



Level 4 Ecoregions of Arkansas

*Arkansas
Department of
Environmental
Quality*

Planning Branch
Water Division

Arkansas's Assessment Methodology

for the Preparation of

The 2012 Integrated Water Quality Monitoring and Assessment Report

(pursuant to Clean Water Act Sections 303(d) and 305(b))

December 2011

Water Division Planning Branch

The Planning Branch consists of biologists, ecologists, and geologists that manage activities related to both surface and ground water. Among the numerous activities is the management of the State Water Quality Monitoring Networks for both surface and subsurface waters. Other activities include routine monitoring and intensive, special investigations of the physical, chemical, and biological characteristics of waterbodies and/or aquifers. The data generated from these activities, as well as all other existing and readily available data, are used to prepare the biennial “Integrated Water Quality Monitoring and Assessment Report (305(b)),” the “List of Impaired Waterbodies, (303(d) list),” and develop Total Maximum Daily Loads (TMDLs) for impaired waterbodies. The data may also be used to develop water quality standards and criteria for the evaluation of designated use attainment and to prioritize restoration and remediation activities.

The staff continues to develop and/or enhance ecoregion-based, biological assessment criteria for both fish and macroinvertebrates. The staff is active in the development and updating of water quality standards and the technical review and administration of the National Pollutant Discharge Elimination System Permits Whole Effluent Toxicity Program. Staff members represent the Department on numerous federal, state, local, and watershed-based advisory boards and technical support groups. The Education and Outreach Section develops and administers outreach and educational materials and programs to all ages. They also coordinate and implement the activities of the Arkansas Watershed Advisory Group; a group of federal, state, local, and private citizens working together to assist watershed groups in protecting and enhancing the natural environment in Arkansas. The Groundwater Section is currently engaged in development of statewide groundwater standards and management of remediation projects that do not fall under the purview of other Arkansas Department of Environmental Quality divisions. The section also oversees portions of the Groundwater Protection Program that are delegated to the Arkansas Department of Health (Wellhead Protection Program) and the Arkansas Natural Resources Commission (Groundwater Protection and Management Program).

Current staff includes:

Sarah Clem, ADEQ Branch Manager

Planning Section

Jim Wise, Ecologist Coordinator
Mary Barnett, Ecologist
Nathan Wentz, Ecologist
Jason Hooks, Ecologist
Kristi Williams, Ecologist
Edward Kluender, Ecologist
Mark Hathcote, Ecologist

Education and Outreach Section

Sarah DeVries, Environmental Program Coordinator
Philip Osborne, Environmental Program Coordinator
Barbara Miller, Ecologist

Ground Water Section

Roger Miller, PG, Geologist
Evelyn Kort, PG, Geologist

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
2.0 ASSESSMENT	2
2.1 Narrative Criteria	3
2.3 Impairment Source Determination.....	3
3.0 LISTING OF WATER BODIES.....	4
4.0 WATER QUALITY STANDARDS.....	5
4.1 Antidegradation.....	5
4.2 Designated Uses.....	5
4.3 General Criteria.....	6
4.3.1 Reg. 2.405 - Biological Integrity	6
4.4 Specific Standards.....	7
4.4.1 Reg. 2.502 - Temperature.....	7
4.4.2 Reg. 2.503 – Turbidity.....	13
4.4.3 Reg. 2.504 - pH	14
4.4.4 Reg. 2.505 - Dissolved Oxygen.....	14
4.4.5 Reg. 2.506 - Radioactivity.....	14
4.4.6 Reg. 2.507 - Bacteria	14
4.4.8 Reg. 2.511 - Mineral Quality.....	16
4.4.9 Reg. 2.512 - Ammonia	17
4.4.10 Domestic, Agricultural, and Industrial Water Supply Uses	17

1.0 INTRODUCTION

This assessment methodology considers the Environmental Protection Agency's (EPA) most current 305(b) reporting and 303(d) listing requirements and guidance following the percent method. In addition, the Arkansas Department of Environmental Quality follows the specific requirements of 40 C.F.R. § 130.7 - 130.8. The criteria within this assessment methodology are utilized to make decisions about attainment of water quality standards of a given waterbody or waterbody segment. Monitoring data will be assessed based upon the frequency, duration, and/or magnitude of water quality standard exceedances.

A biennial report on the condition of the state's waters is prepared by ADEQ in accordance with the "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act, July 29, 2005," and subsequent updates. Waters are evaluated in terms of whether their assigned water quality standards, as delineated in the Arkansas Pollution Control and Ecology Commission's Regulation No. 2, are being attained.

The primary data used in the evaluations are generated as part of ADEQ's water quality monitoring activities described in the "State of Arkansas's Water Quality Monitoring and Assessment Program." In addition, pursuant to 40 C.F.R. § 130.7(b)(5), ADEQ assembles and evaluates all existing and *readily available* water quality data and information.

State and federal agencies and other entities that collect water quality data are solicited to aid ADEQ in its evaluation of the State's waters. All data submitted to ADEQ will be considered. However, the data must:

- represent actual annual ambient conditions, as described below;
- have been collected and analyzed under a quality-assurance/quality-control protocol equivalent to or more stringent than that of ADEQ or the USGS;
- have been analyzed pursuant to the rules outlined in the State Environmental Laboratory Certification Program Act, Ark, Code Ann. § 8-2-201 *et seq.*;
- be reported in standard units recommended in the relevant approved method;
- be accompanied by precise sample site location(s) data, preferably latitude and longitude in either decimal degrees or degrees, minutes, seconds;
- be received in either an Excel spreadsheet or compatible format; and
- have been collected within the period of record.

The data set must be spatially and temporally representative of the actual annual ambient conditions of the waterbody. Sample locations in streams and open waterbodies should be characteristic of the main water mass or distinct hydrologic areas. At a minimum, samples should be distributed over at least three seasons (to include inter-seasonal variation) and over two years (to include inter-year variation) to be utilized. The data set should not be biased toward specific conditions, such as flow, runoff, or season. No more than two-thirds of the samples should be in one year or one season. The exception to this is the analysis of data for those designated uses that require seasonally based water quality data; i.e. primary contact recreation, biological community data, critical season dissolved oxygen.

PERIOD OF RECORD:

metals and ammonia toxicity analysis - *April 1, 2008 to March 31, 2011*
all other analyses - *April 1, 2006 to March 31, 2011*

Data developed prior to the period of record should only be used for long-term trend analysis because the data would have been evaluated as part of a previous assessment. Data developed after the period of record, including but not limited to water quality data, the completion of surveys (including the completion of the final report), revisions in water quality standards, and the completion of total maximum daily loads, will be considered during the next assessment period.

2.0 ASSESSMENT

Routine water quality data collection generally follows a monthly or bimonthly sampling regime, producing 12 to 60 data points over a five-year period. Therefore, a minimum of 12 water quality samples is required for water quality standards attainment decisions, unless otherwise established by Regulation No. 2 or elsewhere in this assessment methodology.

For the assessment of waterbodies where no new data have been generated, the previous assessment decisions will be carried forward. However, if a substantial change in the water quality standards or the assessment methodology has occurred, and those changes would affect the previous assessment decisions, the waterbody will be re-assessed utilizing the dataset from the previous assessment.

The percent exceedances shown in the Assessment Criteria Tables are calculated using the total number of samples collected. The number of data points exceeding the criteria that are necessary for an assessment decision will be calculated and rounded up to the nearest whole number; e.g., 25% of 38 data points = 9.5, therefore ten (10) exceedances is the criteria.

An evaluated assessment of attainment of water quality standards, in the absence of data, can be made for contiguous stream segments to monitored waters if there is reason to believe that the segments are similar with respect to the watershed characteristics and watershed conditions. Otherwise, the contiguous stream segments will remain unassessed.

An evaluated assessment of non-attainment can be made for contiguous stream segments to monitored waters if there is reason to believe that the segments are similar with respect to the potential cause and magnitude of impairment. However, an evaluation of non-attainment cannot be made for contiguous stream segments to monitored waters when the source or the origin of the source of the impairment is unknown, and/or when the magnitude or frequency of the impairment is such that contiguous segments may not be affected. In addition, an evaluation of non-attainment cannot be made for contiguous stream segments to monitored waters when a tributary enters the water body either upstream or downstream of the monitored segment. In such cases, the contiguous stream segments will remain unassessed.

Water quality standards, assessment criteria, and monitoring strategies are currently being developed for the State's lakes. Once these items have been adopted into Regulation No. 2 and compiled into the State's overall monitoring strategy plan, an assessment methodology can be developed that will address lake water quality standards. Until this has been accomplished, only those water quality standards currently listed in Regulation No. 2 can be assessed. In addition, there has not been a significant quantity of data recently collected from any of the State's lakes, except for a very limited amount of data collected from lakes associated with reference lake projects.

The possibility of naturally occurring disruptions that may cause exceedances of a standard, but do not result in designated use impairment, must be considered. Exceedances resulting from *Naturally Occurring Excursions* (NOE), or determined to be *Natural Background* conditions, as defined in Reg. 2.106, will not be assessed as impaired. These determinations will be made on a case-by-case basis which will usually involve performing an intensive survey of the waterbody segment as outlined in the most current version of "State of Arkansas Water Quality Monitoring and Assessment Program."

2.1 Narrative Criteria

Waters will be assessed as "non-support" when a violation of any narrative water quality standard has been verified by ADEQ. This will be accomplished by the use of scientific study reports that document an impairment is caused by the exceedance of a narrative criterion. The validity of the report must have been verified by ADEQ. In addition, waters will be assessed as "non-support" if any associated numeric standard of a narrative criterion is violated pursuant to this assessment methodology.

2.2 Numeric Criteria

All waters of the State with qualifying data will be assessed as either "support" or "non-support" based on the assessment of numeric criteria outlined in Section 4.0.

2.3 Impairment Source Determination

For any water body segment where a water quality standard has been evaluated as non-supported, the source(s) of impairment will be identified using available information (field observation, land use maps, point source location, nonpoint source assessment reports, special studies, and knowledge of field personnel familiar with the water body) and best professional judgment.

3.0 LISTING OF WATER BODIES

The State's waterbodies are segmented based on the medium resolution NHD dataset. Stream reaches that are assessed as not attaining water quality standard(s) will be listed and categorized based on the confidence level, quality assurance, and quantity of the data.

Arkansas's List of Water Quality Limited Waterbodies has been formatted to reflect the most current EPA guidance which suggests placing waterbody segments into five categories. Category 5 is further subdivided by ADEQ for planning and management purposes.

- 1 = Attaining all water quality standards;
- 2 = Attaining some water quality standards, but there is insufficient data to determine if other standards are being attained;
- 3 = Insufficient data to determine if any water quality standards are attained;
 - No data available;
 - The data does not meet the spatial and/or temporal requirements outlined in this assessment methodology;
 - Waters in which the data is questionable because of QA/QC procedures and those requiring confirmation of impairment before a TMDL is scheduled;
- 4 = One or more water quality standards not attained but does not require the development of a TMDL because:
 - a. A TMDL has been completed for the listed parameter(s);
 - b. Waters which are impaired by point source discharges and future permits restrictions are expected to correct the problem(s);
 - c. Waters that currently do not meet an applicable water quality standard, but the impairment is not caused by a pollutant;
- 5 = The waterbody may be impaired, or one or more water quality standards may not be attained. Waterbodies in Category 5 will be prioritized in the following manner:
 - High
 - Truly impaired; develop a TMDL or other corrective action(s) for the listed parameter(s);
 - Medium
 - Waters currently not attaining standards, but may be de-listed with future revisions to Regulation No. 2, the state water quality standards; or
 - Waters which are impaired by point source discharges and future permit restrictions are expected to correct the problem(s);
 - Low
 - Waters currently not attaining one or more water quality standards, but all designated uses are determined to be supported; or
 - There is insufficient data to make a scientifically defensible decision concerning designated use attainment; or
 - Waters ADEQ assessed as unimpaired, but were added to the list by EPA.

4.0 WATER QUALITY STANDARDS

4.1 Antidegradation

A Tier 3 waterbody (e.g., Extraordinary Resource Waterbody, Ecologically Sensitive Waters, Natural and Scenic Waterways) will be listed as “non-support” if it can be determined that the water quality that existed at the time of designation has declined. For all other waters (Tier 1 and Tier 2) the listing requirements discussed above will apply.

4.2 Designated Uses

Designated Use	Parameters
Fisheries (Regulation 2.302(F))	Biological Integrity (macroinvertebrate and/or fish) data.
Domestic Water Supply (Regulation 2.302(G))	Compounds which are not easily removed by drinking water treatment facilities; compounds with established secondary maximum contaminant levels's, e.g., chlorides, sulfates, & total dissolved solids.
Primary and Secondary Contact (Regulation 2.302D, (E))	<i>Escherichia coli</i> (use Fecal Coliform bacteria data in the absence of <i>E. coli</i> data).
Industrial Water Supply (Regulation 2.302(H))	Compounds which interfere with industrial uses such as cooling water or the water used in certain manufacturing processes; or waters unsuitable for livestock watering or crop irrigation; most often includes chlorides, sulfates, & total dissolved solids.
Agriculture Water Supply (Regulation 2.302(I))	

The following are ecoregion and/or stream segment-specific assessment criteria that are used to evaluate waterbody water quality standards attainment. These criteria were developed using Arkansas’s water quality standards, EPA guidance documents, and historical surveys.

Arkansas bases its water quality assessments on the ability of a waterbody to support the State’s water quality standards. Two decisions are employed – “Support” and “Non-Support.” A waterbody is assessed as “Support” if the waterbody meets all assessment criteria for which data are available. A waterbody will be assessed as “Not-Support” if any assessment criterion is not attained. In either case, the evaluation must be based on scientifically defensible data and techniques.

Key to the footnotes in the Assessment Criteria Tables in the following sections:

- 1 - Except for site specific standards approved in water quality standards
- 2 - Criteria based on 90th percentile of ecoregion values
- 3 - Refers to the number of data points instead of a percentage (i.e. greater than one value exceeding criteria = non-support).

4.3 General Criteria

4.3.1 Reg. 2.405 - Biological Integrity

The Fisheries Designated Use will be evaluated based on the biological integrity (macroinvertebrate and/or fish communities) of the waterbody, if biological data exists to make an evaluation. At a minimum, the data must have been collected over two seasons (preferably a minimum of two years) using methods outlined in a quality assurance project plan with requirements equal to or more stringent than that of ADEQ's. The following tables outline the evaluation protocol and the listing protocol for biological integrity support determinations.

Biological Integrity Evaluation Protocol

Indicator	Data Type	Support	Non-Support
Macroinvertebrate Community	Macroinvertebrate Community Data Available	Until a MBMI* is developed, either an upstream/downstream comparison of communities will be utilized, or the community data will be compared to historical ecoregion data using: total taxa richness, EPT, and % dominant taxa. As these metrics are indicative of perturbation/degradation.	
		Hilsenhoff Biotic Index (HBI), Ephemeroptera/Plecoptera/Trichoptera (EPT), and taxa richness indices are highly, generally, or fairly similar to comparison site.	HBI, EPT, and taxa richness indices are not similar to comparison site.**
Fish Community	Fish Community Data Available	Index of Biotic Integrity (IBI) score either highly, generally, or fairly similar; general presence of sensitive and indicator species.	IBI score not similar; absence of sensitive and indicator species.**

* - Macroinvertebrate Biological Monitoring Index

** - The Fisheries designated use will be assessed as fully supporting if the low fish community IBI score or the macroinvertebrate community is assessed as non-support as the result of an abnormal occurrence in the aquatic life communities and not an environmental factor (low dissolved oxygen, low pH, toxicity).

Evaluation methods for the determination of similarity as referenced in the table above are those outlined in the most current version of "Arkansas's Water Quality and Compliance Monitoring Quality Assurance Project Plan.

Fisheries Designated Use Listing Protocols

Type of Data Present	Evaluation Result		Final Assessment	303 (d) Listing Category
	Fish Community	Macroinvertebrate Community		
Fish Community and/or Macroinvertebrate Community	S	S	FS	1
	S	NS	NS	5
	NS	S	NS	5
	NS	NS	NS	5
At Least One Biological Community	S	NA	FS	1
	NA	S	FS	1
	S	S	FS	1
	NA	NA	FS	1
	NS	NA	NS	5
	NA	NS	NS	5

S = Supporting NS = Non-Supporting FS = Fully Supporting NA = None Available

4.4 Specific Standards

4.4.1 Reg. 2.502 - Temperature

If more than 10 percent of the total samples from a site exceed the water temperature standard, as listed in the following tables, because of a discernible man-induced cause, the water body will be listed as not attaining the temperature standard. However, if the water temperature standard is exceeded due to a natural condition, excessively high ambient temperatures, drought, etc., the water body will not be listed as impaired but will be reported as such in the document.

For lakes and reservoirs, water temperature will be considered for a single sample collected between one to three feet below the surface. The criteria listed in the paragraph above apply.

ASSESSMENT CRITERIA FOR OZARK HIGHLANDS ECOREGION STREAMS

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	29 C		< = 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
<10 mi ²	6	2	< 5 samples or < = 10%		>10%	
10-100 mi ²	6	5	< 5 samples or < = 10%		>10%	
> 100 mi ²	6	6	< 5 samples or < = 10%		>10%	
Trout Waters	6	6	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
TURBIDITY						
Base Flows	10 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	17 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR BOSTON MOUNTAINS ECOREGION STREAMS

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	31 C		<= 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
<10 mi ²	6	2	< 5 samples or <= 10%		>10%	
> 10 mi ²	6	6	< 5 samples or <= 10%		>10%	
pH	6 to 9 standard pH units		<=10%		>10%	
TURBIDITY						
Base Flows	10 NTU		< 4 samples or <= 25%		≥ 4 samples >25%	
All Flows	19 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR ARKANSAS RIVER VALLEY ECOREGION STREAMS

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	31 C		<=10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
<10 mi ²	5	2	< 5 samples or <= 10%		>10%	
10-150 mi ²	5	3	< 5 samples or <= 10%		>10%	
151-400 mi ²	5	4	< 5 samples or <= 10%		>10%	
>400 mi ²	5	5	< 5 samples or <= 10%		>10%	
pH	6 to 9 standard pH units		<=10%		>10%	
TURBIDITY						
Base Flows	21 NTU		< 4 samples or <= 25%		≥ 4 samples >25%	
All Flows	40 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR OUACHITA MOUNTAINS ECOREGION STREAMS

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	30 C		<= 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
<10 mi ²	6	2	< 5 samples or <= 10%		>10%	
>10 mi ²	6	6	< 5 samples or <= 10%		>10%	
pH	6 to 9 standard pH units		<=10%		>10%	
TURBIDITY						
Base Flows	10 NTU		< 4 samples or <= 25%		≥ 4 samples >25%	
All Flows	18 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR GULF COASTAL ECOREGION (typical streams)

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	30 C		<= 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
<10 mi ²	5	2	< 5 samples or <= 10%		>10%	
10-500 mi ²	5	3	< 5 samples or <= 10%		>10%	
>500 mi ²	5	5	< 5 samples or <= 10%		>10%	
pH	6 to 9 standard pH units		<=10%		>10%	
TURBIDITY						
Base Flows	21 NTU		< 4 samples or <= 25%		≥ 4 samples >25%	
All Flows	32 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR GULF COASTAL ECOREGION (springwater influenced)

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	30 C		<= 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
ALL WATERSHEDS	6	5	< 5 samples or <= 10%		>10%	
pH	6 to 9 standard pH units		<=10%		>10%	
TURBIDITY						
Base Flows	21 NTU		< 4 samples or <= 25%		≥ 4 samples >25%	
All Flows	32 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR DELTA ECOREGION (least altered)

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	30 C		<= 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
<10 mi ²	5	2	< 5 samples or <= 10%		>10%	
10-100 mi ²	5	3	< 5 samples or <= 10%		>10%	
>100 mi ²	5	5	< 5 samples or <= 10%		>10%	
pH	6 to 9 standard pH units		<=10%		>10%	
TURBIDITY						
Base Flows	45 NTU		< 4 samples or <= 25%		≥ 4 samples >25%	
All Flows	84 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR DELTA ECOREGION (channel-altered)

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	32 C		< =10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
<10 mi ²	5	2	< 5 samples or < = 10%		>10%	
10-100 mi ²	5	3	< 5 samples or < = 10%		>10%	
>100 mi ²	5	5	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
TURBIDITY						
Base Flows	75 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	250 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR WHITE RIVER (MAIN STEM)

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹						
DAM #1 TO MOUTH	32 C		< =10%		>10%	
OZARK HIGHLANDS	29 C		< = 10%		>10%	
TROUT WATERS	20 C		< = 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
DELTA	5	5	< 5 samples or < = 10%		>10%	
OZARK HIGHLANDS	6	6	< 5 samples or < = 10%		>10%	
TROUT WATERS	6	6	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
CL/SO ₄ /TDS ¹						
Mouth to Dam #3	20/60/430		< =10%		>10%	
DAM #3 TO MO. LINE ¹	20/20/180		< =10%		>10%	
MO. LINE TO HEADWATERS ¹	20/20/160		< =10%		>10%	
TURBIDITY						
Base Flows - Delta	45 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows - Delta ²	84 NTU		See 2.503 below		See 2.503 below	
Base Flows - Ozark Highlands	10 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows - Ozark Highlands ²	17 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR ST. FRANCIS RIVER

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	32 C		< = 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
ALL WATERS	5	5	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
CL/SO ₄ /TDS ¹						
MOUTH TO 36 ⁰ N. LAT. ¹	10/30/330		< =10%		>10%	
36 ⁰ N. LAT. TO 36 ⁰ 30'N LAT. ¹	10/20/180		< =10%		>10%	
TURBIDITY						
Base Flows	75 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	100 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR THE ARKANSAS RIVER

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	32 C		< = 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
ALL WATERS	5	5	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
CL/SO ₄ /TDS ¹						
MOUTH TO L&D #7 ¹	250/100/500		< =10%		>10%	
L&D #7 TO L&D #10 ¹	250/100/500		< =10%		>10%	
L&D #10 TO OK LINE ¹	250/120/500		< =10%		>10%	
TURBIDITY						
Base Flows	50 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	52 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR THE OUACHITA RIVER

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	32 C		< = 10%		>10%	
L. MISSOURI TO S.LINE	32 C		< =10%		>10%	
ABOVE L. MISSOURI	30 C		< =10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
ALL WATERS	5	5	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
CL/SO ₄ /TDS ¹						
LA LINE TO CAMDEN ¹	160/40/350		< =10%		>10%	
CAMDEN TO CARPENTER DAM ¹	50/40/150		< =10%		>10%	
CARPENTER DAM TO HEADWATERS ¹	10/10/100		< =10%		>10%	
TURBIDITY						
Base Flows	21 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	32 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR THE RED RIVER

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	32 C		< = 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
ALL WATERS	5	5	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
CL/SO ₄ /TDS ¹						
OK LINE TO CONFLUENCE WITH LITTLE RIVER ¹	250/200/850		< =10%		>10%	
LITTLE RIVER TO LA LINE ¹	250/200/500		< =10%		>10%	
TURBIDITY						
Base Flows	50 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	150 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR THE MISSISSIPPI RIVER

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	32 C		< = 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	Primary	Critical	Primary	Critical	Primary	Critical
ALL WATERS	5	5	< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
CL/SO ₄ /TDS ¹						
LA LINE TO AR RIVER ¹	60/150/425		< =10%		>10%	
AR RIVER TO MO LINE ¹	60/175/450		< =10%		>10%	
TURBIDITY						
Base Flows	50 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	75 NTU		See 2.503 below		See 2.503 below	

ASSESSMENT CRITERIA FOR LAKES

PARAMETER	STANDARD		SUPPORT		NON-SUPPORT	
			DATA POINTS EXCEEDING CRITERIA			
TEMPERATURE ¹	32 C		< = 10%		>10%	
DISSOLVED OXYGEN ¹ (mg/l)	5		< 5 samples or < = 10%		>10%	
pH	6 to 9 standard pH units		< =10%		>10%	
CL/SO ₄ /TDS ¹	205/205/500		< =10%		>10%	
TURBIDITY						
Base Flows	25 NTU		< 4 samples or < = 25%		≥ 4 samples >25%	
All Flows	45 NTU		See 2.503 below		See 2.503 below	

4.4.2 Reg. 2.503 – Turbidity

Turbidity, Reg. 2.503, will be evaluated for both base and all flows. If a waterbody is not meeting either of these conditions, it will be listed as non-supporting the turbidity criteria.

Base flow values represent the critical season, June 1 to October 31, when rainfall is infrequent. If four or more samples, or more than 25 percent of the total samples, whichever is greater, collected between June 1 and October 31 for the period of record exceed the base flows values, the stream segment will be listed as not attaining the turbidity standard.

All flows assessment takes into account samples collected throughout the year. If more than 20 percent of the total samples (not to be less than 24) collected from the Ambient Water Quality Monitoring Network (AWQMN) sites exceed the all flows values, the waterbody will be listed as not attaining the turbidity standard. For data collected from sites other than the AWQMN, if five or more samples, or more than 20 percent of the total samples, whichever is greater, exceed the all flows values, the waterbody will be listed as not attaining the turbidity standard.

4.4.3 Reg. 2.504 - pH

If greater than 10 percent of the samples collected from a water body segment exceed the pH standards due to a waste discharge, the waterbody will be listed as not attaining the pH standard. If greater than 10 percent of the samples collected from a water body segment exceed the pH standards but the source cannot be identified as being from a waste discharge, the segment will not be listed but will be reported.

For lakes and reservoirs, pH will be considered for a single sample collected between one to three feet below the surface. The criteria listed in the paragraph above apply.

4.4.4 Reg. 2.505 - Dissolved Oxygen

Dissolved oxygen standards are divided into two categories: primary season when water temperatures are at or below 22° C; and critical season when water temperatures exceed 22° C. If five or more samples, or greater than 10 percent of the total samples collected, which ever is greater, fail to meet the minimum dissolved oxygen standard, the water body will be listed as not attaining the dissolved oxygen standard.

For lakes and reservoirs, dissolved oxygen will be considered for a single sample collected between one to three feet below the surface. The criteria listed in the paragraph above apply.

4.4.5 Reg. 2.506 - Radioactivity

For the assessment of ambient waters for radioactivity, at no time shall the concentration of radium-226 exceed 3 picocuries/Liter nor shall the concentration of strontium-90 exceed 10 picocuries/Liter. If qualifying data indicate an exceedance of either of these parameters, the water body will be listed as not attaining the radioactivity standard.

4.4.6 Reg. 2.507 - Bacteria

For assessment of ambient waters, contact recreation designated uses will be evaluated using *Escherichia coli* as outlined in Reg. 2.507. In the absence of *Escherichia coli* bacteria data, fecal coliform bacteria data will be utilized. A minimum of eight (8) samples, all of which must be collected and equally spaced within one contact recreation season (May through September or October through April of contiguous months) is required to make an evaluation. The geometric mean will be calculated on a minimum of five (5) samples equally spaced over a 30-day period.

Statewide Bacteria Assessment Criteria

<i>Escherichia coli</i>		STANDARD	SUPPORT	NON-SUPPORT
PRIM. CONTACT	ERW, ESW, and NSW Waters Lakes, Reservoirs	298 col/100 ml (May-Sept)	< = 25%	>25%
		GM 126 col/100 ml	< = standard	> standard
	All other waters	410 col/100 ml (May-Sept)	< = 25%	>25%
SEC. CONTACT	ERW, ESW, and NSW Waters Lakes, Reservoirs	1490 col/100 ml(anytime)	< = 25%	>25%
		GM 630 col/100 ml	< = standard	> standard
	All other waters	2050 col/100 ml(anytime)	< = 25%	>25%
<i>Fecal Coliform</i>		STANDARD	SUPPORT	NON-SUPPORT
<u>PRIMARY CONTACT</u> All Waters including ERW, ESW, NSW, Lakes, and Reservoirs		400 col/100 ml (May-Sept)	< = 25%	>25%
		GM 200 col/100 ml	< = standard	> standard
<u>SECONDARY CONTACT</u> All Waters including ERW, ESW, NSW, Lakes, and Reservoirs		2000 col/100 ml(anytime)	< = 25%	>25%
		GM 1000 col/100 ml	< = standard	> standard

In either case, if either the single sample criterion or the geometric mean is exceeded for the period of record, the waterbody will be listed as impaired. Listings prior to 2004 may have identified waterbodies as water quality impaired using fecal coliform data. These listings previously were retained, and will be retained unless additional data for *E. coli* becomes available. If data shows the current *E. coli* criteria are met, the waterbody will be delisted.

4.4.7 Reg. 2.508 - Toxic Substances

In accordance with Reg. 2.508, metals toxicity will be evaluated based on instream hardness values at the time of sample collection. If the ambient hardness value is less than 25 mg/l, then a hardness value of 25 mg/l will be used to calculate metals toxicity. If more than one exceedance of the criterion occurs during the period of record, the water body will be listed as not attaining the standard.

Statewide Metals Assessment Criteria

	Acute ³	Chronic
Support	< =1	< =1
Non-Support	>1	>1

Waters will be listed as “non-support” for fish consumption if a primary segment of the fish community (e.g., all predators or all Largemouth bass) is recommended for non-consumption by any user group (e.g., general population or high risk groups). However, if a consumption restriction is recommended, e.g., no more than two meals per month or no consumption of fish over 15-inches, these waters will not be listed as “non-support”.

Statewide Fish Consumption Assessment Criteria

Support	No restrictions; limited consumption
Non-Support	No consumption for any user group

4.4.8 Reg. 2.511 - Mineral Quality

Mineral quality will be evaluated as follows: assessments for waterbodies with site specific criteria are made according to the specific values listed in Reg. 2.511(A). For those waterbodies without site-specific criteria, the criteria of 250 mg/l of chlorides, 250 mg/l of sulfates, and 500 mg/l of total dissolved solids will apply. In either case, if greater than 10 percent of the total samples for the period of record exceed the applicable criteria, the waterbody will be included on the 303(d) list as non-support of the mineral standard(s).

Statewide Minerals Assessment Criteria

Parameter	Standard	Support	Non-Support
Site Specific Standards (mg/L)	See Reg. 2.511(A)	< =10%	>10%
No Site Specific Standards (mg/L)	250/250/500	< =10%	>10%

The Calculated Ecoregion Reference Stream Values (mg/L) listed in Reg. 2.511(B) are used to determine whether there is a ‘significant modification of the water quality.’ These values are not intended to be used to evaluate designated use attainment. Any discharge that results in instream chlorides, sulfates, and or total dissolved solids concentrations greater than the calculated values listed below in more than 10 percent of the samples will be considered to be a significant modification of the water quality; thus the process outlined in Reg. 2.306 should be implemented.

CALCULATED ECOREGION REFERENCE STREAM VALUES (mg/L)

Ecoregion	Chlorides	Sulfates	TDS
Ozark Highlands	17.3	22.7	250
Boston Mountains	17.3	15	95.3
Arkansas River Valley	15	17.3	112.3
Ouachita Mountains	15	20	142
Gulf Coastal Plains	18.7	41.3	138
Delta	48	37.3	411.3

4.4.9 Reg. 2.512 - Ammonia

(1) Total ammonia nitrogen will be evaluated using Reg. 2.512(A) – (D) based on instream pH and temperature, as applicable, at the time of sample collection.

(2) If more than one violation of the one-hour average concentration of total ammonia nitrogen exceeds the calculated Acute Criterion; or

(3) If more than one violation of the thirty-day average concentration of total ammonia nitrogen exceeds the Chronic Criterion; or

If more than one violation of the four-day average within a 30-day period exceeds 2.5 times the Chronic Criterion value, the water body will be listed as not attaining ammonia toxicity standards.

Statewide Total Ammonia Nitrogen Assessment Criteria

	ONE-HOUR AVERAGE	THIRTY-DAY AVERAGE	4-DAY AVERAGE
Support	<=1 in 3 years	<=1 in 3 years	<=1 in 3 years
Non-Support	>1 in 3 years	>1 in 3 years	>1 in 3 years

4.4.10 Domestic, Agricultural, and Industrial Water Supply Uses

For assessment of ambient waters, the domestic, agricultural, and industrial water supply designated uses will be evaluated using (Reg 2.511) chloride, sulfate, and total dissolved solids in accordance with the Federal Safe Drinking Water Act (40 § C.F.R 143.3). If greater than 10 percent of the total samples for the period of record exceed the criteria, the waterbody will be included on the 303(d) list as non-support of the mineral standard(s).

Statewide Water Supply Assessment Criteria

PARAMETER	STANDARD	SUPPORT	NON-SUPPORT
Chloride ¹	250	<=10%	>10%
Sulfates ¹	250	<=10%	>10%
Total Dissolved Solids ¹	500	<=10%	>10%