =		6	14
							Percent exceeding applicable water quality standard for turbidity =		50%	21%

FILE: R:\PROJECTS\2110-615\TECH\TMDL\CACHE\CACHE TMDL-CHR02-DEC2005.XLS

Table B.5. Observed Turbidity and TSS Data for Cache River at CHR0003.

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
10/2/1995	32	49.5	12	0.02	4.57E+00	97.09	Base flow	75	Yes	
4/10/1995	100	77.5	14	0.02	8.35E+00	96.79	Base flow	75	No	
10/7/1996	56	61.5	25	0.04	1.18E+01	93.06	Base flow	75	Yes	
11/4/2002	73.4	43.2	25	0.04	8.31E+00	92.99	Base flow	75	Yes	
5/6/1996	410	285	72	0.10	1.58E+02	81.19	Base flow	75	No	
6/23/2003	61.4	43.3	79	0.11	2.63E+01	79.33	Base flow	75	Yes	
9/12/1994	29	60	117	0.17	5.40E+01	71.00	Base flow	75	Yes	
2/19/1996	250		120	0.17		70.49	Base flow	75	No	
10/22/2001	2.8	35.3	180	0.26	4.89E+01	61.13	Base flow	75	Yes	
7/29/2002	38	65	180	0.26	9.00E+01	61.13	Base flow	75	Yes	
6/13/1994	94	37	225	0.32	6.40E+01	55.95	Storm-flow	250		Yes
3/10/2003	368	157	292	0.42	3.53E+02	50.47	Storm-flow	250		No
7/17/1995	52	79.5	297	0.42	1.82E+02	50.13	Storm-flow	250		Yes
1/16/1995	170	104.5	335	0.48	2.69E+02	47.46	Storm-flow	250		Yes
8/25/2003	15.5	46	799	1.14	2.83E+02	31.34	Storm-flow	250		Yes
4/28/2003	77.7	322	2290	3.27	5.67E+03	13.63	Storm-flow	250		Yes
1/28/2002	370	176	2920	4.17	3.95E+03	8.89	Storm-flow	250		No
5/21/2002	225	144	3170	4.52	3.51E+03	7.15	Storm-flow	250		Yes
3/25/2002		138	3210	4.58	3.41E+03	6.86	Storm-flow	250		
9/23/2002	53	61.6	3320	4.74	1.57E+03	6.05	Storm-flow	250		Yes
1/7/2003	288	65.3	3450	4.92	1.73E+03	5.15	Storm-flow	250		No
							Number exceeding applicable water quality standard for turbidity =		3	3
							Total number of observations in each category =		10	10
							Percent exceeding applicable water quality standard for turbidity =		30%	30%

FILE: R:\PROJECTS\2110-615\TECH\TMDL\CACHE\CACHE TMDL-CHR03-DEC2005.XLS

Table B.6. Observed Turbidity and TSS Data for Cache River at CHR0004.

Date	Observed turbidity (NTU)	Observed TSS (mg/L)	Flow at USGS gage (cfs)	Flow per unit area (cfs/mi2)	Load per unit area (lbs/day/mi2)	Percent of days flow exceeded	Applicable category	Applicable water quality standard (NTU)	Turbidity meeting base flow standard?	Turbidity meeting storm-flow standard?
10/2/1995	17	13.5	12	0.02	1.25E+00	97.12	Base flow	75	Yes	
4/10/1995	50	50.5	14	0.02	5.44E+00	96.81	Base flow	75	Yes	
10/7/1996	27	16.5	25	0.04	3.17E+00	93.21	Base flow	75	Yes	
11/4/2002	27.9	5.3	25	0.04	1.02E+00	93.21	Base flow	75	Yes	
5/6/1996	220	128	72	0.10	7.09E+01	81.28	Base flow	75	No	
6/23/2003	95.3	85.4	79	0.11	5.19E+01	79.46	Base flow	75	No	
9/12/1994	34	48	117	0.17	4.32E+01	71.07	Base flow	75	Yes	
2/19/1996	195		120	0.17		70.56	Base flow	75	No	
10/22/2001	79	76	180	0.26	1.05E+02	61.24	Base flow	75	No	
7/29/2002	34	69.5	180	0.26	9.62E+01	61.24	Base flow	75	Yes	
6/13/1994	82	101	225	0.32	1.75E+02	55.98	Storm-flow	250		Yes
3/10/2003	469	480	292	0.42	1.08E+03	50.51	Storm-flow	250		No
7/17/1995	53	94.5	297	0.42	2.16E+02	50.15	Storm-flow	250		Yes
1/16/1995	91	57	335	0.48	1.47E+02	47.51	Storm-flow	250		Yes
8/25/2003	58.9	70.5	799	1.14	4.33E+02	31.36	Storm-flow	250		Yes
4/28/2003	449	261	2290	3.27	4.60E+03	13.67	Storm-flow	250		No
1/28/2002	310	160	2920	4.17	3.59E+03	8.94	Storm-flow	250		No
5/21/2002	220	88.5	3170	4.52	2.16E+03	7.18	Storm-flow	250		Yes
3/25/2002		55	3210	4.58	1.36E+03	6.88	Storm-flow	250		
9/23/2002	53	88.2	3320	4.74	2.25E+03	6.07	Storm-flow	250		Yes
1/7/2003	274	55.5	3450	4.92	1.47E+03	5.18	Storm-flow	250		No
							Number exceeding applicable water quality standard for turbidity =		4	4
							Total number of observations in each category =		10	10
							Percent exceeding applicable water quality standard for turbidity =		40%	40%

FILE: R:\PROJECTS\2110-615\TECH\TMDL\CACHE\CACHE TMDL-CHR04-DEC2005.XLS

Figure B.1. Long Term TSS for Bayou DeView at Hwy 64 (BDV0002)

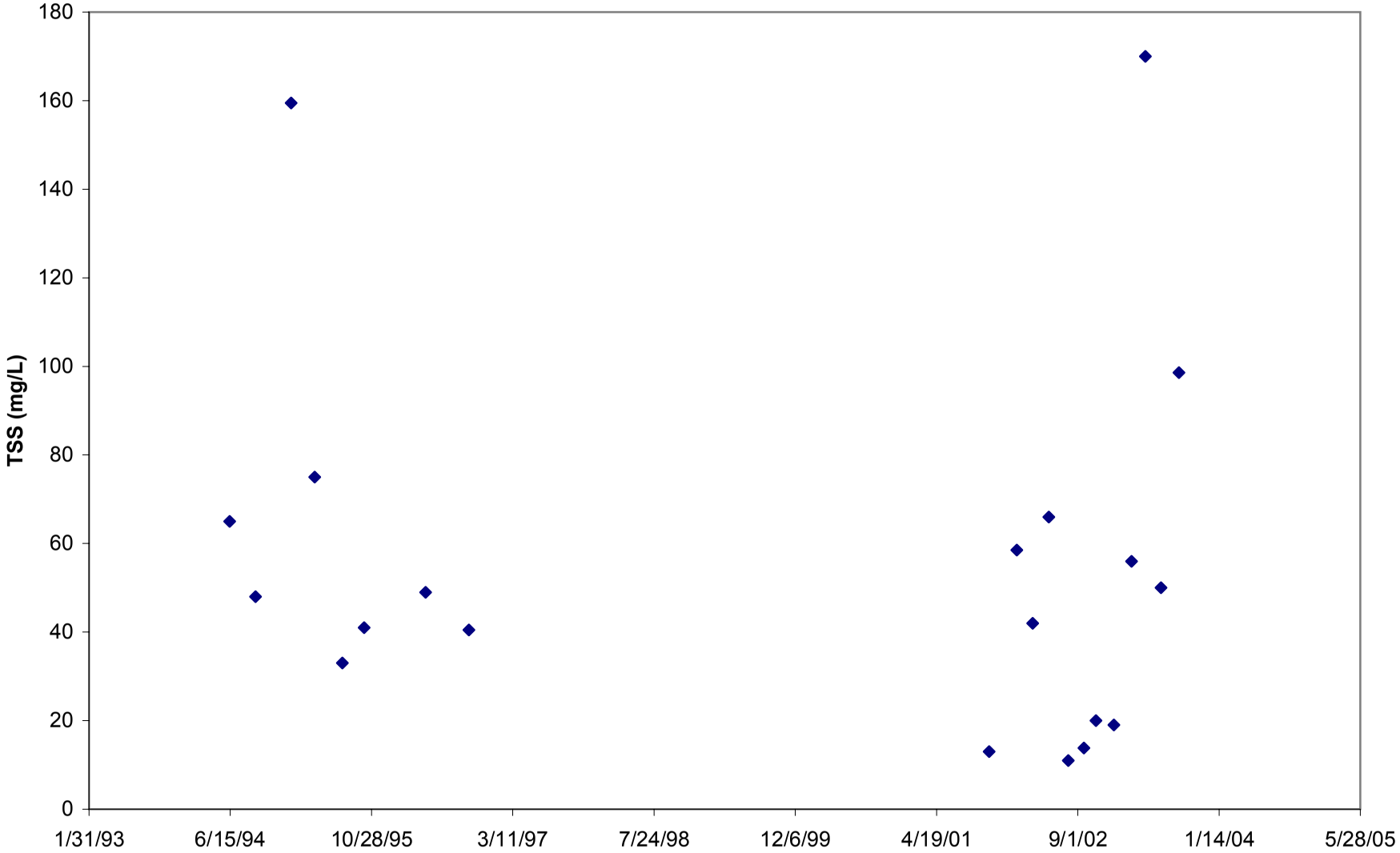


Figure B.2. Long Term Turbidity for Bayou DeView at Hwy 64 (BDV0002)

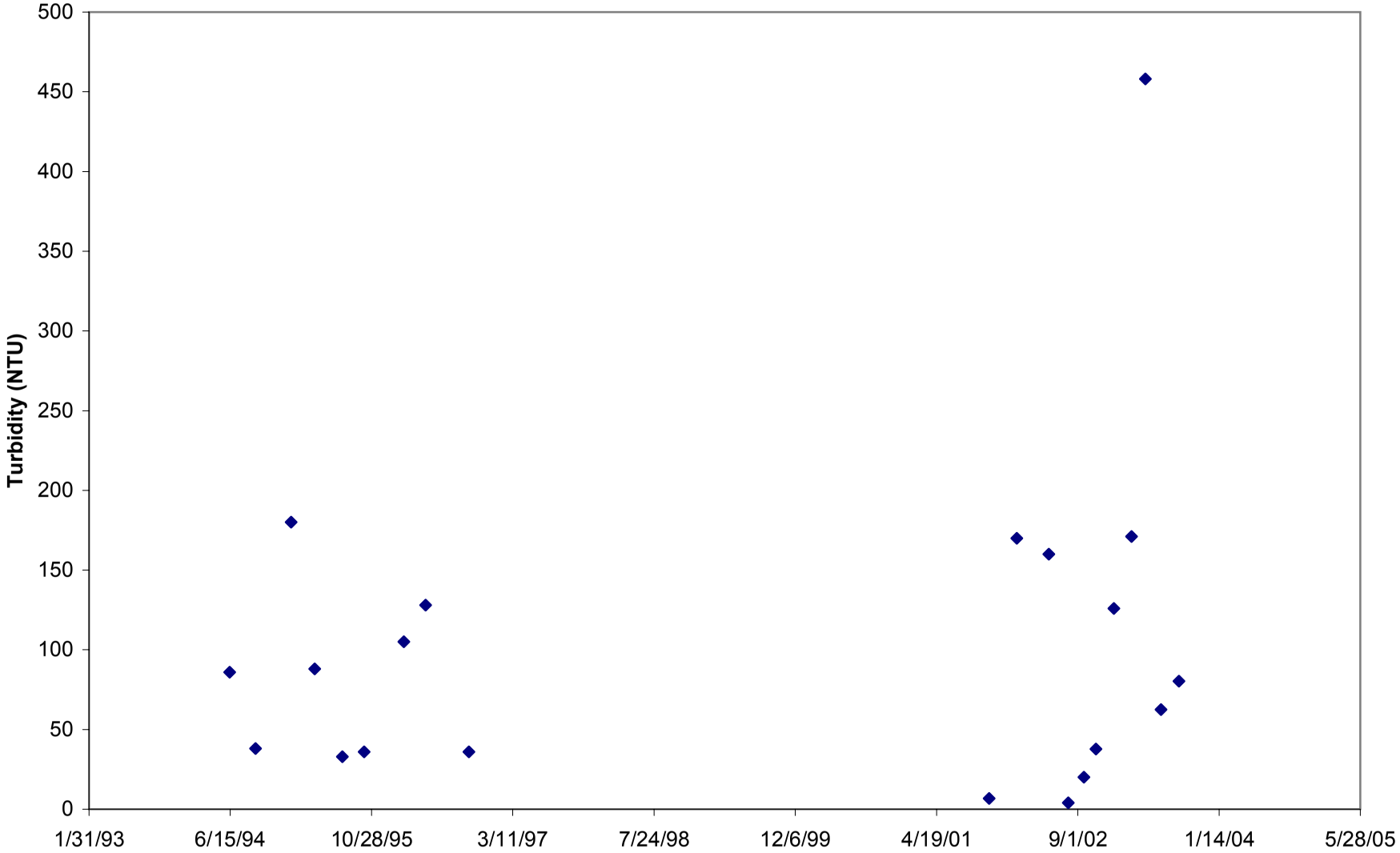


Figure B.3. Observed Long Term TSS for Bayou DeView West of Gibson, AR (WHI0026)

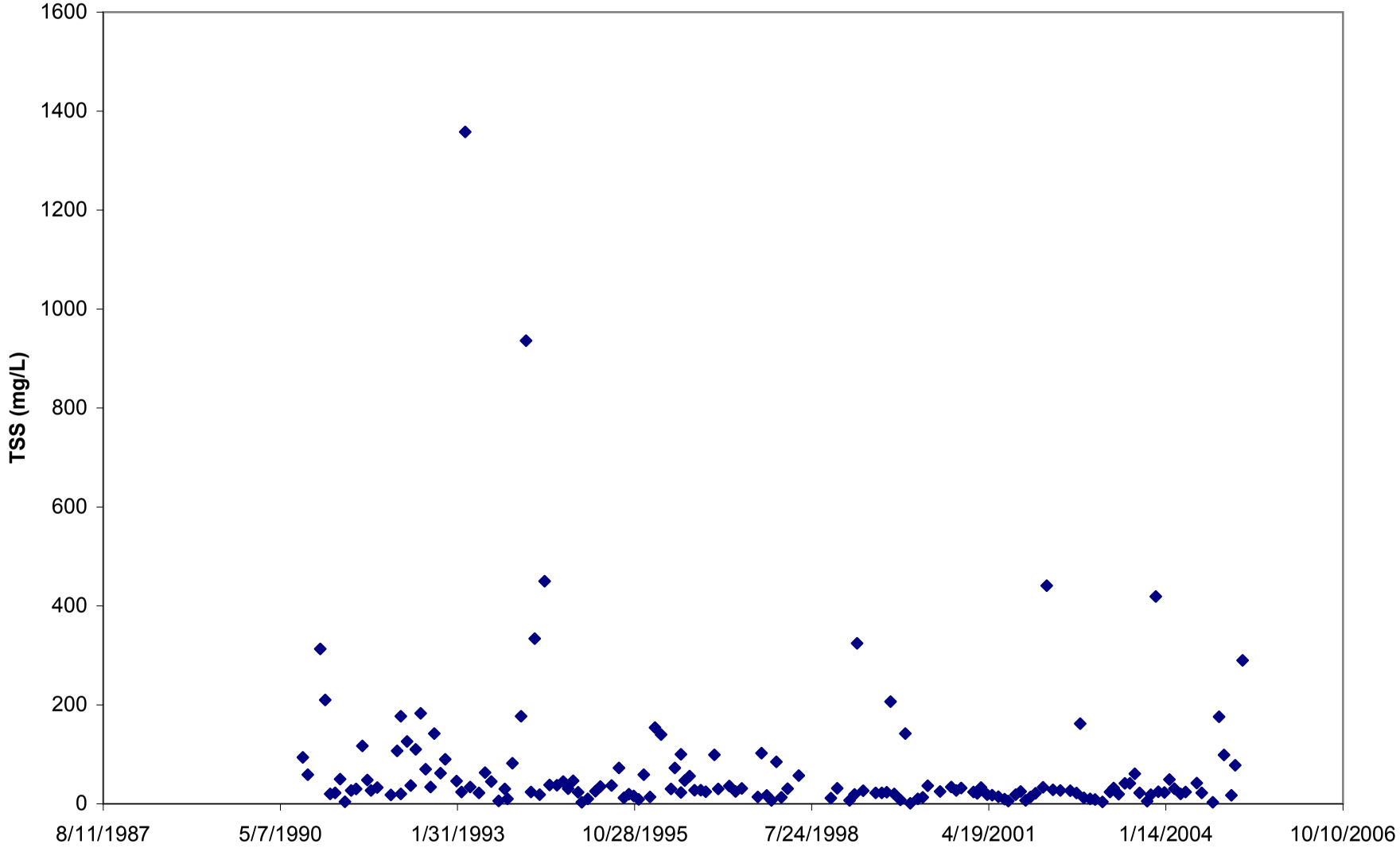


Figure B.4. Observed Long Term Turbidity for Bayou DeView West of Gibson, AR (WHI0026)

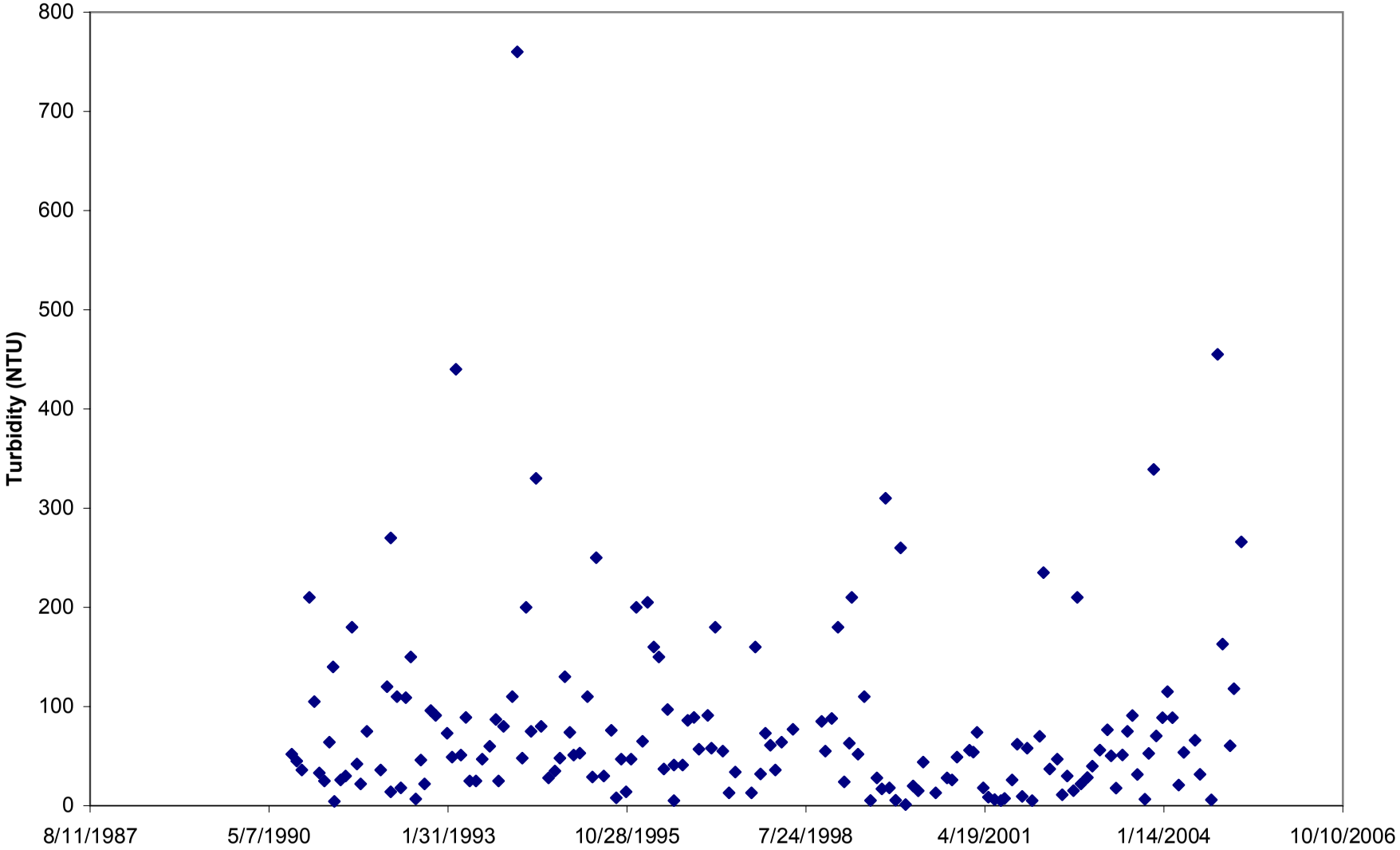


Figure B.5. Observed Long Term TSS for Cache RIver near Brasfield, AR (WHI0032)

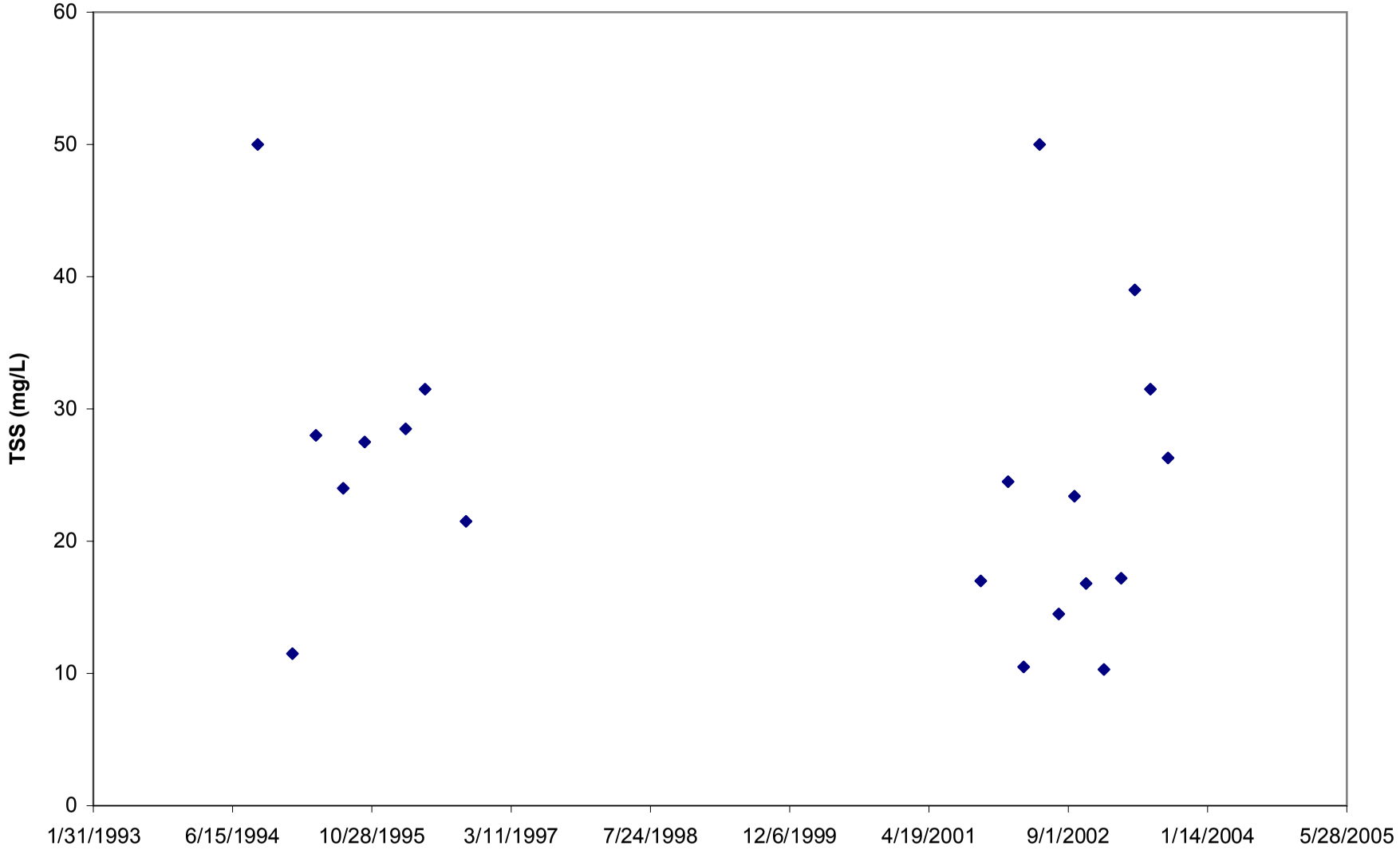


Figure B.6. Observed Long Term Turbidity for Cache RIver near Brasfield, AR (WHI0032)

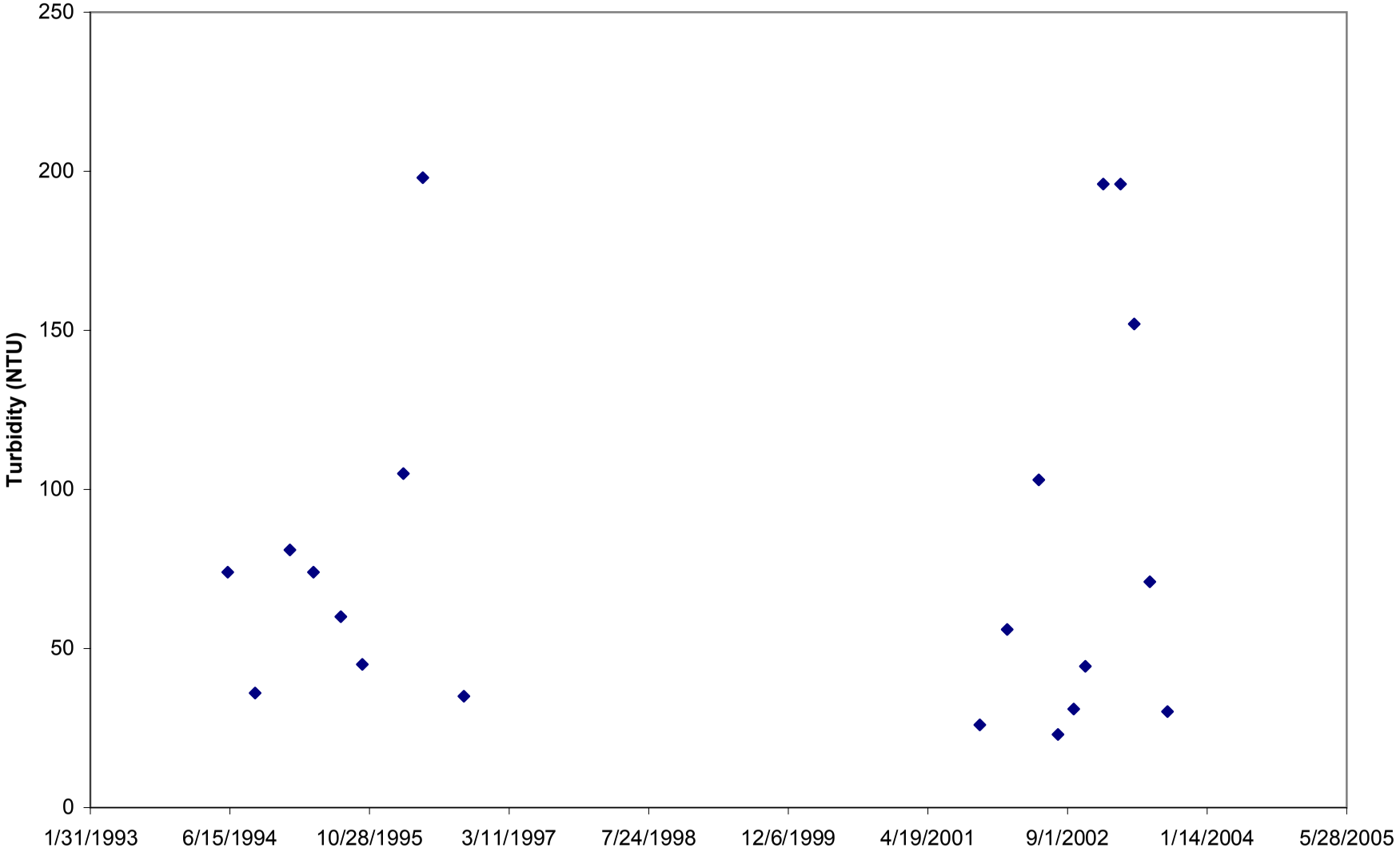


Figure B.7. Observed Long TermTSS for Cache River near Peterson, AR (CHR0002)

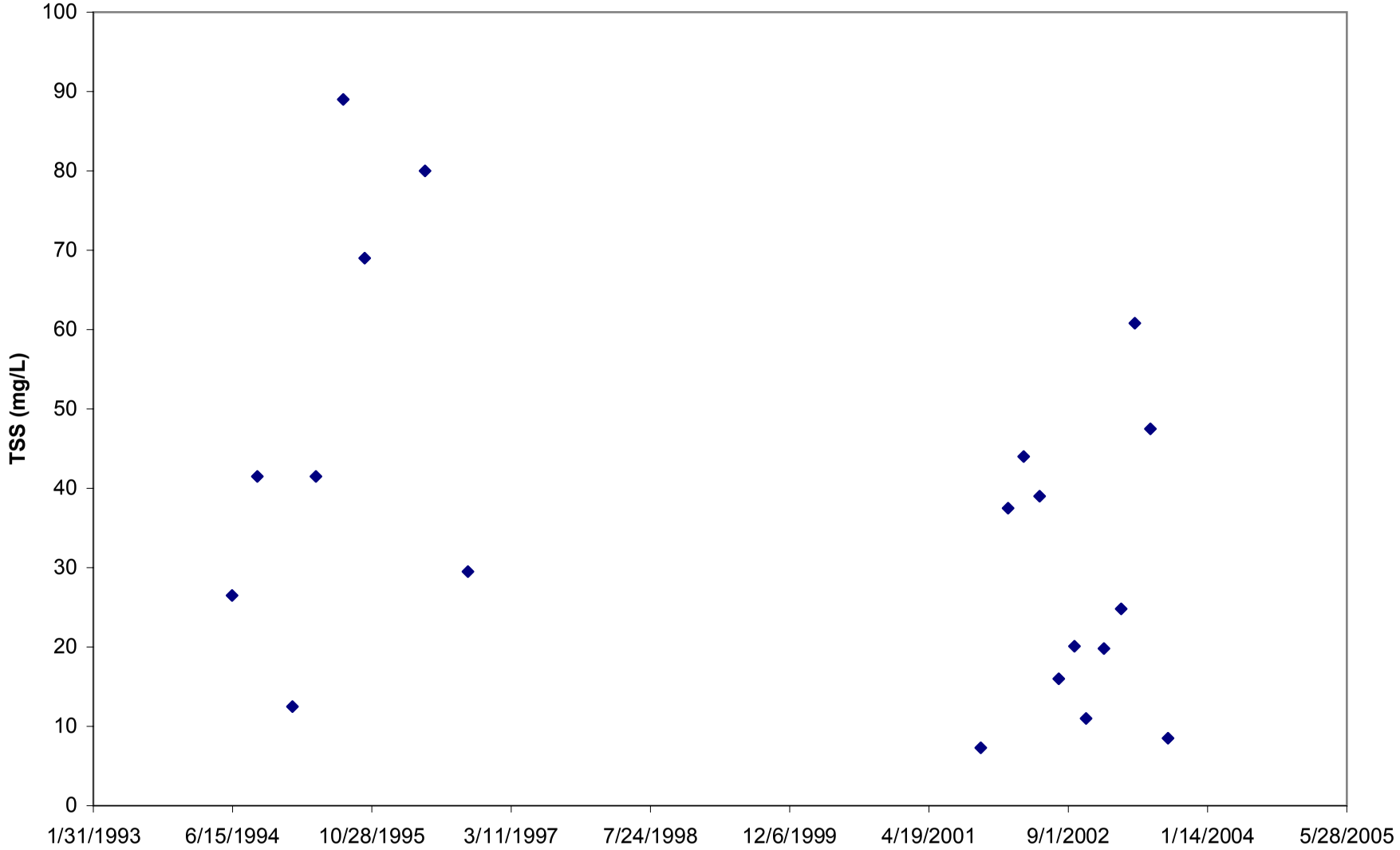


Figure B.8. Observed Long TermTurbidity for Cache River near Peterson, AR (CHR0002)

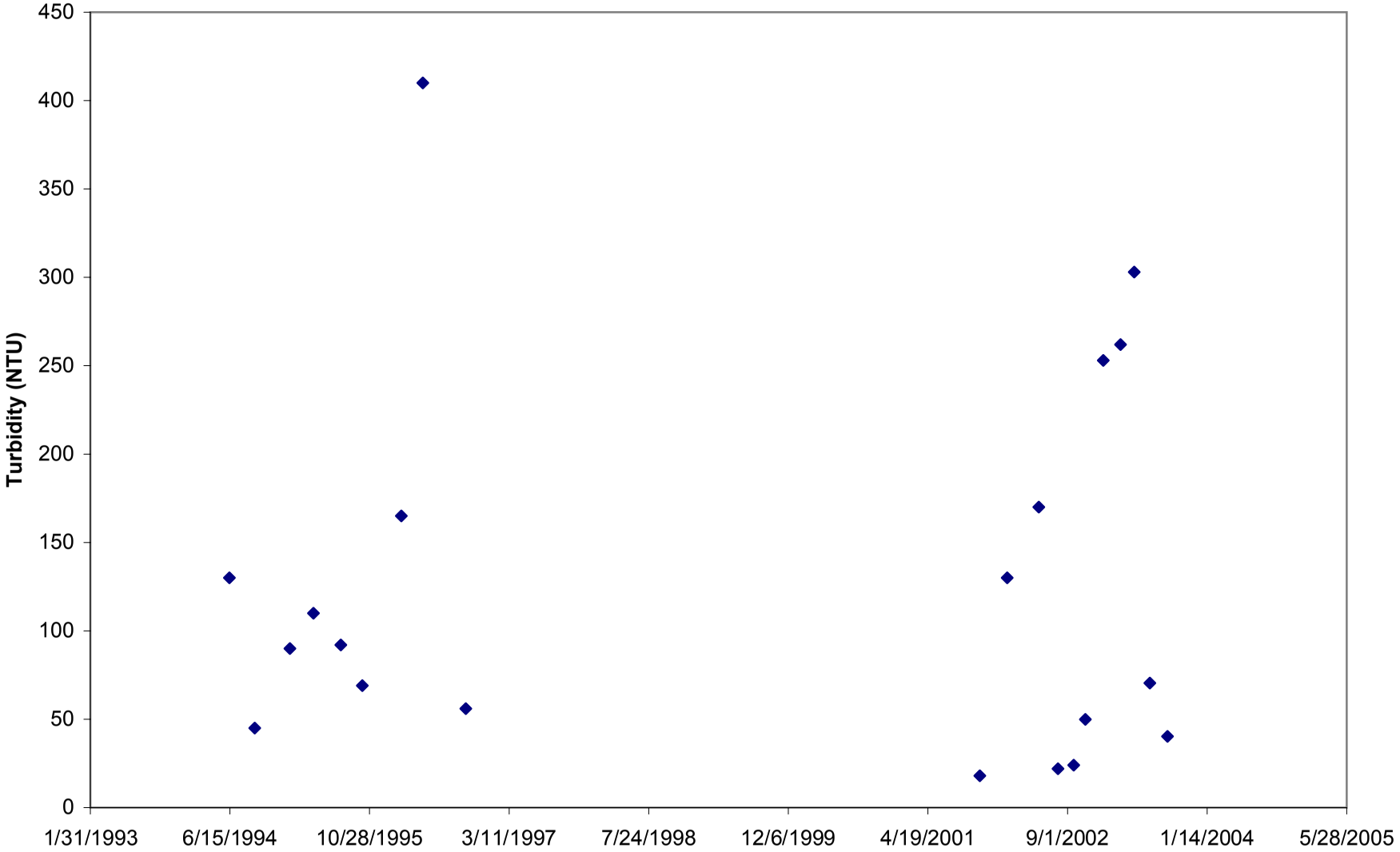


Figure B.9. Observed Long Term TSS for Cache River at Hwy 18 (CHR0003)

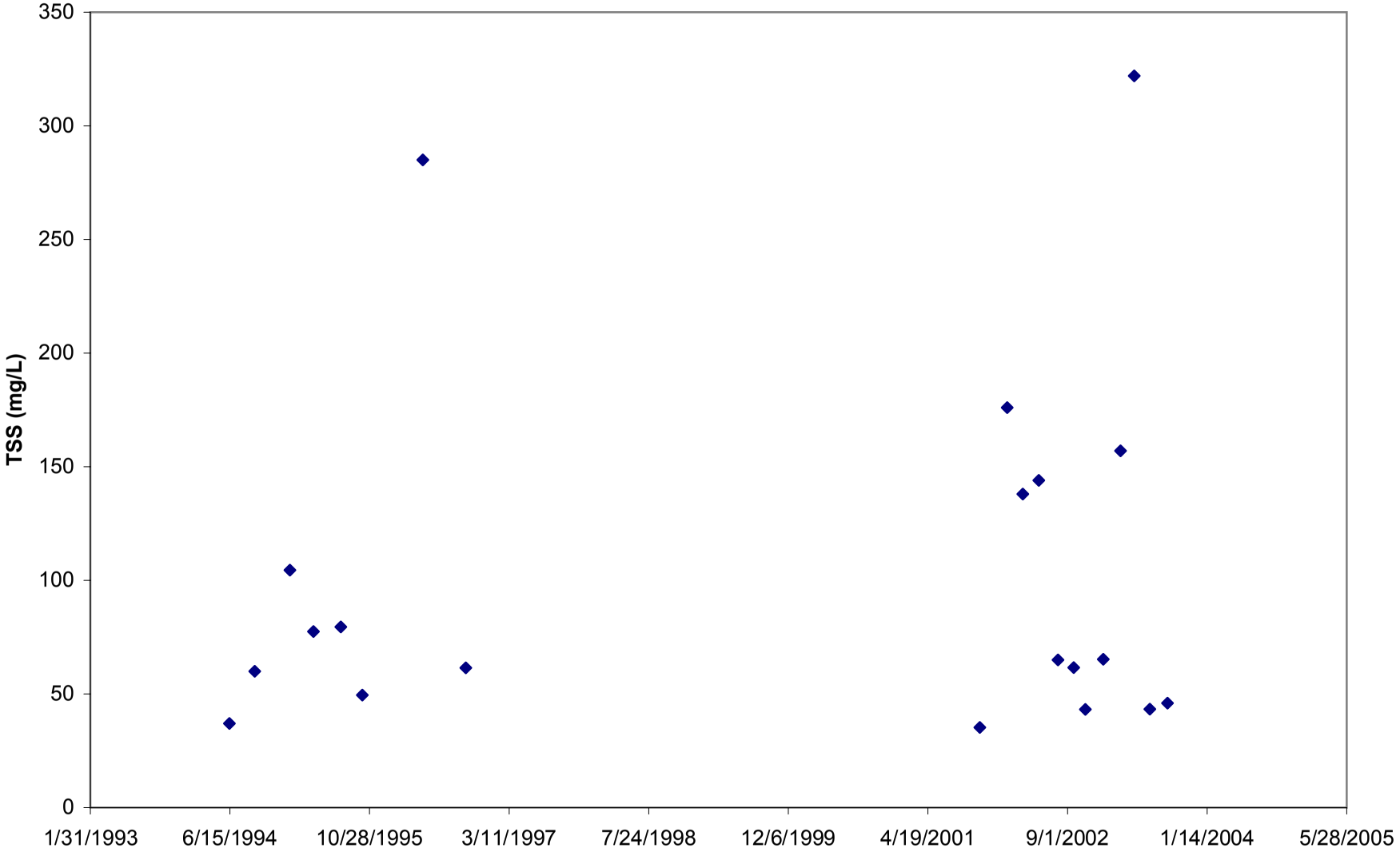


Figure B.10. Observed Long Term Turbidity for Cache River at Hwy 18 (CHR0003)

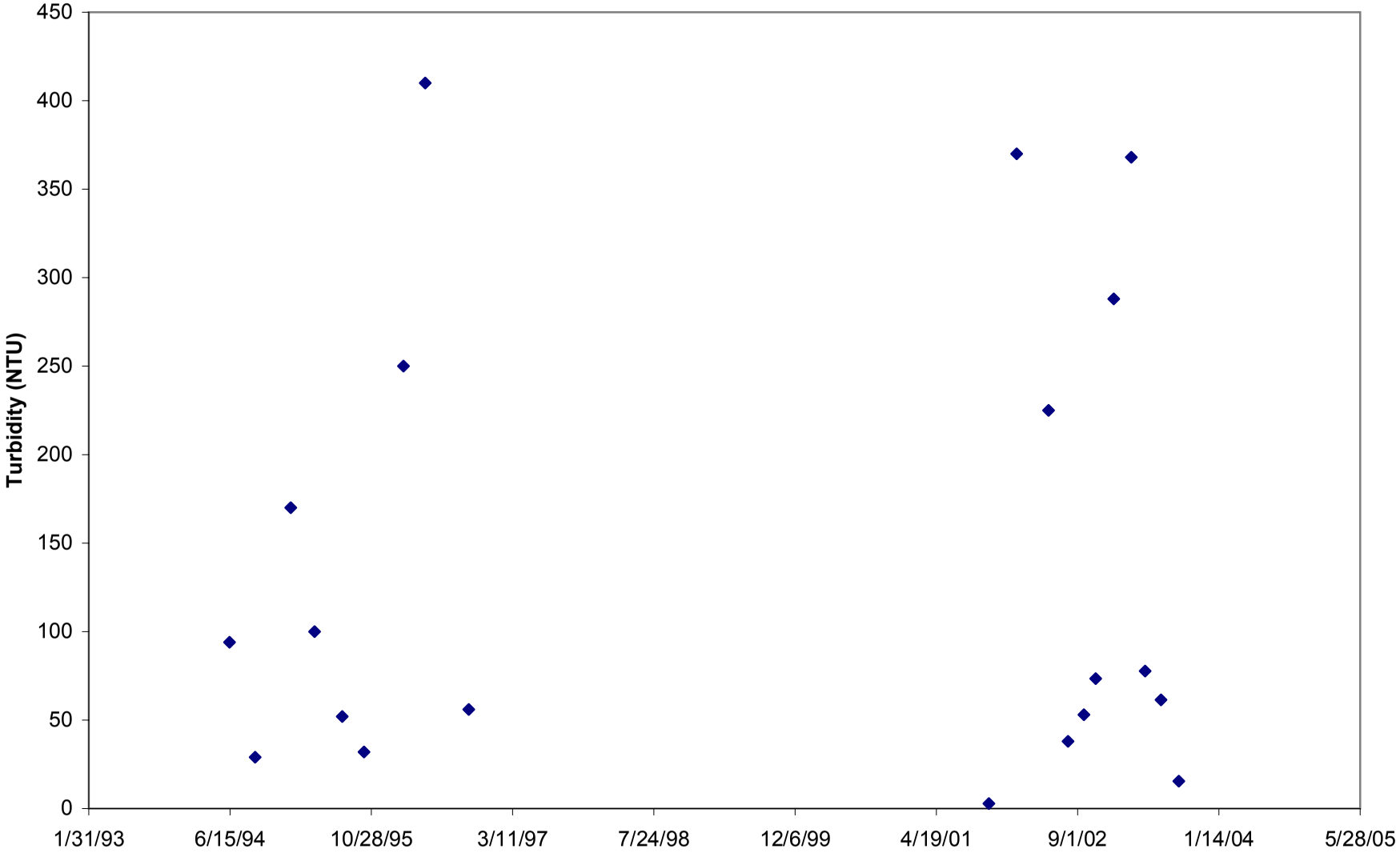


Figure B.11. Observed Long Term TSS for Cache River near Hwy 412 (CHR0004)

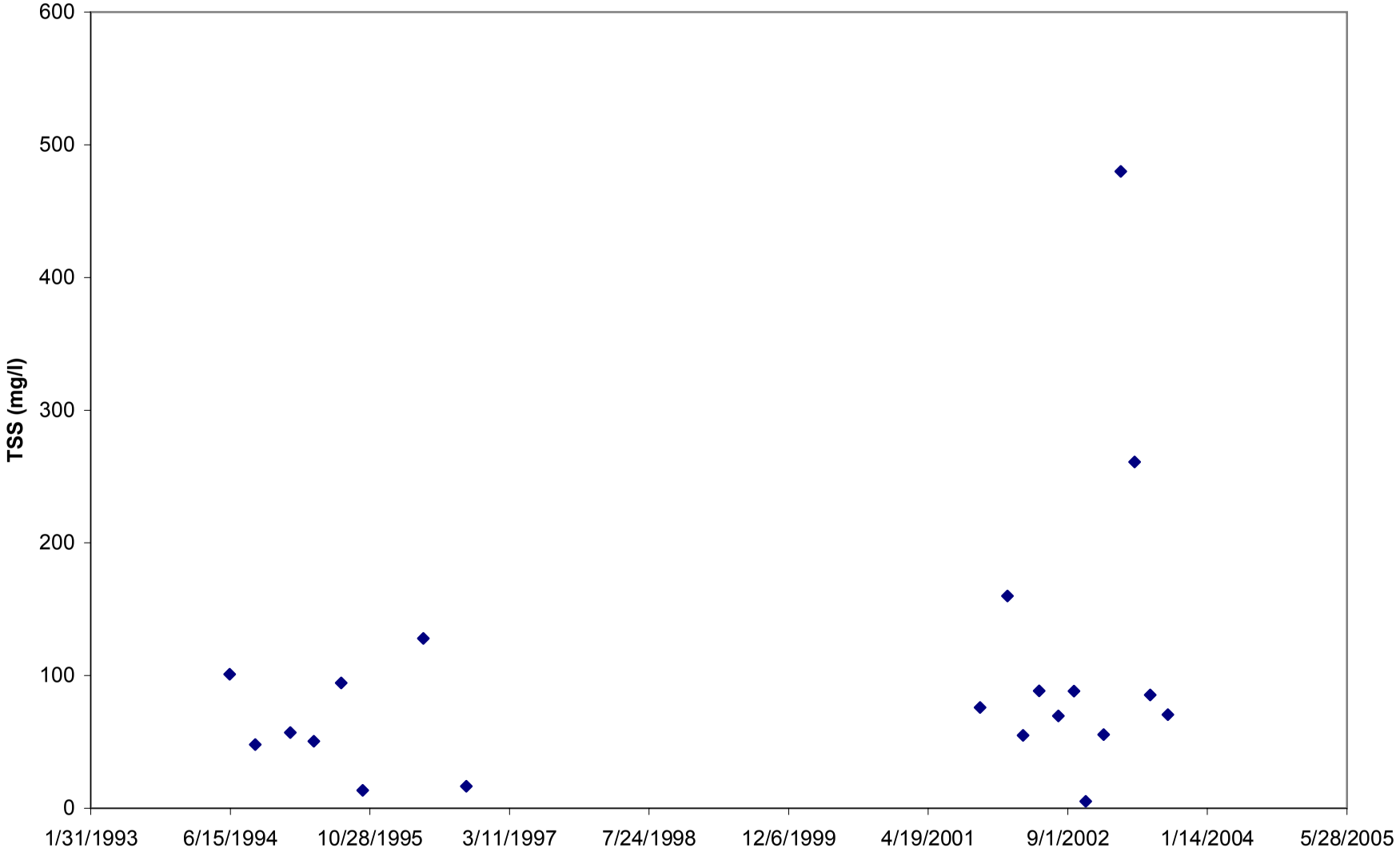
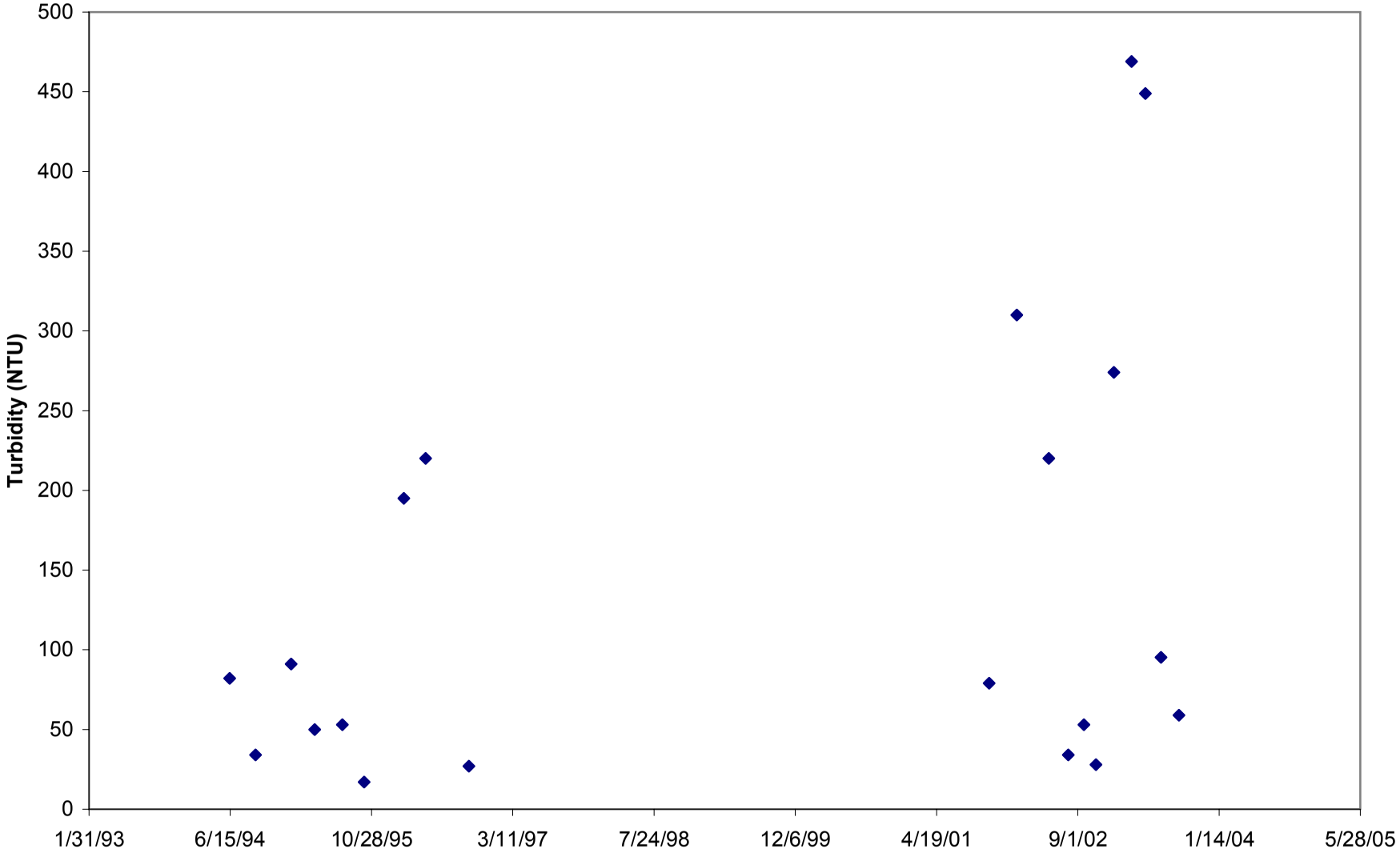


Figure B.12. Observed Long Term Turbidity for Cache River near Hwy 412 (CHR0004)



APPENDIX C

Seasonal Plots of Turbidity and TSS

Figure C.1. Seasonal TSS for Bayou DeView at Hwy 64 (BDV0002)

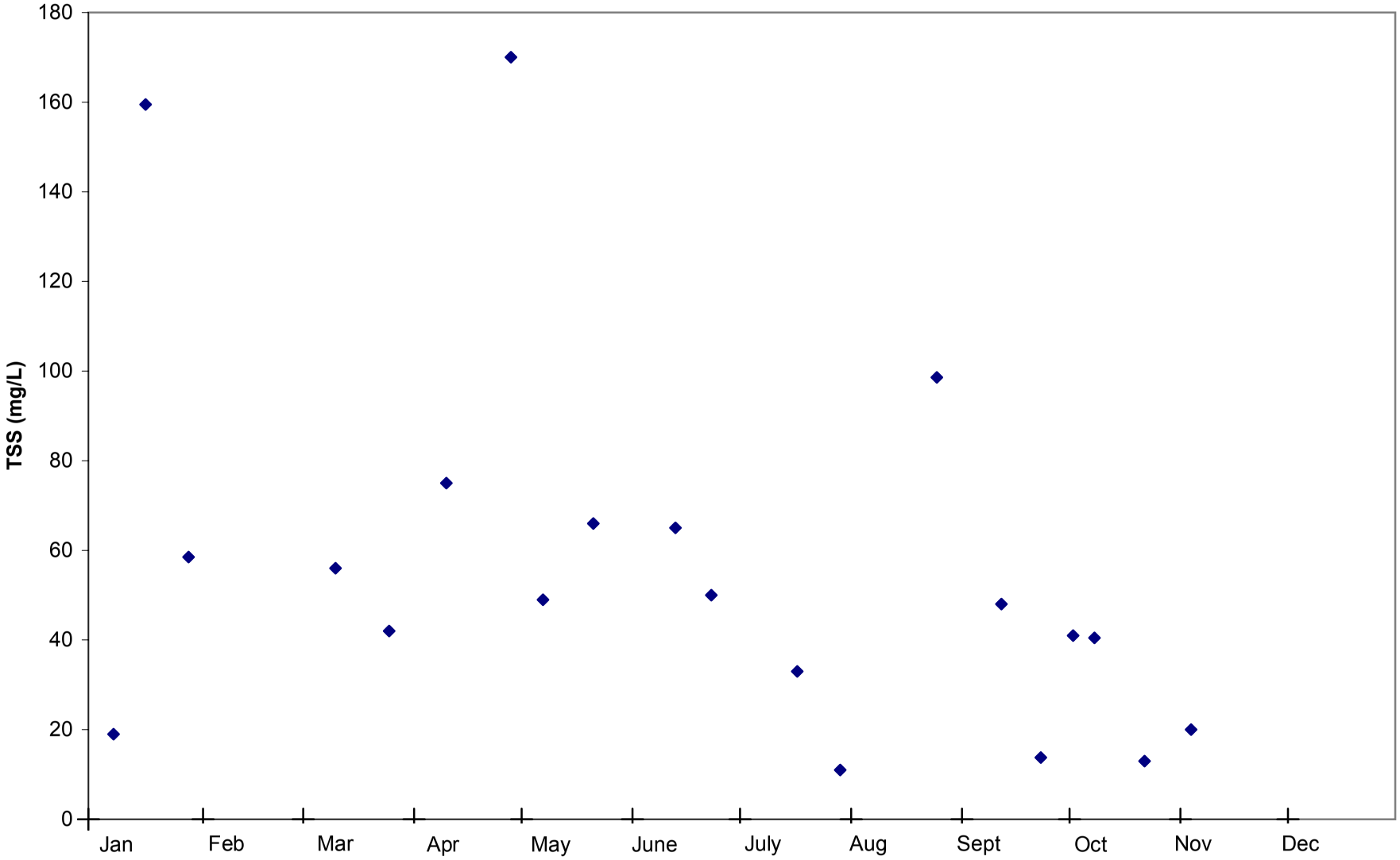


Figure C.2. Seasonal Turbidity for Bayou DeView at Hwy 64 (BDV0002)

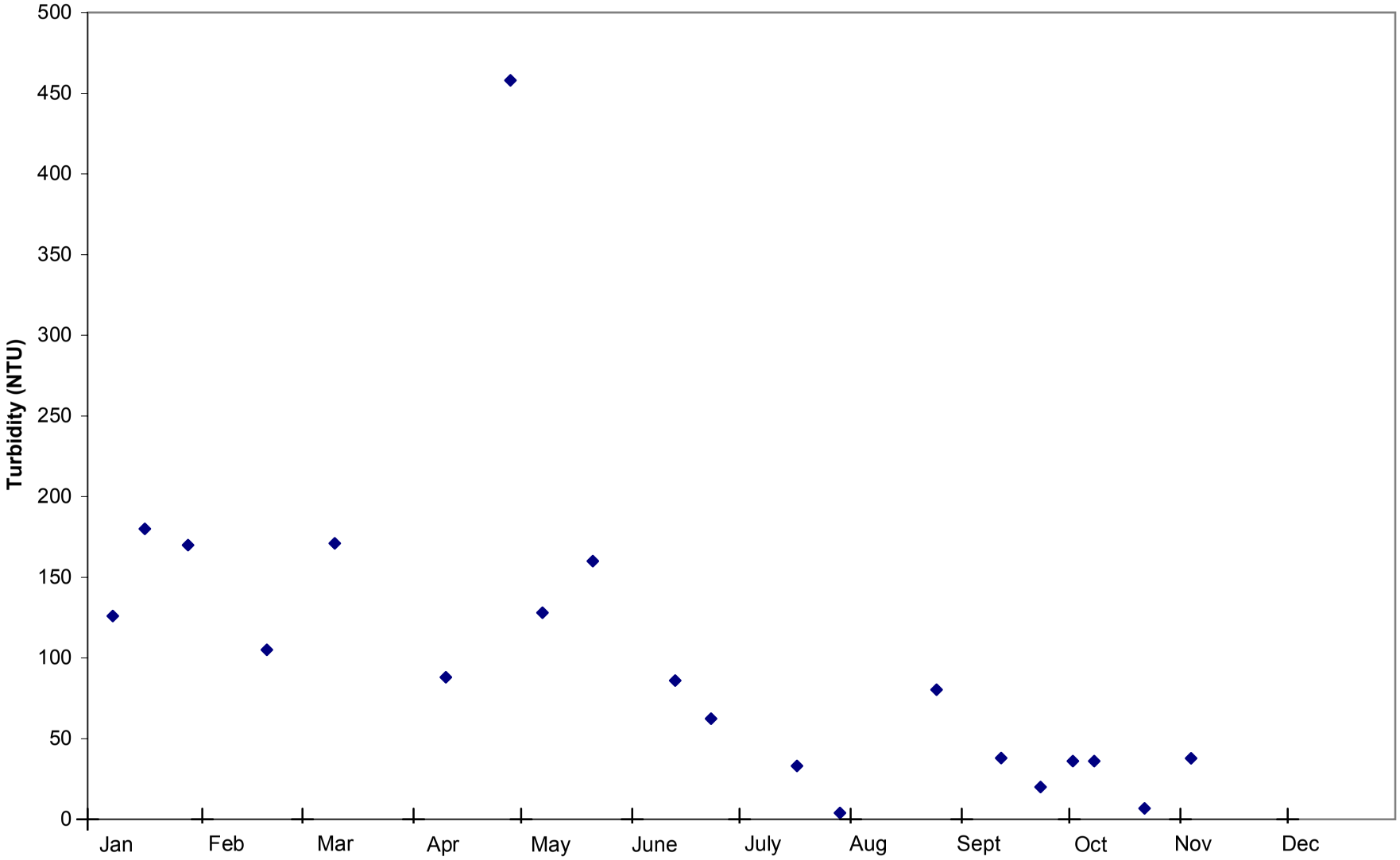


Figure C.3. Observed Seasonal TSS for Bayou DeView West of Gibson, AR (WHI0026)

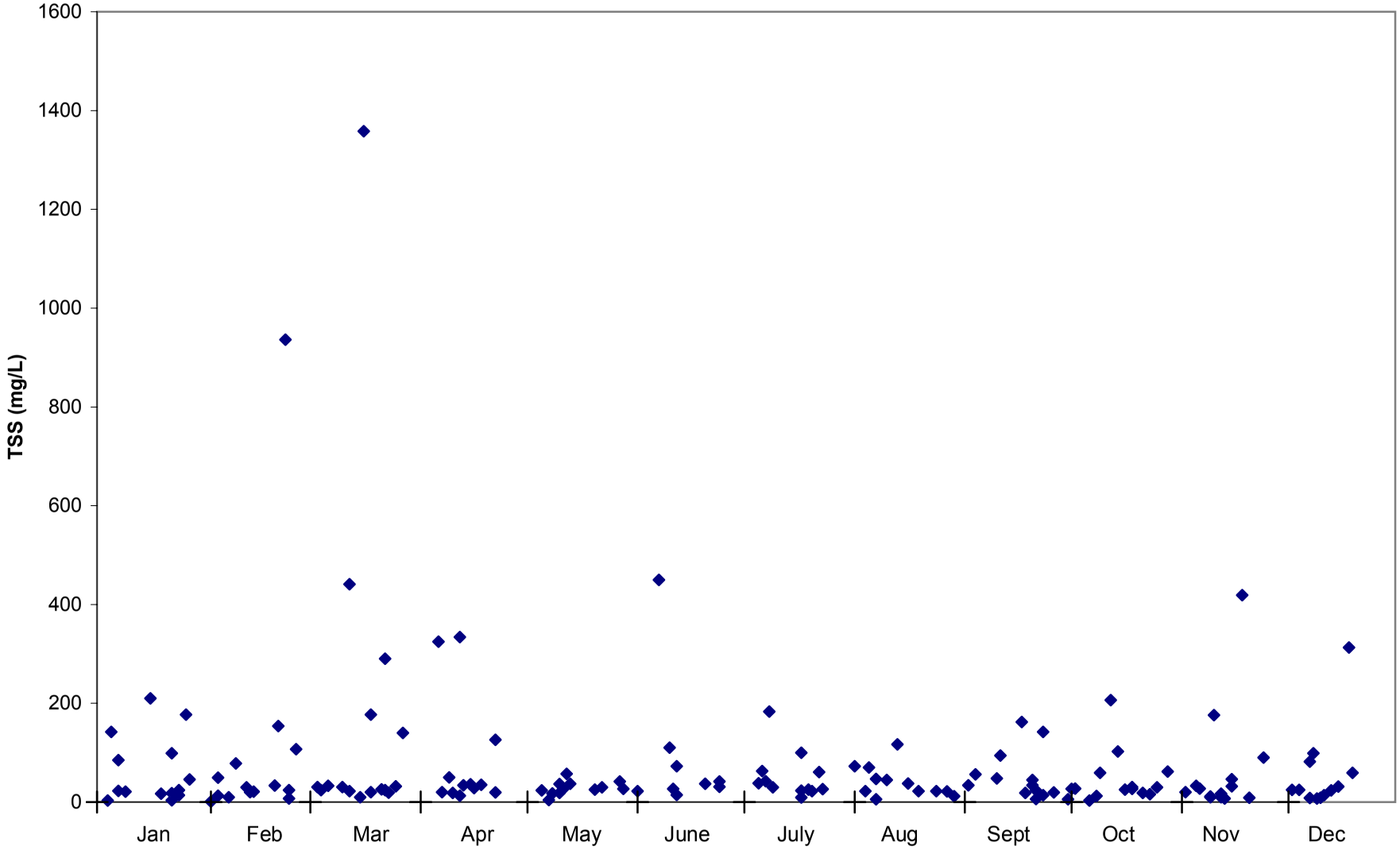


Figure C.4. Observed Seasonal Turbidity for Bayou DeView West of Gibson, AR (WHI0026)

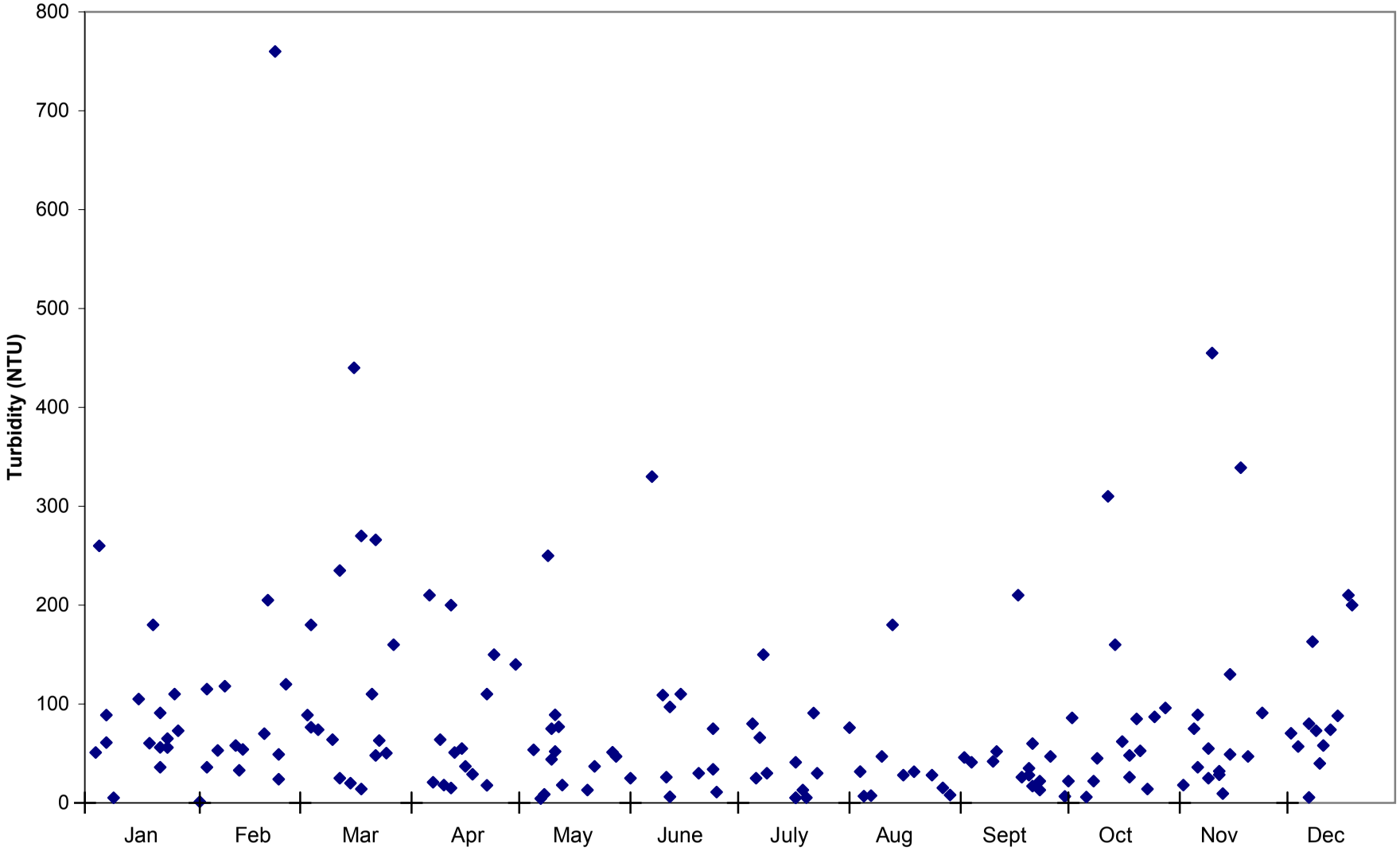


Figure C.5. Observed Seasonal TSS for Cache River near Brasfield, AR (WHI0032)

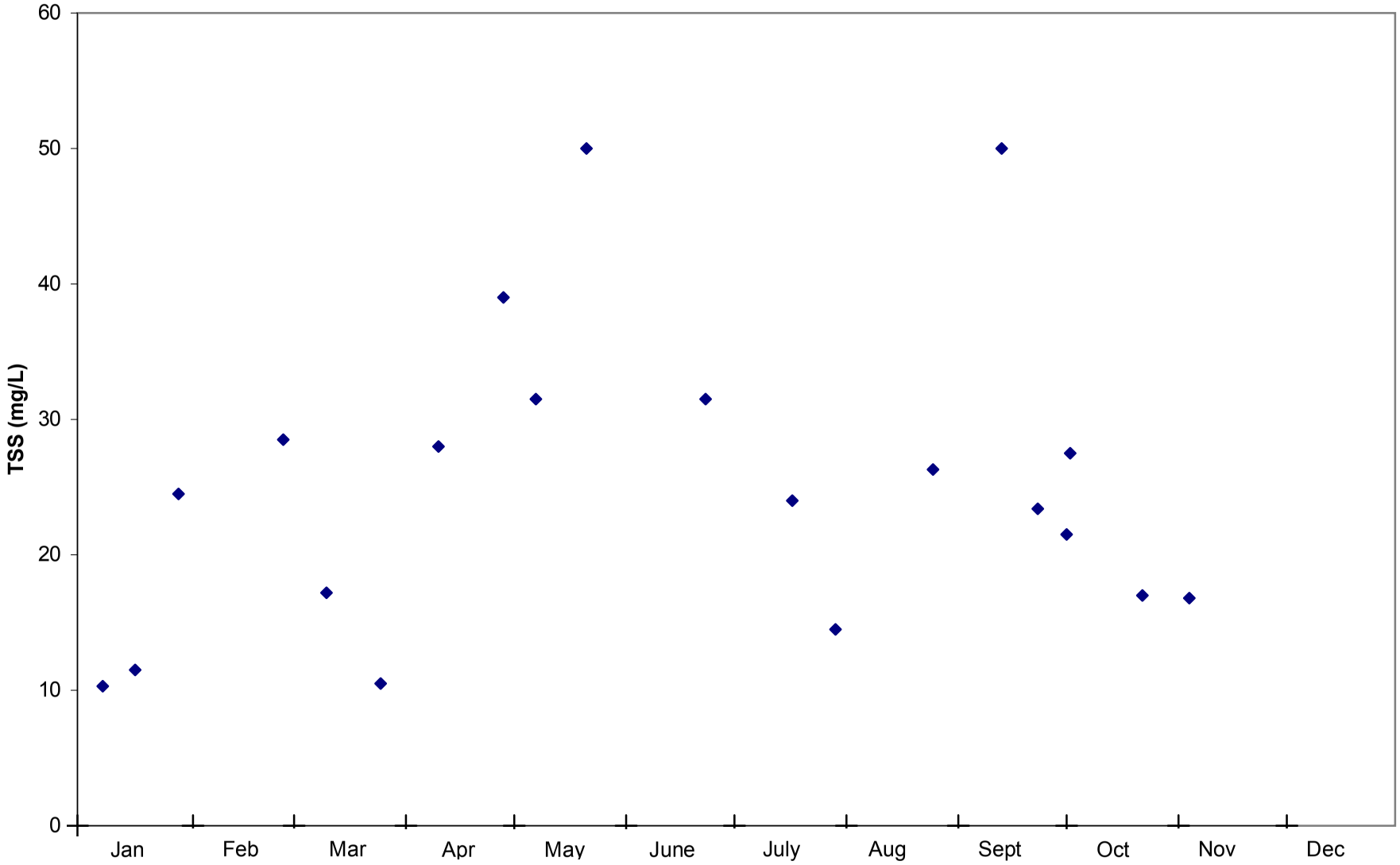


Figure C.6. Observed Seasonal Turbidity for Cache River near Brasfield, AR (WHI0032)

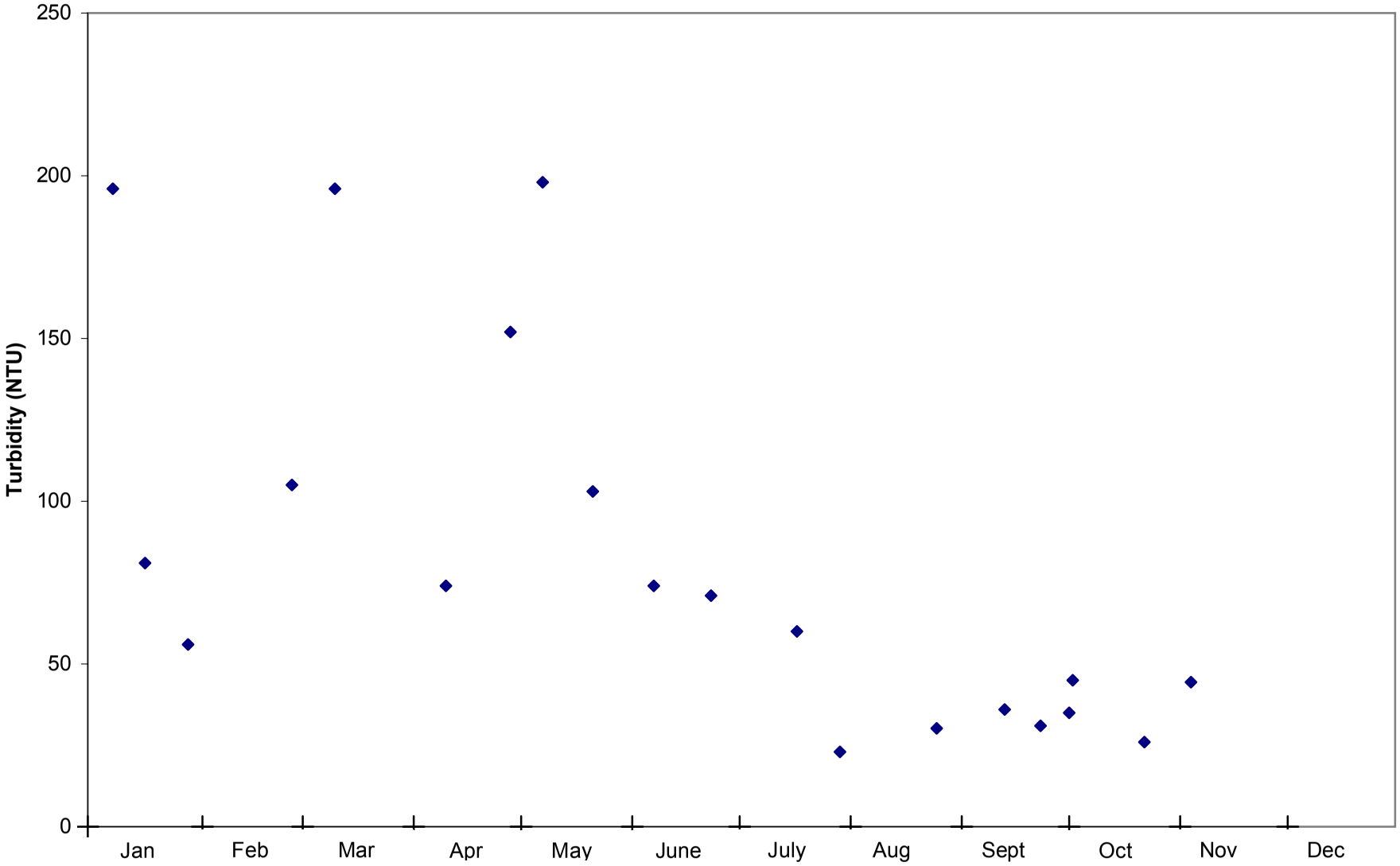


Figure C.7. Observed Seasonal TSS for Cache River near Peterson, AR (CHR0002)

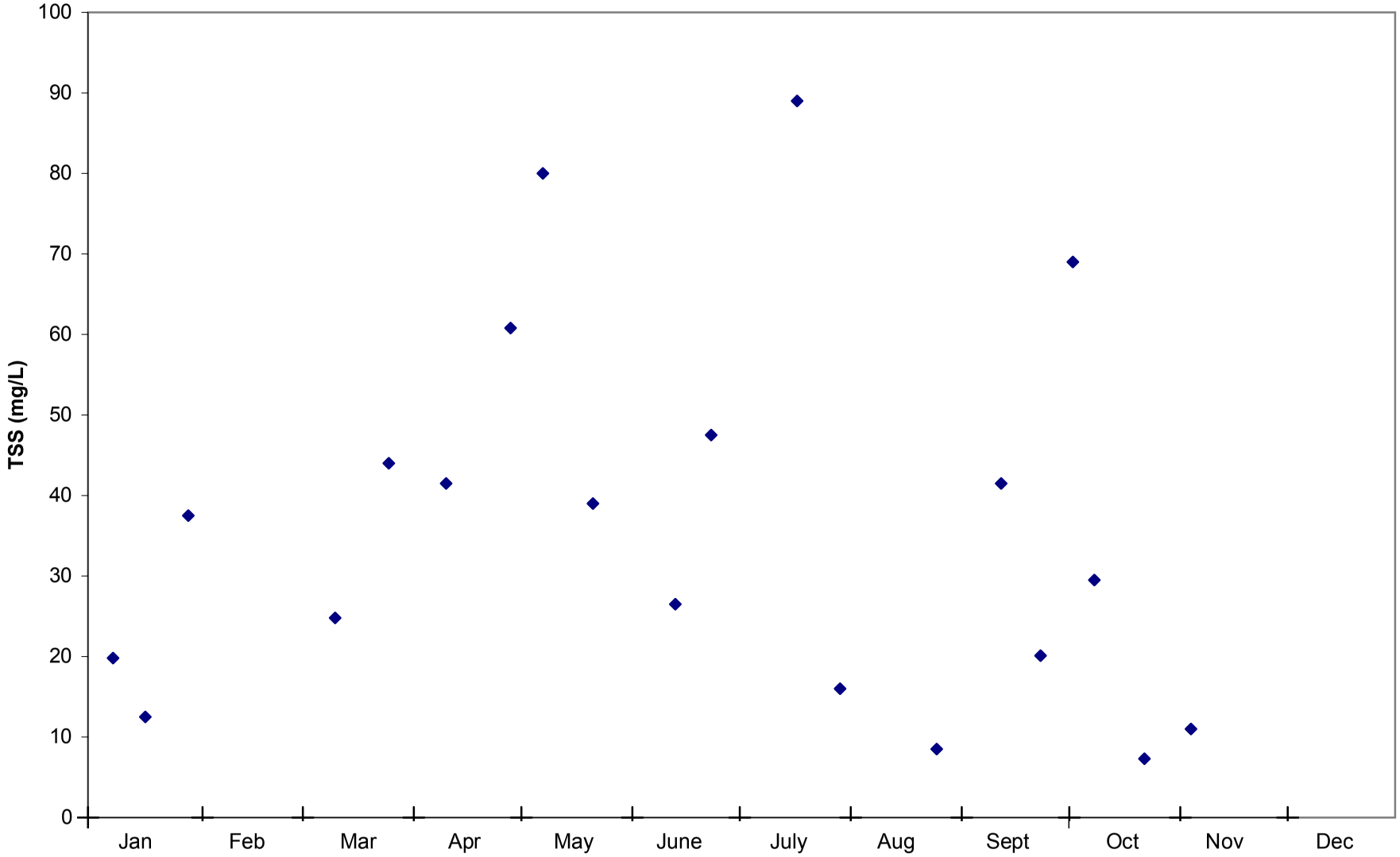


Figure C.8. Observed Seasonal Turbidity for Cache River near Peterson, AR (CHR0002)

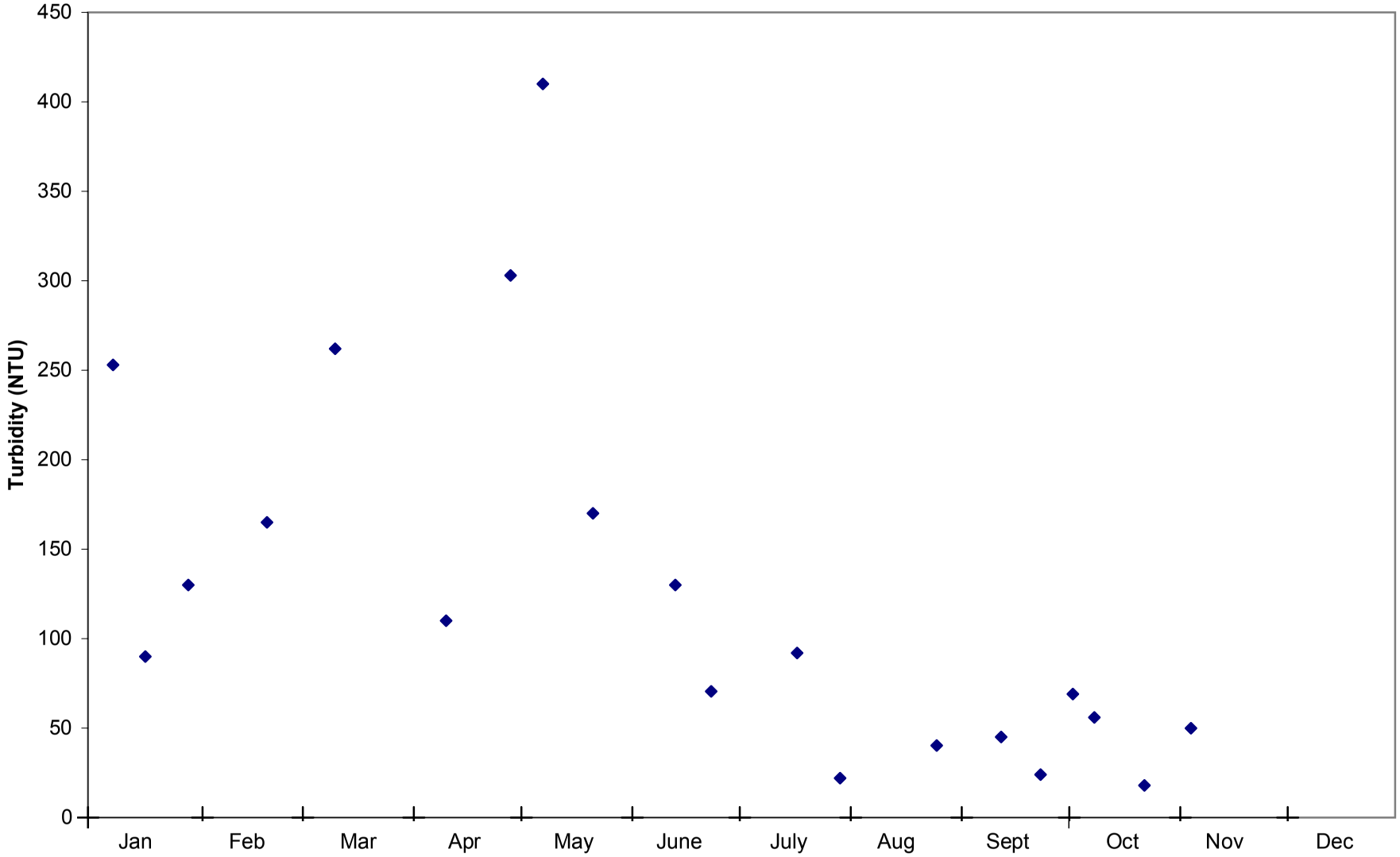


Figure C.9. Observed Seasonal TSS for Cache River at Hwy 18 (CHR0003)

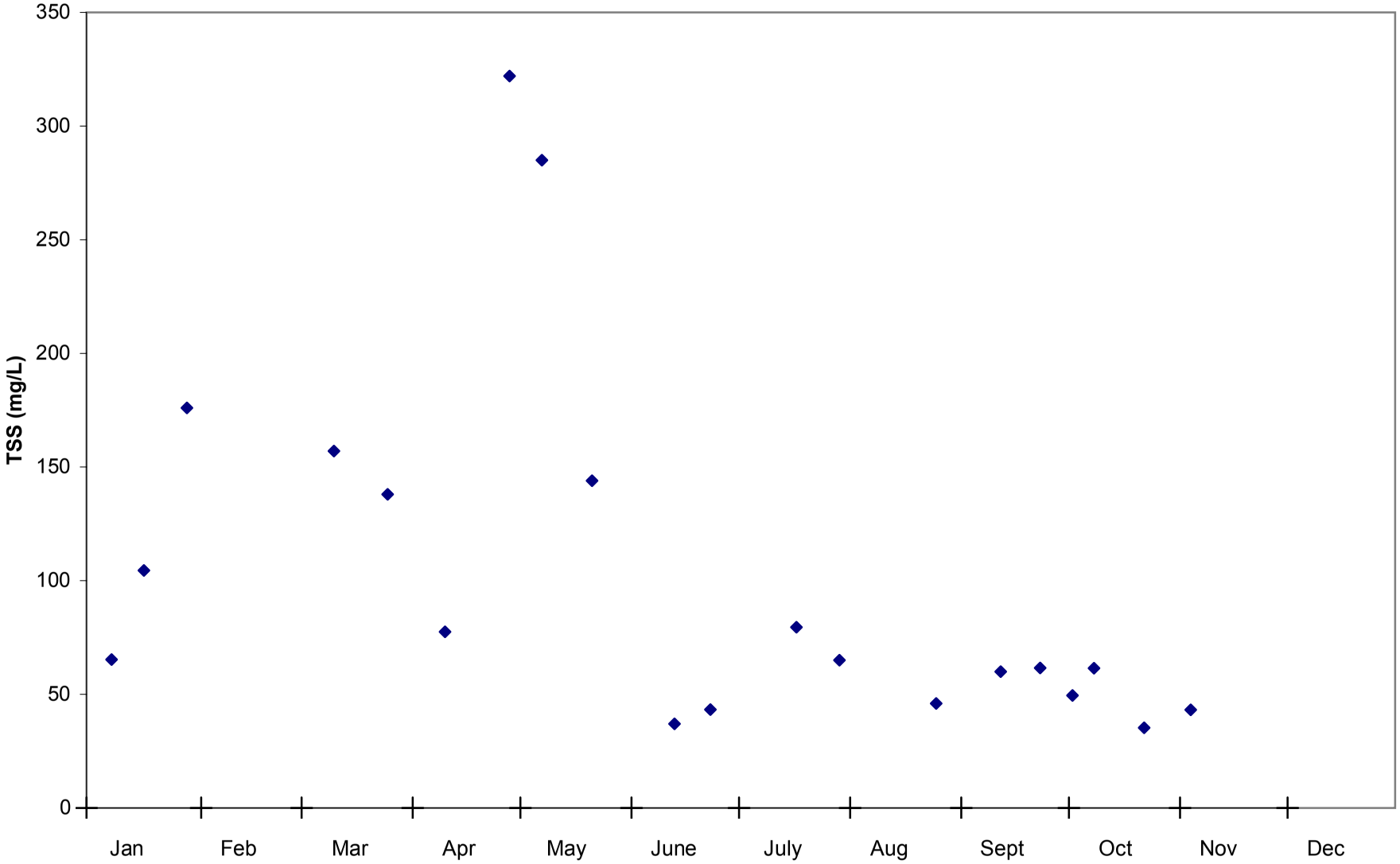


Figure C.10. Observed Seasonal Turbidity for Cache River at Hwy 18 (CHR0003)

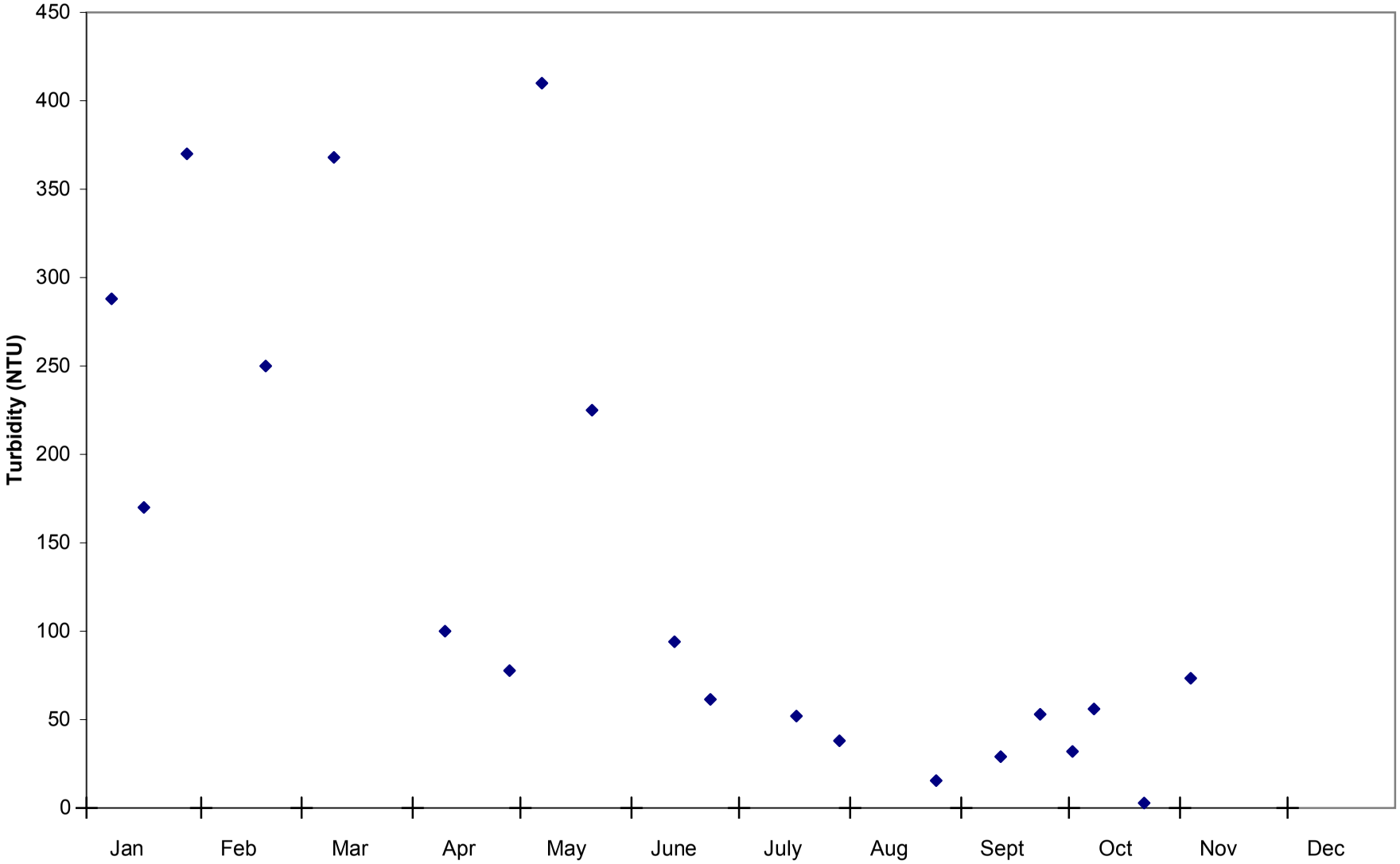


Figure C.11. Observed Seasonal TSS for Cache River near Hwy 412 (CHR0004)

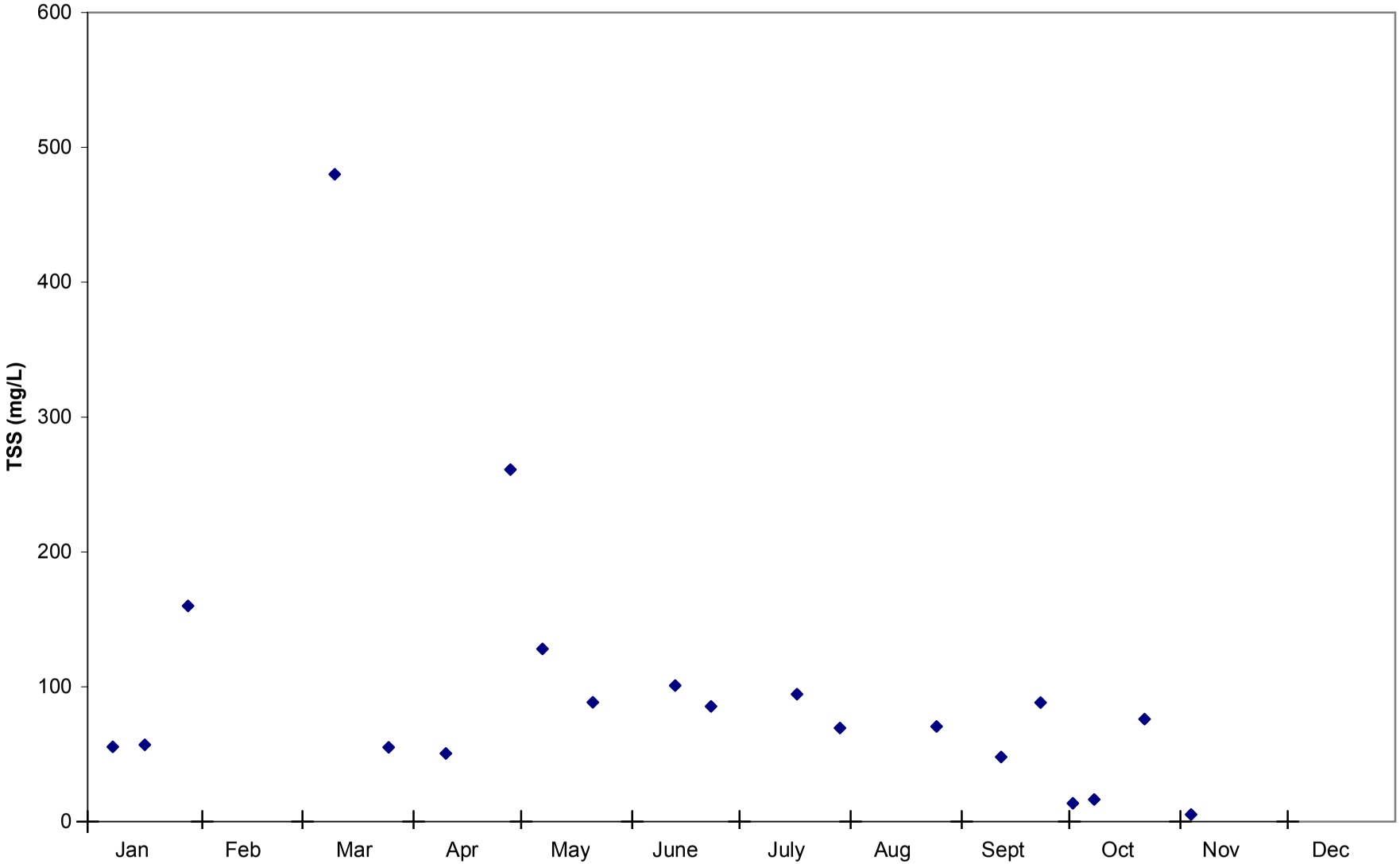
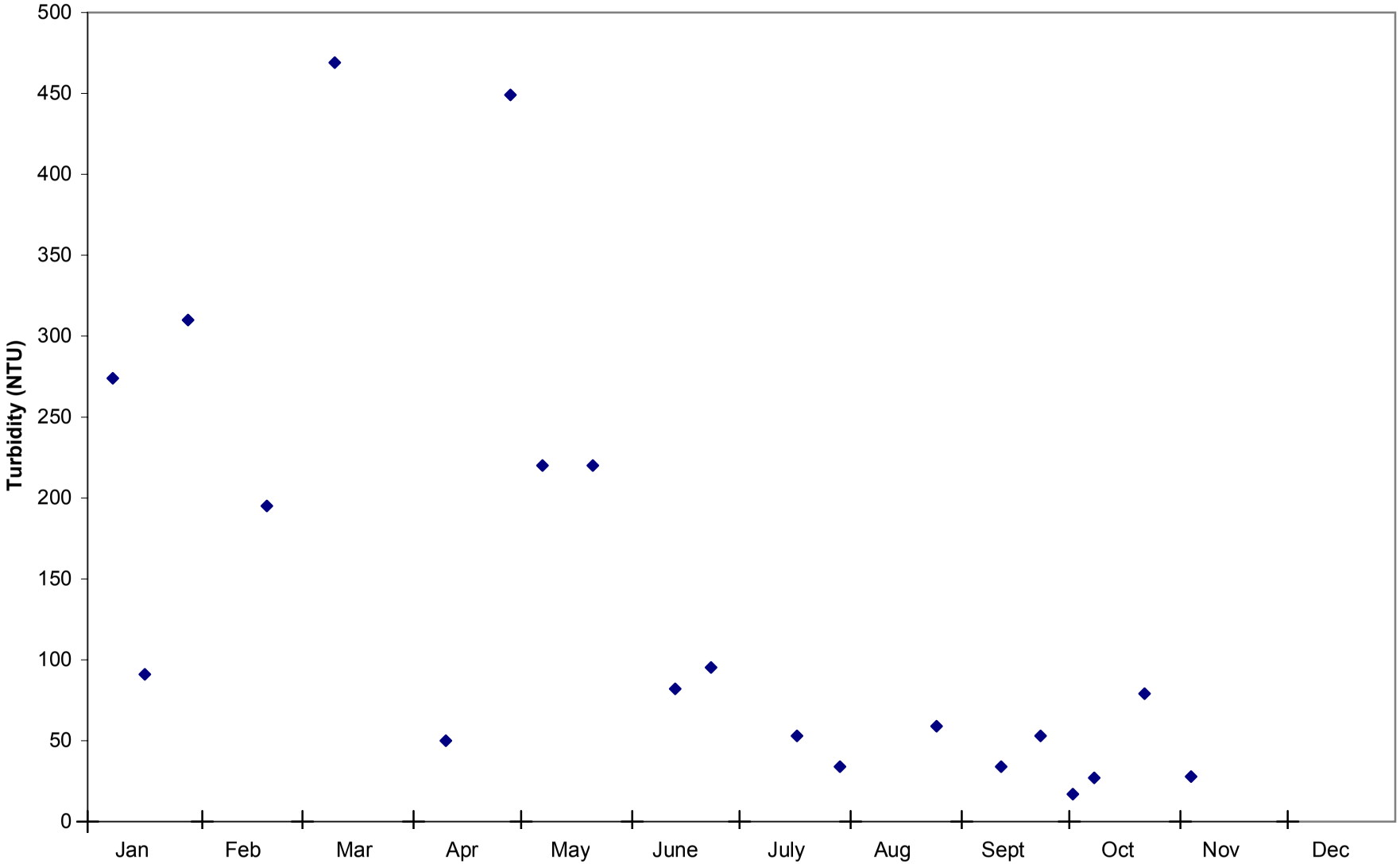


Figure C.12. Observed Seasonal Turbidity for Cache River near Hwy 412 (CHR0004)



APPENDIX D

Plots of Turbidity and TSS vs Flow

Figure D.1. TSS vs flow for Bayou DeView at Hwy 64 (BDV0002)

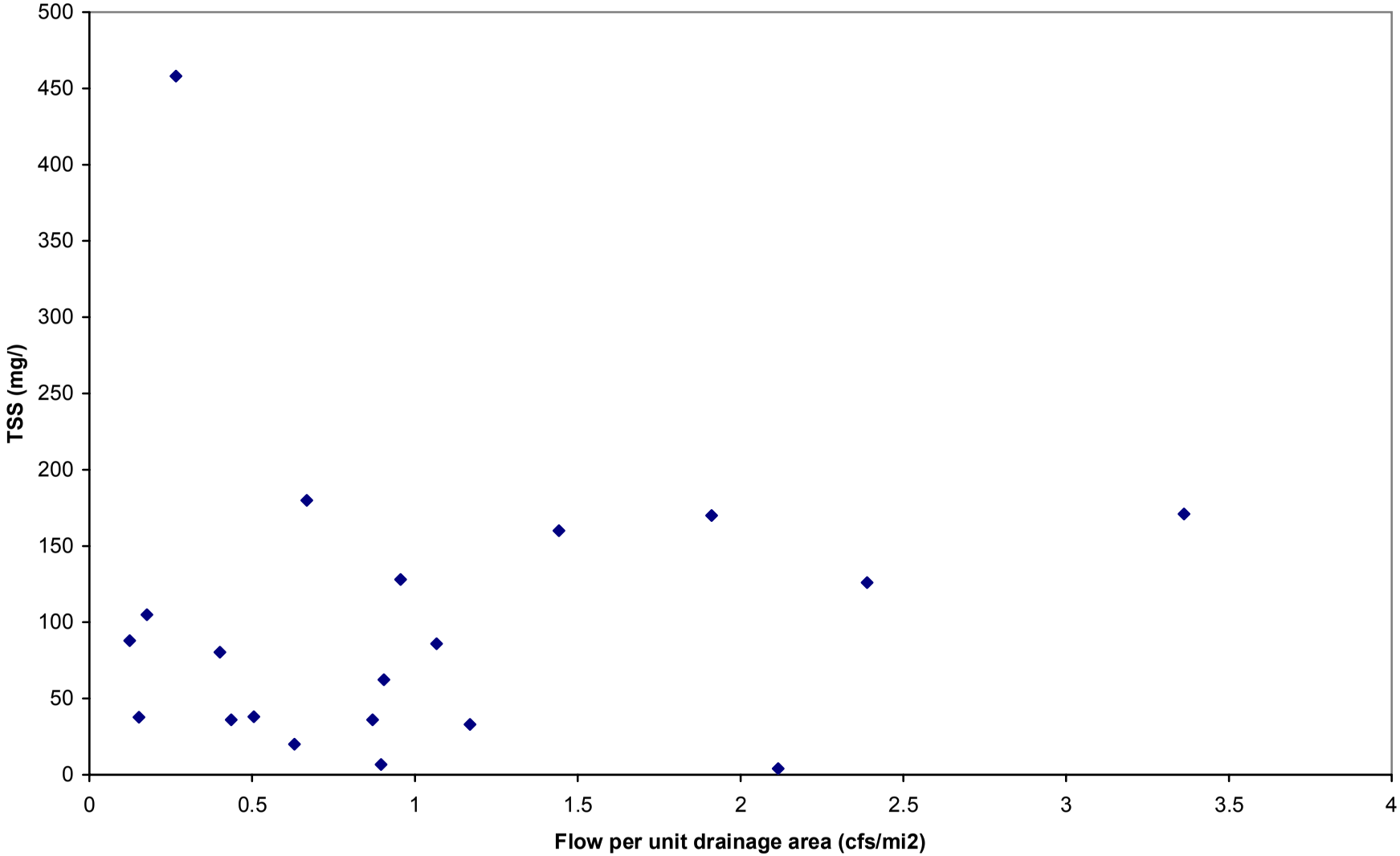


Figure D.2. Turbidity vs flow for Bayou DeView at Hwy 64 (BDV0002)

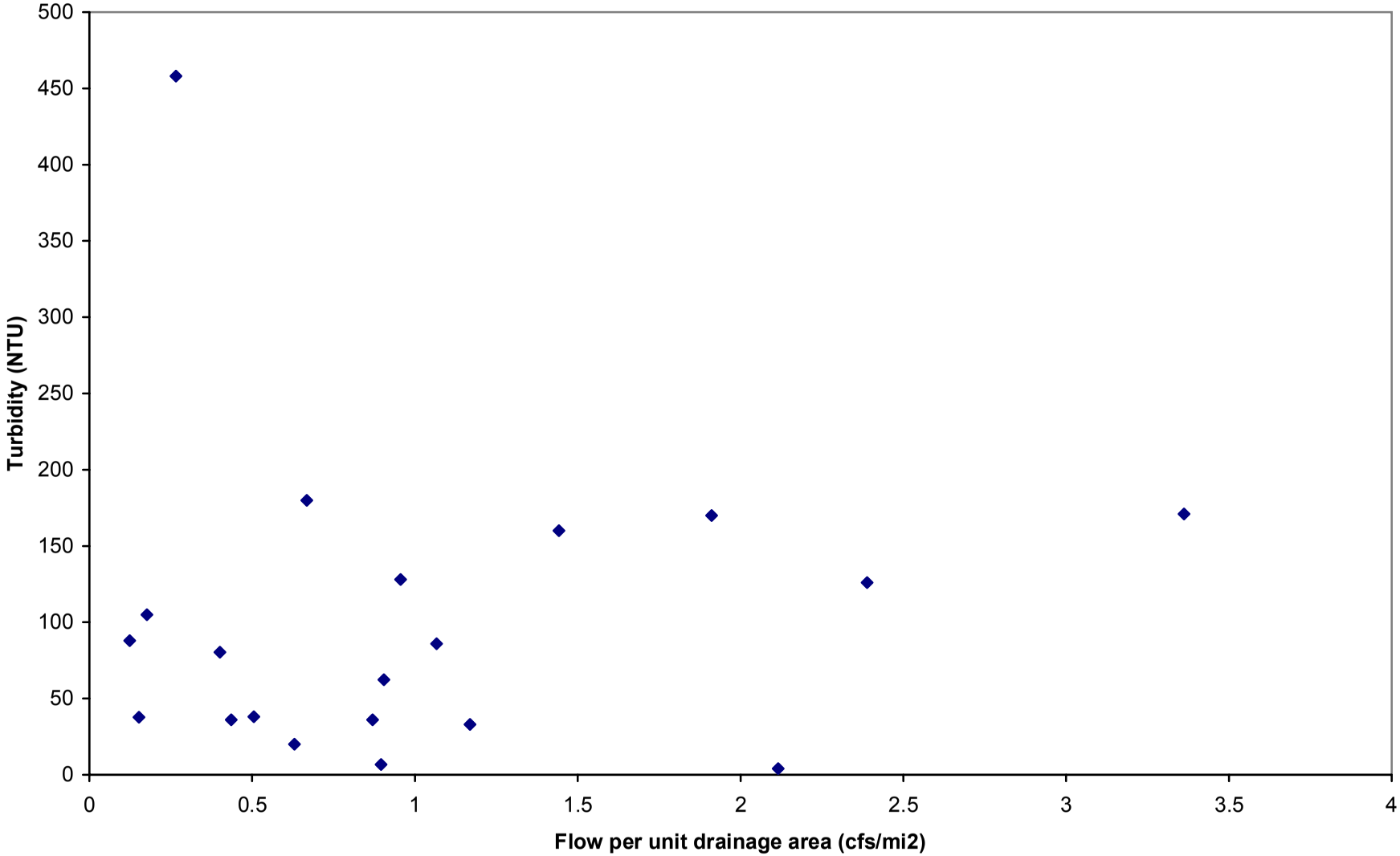


Figure D.3. TSS vs. flow for Bayou DeView West of Gibson, AR (WHI0026)

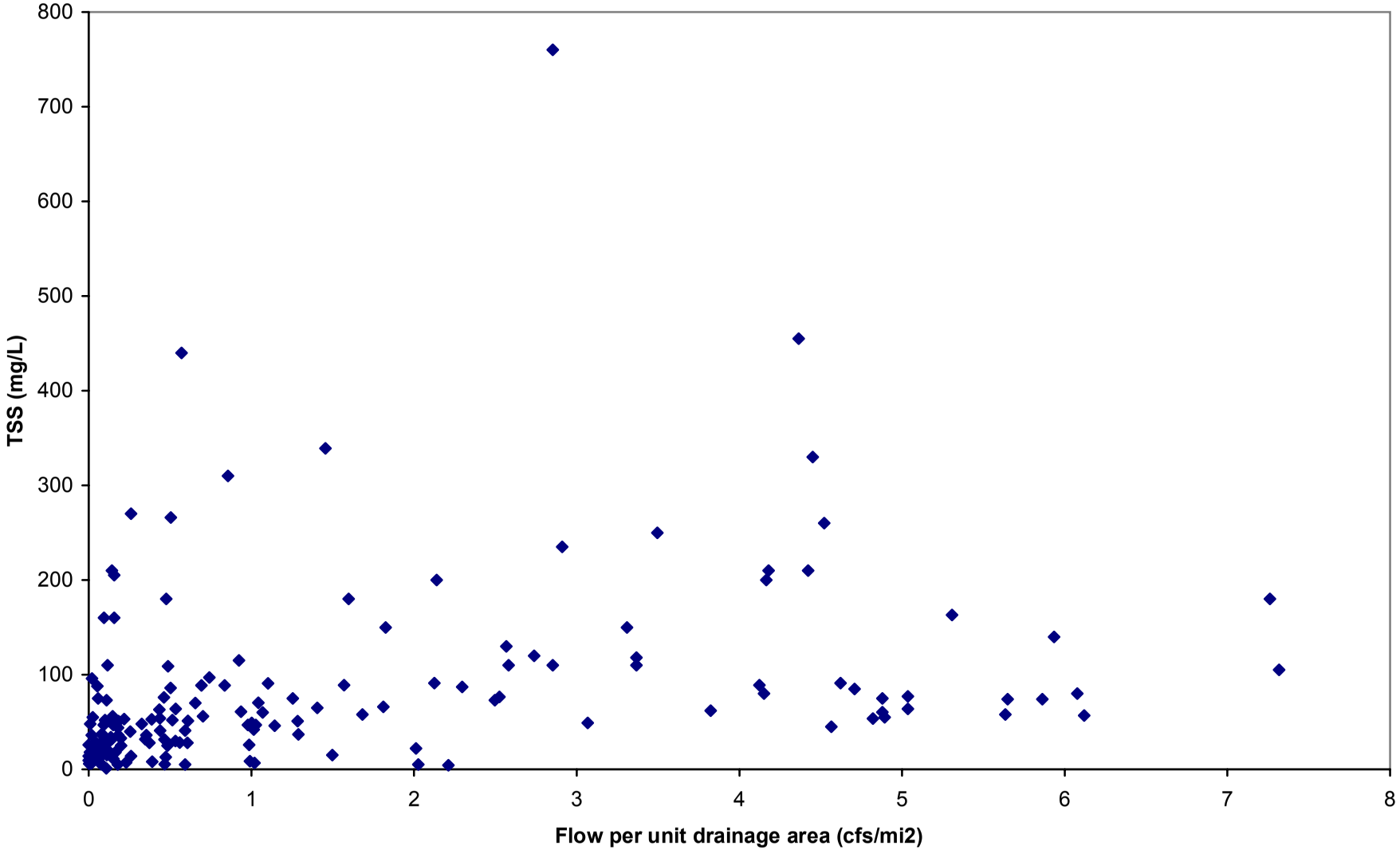


Figure D.4. Turbidity vs flow for Bayou DeView West of Gibson, AR (WHI0026)

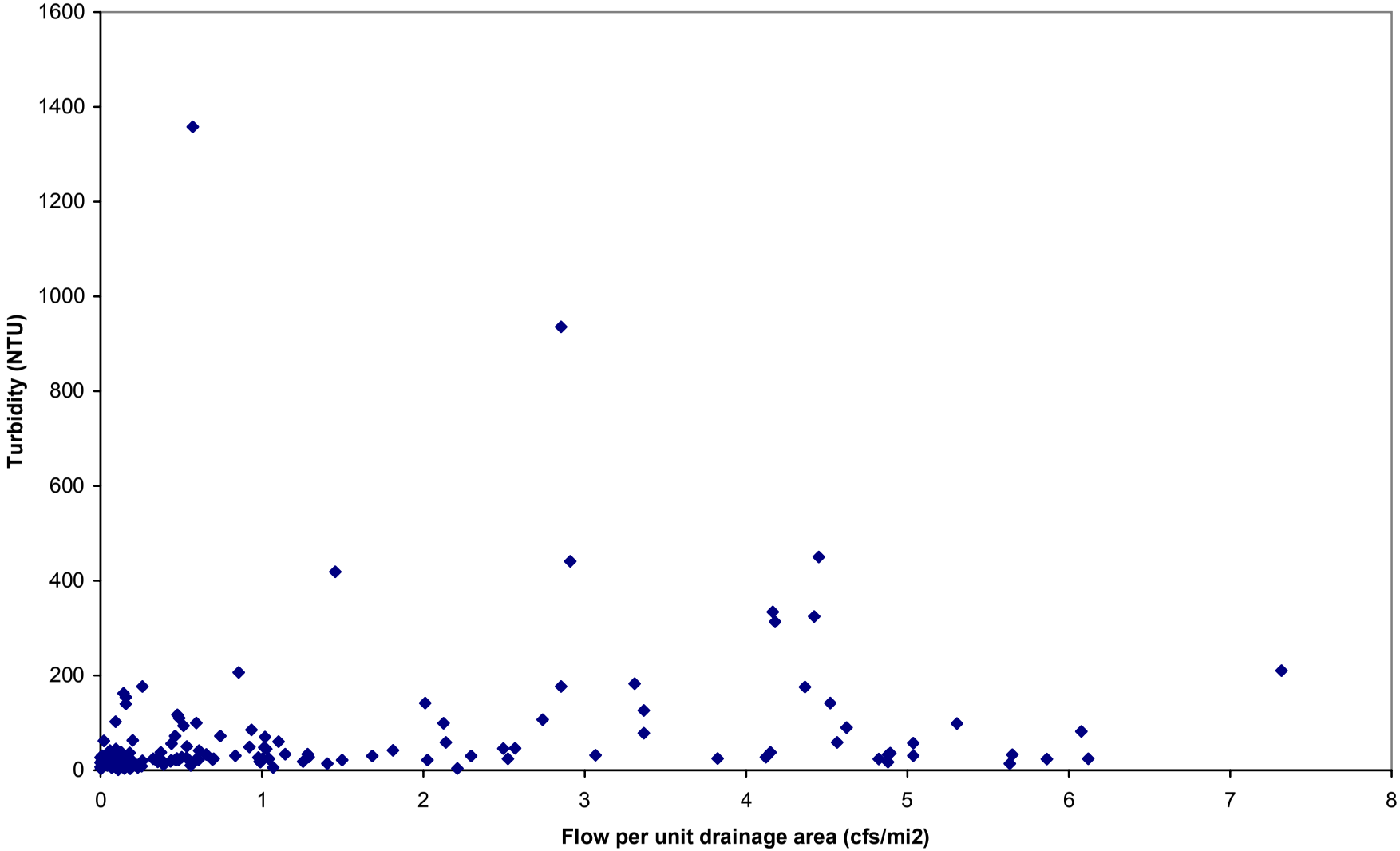


Figure D.5. TSS vs flow for Cache River near Brasfield, AR (WHI0032)

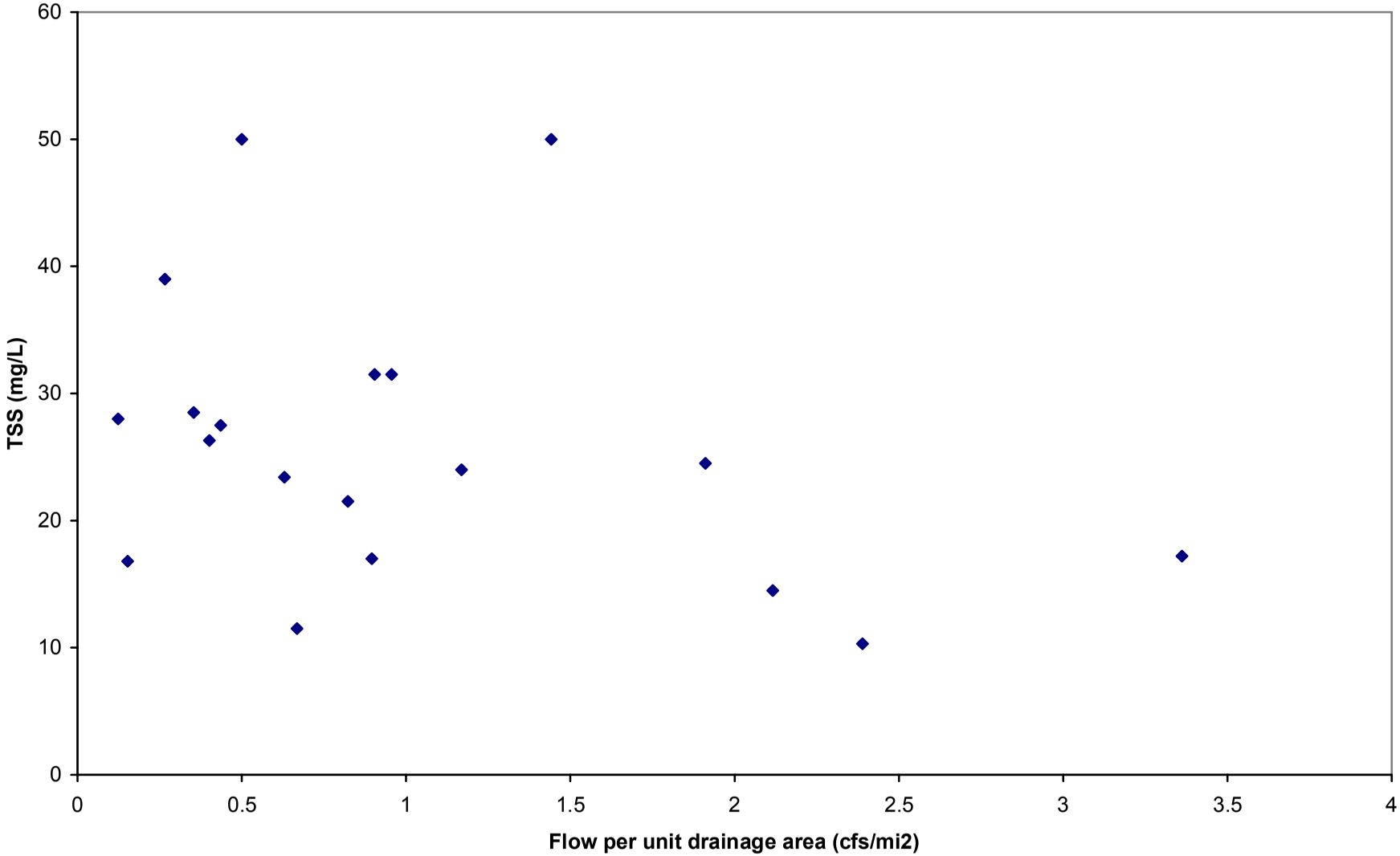


Figure D.6. Turbidity vs flow for Cache River near Brasfield, AR (WHI0032)

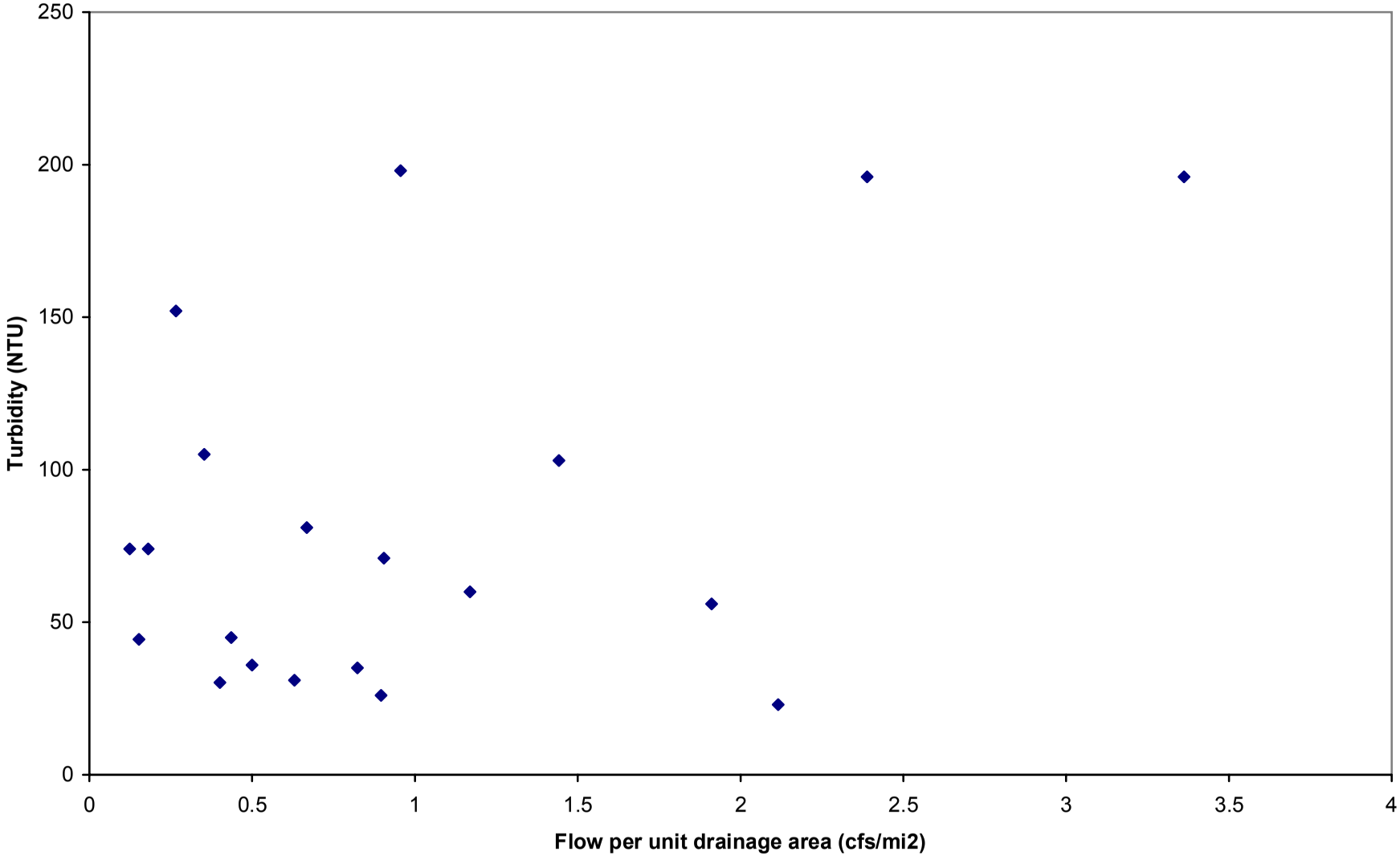


Figure D.7. TSS vs flow for Cache River near Peterson, AR (CHR0002)

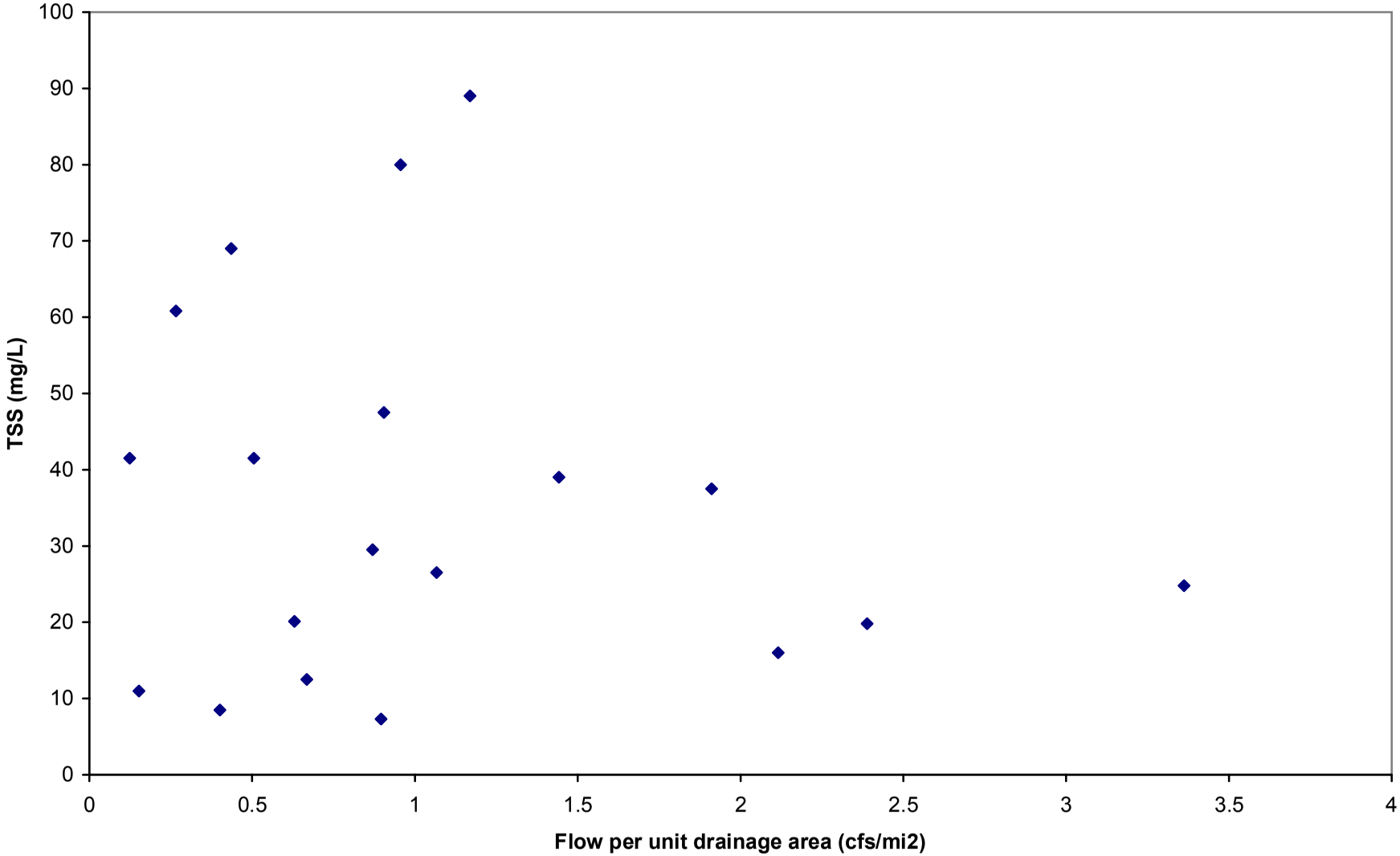


Figure D.8. Turbidity vs flow for Cache River near Peterson, AR (CHR0002)

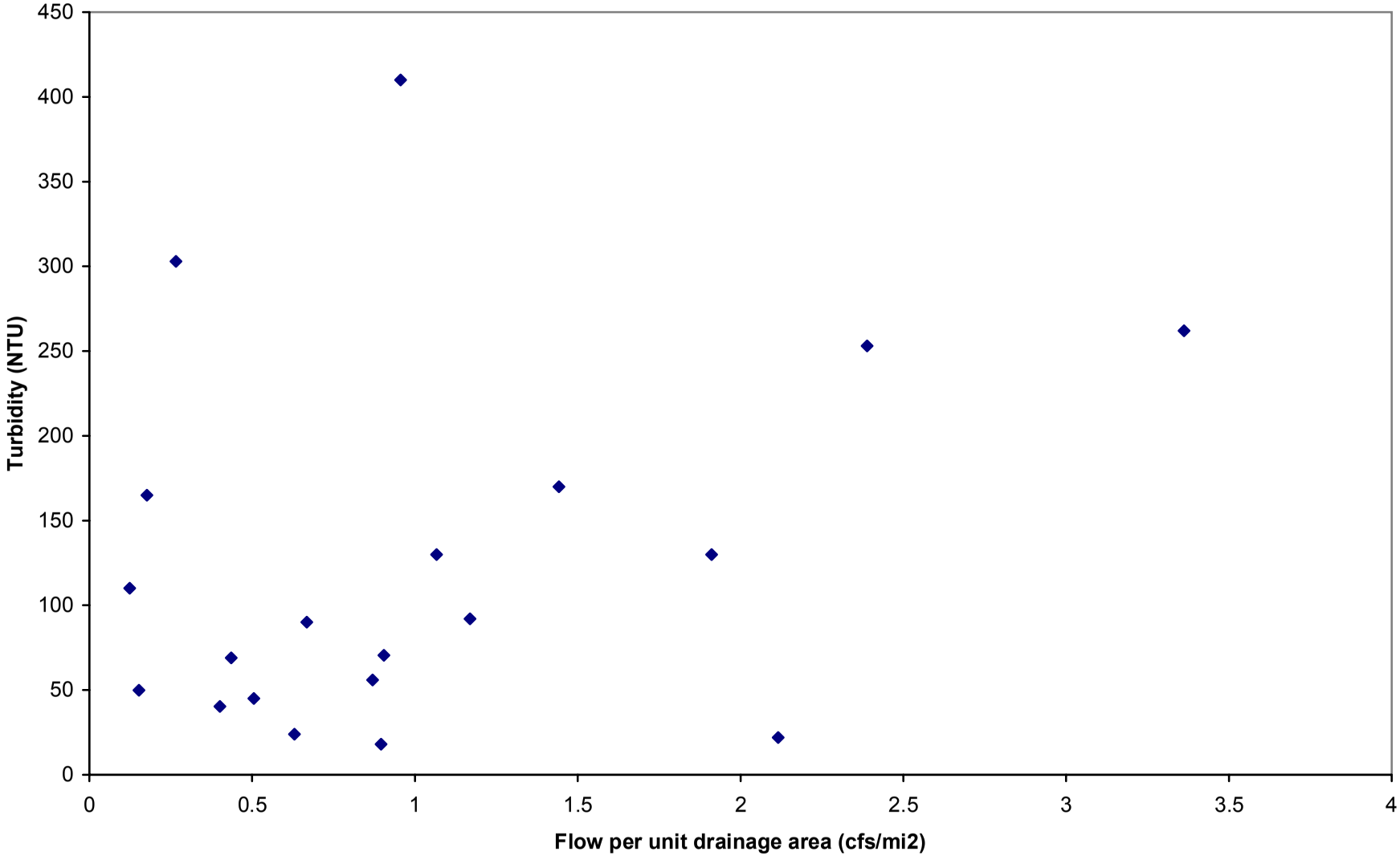


Figure D.9. TSS vs flow for Cache River near Hwy 18 (CHR0003)

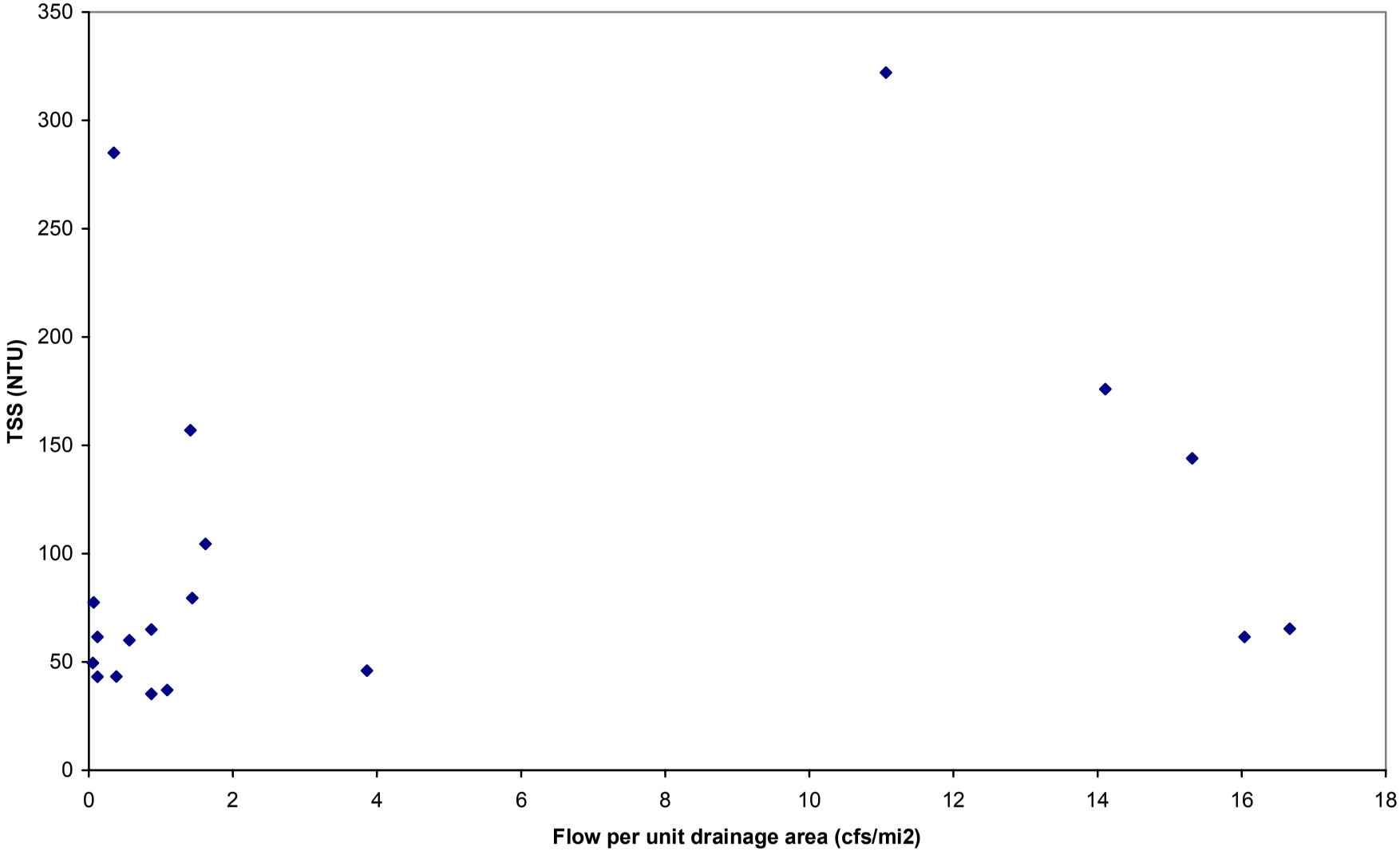


Figure D.10. Turbidity vs flow for Cache River near Hwy 18 (CHR0003)

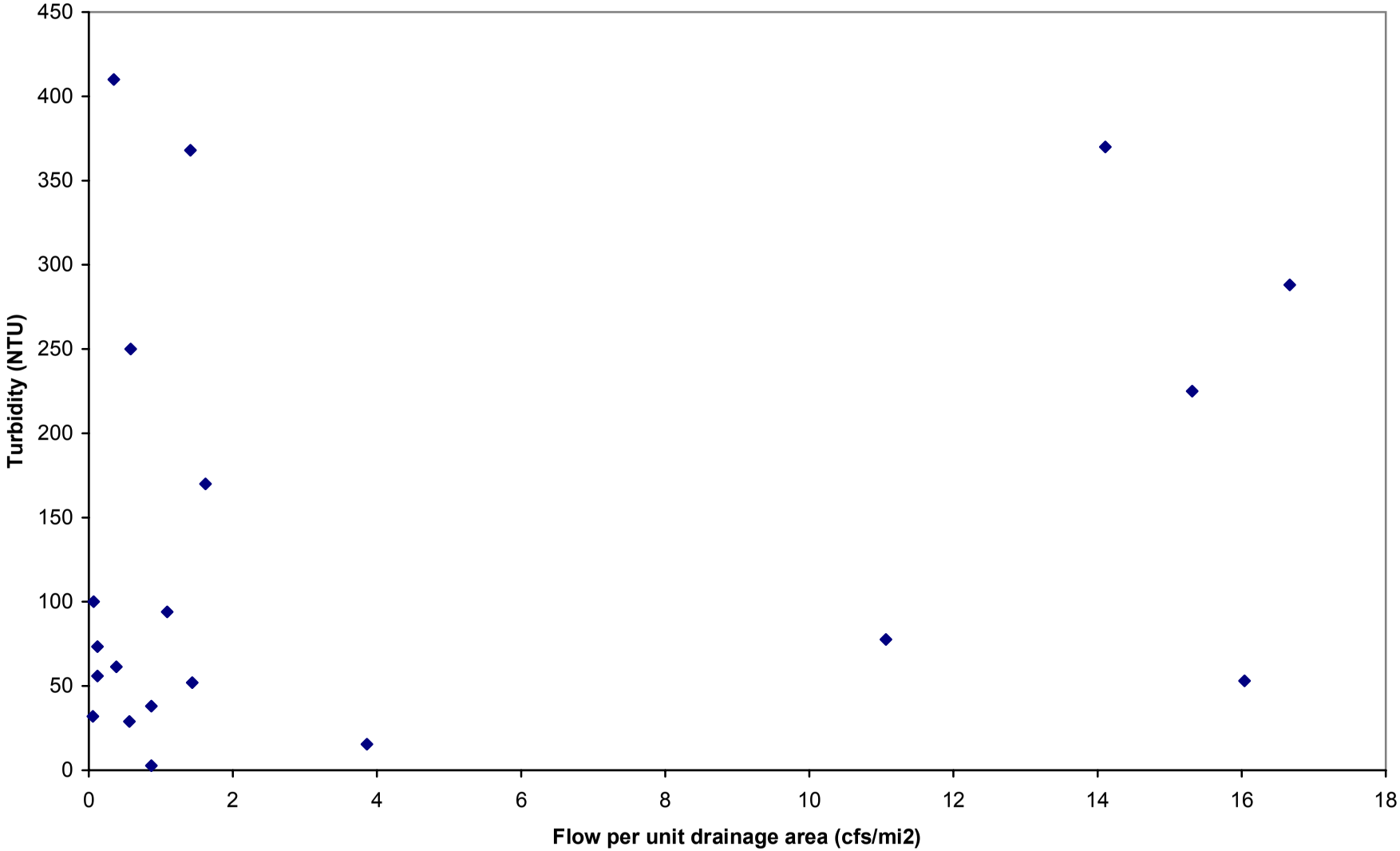


Figure D.11. TSS vs flow for Cache River at Hwy 412 (CHR0004)

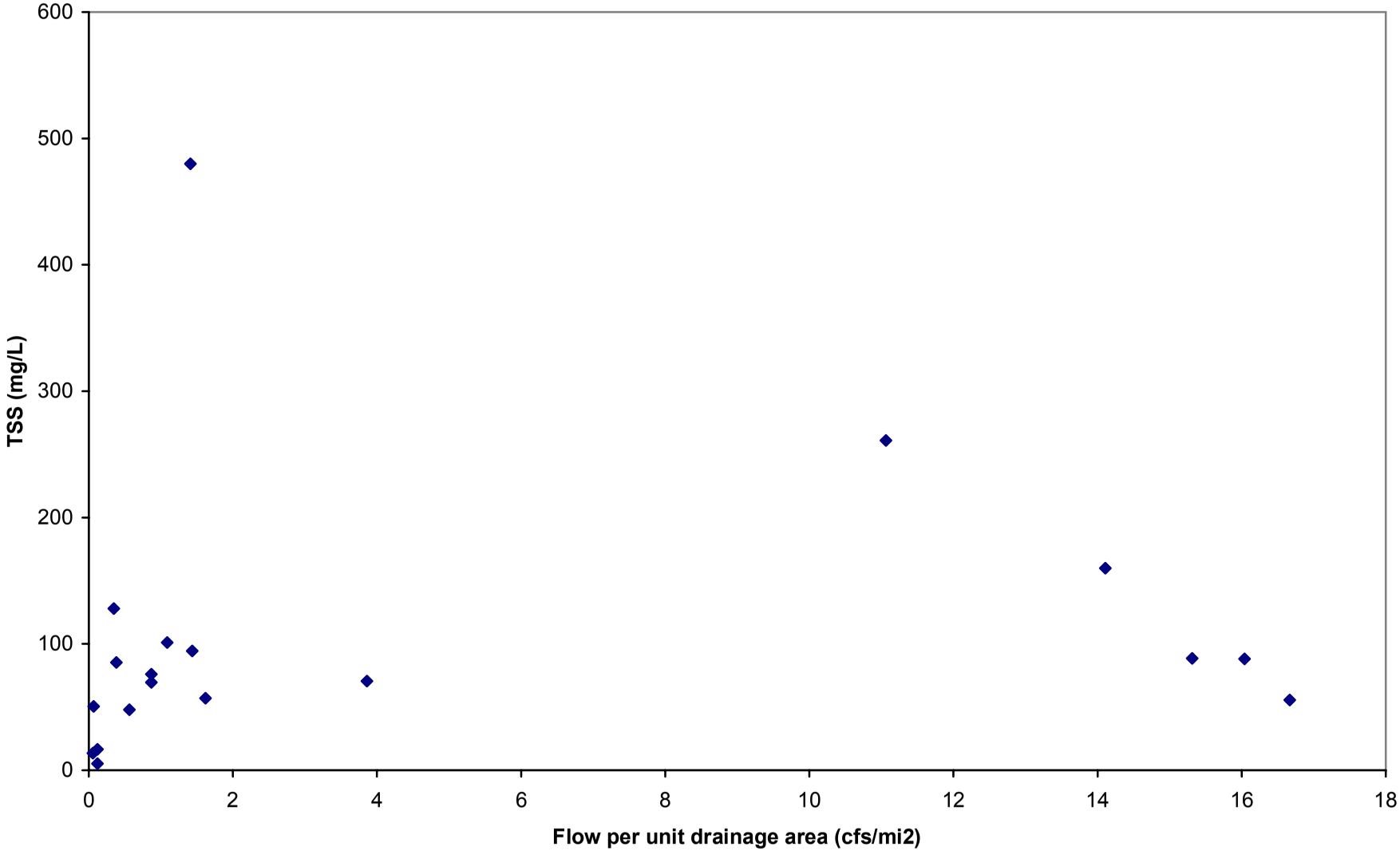
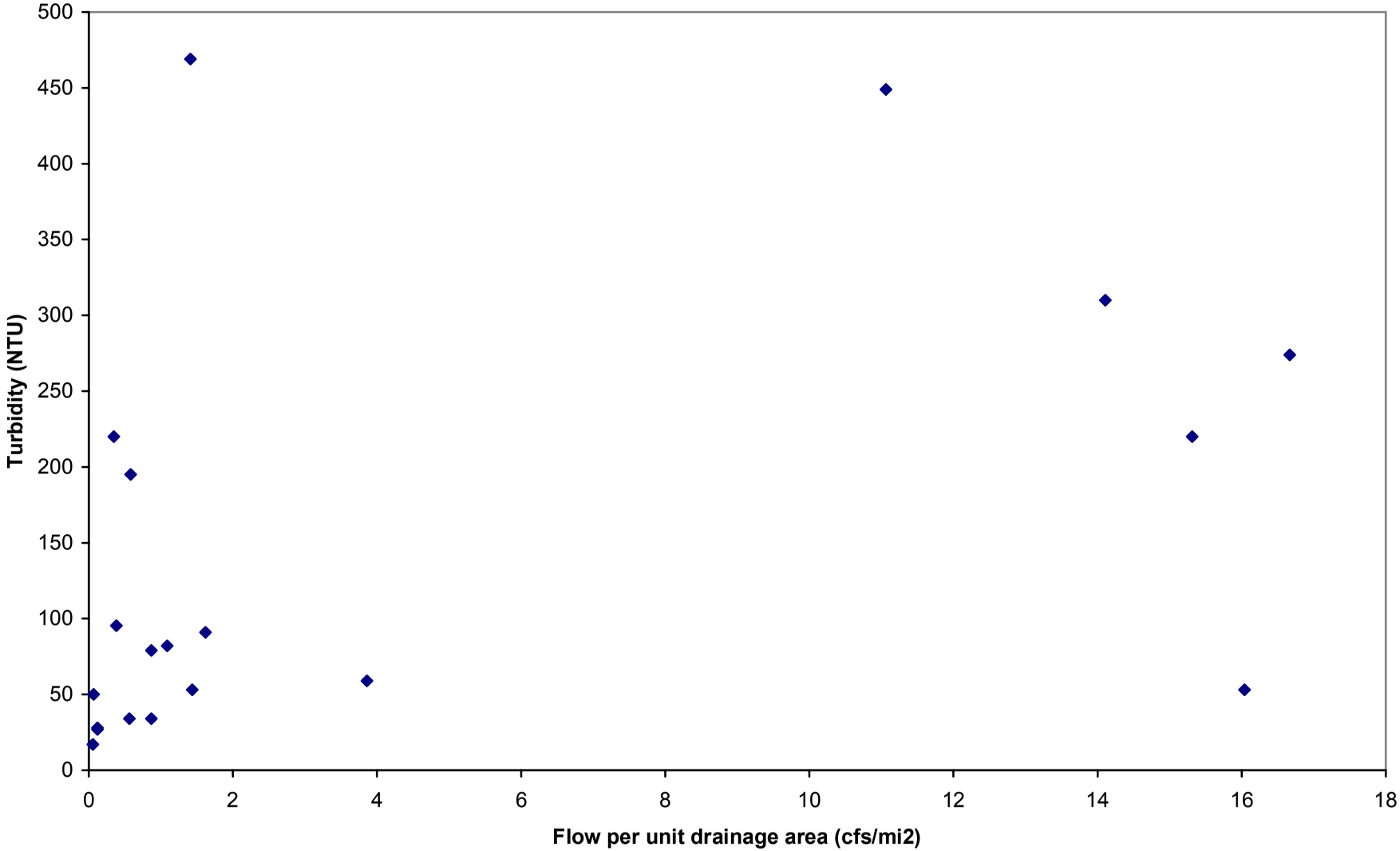


Figure D.12. Turbidity vs flow for Cache River at Hwy 412 (CHR0004)



APPENDIX E

Plots of TSS vs Turbidity

Figure E.1. Base flow regression for TSS vs Turbidity for Bayou DeView (BDV0002)

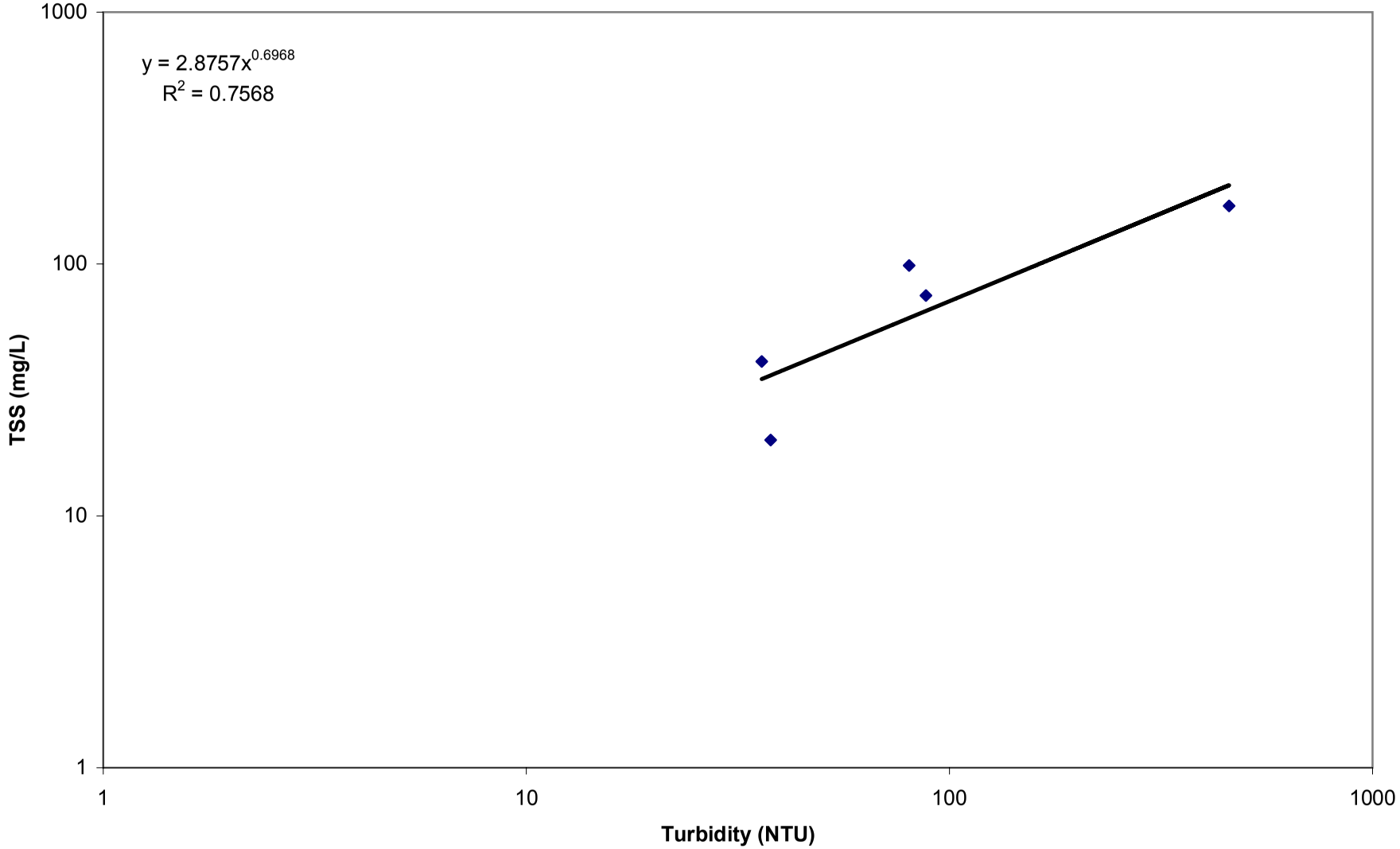


Figure E.2. Storm flow regression for TSS for Bayou DeView at Hwy 64 (BDV0002)

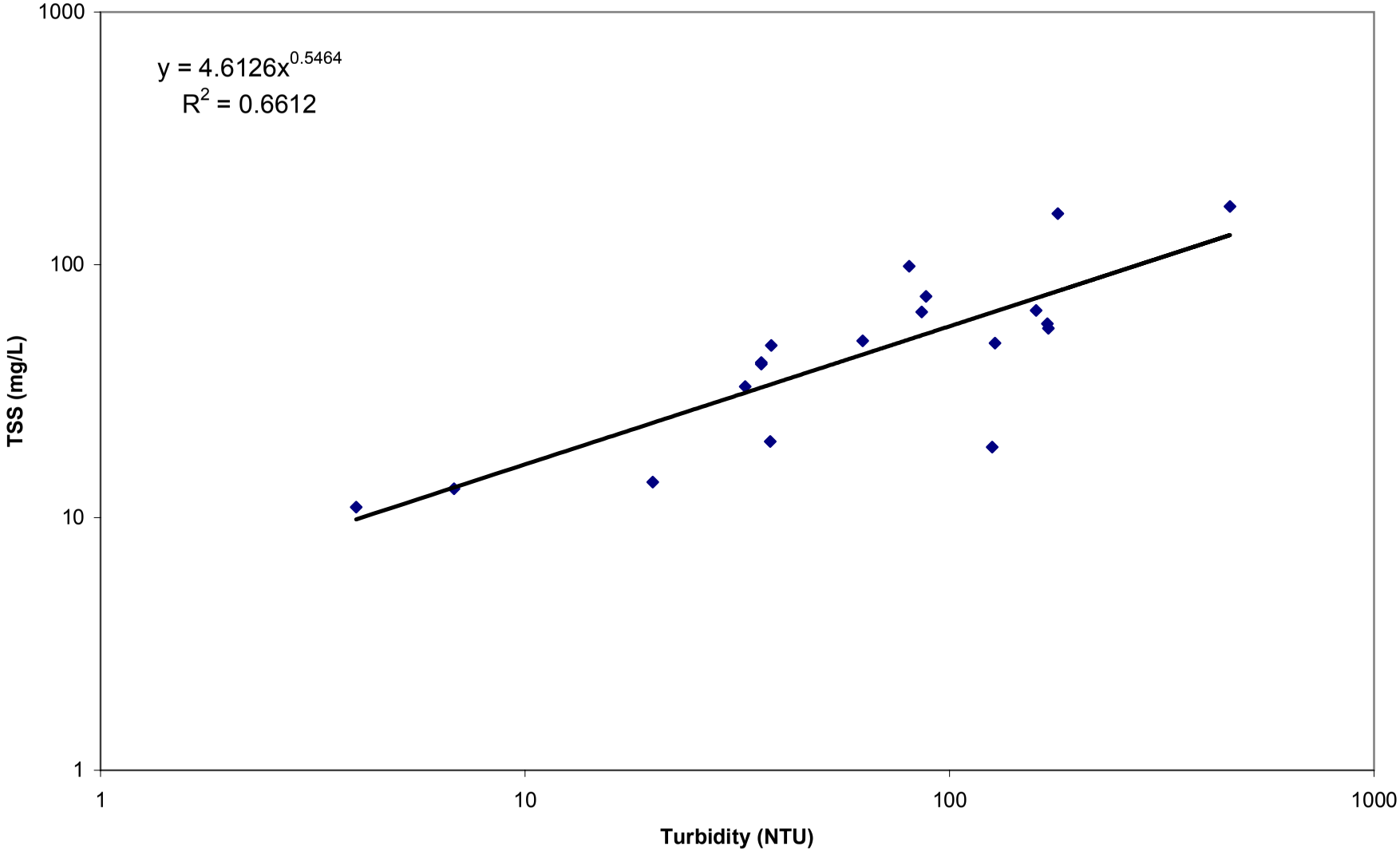


Figure E.3. Base flow regression for TSS vs Turbidity for Bayou DeView (WHI0026)

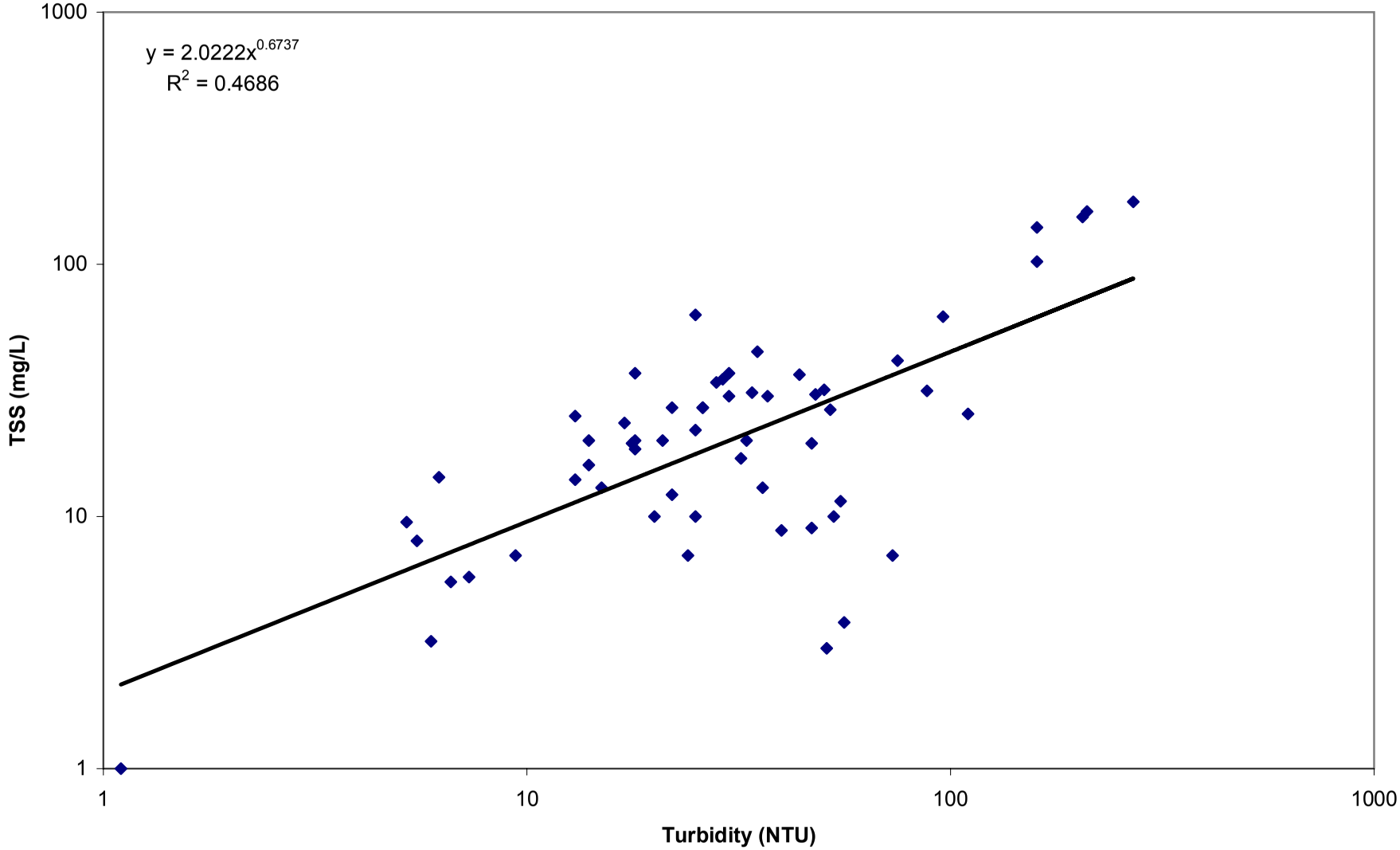


Figure E.4. Storm flow regression for Turbidity vs TSS for Bayou DeView AR (WHI0026)

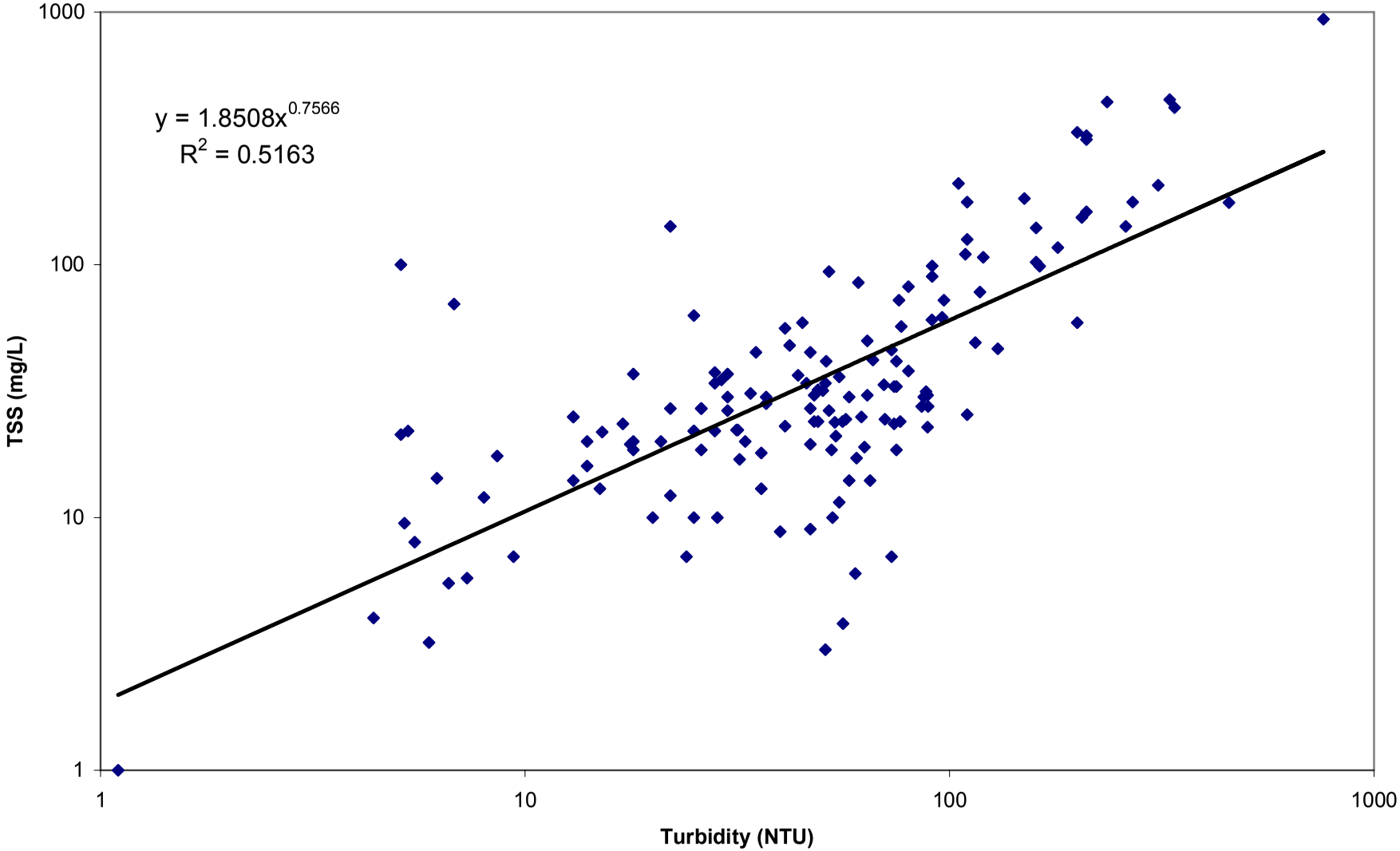


Figure E.5. Base flow regression for TSS vs Turbidity for Cache River near Brasfield (WHI0032)

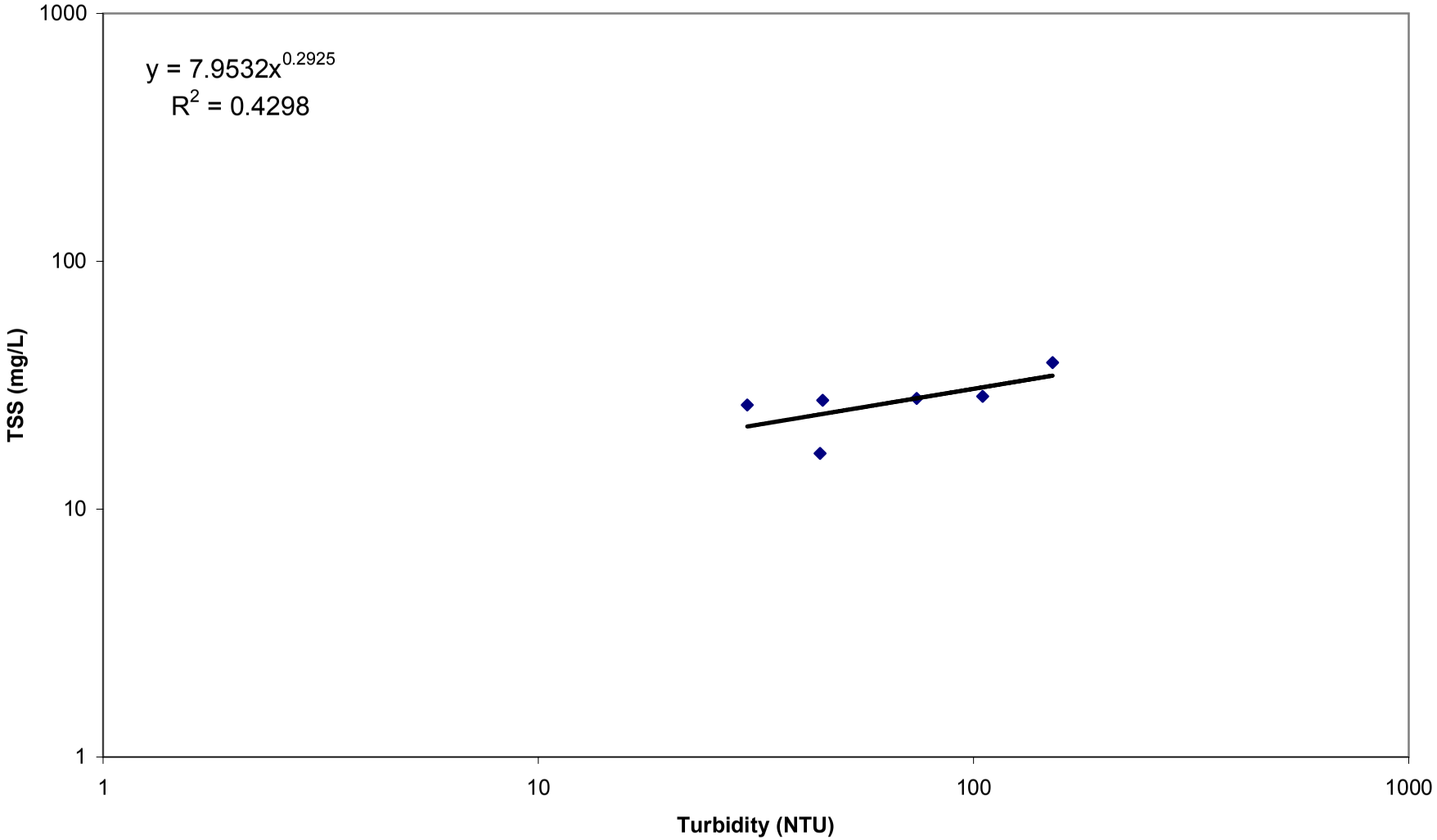


Figure E.6. Storm flow regression for TSS vs Turbidity for Cache River near Brasfield (WHI0032)

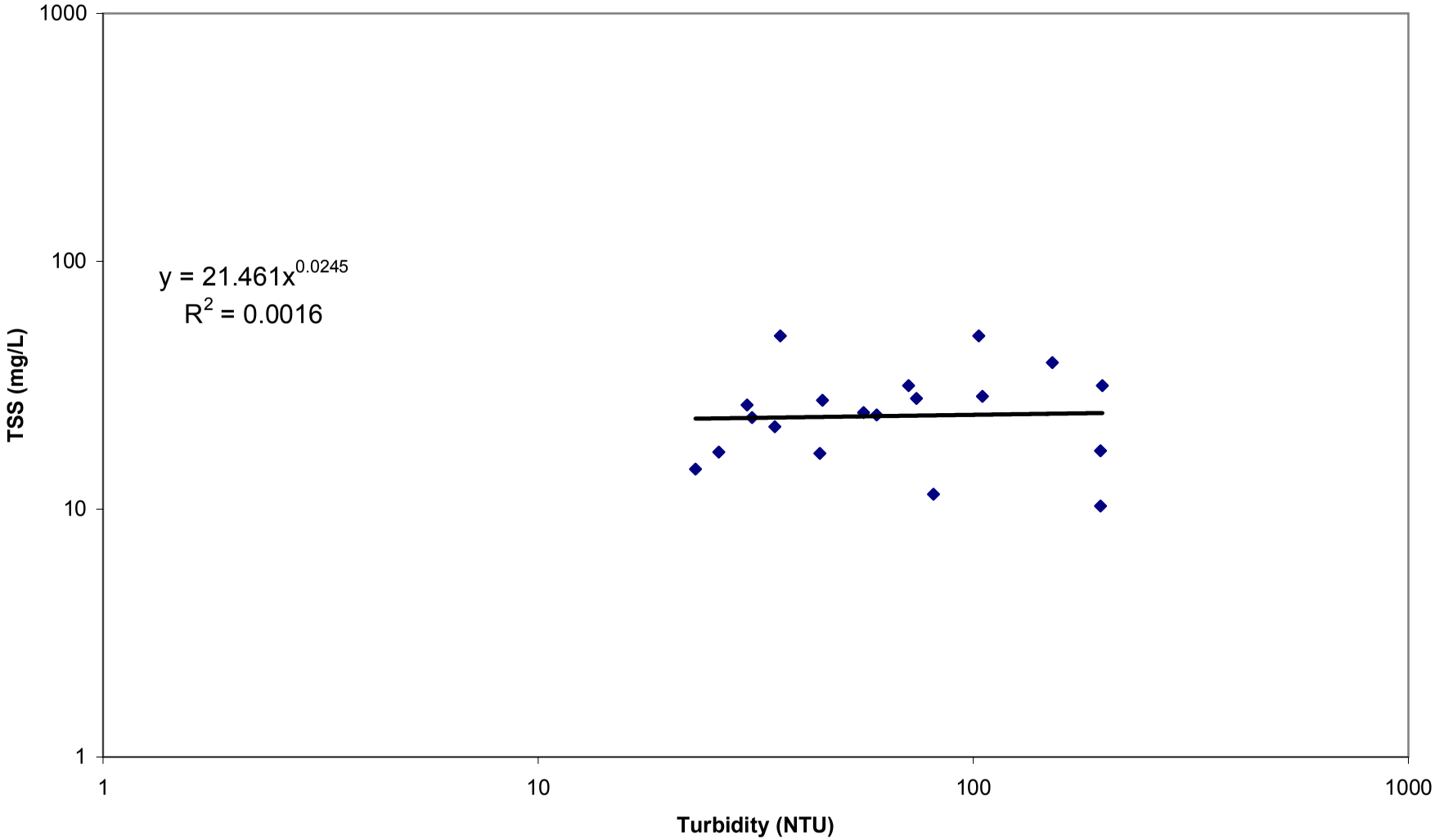


Figure E.7. Base flow regression for Turbidity vs TSS for Cache River (CHR0002)

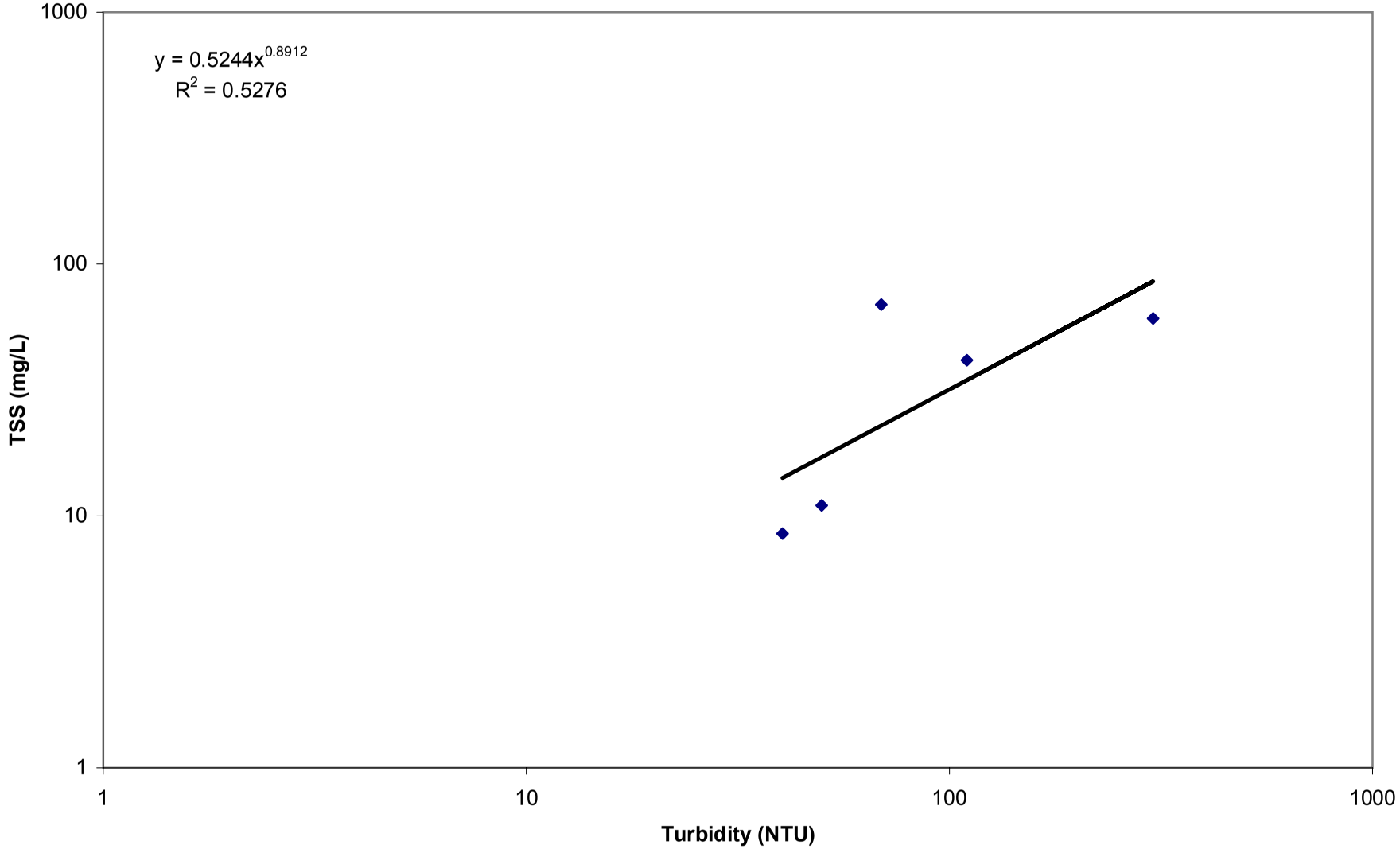


Figure E.8. Storm flow regression for TSS vs Turbidity for Cache River (CHR0002)

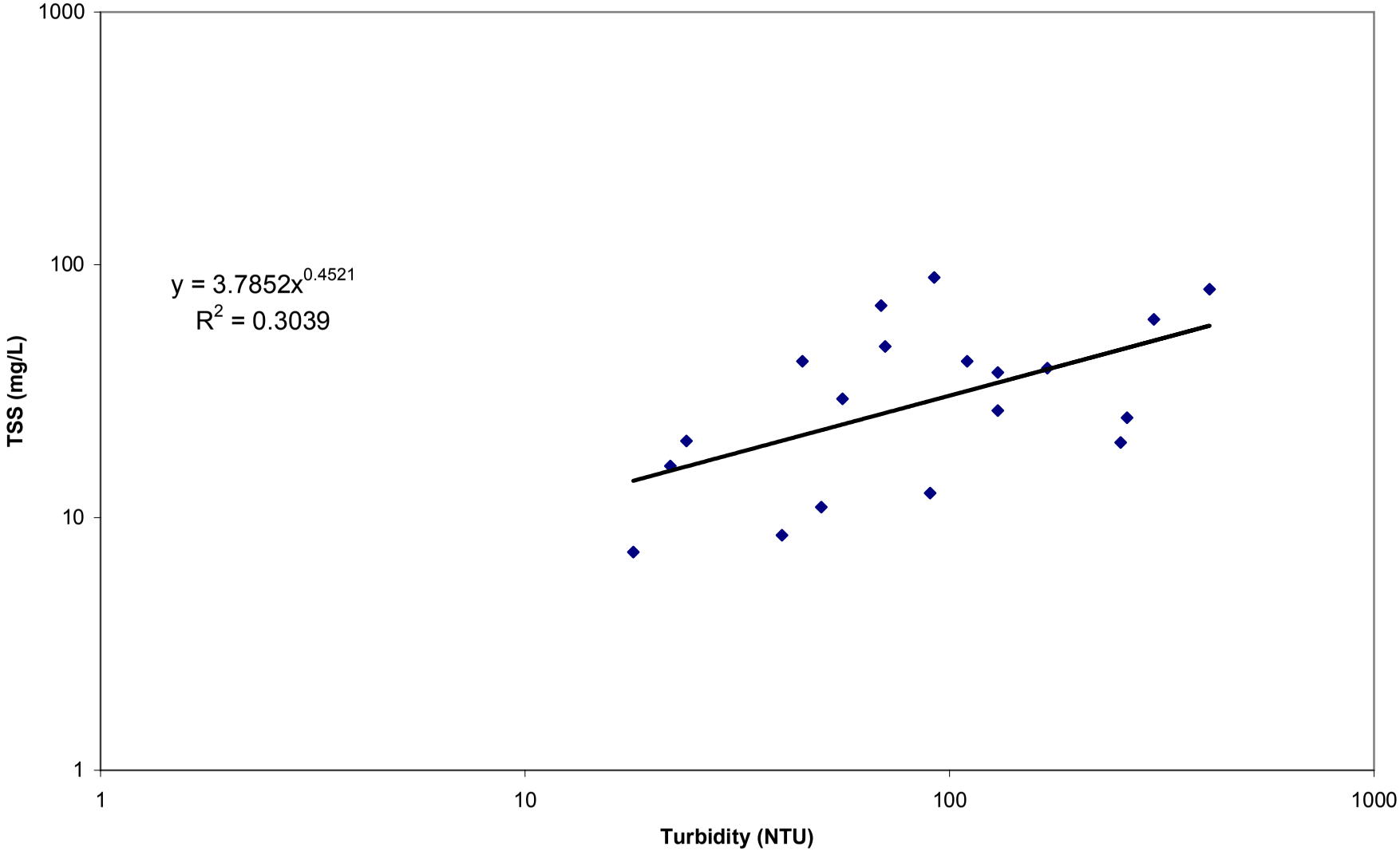


Figure E.9. Base flow TSS vs Turbidity for Cache River near Hwy 18 (CHR0003)

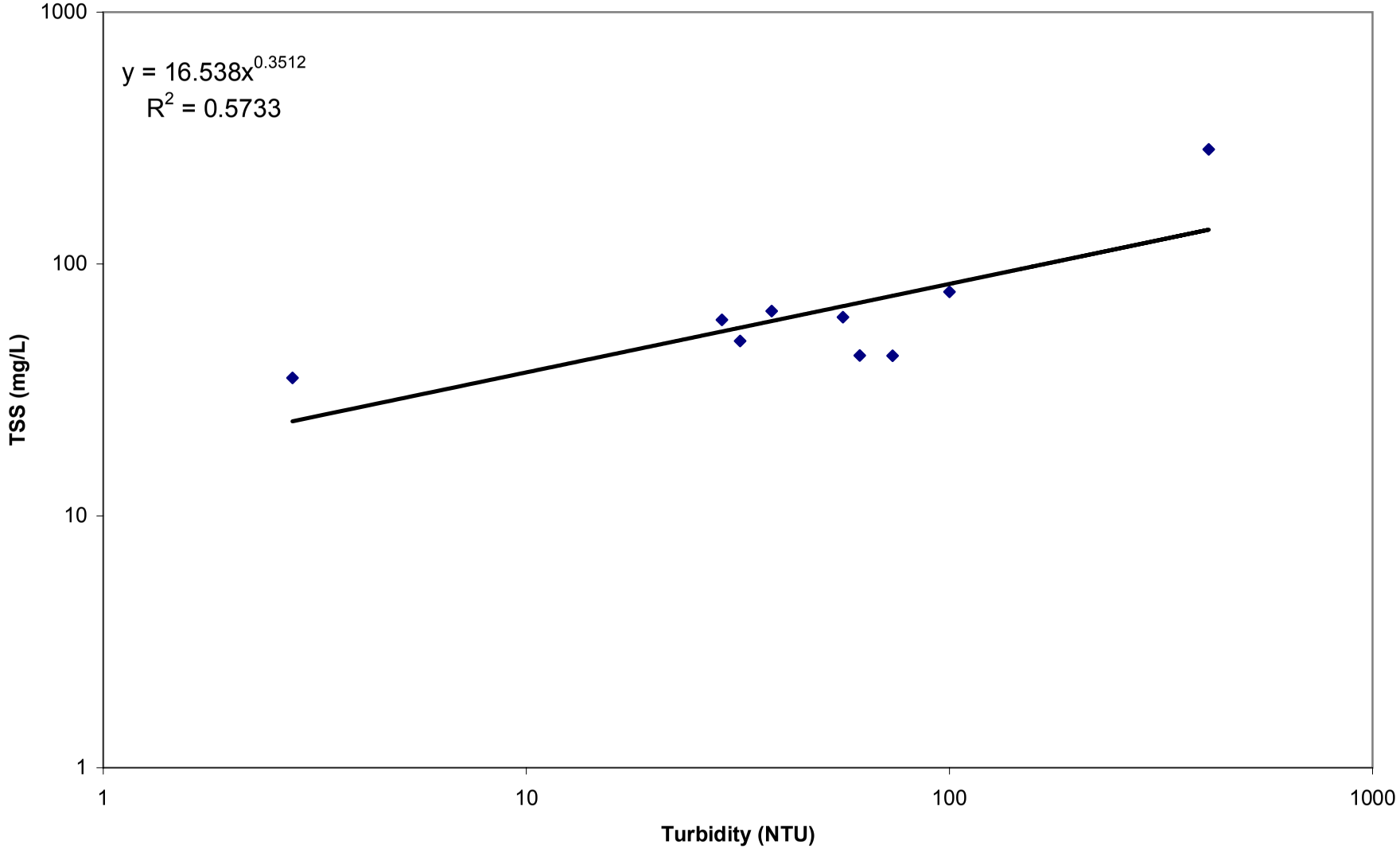


Figure E.10. Storm flow TSS vs Turbidity for Cache River near Hwy 18 (CHR0003)

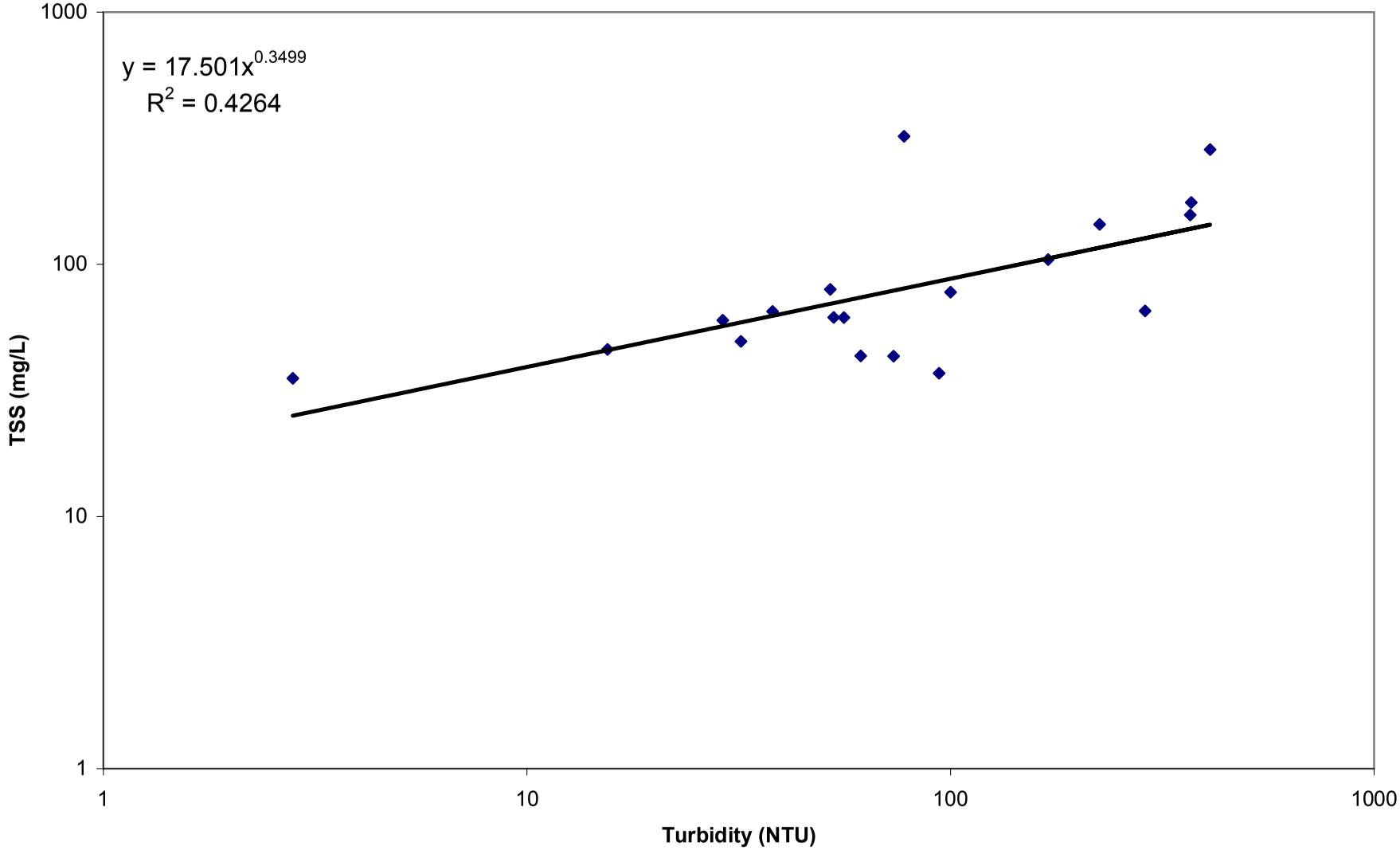


Figure E.11. Base flow regression for TSS vs Turbidity for Cache River (CHR0004)

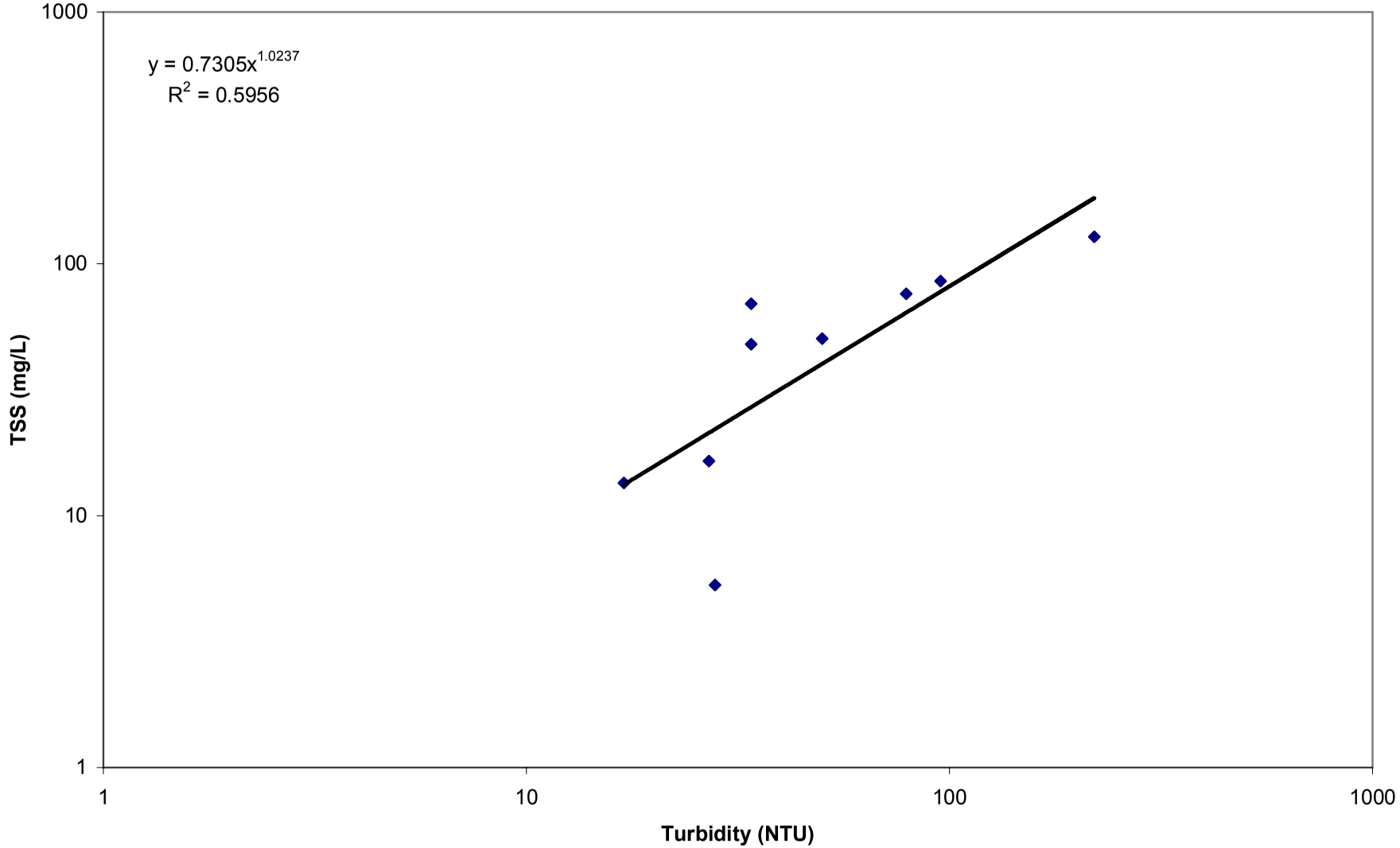
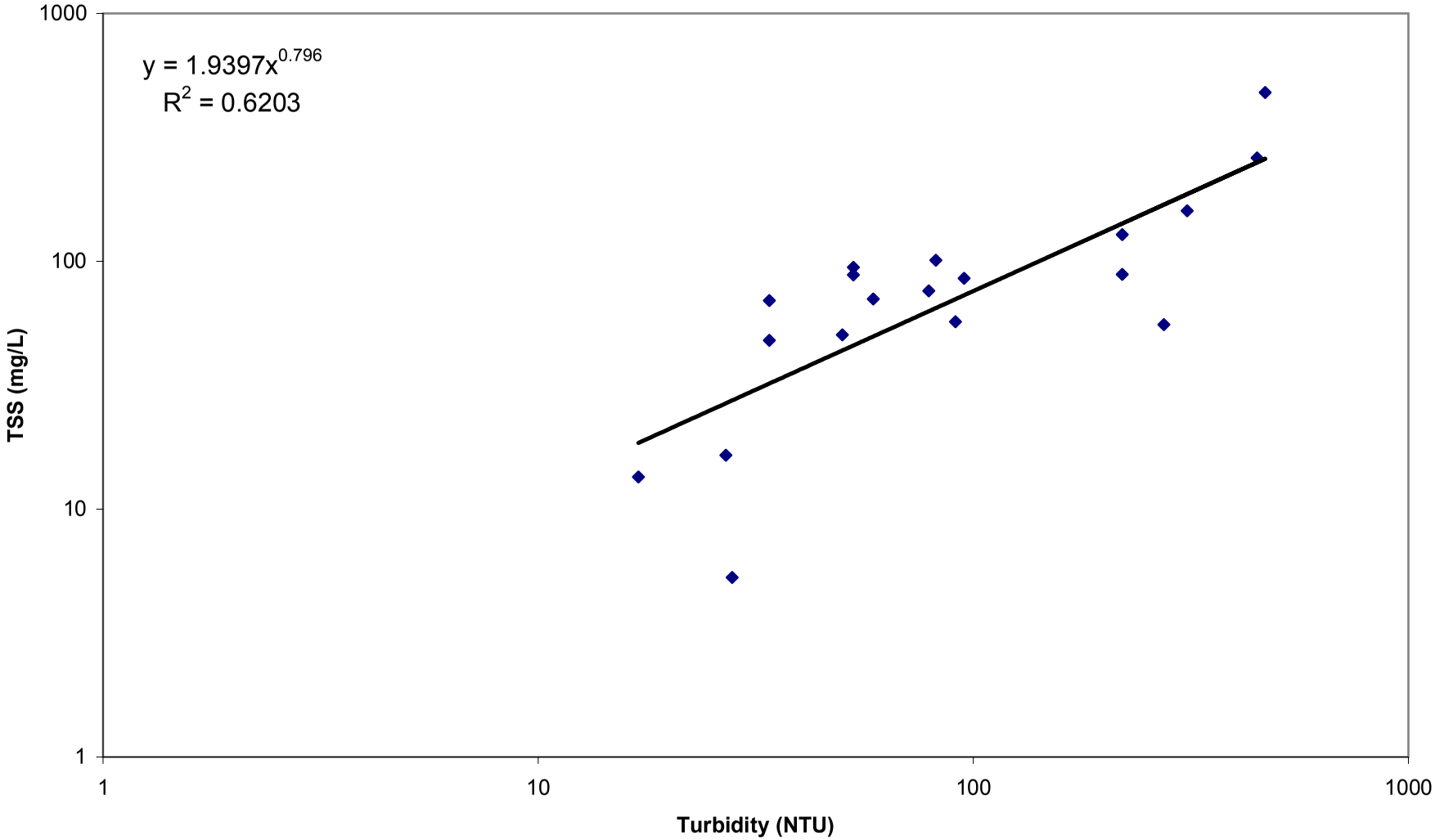


Figure E.12. Storm flow regression for Turbidity verse TSS for Cache River at Hwy 412 (CHR0004)



APPENDIX F

Load Duration Curves and TMDL Calculations

Figure F.1. Flow Duration Curve for Cache River near Cotton Plant (07077555)

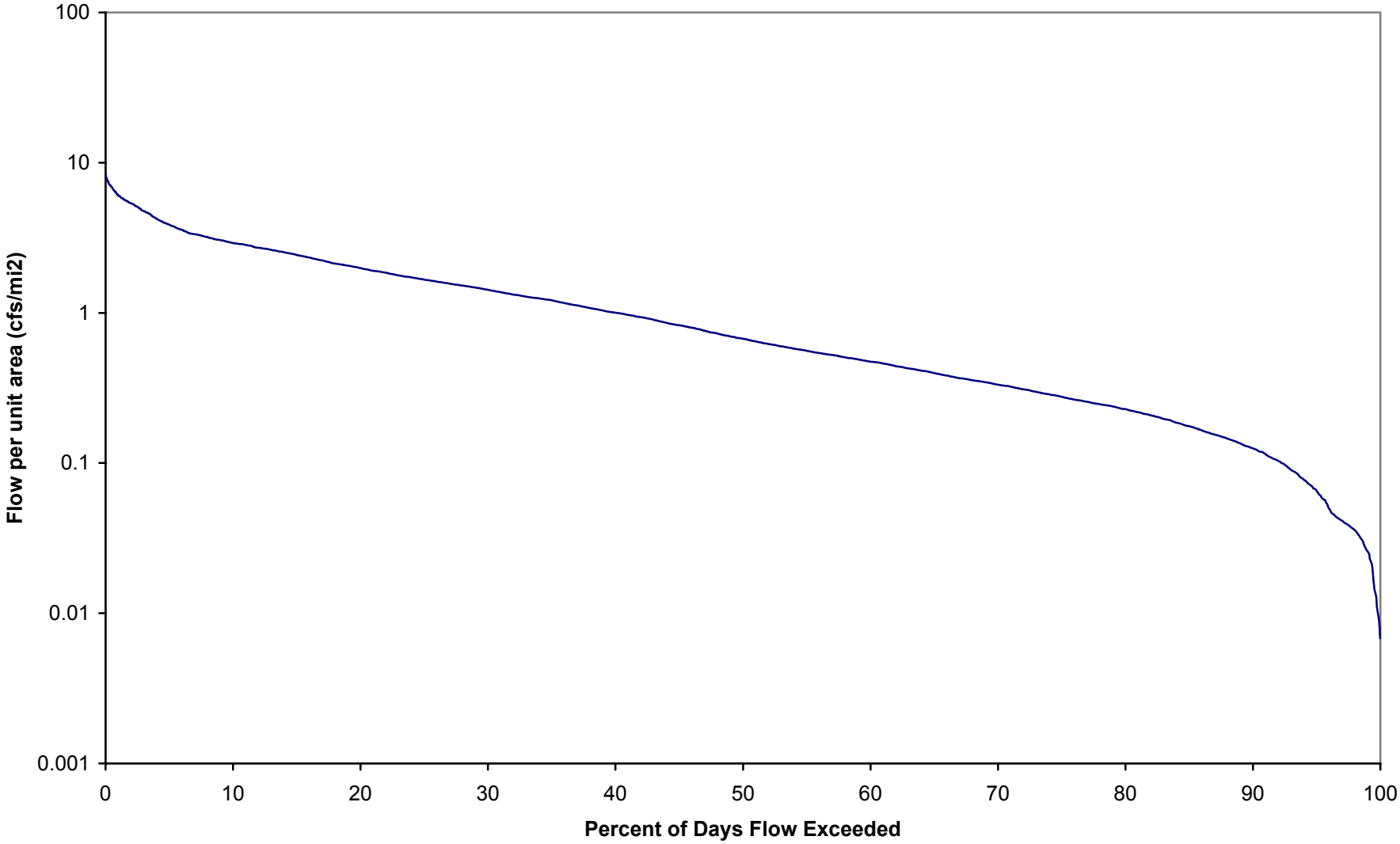


Figure F.2. Flow Duration Curve for Cache River at Egypt (07077380)

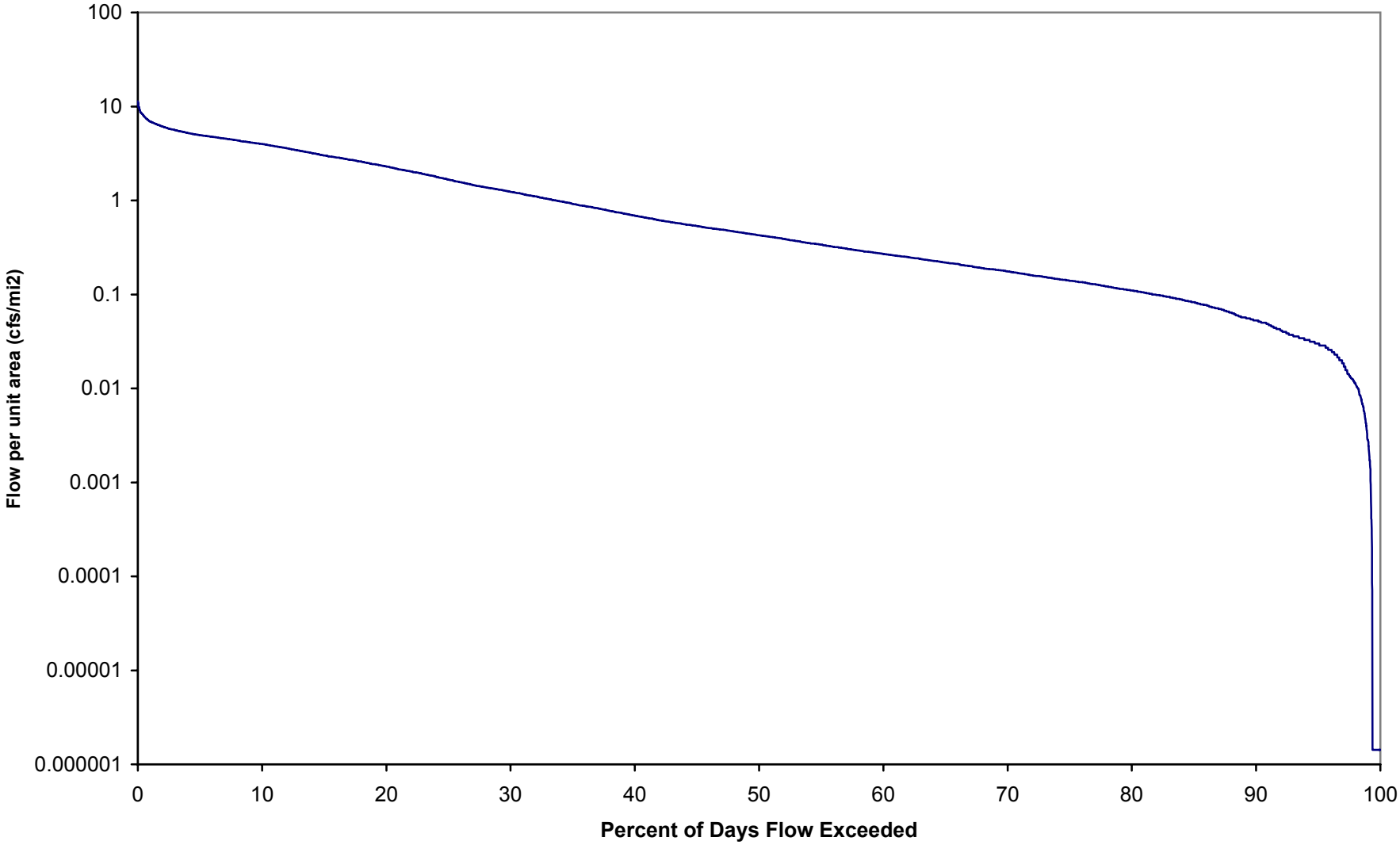


Figure F.3. Storm-Flow load Duration Curve for Bayou DeView (BDV0002)

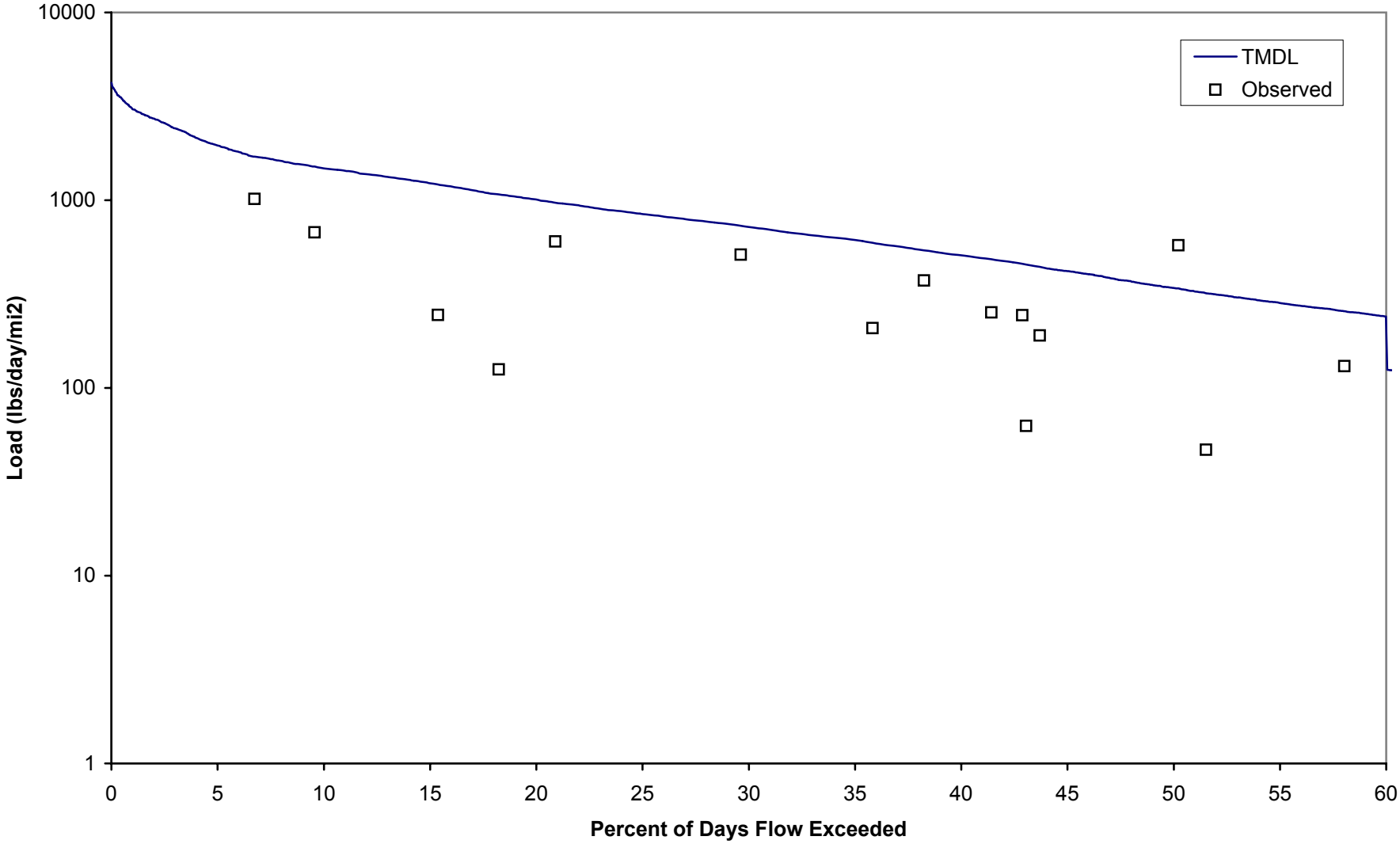


Figure F.4. Base Flow Load Duration Curve For Bayou DeView (BDV0002)

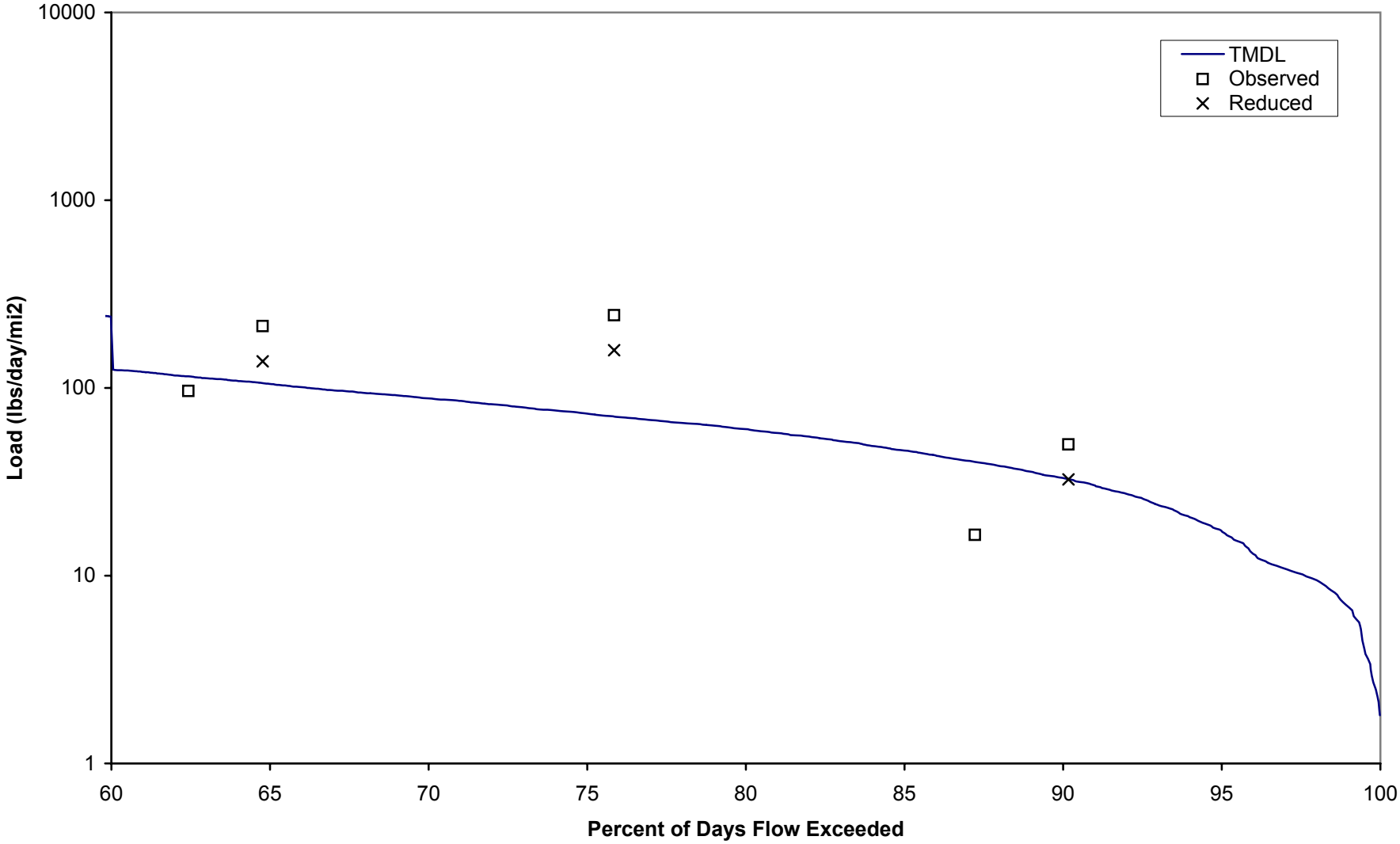


Figure F.5. Storm-Flow load Duration Curve for Bayou DeView (WHI0026)

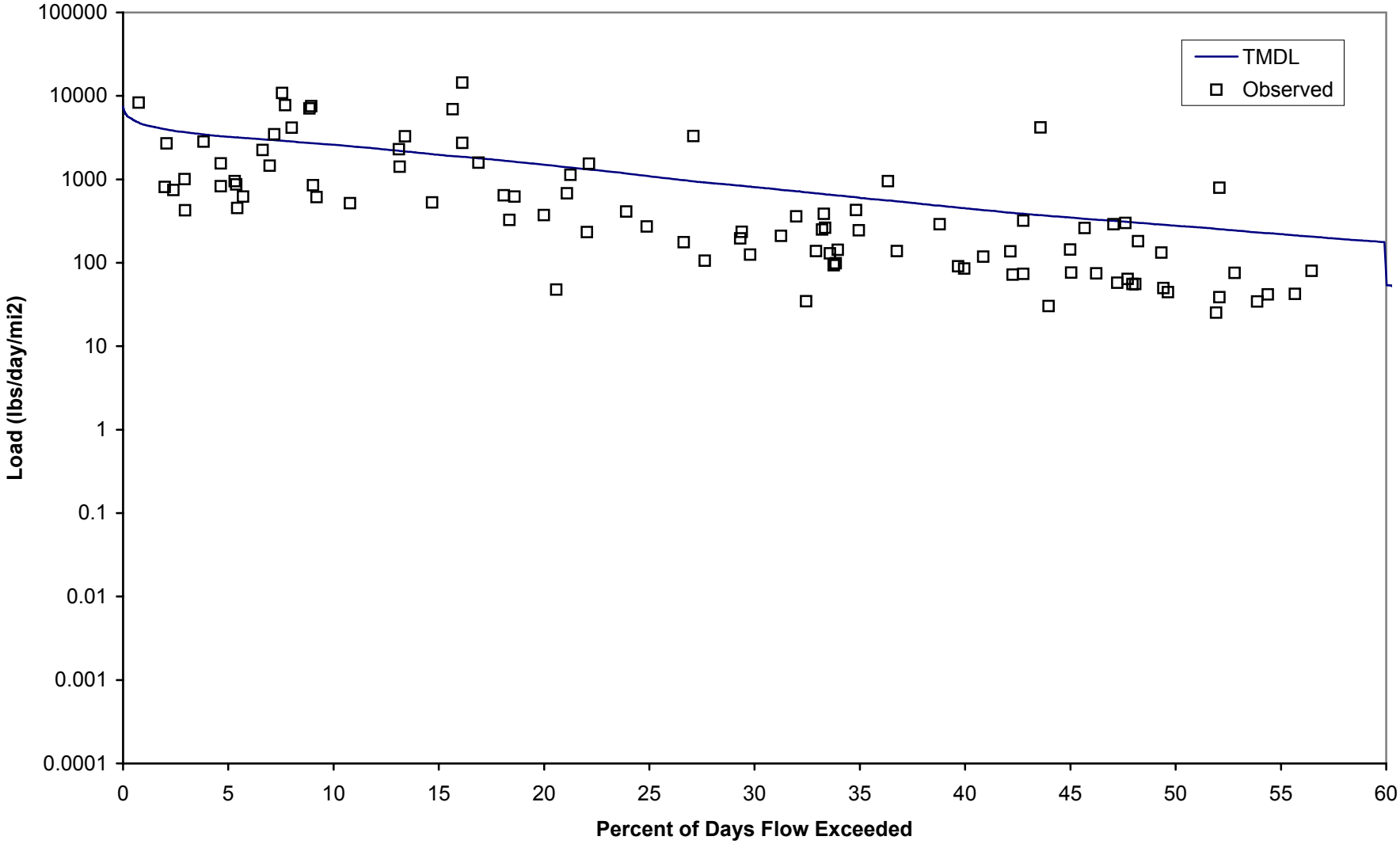


Figure F.6. Base Flow load Duration Curve for Bayou DeView (WHI0026)

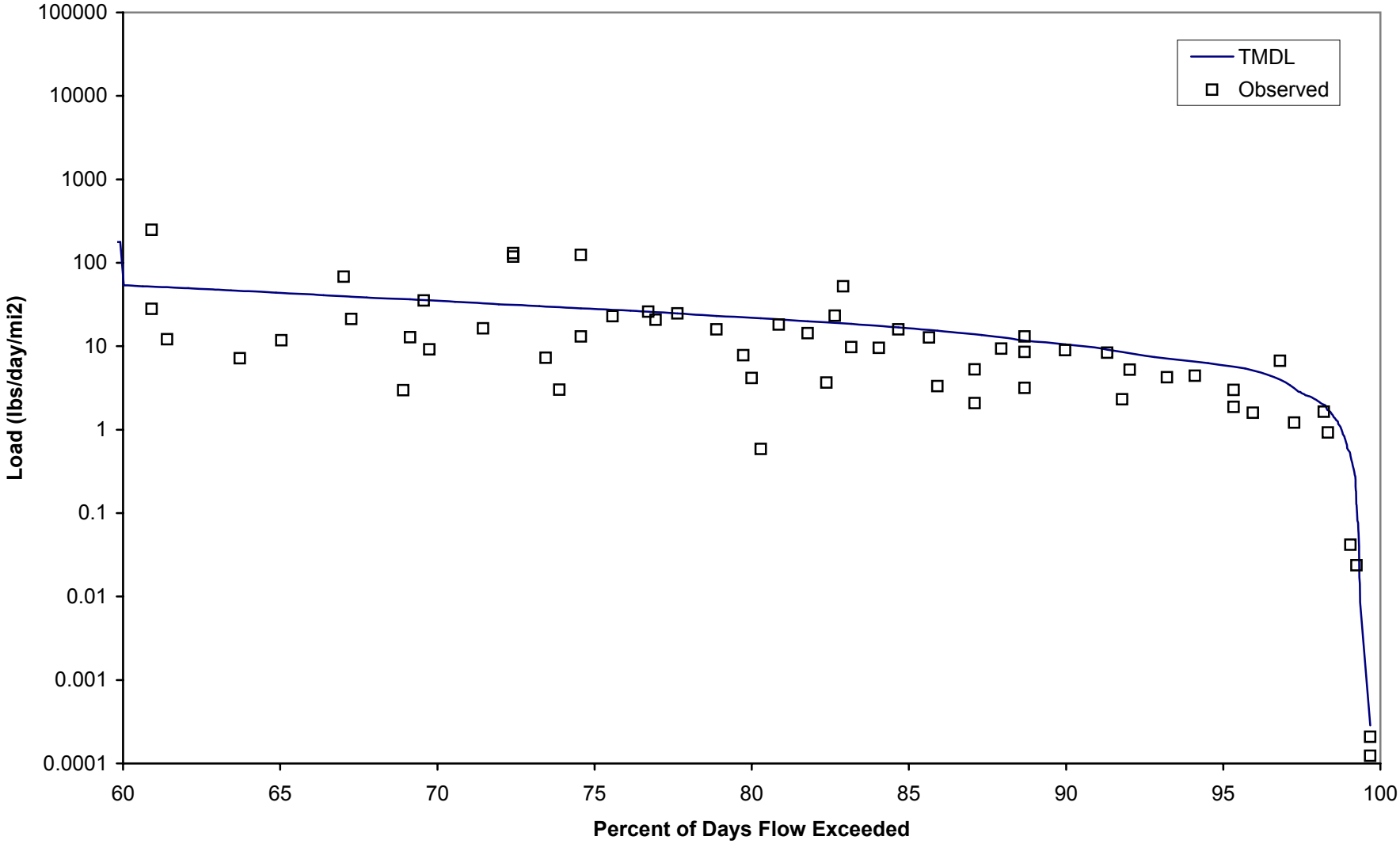


Figure F.7. Storm-Flow Load Duration Curve for Cache River at CHR0002

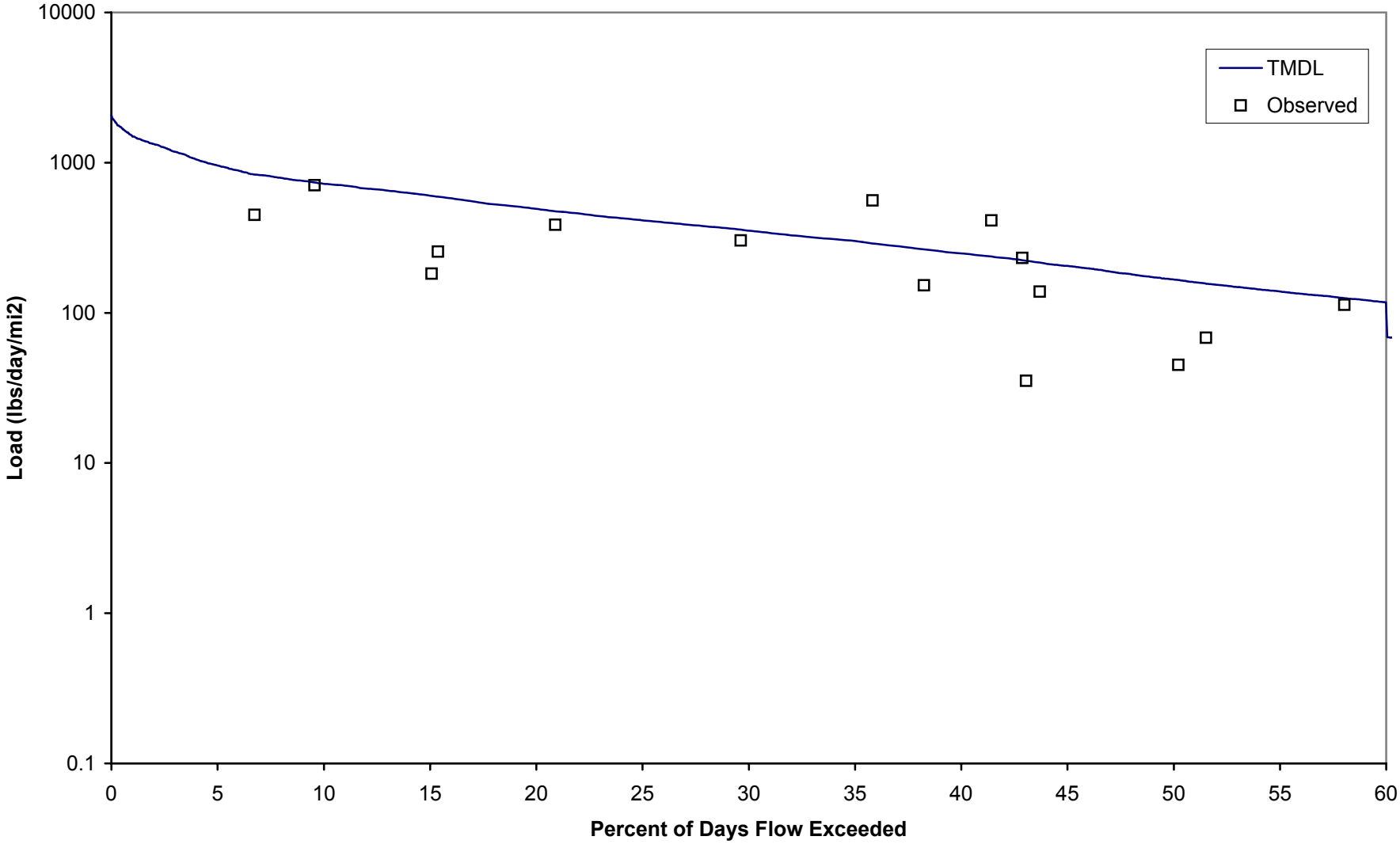


Figure F.8. Base Flow Load Duration Curve For Cache River at CHR0002

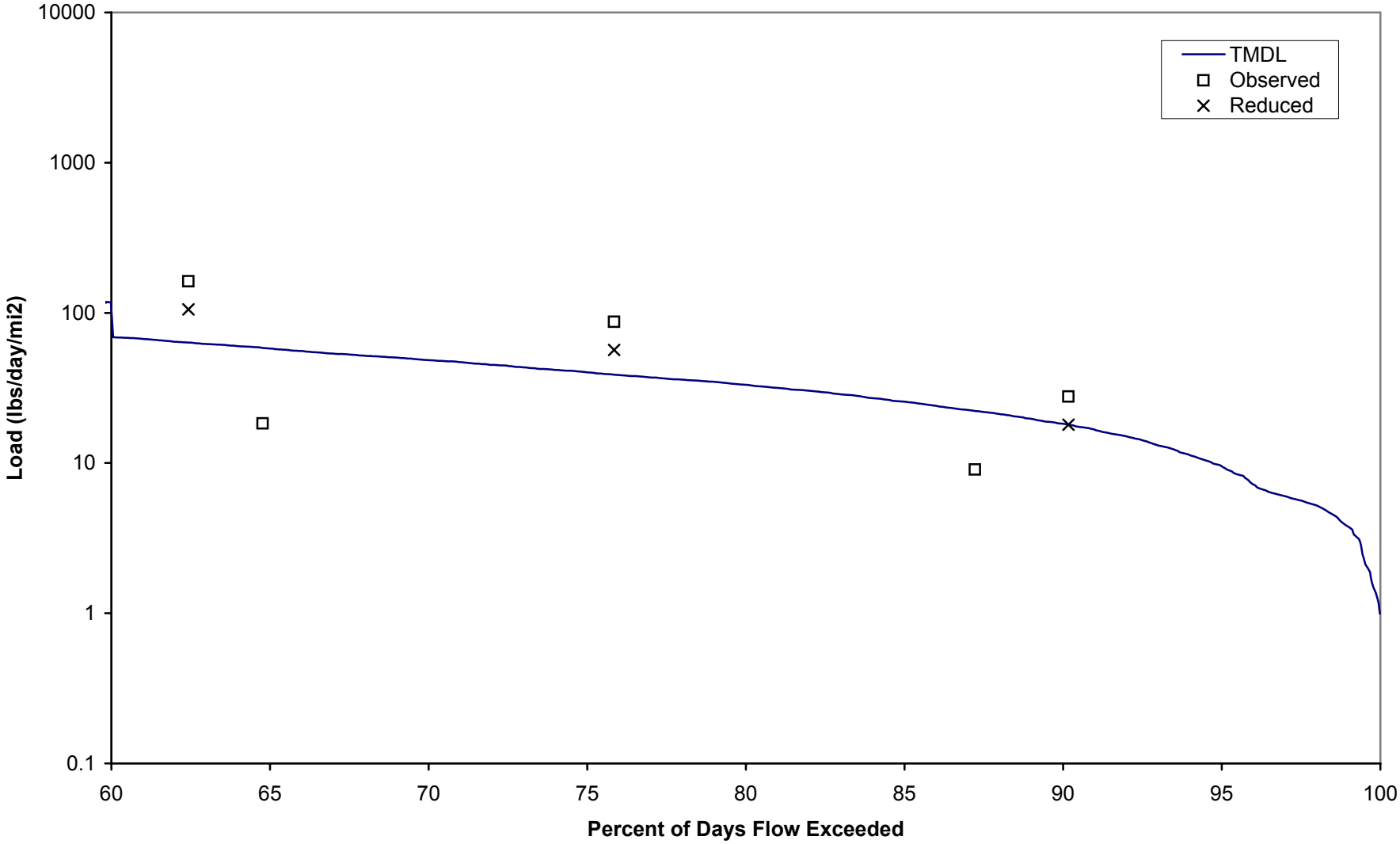


Figure F.9. Storm-Flow Load Duration Curve for Cache River (CHR0003)

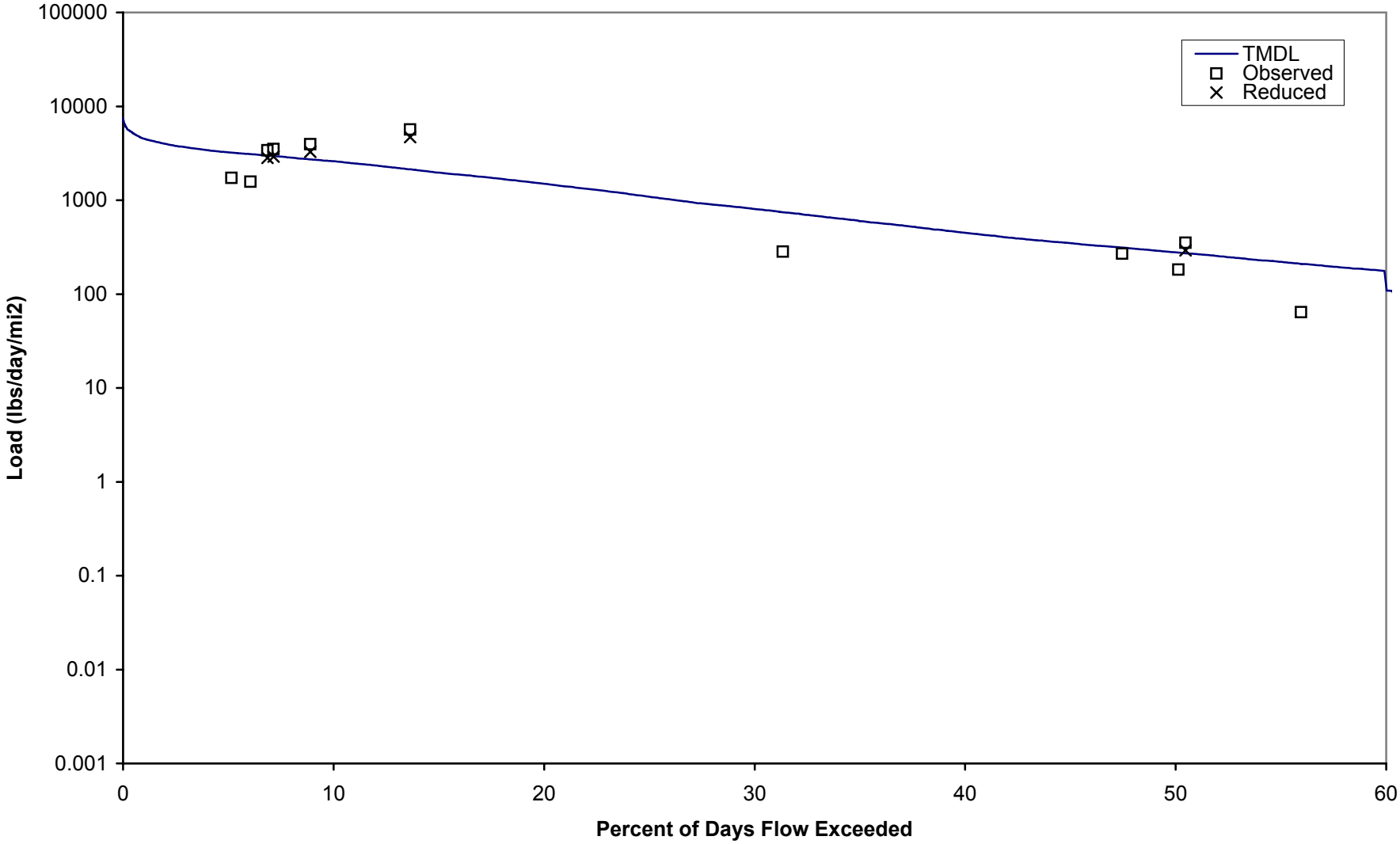


Figure F.10. Base Flow Load Duration Curve For Cache River (CHR0003)

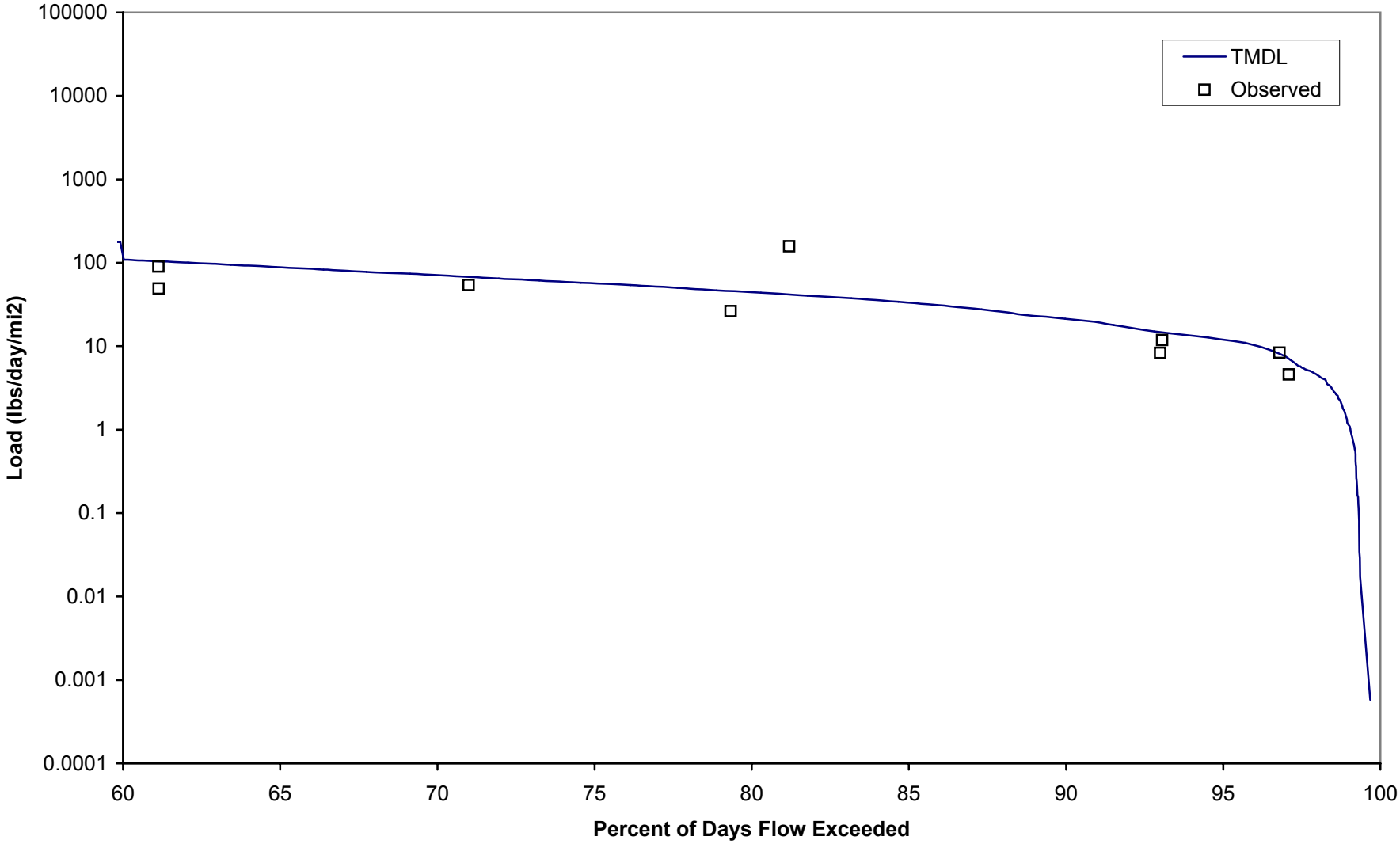


Figure F.11. Storm-Flow Load Duration Curve For Cache River (CHR0004)

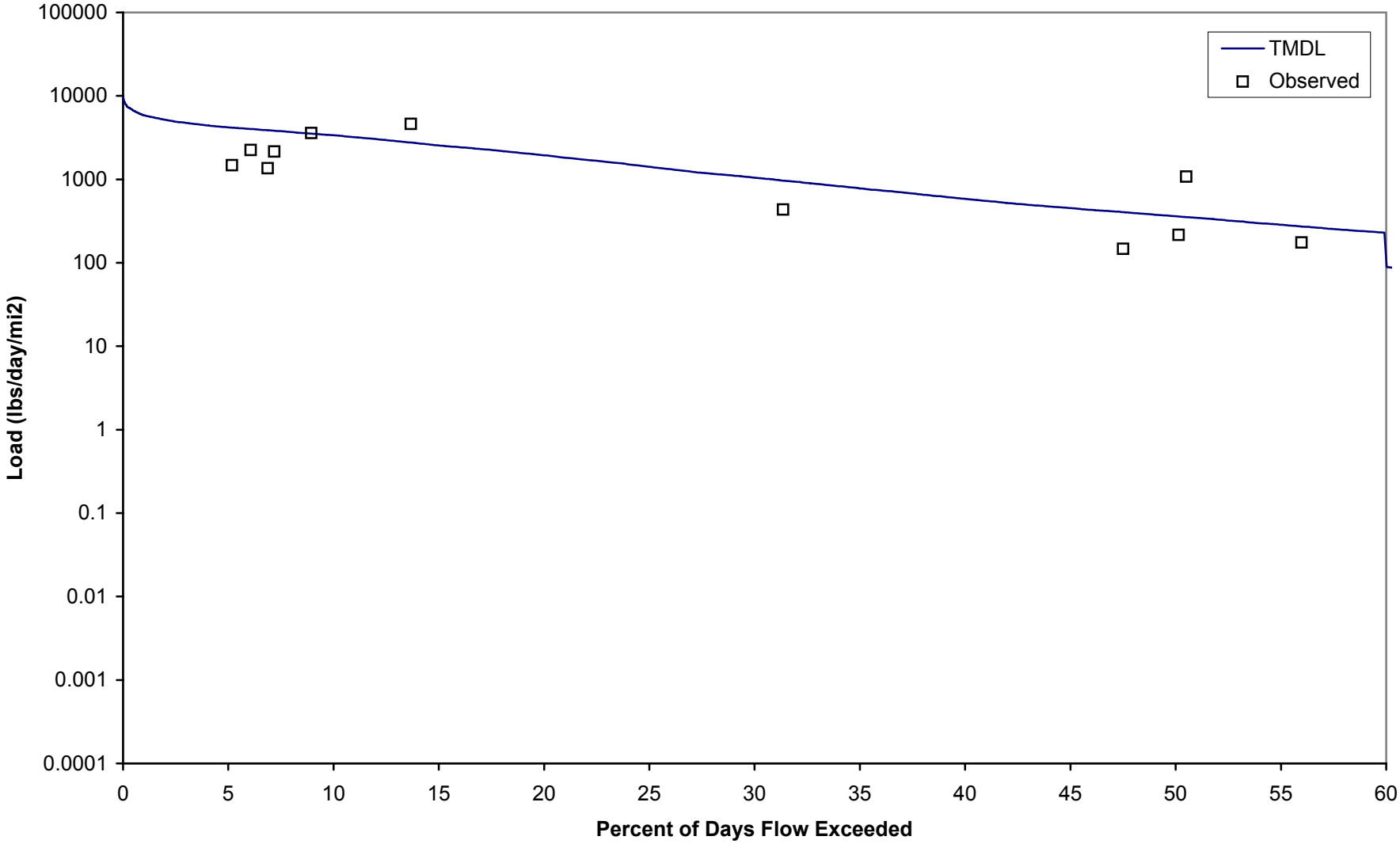


Figure F.12. Base Flow Load Duration Curve For Cache River (CHR0004)

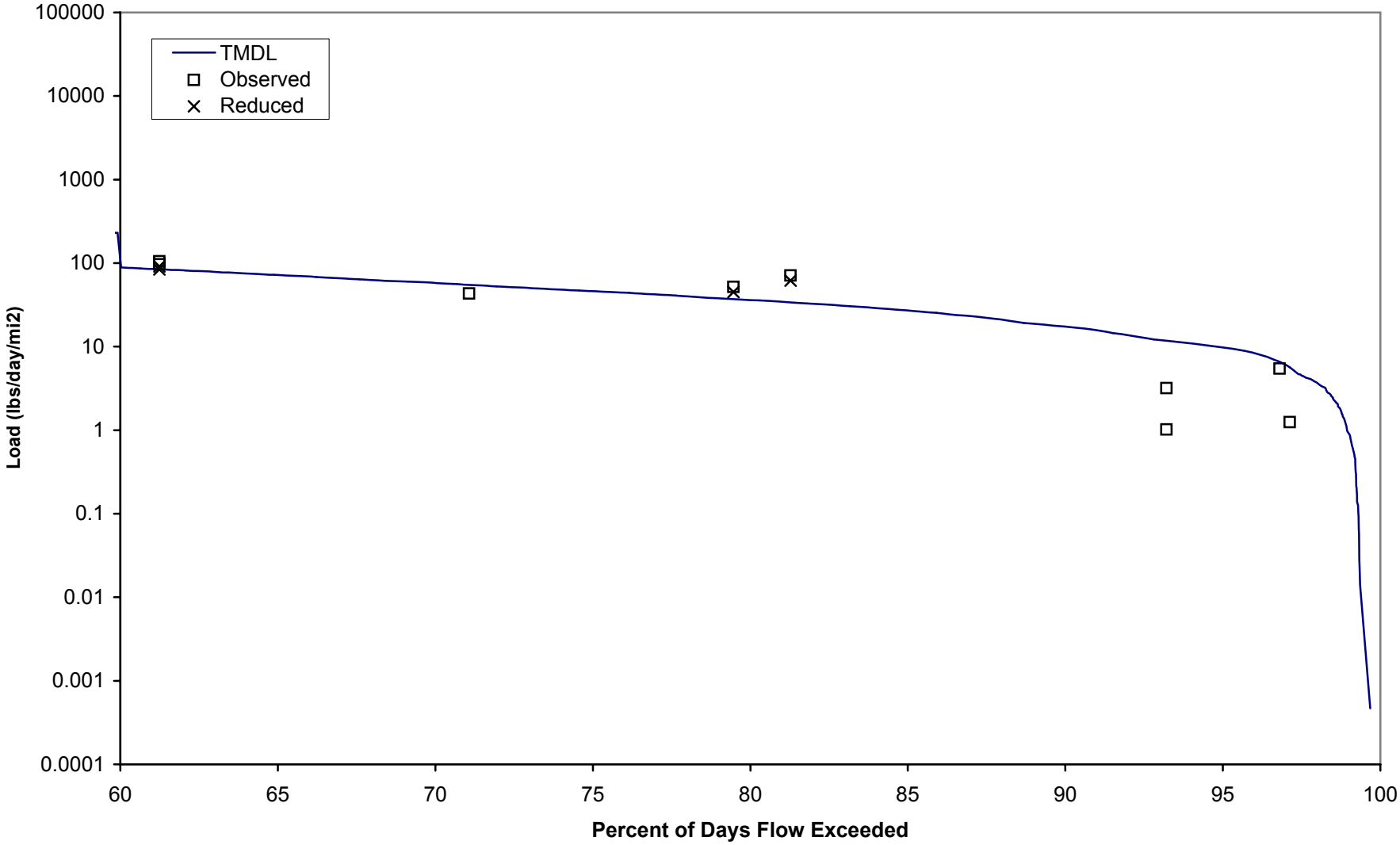


Table F.1. Calcuations for allowable TSS load for Bayou DeView (BDV0002).
drainage area at USGS flow gage = 1172 mi2, (Cache River near Cotton plant)

Date	Flow at gage (cfs)	Flow (cfs/mi2)	Percent of days flow exceeded	WQ Standard type	WQ Standard (NTU)	Target TSS (mg/L)	Allowable TSS load (lbs/day/mi2)
12/2/1999	8	6.83E-03	99.98%	Base flow	75	49	1.80E+00
12/1/1999	8.5	7.25E-03	99.96%	Base flow	75	49	1.92E+00
11/22/1999	9.4	8.02E-03	99.95%	Base flow	75	49	2.12E+00
The rows between 99.95 and 80.06 percent flow exceedances are not shown for the sake of brevity.							
10/14/1996	267	2.28E-01	80.06%	Base flow	75	49	6.02E+01
5/27/2000	267	2.28E-01	80.06%	Base flow	75	49	6.02E+01
8/23/2000	267	2.28E-01	80.06%	Base flow	75	49	6.02E+01
The rows between 80.06 and 60.05 percent flow exceedances are not shown for the sake of brevity.							
8/21/1994	554	4.73E-01	60.05%	Base flow	75	49	1.25E+02
4/9/1996	554	4.73E-01	60.05%	Base flow	75	49	1.25E+02
7/27/1998	554	4.73E-01	60.05%	Base flow	75	49	1.25E+02
5/22/1989	555	4.74E-01	59.98%	Storm-flow	250	94	2.40E+02
6/13/1992	555	4.74E-01	59.98%	Storm-flow	250	94	2.40E+02
9/14/1994	555	4.74E-01	59.98%	Storm-flow	250	94	2.40E+02
The rows between 59.98 and 30.12 percent flow exceedances are not shown for the sake of brevity.							
6/26/2000	1660	1.42E+00	30.12%	Storm-flow	250	94	7.18E+02
12/4/2001	1660	1.42E+00	30.12%	Storm-flow	250	94	7.18E+02
2/19/2003	1660	1.42E+00	30.12%	Storm-flow	250	94	7.18E+02
The rows between 30.12 and 0.04 percent flow exceedances are not shown for the sake of brevity.							
12/30/1987	9380	8.00E+00	0.04%	Storm-flow	250	94	4.06E+03
12/29/1987	9730	8.30E+00	0.02%	Storm-flow	250	94	4.21E+03
12/28/1987	9770	8.34E+00	0.00%	Storm-flow	250	94	4.23E+03

Flow per unit area in middle of base flow range (80% exceedance) =	0.228	cfs/mi2
Cumulative drainage area at downstream end of reach 004 =	505.2	mi2
Flow at downstream end of reach 004 for base flow conditions =	115	cfs
Target TSS for base flow conditions for reach 004 =	49	mg/L
Allowable TSS load for base flow conditions for reach 004 =	15.2	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.416	cfs/mi2
Cumulative drainage area at downstream end of reach 004 =	505.2	mi2
Flow at downstream end of reach 004 for stormwater conditions =	716	cfs
Target TSS for stormwater conditions for reach 004 =	94	mg/L
Allowable TSS load for stormwater conditions for reach 004 =	181	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.229	cfs/mi2
Cumulative drainage area at downstream end of reach 005 =	402.5	mi2
Flow at downstream end of reach 005 for base flow conditions =	92	cfs

Target TSS for base flow conditions for reach 005 =	49	mg/L
Allowable TSS load for base flow conditions for reach 005 =	12.2	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.433	cfs/mi2
Cumulative drainage area at downstream end of reach 005 =	402.5	mi2
Flow at downstream end of reach 005 for stormwater conditions =	577	cfs
Target TSS for stormwater conditions for reach 005 =	94	mg/L
Allowable TSS load for stormwater conditions for reach 005 =	146	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.231	cfs/mi2
Cumulative drainage area at downstream end of reach 006 =	352.9	mi2
Flow at downstream end of reach 006 for base flow conditions =	82	cfs
Target TSS for base flow conditions for reach 006 =	49	mg/L
Allowable TSS load for base flow conditions for reach 006 =	10.8	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.442	cfs/mi2
Cumulative drainage area at downstream end of reach 006 =	352.9	mi2
Flow at downstream end of reach 006 for stormwater conditions =	509	cfs
Target TSS for stormwater conditions for reach 006 =	94	mg/L
Allowable TSS load for stormwater conditions for reach 006 =	129	tons/day

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Table F.1. Allowable Load Calculations BDV0002

Table F.2. Calcuations for allowable TSS load for Bayou DeView (WHI0026).
drainage area at USGS flow gage = 701 mi2, at (Cache River at Egypt)

Date	Flow at gage (cfs)	Flow (cfs/mi2)	Percent of days flow exceeded	WQ Standard type	WQ Standard (NTU)	Target TSS (mg/L)	Allowable TSS load (lbs/day/mi2)
1982-11-06	1.00E-03	1.43E-06	99.68%	Base flow	75	37	2.85E-04
1982-11-07	1.00E-03	1.43E-06	99.68%	Base flow	75	37	2.85E-04
1982-11-08	1.00E-03	1.43E-06	99.68%	Base flow	75	37	2.85E-04
The rows between 99.68 and 80.00 percent flow exceedances are not shown for the sake of brevity.							
1998-09-12	7.70E+01	1.10E-01	80.00%	Base flow	75	37	2.19E+01
2000-12-29	7.70E+01	1.10E-01	80.00%	Base flow	75	37	2.19E+01
2001-03-25	7.70E+01	1.10E-01	80.00%	Base flow	75	37	2.19E+01
The rows between 80.00 and 60.03 percent flow exceedances are not shown for the sake of brevity.							
1995-11-04	1.89E+02	2.70E-01	60.03%	Base flow	75	37	5.38E+01
1997-07-10	1.89E+02	2.70E-01	60.03%	Base flow	75	37	5.38E+01
2003-03-13	1.89E+02	2.70E-01	60.03%	Base flow	75	37	5.38E+01
1971-08-02	1.90E+02	2.71E-01	59.91%	Storm-flow	250	121	1.77E+02
1974-09-19	1.90E+02	2.71E-01	59.91%	Storm-flow	250	121	1.77E+02
1975-01-28	1.90E+02	2.71E-01	59.91%	Storm-flow	250	121	1.77E+02
The rows between 59.91 and 30.00 percent flow exceedances are not shown for the sake of brevity.							
1977-04-13	8.66E+02	1.24E+00	30.00%	Storm-flow	250	121	8.06E+02
1982-05-10	8.66E+02	1.24E+00	30.00%	Storm-flow	250	121	8.06E+02
1985-12-08	8.66E+02	1.24E+00	30.00%	Storm-flow	250	121	8.06E+02
The rows between 30.00 and 0.01 percent flow exceedances are not shown for the sake of brevity.							
1973-04-24	7.70E+03	1.10E+01	0.01%	Storm-flow	250	121	7.17E+03
1973-04-26	7.91E+03	1.13E+01	0.01%	Storm-flow	250	121	7.36E+03
1973-04-25	7.94E+03	1.13E+01	0.00%	Storm-flow	250	121	7.39E+03

Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 007 =	277.7	mi2
Flow at downstream end of reach 007 for base flow conditions =	31	cfs
Target TSS for base flow conditions for reach 007 =	37	mg/L
Allowable TSS load for base flow conditions for reach 007 =	3.04	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.24	cfs/mi2
Cumulative drainage area at downstream end of reach 007 =	277.7	mi2
Flow at downstream end of reach 007 for stormwater conditions =	343	cfs
Target TSS for stormwater conditions for reach 007 =	121	mg/L
Allowable TSS load for stormwater conditions for reach 007 =	112	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 009 =	171.7	mi2
Flow at downstream end of reach 009 for base flow conditions =	19	cfs

Target TSS for base flow conditions for reach 009 =	37	mg/L
Allowable TSS load for base flow conditions for reach 009 =	1.88	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.24	cfs/mi2
Cumulative drainage area at downstream end of reach 009 =	171.7	mi2
Flow at downstream end of reach 009 for stormwater conditions =	212	cfs
Target TSS for stormwater conditions for reach 009 =	121	mg/L
Allowable TSS load for stormwater conditions for reach 009 =	69.2	tons/day

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Table F.3. Calcuations for allowable load for Cache River at CHR0002.
drainage area at USGS flow gage = 1172 mi2, (Cache River near Cotton Plant)

Date	Flow at gage (cfs)	Flow (cfs/mi2)	Percent of days flow exceeded	WQ Standard type	WQ Standard (NTU)	Target TSS (mg/L)	Allowable TSS load (lbs/day/mi2)
12/02/99	8	6.83E-03	99.98%	Base flow	75	27	9.94E-01
12/01/99	8.5	7.25E-03	99.96%	Base flow	75	27	1.06E+00
11/22/99	9.4	8.02E-03	99.95%	Base flow	75	27	1.17E+00
The rows between 99.95 and 80.06 percent flow exceedances are not shown for the sake of brevity.							
10/14/96	267	2.28E-01	80.06%	Base flow	75	27	3.32E+01
05/27/00	267	2.28E-01	80.06%	Base flow	75	27	3.32E+01
08/23/00	267	2.28E-01	80.06%	Base flow	75	27	3.32E+01
The rows between 80.06 and 60.05 percent flow exceedances are not shown for the sake of brevity.							
08/21/94	554	4.73E-01	60.05%	Base flow	75	27	6.88E+01
04/09/96	554	4.73E-01	60.05%	Base flow	75	27	6.88E+01
07/27/98	554	4.73E-01	60.05%	Base flow	75	27	6.88E+01
05/22/89	555	4.74E-01	59.98%	Storm-flow	250	46	1.17E+02
06/13/92	555	4.74E-01	59.98%	Storm-flow	250	46	1.17E+02
09/14/94	555	4.74E-01	59.98%	Storm-flow	250	46	1.17E+02
The rows between 59.98 and 30.12 percent flow exceedances are not shown for the sake of brevity.							
06/26/00	1660	1.42E+00	30.12%	Storm-flow	250	46	3.51E+02
12/04/01	1660	1.42E+00	30.12%	Storm-flow	250	46	3.51E+02
02/19/03	1660	1.42E+00	30.12%	Storm-flow	250	46	3.51E+02
The rows between 30.12 and 0.04 percent flow exceedances are not shown for the sake of brevity.							
12/30/87	9380	8.00E+00	0.04%	Storm-flow	250	46	1.99E+03
12/29/87	9730	8.30E+00	0.02%	Storm-flow	250	46	2.06E+03
12/28/87	9770	8.34E+00	0.00%	Storm-flow	250	46	2.07E+03

Flow per unit area in middle of base flow range (80% exceedance) =	0.228	cfs/mi2
Cumulative drainage area at downstream end of reach 016 =	1282.5	mi2
Flow at downstream end of reach 016 for base flow conditions =	292	cfs
Target TSS for base flow conditions for reach 016 =	27	mg/L
Allowable TSS load for base flow conditions for reach 016 =	21.3	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.416	cfs/mi2
Cumulative drainage area at downstream end of reach 016 =	1282.5	mi2
Flow at downstream end of reach 016 for stormwater conditions =	1817	cfs
Target TSS for stormwater conditions for reach 016 =	46	mg/L
Allowable TSS load for stormwater conditions for reach 016 =	225	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.228	cfs/mi2
Cumulative drainage area at downstream end of reach 017 =	1168.1	mi2
Flow at downstream end of reach 017 for base flow conditions =	266.112	cfs

Target TSS for base flow conditions for reach 017 =	27	mg/L
Allowable TSS load for base flow conditions for reach 017 =	19.4	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.416	cfs/mi2
Cumulative drainage area at downstream end of reach 017 =	1168.1	mi2
Flow at downstream end of reach 017 for stormwater conditions =	1654	cfs
Target TSS for stormwater conditions for reach 017 =	46	mg/L
Allowable TSS load for stormwater conditions for reach 017 =	205	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.228	cfs/mi2
Cumulative drainage area at downstream end of reach 018 =	1151.5	mi2
Flow at downstream end of reach 018 for base flow conditions =	262	cfs
Target TSS for base flow conditions for reach 018 =	27	mg/L
Allowable TSS load for base flow conditions for reach 018 =	19.1	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.416	cfs/mi2
Cumulative drainage area at downstream end of reach 018 =	1151.5	mi2
Flow at downstream end of reach 018 for stormwater conditions =	1631	cfs
Target TSS for stormwater conditions for reach 018 =	46	mg/L
Allowable TSS load for stormwater conditions for reach 018 =	202	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.228	cfs/mi2
Cumulative drainage area at downstream end of reach 019 =	1007.2	mi2
Flow at downstream end of reach 019 for base flow conditions =	229	cfs
Target TSS for base flow conditions for reach 019 =	27	mg/L
Allowable TSS load for base flow conditions for reach 019 =	16.7	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.416	cfs/mi2
Cumulative drainage area at downstream end of reach 019 =	1007.2	mi2
Flow at downstream end of reach 019 for stormwater conditions =	1427	cfs
Target TSS for stormwater conditions for reach 019 =	46	mg/L
Allowable TSS load for stormwater conditions for reach 019 =	176.9	tons/day

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Table F.4. Calcuations for allowable load for Cache River (CHR0003).
drainage area at USGS flow gage = 701 mi2, (Cache River at Egpyt)

Date	Flow at gage (cfs)	Flow (cfs/mi2)	Percent of days flow exceeded	WQ Standard type	WQ Standard (NTU)	Target TSS (mg/L)	Allowable TSS load (lbs/day/mi2)
1982-11-06	0.001	1.43E-06	99.68%	Base flow	75	75	5.77E-04
1982-11-07	0.001	1.43E-06	99.68%	Base flow	75	75	5.77E-04
1982-11-08	0.001	1.43E-06	99.68%	Base flow	75	75	5.77E-04
The rows between 99.68 and 80.00 percent flow exceedances are not shown for the sake of brevity.							
1998-09-12	77	1.10E-01	80.00%	Base flow	75	75	4.44E+01
2000-12-29	77	1.10E-01	80.00%	Base flow	75	75	4.44E+01
2001-03-25	77	1.10E-01	80.00%	Base flow	75	75	4.44E+01
The rows between 80.00 and 60.03 percent flow exceedances are not shown for the sake of brevity.							
1995-11-04	189	2.70E-01	60.03%	Base flow	75	75	1.09E+02
1997-07-10	189	2.70E-01	60.03%	Base flow	75	75	1.09E+02
2003-03-13	189	2.70E-01	60.03%	Base flow	75	75	1.09E+02
1971-08-02	190	2.71E-01	59.91%	Storm-flow	250	121	1.77E+02
1974-09-19	190	2.71E-01	59.91%	Storm-flow	250	121	1.77E+02
1975-01-28	190	2.71E-01	59.91%	Storm-flow	250	121	1.77E+02
The rows between 59.91 and 30.04 percent flow exceedances are not shown for the sake of brevity.							
1975-03-09	864	1.23E+00	30.04%	Storm-flow	250	121	8.04E+02
1985-03-26	865	1.23E+00	30.02%	Storm-flow	250	121	8.05E+02
1999-08-09	865	1.23E+00	30.02%	Storm-flow	250	121	8.05E+02
The rows between 30.02 and 0.01 percent flow exceedances are not shown for the sake of brevity.							
1973-04-24	7700	1.10E+01	0.01%	Storm-flow	250	121	7.17E+03
1973-04-26	7910	1.13E+01	0.01%	Storm-flow	250	121	7.36E+03
1973-04-25	7940	1.13E+01	0.00%	Storm-flow	250	121	7.39E+03

Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 020 =	863.3	mi2
Flow at downstream end of reach 020 for base flow conditions =	95	cfs
Target TSS for base flow conditions for reach 020 =	75	mg/L
Allowable TSS load for base flow conditions for reach 020 =	19.3	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.23	cfs/mi2
Cumulative drainage area at downstream end of reach 020 =	863.3	mi2
Flow at downstream end of reach 020 for stormwater conditions =	1064	cfs
Target TSS for stormwater conditions for reach 020 =	121	mg/L
Allowable TSS load for stormwater conditions for reach 020 =	347	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 021 =	773.7	mi2
Flow at downstream end of reach 021 for base flow conditions =	85	cfs

Date	Flow at gage (cfs)	Flow (cfs/mi2)	Percent of days flow exceeded	WQ Standard type	WQ Standard (NTU)	Target TSS (mg/L)	Allowable TSS load (lbs/day/mi2)
Target TSS for base flow conditions for reach 021 =						75	mg/L
Allowable TSS load for base flow conditions for reach 021 =						17.3	tons/day
Flow in middle of stormwater range (30% exceedance) =						1.23	cfs/mi2
Cumulative drainage area at downstream end of reach 021 =						773.7	mi2
Flow at downstream end of reach 021 for stormwater conditions =						954	cfs
Target TSS for stormwater conditions for reach 021 =						121	mg/L
Allowable TSS load for stormwater conditions for reach 021 =						311	tons/day

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Table F.5. Calcuations for allowable load for Cache River (CHR0004).
drainage area at USGS flow gage = 701 mi2, (Cache River at Egypt)

Date	Flow at gage (cfs)	Flow (cfs/mi2)	Percent of days flow exceeded	WQ Standard type	WQ Standard (NTU)	Target TSS (mg/L)	Allowable TSS load (lbs/day/mi2)
1982-11-06	0.001	1.43E-06	99.68%	Base flow	75	61	4.69E-04
1982-11-07	0.001	1.43E-06	99.68%	Base flow	75	61	4.69E-04
1982-11-08	0.001	1.43E-06	99.68%	Base flow	75	61	4.69E-04
The rows between 99.68 and 80.00 percent flow exceedances are not shown for the sake of brevity.							
1998-09-12	77	1.10E-01	80.00%	Base flow	75	61	3.61E+01
2000-12-29	77	1.10E-01	80.00%	Base flow	75	61	3.61E+01
2001-03-25	77	1.10E-01	80.00%	Base flow	75	61	3.61E+01
The rows between 80.00 and 60.03 percent flow exceedances are not shown for the sake of brevity.							
1995-11-04	189	2.70E-01	60.03%	Base flow	75	61	8.87E+01
1997-07-10	189	2.70E-01	60.03%	Base flow	75	61	8.87E+01
2003-03-13	189	2.70E-01	60.03%	Base flow	75	61	8.87E+01
1971-08-02	190	2.71E-01	59.91%	Storm-flow	250	157	2.29E+02
1974-09-19	190	2.71E-01	59.91%	Storm-flow	250	157	2.29E+02
1975-01-28	190	2.71E-01	59.91%	Storm-flow	250	157	2.29E+02
The rows between 59.91 and 30.04 percent flow exceedances are not shown for the sake of brevity.							
1975-03-09	864	1.23E+00	30.04%	Storm-flow	250	157	1.04E+03
1985-03-26	865	1.23E+00	30.02%	Storm-flow	250	157	1.04E+03
1999-08-09	865	1.23E+00	30.02%	Storm-flow	250	157	1.04E+03
The rows between 30.02 and 0.01 percent flow exceedances are not shown for the sake of brevity.							
1973-04-24	7700	1.10E+01	0.01%	Storm-flow	250	157	9.30E+03
1973-04-26	7910	1.13E+01	0.01%	Storm-flow	250	157	9.55E+03
1973-04-25	7940	1.13E+01	0.00%	Storm-flow	250	157	9.59E+03

Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of Reach 027 =	581.5	mi2
Flow at downstream end of Reach 027 for base flow conditions =	64	cfs
Target TSS for base flow conditions for Reach 027 =	61	mg/L
Allowable TSS load for base flow conditions for Reach 027 =	10.5	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.23	cfs/mi2
Cumulative drainage area at downstream end of Reach 027 =	581.5	mi2
Flow at downstream end of Reach 027 for stormwater conditions =	718	cfs
Target TSS for stormwater conditions for Reach 027 =	157	mg/L
Allowable TSS load for stormwater conditions for Reach 027 =	304	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 028 =	510.2	mi2
Flow at downstream end of reach 028 for base flow conditions =	56	cfs

Target TSS for base flow conditions for reach 028 =	61	mg/L
Allowable TSS load for base flow conditions for reach 028 =	9.22	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.23	cfs/mi2
Cumulative drainage area at downstream end of reach 028 =	510.2	mi2
Flow at downstream end of reach 028 for stormwater conditions =	630	cfs
Target TSS for stormwater conditions for reach 028 =	157	mg/L
Allowable TSS load for stormwater conditions for reach 028 =	267	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 029 =	455.2	mi2
Flow at downstream end of reach 029 for base flow conditions =	50	cfs
Target TSS for base flow conditions for reach 029 =	61	mg/L
Allowable TSS load for base flow conditions for reach 029 =	8.22	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.23	cfs/mi2
Cumulative drainage area at downstream end of reach 029 =	455.2	mi2
Flow at downstream end of reach 029 for stormwater conditions =	562	cfs
Target TSS for stormwater conditions for reach 029 =	157	mg/L
Allowable TSS load for stormwater conditions for reach 029 =	238	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 031 =	413.3	mi2
Flow at downstream end of reach 031 for base flow conditions =	45.4	cfs
Target TSS for base flow conditions for reach 031 =	61	mg/L
Allowable TSS load for base flow conditions for reach 031 =	7.47	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.23	cfs/mi2
Cumulative drainage area at downstream end of reach 031 =	413.3	mi2
Flow at downstream end of reach 031 for stormwater conditions =	510	cfs
Target TSS for stormwater conditions for reach 031 =	157	mg/L
Allowable TSS load for stormwater conditions for reach 031 =	216	tons/day
Flow per unit area in middle of base flow range (80% exceedance) =	0.110	cfs/mi2
Cumulative drainage area at downstream end of reach 032 =	355.7	mi2
Flow at downstream end of reach 032 for base flow conditions =	39	cfs
Target TSS for base flow conditions for reach 032 =	61	mg/L
Allowable TSS load for base flow conditions for reach 032 =	6.43	tons/day
Flow in middle of stormwater range (30% exceedance) =	1.23	cfs/mi2
Cumulative drainage area at downstream end of reach 032 =	355.7	mi2
Flow at downstream end of reach 032 for stormwater conditions =	439	cfs
Target TSS for stormwater conditions for reach 032 =	157	mg/L
Allowable TSS load for stormwater conditions for reach 032 =	186	tons/day

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TABLE F.6. CALCULATIONS FOR PERCENT REDUCTION FOR STORM-FLOW CONDITIONS
FOR BAYOU DEVIEW (STATION BDV00002)

Storm-flow target TSS conc. =	94 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	0%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at BDV0002 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	9/12/1994	48	0.51	58.03%	130.8	130.8	256.1	Yes
Storm-flow	9/23/2002	13.8	0.63	51.52%	46.9	46.9	319.2	Yes
Storm-flow	1/16/1995	159.5	0.67	50.22%	574.7	574.7	338.7	No
Storm-flow	10/7/1996	40.5	0.87	43.69%	190.1	190.1	441.2	Yes
Storm-flow	10/22/2001	13	0.90	43.06%	62.8	62.8	454.2	Yes
Storm-flow	6/23/2003	50	0.90	42.88%	243.9	243.9	458.5	Yes
Storm-flow	5/6/1996	49	0.96	41.41%	252.5	252.5	484.4	Yes
Storm-flow	6/13/1994	65	1.07	38.25%	373.9	373.9	540.7	Yes
Storm-flow	7/17/1995	33	1.17	35.82%	208.0	208.0	592.6	Yes
Storm-flow	5/21/2002	66	1.44	29.62%	513.2	513.2	731.0	Yes
Storm-flow	1/28/2002	58.5	1.91	20.89%	603.0	603.0	968.9	Yes
Storm-flow	7/29/2002	11	2.12	18.23%	125.5	125.5	1072.7	Yes
Storm-flow	1/7/2003	19	2.39	15.37%	244.8	244.8	1211.1	Yes
Storm-flow	3/25/2002	42	2.98	9.57%	674.5	674.5	1509.6	Yes
Storm-flow	3/10/2003	56	3.36	6.74%	1015.3	1015.3	1704.2	Yes

Total number of values =	15
Allowable % of exceedances =	20%
Allowable no. of exceedances =	3
No. of exceedances before reductions =	1
No. of exceedances after reductions =	1

Table F.6. Storm-flow percent reduction
BDV0002

TABLE F.7. CALCULATIONS FOR PERCENT REDUCTION FOR BASE FLOW CONDITIONS
FOR BAYOU DEVIEW (STATION BDV00002)

Base flow target TSS conc. =	49 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	35%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at BDV0002 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Base flow	4/10/1995	75	0.12	90.17%	50.0	32.5	32.7	Yes
Base flow	11/4/2002	20	0.15	87.22%	16.5	10.7	40.4	Yes
Base flow	4/28/2003	170	0.27	75.85%	244.1	158.6	70.3	No
Base flow	8/25/2003	98.6	0.40	64.77%	213.2	138.6	106.0	No
Base flow	10/2/1995	41	0.44	62.43%	96.4	62.7	115.2	Yes

Total number of values =	5
Allowable % of exceedances =	25%
Allowable no. of exceedances =	2
No. of exceedances before reductions =	3
No. of exceedances after reductions =	2

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TABLE F.8. CALCULATIONS FOR PERCENT REDUCTION FOR STORM-FLOW CONDITIONS
FOR BAYOU DEVIEW (STATION WHI0026)

Storm-flow target TSS conc. =	121 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	0%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at WHI0026 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	8/6/1996	47.0	0.32	56.47%	79.91	79.91	205.72	Yes
Storm-flow	3/22/1994	24.0	0.33	55.66%	42.28	42.28	213.17	Yes
Storm-flow	8/3/2004	22.2	0.35	54.37%	41.67	41.67	227.13	Yes
Storm-flow	1/21/1992	18.0	0.35	53.88%	34.34	34.34	230.86	Yes
Storm-flow	8/16/1994	37.5	0.37	52.80%	75.59	75.59	243.89	Yes
Storm-flow	10/21/2003	18.5	0.39	52.09%	38.71	38.71	253.20	Yes
Storm-flow	8/29/1995	12.0	0.39	51.92%	25.30	25.30	255.06	Yes
Storm-flow	3/23/1999	19.0	0.43	49.63%	44.44	44.44	282.98	Yes
Storm-flow	2/13/2001	21.0	0.44	49.42%	49.60	49.60	285.78	Yes
Storm-flow	9/3/1996	56.0	0.44	49.33%	132.69	132.69	286.71	Yes
Storm-flow	8/1/1995	72.5	0.46	48.22%	180.71	180.71	301.60	Yes
Storm-flow	8/19/2003	22.2	0.47	48.08%	55.68	55.68	303.46	Yes
Storm-flow	7/20/1999	22.0	0.47	47.95%	55.51	55.51	305.33	Yes
Storm-flow	7/18/2000	25.0	0.47	47.72%	63.85	63.85	309.05	Yes
Storm-flow	8/13/1991	117.0	0.48	47.61%	300.63	300.63	310.91	Yes
Storm-flow	6/1/1993	22.0	0.49	47.23%	57.54	57.54	316.50	Yes
Storm-flow	6/9/1992	110.0	0.49	47.05%	289.42	289.42	318.36	Yes
Storm-flow	10/1/1996	27.5	0.50	46.23%	74.68	74.68	328.60	Yes
Storm-flow	3/22/2005	290.0	0.50	52.09%	789.78	789.78	329.53	No
Storm-flow	9/11/1990	94.0	0.51	45.68%	261.06	261.06	336.04	Yes
Storm-flow	7/23/2002	26.5	0.53	45.04%	76.25	76.25	348.15	Yes
Storm-flow	4/9/1991	50.0	0.53	44.99%	144.25	144.25	349.08	Yes
Storm-flow	11/12/2002	10.0	0.56	43.96%	30.16	30.16	364.90	Yes
Storm-flow	3/16/1993	1358.0	0.57	43.58%	4178.92	4178.92	372.35	No

Category	Date	Observed TSS at WHI0026 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	7/16/1996	100.0	0.59	42.76%	320.03	320.03	387.24	Yes
Storm-flow	7/16/1996	23.0	0.59	42.76%	73.61	73.61	387.24	Yes
Storm-flow	8/24/1999	22.0	0.61	42.26%	72.10	72.10	396.55	Yes
Storm-flow	5/27/2003	41.5	0.61	42.15%	136.65	136.65	398.41	Yes
Storm-flow	2/19/2002	33.5	0.65	40.86%	118.29	118.29	427.27	Yes
Storm-flow	1/6/2004	22.8	0.69	39.96%	85.25	85.25	452.40	Yes
Storm-flow	1/23/2001	24.0	0.70	39.67%	90.84	90.84	457.99	Yes
Storm-flow	6/11/1996	72.5	0.74	38.79%	290.03	290.03	484.05	Yes
Storm-flow	3/2/2004	30.5	0.84	36.76%	137.50	137.50	545.49	Yes
Storm-flow	10/12/1999	206.5	0.86	36.33%	953.18	953.18	558.52	No
Storm-flow	2/3/2004	49.2	0.92	34.96%	244.89	244.89	602.27	Yes
Storm-flow	1/6/1998	85.0	0.94	34.82%	428.97	428.97	610.65	Yes
Storm-flow	5/28/2002	27.0	0.98	33.95%	142.49	142.49	638.58	Yes
Storm-flow	9/18/2001	18.5	0.99	33.86%	98.35	98.35	643.23	Yes
Storm-flow	5/8/2001	17.5	0.99	33.77%	93.57	93.57	646.96	Yes
Storm-flow	2/23/1993	24.0	1.00	33.59%	129.80	129.80	654.40	Yes
Storm-flow	9/10/1991	48.0	1.01	33.35%	262.55	262.55	661.85	Yes
Storm-flow	8/4/1992	70.0	1.02	33.29%	385.04	385.04	665.57	Yes
Storm-flow	8/10/1993	45.0	1.03	33.21%	249.26	249.26	670.23	Yes
Storm-flow	12/2/2003	24.5	1.04	32.92%	137.78	137.78	680.47	Yes
Storm-flow	9/21/1993	6.0	1.07	32.45%	34.62	34.62	698.15	Yes
Storm-flow	7/22/2003	60.6	1.10	31.98%	360.38	360.38	719.56	Yes
Storm-flow	9/1/1992	34.0	1.14	31.26%	209.78	209.78	746.56	Yes
Storm-flow	5/10/1994	18.5	1.26	29.79%	125.24	125.24	819.17	Yes
Storm-flow	4/13/1993	34.0	1.28	29.39%	235.41	235.41	837.78	Yes
Storm-flow	4/16/2002	28.2	1.29	29.31%	196.12	196.12	841.51	Yes
Storm-flow	1/23/1996	14.0	1.41	27.64%	106.09	106.09	916.91	Yes
Storm-flow	11/18/2003	419.0	1.46	27.09%	3287.90	3287.90	949.49	No
Storm-flow	8/27/2002	21.8	1.50	26.64%	176.10	176.10	977.41	Yes
Storm-flow	2/11/1997	30.0	1.68	24.88%	272.34	272.34	1098.43	Yes

Table F.8. Storm-flow percent reductions
WHI0026

Category	Date	Observed TSS at WHI0026 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	7/6/2004	42.0	1.81	23.90%	410.35	410.35	1182.21	Yes
Storm-flow	9/22/1992	142.0	2.01	22.14%	1540.32	1540.32	1312.53	No
Storm-flow	1/8/2002	21.3	2.03	22.03%	232.69	232.69	1321.84	Yes
Storm-flow	1/21/1997	99.0	2.13	21.26%	1134.82	1134.82	1387.00	Yes
Storm-flow	12/19/1995	59.0	2.14	21.09%	680.84	680.84	1396.31	Yes
Storm-flow	5/7/1991	4.0	2.21	20.58%	47.70	47.70	1442.85	Yes
Storm-flow	10/25/1993	30.0	2.30	19.99%	371.58	371.58	1498.70	Yes
Storm-flow	1/26/1993	46.0	2.50	18.59%	619.30	619.30	1629.02	Yes
Storm-flow	3/4/2003	24.0	2.52	18.36%	326.80	326.80	1647.64	Yes
Storm-flow	11/15/1994	46.5	2.57	18.09%	643.92	643.92	1675.57	Yes
Storm-flow	2/25/1992	107.0	2.74	16.88%	1580.48	1580.48	1787.27	Yes
Storm-flow	1/25/1994	177.0	2.85	16.11%	2723.37	2723.37	1861.74	No
Storm-flow	2/22/1994	936.0	2.85	16.11%	14401.57	14401.57	1861.74	No
Storm-flow	3/12/2002	441.0	2.91	15.66%	6921.06	6921.06	1898.98	No
Storm-flow	11/14/2000	32.0	3.07	14.68%	529.29	529.29	2001.37	Yes
Storm-flow	7/7/1992	183.0	3.31	13.40%	3266.20	3266.20	2159.62	No
Storm-flow	2/8/2005	78.0	3.37	13.14%	1416.15	1416.15	2196.85	Yes
Storm-flow	4/21/1992	126.0	3.37	13.10%	2287.63	2287.63	2196.85	No
Storm-flow	10/16/2001	25.0	3.82	10.78%	515.44	515.44	2494.73	Yes
Storm-flow	11/5/1996	27.5	4.12	9.20%	611.41	611.41	2690.22	Yes
Storm-flow	7/5/1994	38.0	4.15	9.02%	850.71	850.71	2708.83	Yes
Storm-flow	4/12/1994	334.0	4.17	8.94%	7502.97	7502.97	2718.14	No
Storm-flow	12/18/1990	313.0	4.18	8.86%	7055.31	7055.31	2727.45	No
Storm-flow	11/9/2004	176.0	4.37	8.01%	4143.22	4143.22	2848.46	No
Storm-flow	4/6/1999	324.5	4.42	7.71%	7738.92	7738.92	2885.70	No
Storm-flow	6/7/1994	450.0	4.45	7.55%	10801.18	10801.18	2904.32	No
Storm-flow	1/4/2000	142.0	4.52	7.18%	3462.99	3462.99	2950.86	No
Storm-flow	10/9/1990	59.0	4.56	6.96%	1452.47	1452.47	2978.79	Yes
Storm-flow	11/23/1992	90.0	4.62	6.63%	2243.32	2243.32	3016.02	Yes
Storm-flow	5/4/2004	23.8	4.82	5.71%	618.87	618.87	3146.34	Yes

Table F.8. Storm-flow percent reductions
WHI0026

Category	Date	Observed TSS at WHI0026 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	1/18/2005	17.2	4.88	5.43%	452.54	452.54	3183.58	Yes
Storm-flow	11/5/1991	33.0	4.88	5.38%	868.25	868.25	3183.58	Yes
Storm-flow	4/15/1997	36.0	4.89	5.30%	949.95	949.95	3192.89	Yes
Storm-flow	3/10/1998	30.5	5.04	4.64%	828.28	828.28	3285.97	Yes
Storm-flow	5/12/1998	57.0	5.04	4.64%	1547.94	1547.94	3285.97	Yes
Storm-flow	12/7/2004	98.7	5.31	3.83%	2824.65	2824.65	3462.84	Yes
Storm-flow	12/11/2001	14.0	5.63	2.95%	425.43	425.43	3676.94	Yes
Storm-flow	3/6/2001	33.0	5.65	2.92%	1005.34	1005.34	3686.25	Yes
Storm-flow	12/13/1994	23.5	5.86	2.40%	743.04	743.04	3825.88	Yes
Storm-flow	12/7/1993	82.0	6.08	2.07%	2687.37	2687.37	3965.51	Yes
Storm-flow	12/3/1996	24.5	6.12	1.99%	808.59	808.59	3993.44	Yes
Storm-flow	1/15/1991	210.0	7.32	0.75%	8287.83	8287.83	4775.37	No

Total number of values =	96
Allowable % of exceedances =	20%
Allowable no. of exceedances =	20
No. of exceedances before reductions =	17
No. of exceedances after reductions =	17

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Table F.8. Storm-flow percent reductions
WHI0026

TABLE F.9. CALCULATIONS FOR PERCENT REDUCTION FOR BASE FLOW CONDITIONS
FOR BAYOU DEVIEW (STATION WHI0026)

Base flow target TSS conc. =	37 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	0%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at WHI0026 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Base flow	10/23/1995	16.0	0.00	99.68%	0.00	0.00	0.00	Yes
Base flow	10/17/2000	27.0	0.00	99.68%	0.00	0.00	0.00	Yes
Base flow	11/13/2001	7.0	0.00	99.25%	0.02	0.02	0.13	Yes
Base flow	10/5/2004	3.2	0.00	99.05%	0.04	0.04	0.48	Yes
Base flow	11/2/1999	20.0	0.01	98.33%	0.92	0.92	1.71	Yes
Base flow	10/18/1994	30.5	0.01	98.20%	1.64	1.64	1.99	Yes
Base flow	6/12/2001	14.3	0.02	97.26%	1.21	1.21	3.13	Yes
Base flow	10/27/1992	62.0	0.02	96.81%	6.68	6.68	3.99	No
Base flow	11/9/1998	11.5	0.03	95.95%	1.59	1.59	5.12	Yes
Base flow	10/8/2002	12.2	0.03	95.33%	1.88	1.88	5.69	Yes
Base flow	4/22/2003	19.5	0.03	95.33%	3.00	3.00	5.69	Yes
Base flow	5/20/1997	25.0	0.03	94.10%	4.42	4.42	6.55	Yes
Base flow	3/12/1991	22.0	0.04	93.21%	4.23	4.23	7.12	Yes
Base flow	9/21/1999	23.5	0.04	92.03%	5.24	5.24	8.25	Yes
Base flow	11/9/1993	10.0	0.04	91.79%	2.31	2.31	8.54	Yes
Base flow	9/19/2000	34.0	0.05	91.31%	8.37	8.37	9.11	Yes
Base flow	12/15/1998	31.5	0.05	89.97%	8.97	8.97	10.53	Yes
Base flow	10/1/1991	27.0	0.06	88.68%	8.52	8.52	11.67	Yes
Base flow	3/14/2000	10.0	0.06	88.68%	3.15	3.15	11.67	Yes
Base flow	6/24/2003	41.5	0.06	88.68%	13.09	13.09	11.67	No
Base flow	6/11/1991	27.0	0.06	87.94%	9.35	9.35	12.81	Yes
Base flow	9/23/1997	14.0	0.07	87.09%	5.28	5.28	13.95	Yes
Base flow	9/30/2003	5.5	0.07	87.09%	2.07	2.07	13.95	Yes
Base flow	12/7/1999	8.0	0.08	85.91%	3.32	3.32	15.37	Yes

Table F.9. Base flow percent reductions
WHI0026

Category	Date	Observed TSS at WHI0026 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Base flow	5/21/1996	30.0	0.08	85.64%	12.69	12.69	15.66	Yes
Base flow	4/18/1995	35.0	0.08	84.67%	15.89	15.89	16.79	Yes
Base flow	4/6/2004	20.0	0.09	84.05%	9.54	9.54	17.65	Yes
Base flow	9/26/1995	19.5	0.09	83.17%	9.75	9.75	18.50	Yes
Base flow	10/14/1997	102.5	0.09	82.91%	52.04	52.04	18.79	No
Base flow	9/20/1994	45.0	0.10	82.65%	23.19	23.19	19.07	No
Base flow	2/23/1999	7.0	0.10	82.38%	3.66	3.66	19.36	Yes
Base flow	5/11/1999	26.5	0.10	81.79%	14.27	14.27	19.93	Yes
Base flow	3/25/2003	31.8	0.11	80.86%	18.10	18.10	21.06	Yes
Base flow	2/1/2000	1.0	0.11	80.29%	0.58	0.58	21.63	Yes
Base flow	12/9/1997	7.0	0.11	80.00%	4.15	4.15	21.92	Yes
Base flow	4/11/2000	13.0	0.11	79.73%	7.80	7.80	22.20	Yes
Base flow	3/21/1995	25.5	0.12	78.88%	15.89	15.89	23.06	Yes
Base flow	6/20/1995	37.0	0.12	77.64%	24.76	24.76	24.76	Yes
Base flow	7/9/1991	30.0	0.13	76.95%	20.77	20.77	25.62	Yes
Base flow	5/12/1992	37.0	0.13	76.71%	25.90	25.90	25.90	Yes
Base flow	6/24/1997	31.0	0.14	75.58%	22.89	22.89	27.33	Yes
Base flow	11/12/1997	17.0	0.14	74.56%	13.08	13.08	28.46	Yes
Base flow	9/17/2002	162.0	0.14	74.56%	124.63	124.63	28.46	No
Base flow	1/21/2003	3.8	0.15	73.88%	3.01	3.01	29.32	Yes
Base flow	11/20/1995	9.0	0.15	73.45%	7.27	7.27	29.89	Yes
Base flow	2/20/1996	154.0	0.16	72.42%	130.32	130.32	31.31	No
Base flow	3/26/1996	140.0	0.16	72.42%	118.47	118.47	31.31	No
Base flow	4/10/2001	18.5	0.16	71.45%	16.37	16.37	32.73	Yes
Base flow	7/17/2001	9.5	0.18	69.75%	9.14	9.14	35.58	Yes
Base flow	5/9/2000	36.5	0.18	69.57%	35.38	35.38	35.87	Yes
Base flow	2/3/1998	13.0	0.18	69.13%	12.80	12.80	36.43	Yes
Base flow	1/3/1995	3.0	0.18	68.92%	2.98	2.98	36.72	Yes
Base flow	2/12/1991	20.0	0.20	67.26%	21.23	21.23	39.28	Yes
Base flow	7/6/1993	63.0	0.20	67.02%	67.85	67.85	39.85	No

Table F.9. Base flow percent reductions
WHI0026

Category	Date	Observed TSS at WHI0026 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Base flow	2/6/1995	10.0	0.22	65.03%	11.77	11.77	43.55	Yes
Base flow	8/7/2001	5.8	0.23	63.71%	7.17	7.17	46.11	Yes
Base flow	12/10/2002	8.8	0.26	61.40%	12.12	12.12	50.95	Yes
Base flow	3/17/1992	20.0	0.26	60.91%	28.00	28.00	51.81	Yes
Base flow	3/17/1992	177.0	0.26	60.91%	247.83	247.83	51.81	No

Total number of values =	59
Allowable % of exceedances =	25%
Allowable no. of exceedances =	15
No. of exceedances before reductions =	9
No. of exceedances after reductions =	9

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Table F.9. Base flow percent reductions
WHI0026

TABLE F.10. CALCULATIONS FOR PERCENT REDUCTION FOR STORM-FLOW CONDITIONS
FOR CACHE RIVER (STATION CHR0002)

Storm-flow target TSS conc. =	46 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	0%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at CHR0002 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	9/12/1994	41.5	0.51	58.03%	113.05	113.05	125.31	Yes
Storm-flow	9/23/2002	20.1	0.63	51.52%	68.26	68.26	156.21	Yes
Storm-flow	1/16/1995	12.5	0.67	50.22%	45.04	45.04	165.73	Yes
Storm-flow	10/7/1996	29.5	0.87	43.69%	138.46	138.46	215.90	Yes
Storm-flow	10/22/2001	7.3	0.90	43.06%	35.27	35.27	222.25	Yes
Storm-flow	6/23/2003	47.5	0.90	42.88%	231.68	231.68	224.37	No
Storm-flow	5/6/1996	80	0.96	41.41%	412.29	412.29	237.07	No
Storm-flow	6/13/1994	26.5	1.07	38.25%	152.42	152.42	264.58	Yes
Storm-flow	7/17/1995	89	1.17	35.82%	561.05	561.05	289.98	No
Storm-flow	5/21/2002	39	1.44	29.62%	303.28	303.28	357.72	Yes
Storm-flow	1/28/2002	37.5	1.91	20.89%	386.52	386.52	474.13	Yes
Storm-flow	1/7/2003	19.8	2.39	15.37%	255.10	255.10	592.67	Yes
Storm-flow	7/29/2002	16	2.12	15.07%	182.59	182.59	524.93	Yes
Storm-flow	3/25/2002	44	2.98	9.57%	706.60	706.60	738.72	Yes
Storm-flow	3/10/2003	24.8	3.36	6.74%	449.62	449.62	833.97	Yes

Total number of values =	15
Allowable % of exceedances =	20%
Allowable no. of exceedances =	3
No. of exceedances before reductions =	3
No. of exceedances after reductions =	3

TABLE F.11. CALCULATIONS FOR PERCENT REDUCTION FOR BASE FLOW CONDITIONS
FOR CACHE RIVER (STATION CHR0002)

Base flow target TSS conc. =	27 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	35%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at CHR0002 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Base flow	4/10/1995	41.5	0.12	90.17%	27.69	18.00	18.01	Yes
Base flow	11/4/2002	11	0.15	87.22%	9.06	5.89	22.24	Yes
Base flow	4/28/2003	60.8	0.27	75.85%	87.29	56.74	38.76	No
Base flow	8/25/2003	8.5	0.40	64.77%	18.38	11.95	58.39	Yes
Base flow	10/2/1995	69	0.44	62.43%	162.24	105.46	63.49	No

Total number of values =	5
Allowable % of exceedances =	25%
Allowable no. of exceedances =	2
No. of exceedances before reductions =	3
No. of exceedances after reductions =	2

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Table F.11. Base flow percent reductions
CHR0002

TABLE F.12. CALCULATIONS FOR PERCENT REDUCTION FOR STORM-FLOW CONDITIONS
FOR CACHE RIVER (STATION CHR0003)

Storm-flow target TSS conc. = 121 mg/L
Percent reduction needed = 17%
Error check for reduction is / is not needed: ok
Error check for less or more reduction needed: ok

Category	Date	Observed TSS at CHR0003 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	6/13/1994	37	0.32	55.95	64.05	53.16	209.12	Yes
Storm-flow	3/10/2003	157	0.42	50.47	352.68	292.73	271.39	No
Storm-flow	7/17/1995	79.5	0.42	50.13	181.65	150.77	276.03	Yes
Storm-flow	1/16/1995	104.5	0.48	47.46	269.32	223.53	311.35	Yes
Storm-flow	8/25/2003	46	1.14	31.34	282.75	234.69	742.60	Yes
Storm-flow	4/28/2003	322	3.27	13.63	5672.77	4708.40	2128.34	No
Storm-flow	1/28/2002	176	4.17	8.89	3953.66	3281.54	2713.87	No
Storm-flow	5/21/2002	144	4.52	7.15	3511.77	2914.77	2946.22	Yes
Storm-flow	3/25/2002	138	4.58	6.86	3407.91	2828.57	2983.40	Yes
Storm-flow	9/23/2002	61.6	4.74	6.05	1573.34	1305.87	3085.63	Yes
Storm-flow	1/7/2003	65.3	4.92	5.15	1733.15	1438.51	3206.46	Yes

Total number of values = 11
Allowable % of exceedances = 20%
Allowable no. of exceedances = 3
No. of exceedances before reductions = 5
No. of exceedances after reductions = 3

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TABLE F.13. CALCULATIONS FOR PERCENT REDUCTION FOR BASE FLOW CONDITIONS
FOR CACHE RIVER (STATION CHR0003)

Base flow target TSS conc. =	75 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	0%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at CHR0003 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Base flow	10/2/1995	49.5	0.02	97.09	4.57	4.57	6.95	Yes
Base flow	4/10/1995	77.5	0.02	96.79	8.35	8.35	8.11	No
Base flow	10/7/1996	61.5	0.04	93.06	11.83	11.83	14.49	Yes
Base flow	11/4/2002	43.2	0.04	92.99	8.31	8.31	14.49	Yes
Base flow	5/6/1996	285	0.10	81.19	157.86	157.86	41.73	No
Base flow	6/23/2003	43.3	0.11	79.33	26.32	26.32	45.79	Yes
Base flow	9/12/1994	60	0.17	71.00	54.01	54.01	67.81	Yes
Base flow	10/22/2001	35.3	0.26	61.13	48.88	48.88	104.32	Yes
Base flow	7/29/2002	65	0.26	61.13	90.01	90.01	104.32	Yes

Total number of values =	9
Allowable % of exceedances =	25%
Allowable no. of exceedances =	3
No. of exceedances before reductions =	2
No. of exceedances after reductions =	2

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TABLE F.14. CALCULATIONS FOR PERCENT REDUCTION FOR STORM-FLOW CONDITIONS
FOR CACHE RIVER (STATION CHR0004)

Storm-flow target TSS conc. =	157 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	0%	Error check for less or more reduction needed:	ok

Category	Date	Observed TSS at CHR0004 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Storm-flow	6/13/1994	101	3.210E-01	55.98%	174.83	174.83	271.76	Yes
Storm-flow	3/10/2003	480	4.165E-01	50.51%	1,078.27	1,078.27	352.68	No
Storm-flow	7/17/1995	94.5	4.237E-01	50.15%	215.92	215.92	358.72	Yes
Storm-flow	1/16/1995	57	4.779E-01	47.51%	146.90	146.90	404.62	Yes
Storm-flow	8/25/2003	70.5	1.140E+00	31.36%	433.35	433.35	965.05	Yes
Storm-flow	4/28/2003	261	3.267E+00	13.67%	4,598.12	4,598.12	2,765.92	No
Storm-flow	1/28/2002	160	4.165E+00	8.94%	3,594.24	3,594.24	3,526.85	No
Storm-flow	5/21/2002	88.5	4.522E+00	7.18%	2,158.27	2,158.27	3,828.80	Yes
Storm-flow	3/25/2002	55	4.579E+00	6.88%	1,358.22	1,358.22	3,877.11	Yes
Storm-flow	9/23/2002	88.2	4.736E+00	6.07%	2,252.74	2,252.74	4,009.98	Yes
Storm-flow	1/7/2003	55.5	4.922E+00	5.18%	1,473.05	1,473.05	4,166.99	Yes

Total number of values =	11
Allowable % of exceedances =	20%
Allowable no. of exceedances =	3
No. of exceedances before reductions =	3
No. of exceedances after reductions =	3

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TABLE F.15. CALCULATIONS FOR PERCENT REDUCTION FOR BASE FLOW CONDITIONS
FOR CACHE RIVER (STATION CHR0004)

Base flow target TSS conc. = 61 mg/L
Percent reduction needed = 13%
Error check for reduction is / is not needed: ok
Error check for less or more reduction needed: ok

Category	Date	Observed TSS at CHR0004 (mg/L)	Flow per unit area on sampling day (cfs/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
Base flow	10/2/1995	13.5	1.712E-02	97.12%	1.25	1.08	5.63	Yes
Base flow	4/10/1995	50.5	1.997E-02	96.81%	5.44	4.73	6.57	Yes
Base flow	10/7/1996	16.5	3.566E-02	93.21%	3.17	2.76	11.73	Yes
Base flow	11/4/2002	5.3	3.566E-02	93.21%	1.02	0.89	11.73	Yes
Base flow	5/6/1996	128	1.027E-01	81.28%	70.90	61.68	33.79	No
Base flow	6/23/2003	85.4	1.127E-01	79.46%	51.90	45.16	37.07	No
Base flow	9/12/1994	48	1.669E-01	71.07%	43.20	37.59	54.91	Yes
Base flow	10/22/2001	76	2.568E-01	61.24%	105.24	91.56	84.47	No
Base flow	7/29/2002	69.5	2.568E-01	61.24%	96.24	83.73	84.47	Yes

Total number of values = 9
Allowable % of exceedances = 25%
Allowable no. of exceedances = 3
No. of exceedances before reductions = 4
No. of exceedances after reductions = 3

FILE: R:\PROJECTS\2110-615\TECH\TMDL\CACHE\CACHE TMDL-CHR04-DEC2005.XLS