

Methodology for the Development

of the

2002 Section 303(d) List in Missouri

Missouri Department of Natural Resources
Division of Environmental Quality
Water Pollution Control Program

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I. Citation and Requirements

A. Citation of Section of Clean Water Act

This document is required by recent revisions of rules under the federal Clean Water Act, Section 303(d), 40 CFR 130.23 and the timetable for presenting the finished document to EPA and the public is given in 303(d), part 130.24. Section 303(d) requires states to list certain impaired waters and the rules require a document describing how this list will be constructed.

B. Requirements

The entity responsible for administration of the federal Clean Water Act, which in Missouri is the Missouri Department of Natural Resources (the department), must write a draft of a document explaining how the state's 303(d) list will be constructed. This draft document must be made available by the department to the public for at least a 60-day public review and comment period. The department must provide the USEPA with a document summarizing all comments received and DNR "*responses to significant comments.*"

The rules further requires the following specific information to be included in the Methodology Document: a) a listing of all the procedures and methods used to collect water quality data; b) the identification of all the types of data that are considered as "all existing and readily available" data; c) what considerations will be made for data age or data quality; d) how is water quality data used to determine if a stream or lake is impaired; e) by what process are waters¹ added to or deleted from the list; f) by what selection criteria are listed waters placed in the 4 categories on the list; g) how waters on the list are prioritized for TMDLs; and h) how interstate/international disagreements concerning the list are resolved.

II. The Methodology Document

A. Procedures and Methods Used to Collect Water Quality Data

MDNR Monitoring

The major purposes of the Department of Natural Resource's water quality monitoring program are (1) to characterize background or reference water quality conditions; (2) to better understand daily, flow event and seasonal water quality variations and their underlying processes; (3) to characterize aquatic biological communities and habitats and to distinguish between the impacts of water chemistry and habitat quality; (4) to assess time trends in water quality; (5) to characterize the impact of local and regional impacts of point and nonpoint source discharges on water quality; (6) to check for compliance with water quality standards or wastewater permit limits, to develop TMDLs to monitor effectiveness of pollution control activities; and (7) to support development of strategies to return impaired waters to compliance with water quality standards. All of these objectives are statewide in scope.

¹ Waters are "Waters of the State", defined as those not completely on private property owned by a single landowner or by joint tenants in common.

Coordination with Other Monitoring Efforts in Missouri

The Department of Natural Resources cooperates with other agencies in performing special water quality studies.

In 1998, a multi-agency monitoring task force including the Missouri Department of Natural Resources, Missouri Department of Conservation, the U.S. Environmental Protection Agency, the U.S. Geological Survey, the U.S. Forest Service, the USDA Natural Resources Conservation Service and the University of Missouri convened. The goal of this group was to outline a statewide aquatic resources monitoring plan, define partnership roles in this monitoring plan and to discuss the kind of research needed to further this new monitoring effort. The first major product of this work group was an agreement to initiate in 2001, a cooperative statewide aquatic invertebrate and fish monitoring program by the Missouri Department of Conservation and the Department of Natural Resources. The need to further develop sampling methods and document spatial and temporal variation in reference streams has delayed initiation of this monitoring plan until 2003.

To maximize efficiency, the department routinely coordinates its monitoring activities to avoid overlap with other agencies and provide and receive interagency input on monitoring study design. Data from other sources is used for meeting the same objectives as department sponsored monitoring. The agencies most often involved are the U.S. Geological Survey (USGS), the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency (EPA), the Missouri Department of Conservation (MDC), the USDA/Agricultural Research Service (ARS) and the Missouri Department of Health. However, the department also tracks the monitoring efforts of the U.S. Park Service, the U.S. Forest Service, several of the state's larger cities, the states of Arkansas, Kansas, Iowa and Illinois and graduate level research conducted at universities within Missouri. The department also uses monitoring data acquired by wastewater dischargers as a condition of discharge permits issued by the department. The department began using data collected by volunteers that have passed Quality Assurance/Quality Control (QA/QC) tests in 1995.

Networks and Programs

1. Fixed Station Network

- A. Objective: To better characterize background or reference water quality conditions, to better understand daily, flow event and seasonal water quality variations and their underlying processes, to assess time trends and to check for compliance with water quality standards.
- B. Design Methodology: Sites were chosen based on one of the following criteria:
 - site is believed to have water quality representative of many neighboring streams of similar size due to similarity in watershed geology, hydrology and land use, and the absence of any impact from a local point or discrete nonpoint water pollution source.
 - site is downstream of a significant point source or localized nonpoint source area.
- C. Number of Sites, Sampling Methods, Sampling Frequency, Parameters:
 - USGS/DNR cooperative network: 63 sites statewide, horizontal and vertical integrated grab samples, 6-12 times per year, major ions, nutrient ions, temperature, pH, dissolved oxygen, specific conductance, suspended solids, heavy metals flow 2-4 times annually and pesticides 6 times annually at 6 sites.

- Crowder College network: 8 sites in southwest Missouri, grab samples 18 times per year for pH, conductance, temperature, total phosphorus, ammonia nitrogen, nitrate plus nitrite, nitrogen, fecal coliform and fecal strep bacteria.
- DNR raw water sampling of public drinking water reservoirs: 31 drinking water reservoirs are sampled 4 times/year for the most commonly used agricultural herbicides.
- UMC/DNR lake monitoring network, circa 100 lakes monitored in the summer and about 12 monitored spring through fall for nutrients, chlorophyll, turbidity and suspended solids.
- DNR routine monitoring of finished public drinking water supplies for bacteria and trace contaminants.
- Routine bacterial monitoring of swimming beaches at Missouri state parks during the recreational season by DNR, Division of State Parks, Historic Preservation Program.
- Routine monitoring of sediment quality at 25 fixed sites, on a five year rotating basis (five sites monitored annually, and 10 discretionary sites annually). All sites are monitored for several heavy metals and organic contaminants. A pore water sample is analyzed for ammonia and a Microtox toxicity test on the pore water is performed.

2. Intensive Surveys

- A. Objective: To characterize the water quality impacts from a specific pollutant source area.
- B. Design Methodology: Determination of contaminants of concern based on previous water quality studies, effluent sampling and/or NPDES permit applications, use of multiple sampling stations downstream and upstream (if appropriate). If contaminants of concern have significant seasonal or daily variation, season of the year and time of day variation must be accounted for in sampling design. These studies would also require multiple samples per site over a relatively short time frame (e.g., 6-8 visits over a 2-3 day period or 10-15 visits over a 2-3 year period).
- C. Number of Sites, Sampling Methods, Sampling Frequency, Parameters:
Missouri Department of Natural Resources conducts or contracts for 10-15 special studies annually. Each study would have multiple sampling sites. Number of sites, sampling frequency and parameters would all vary greatly depending on the study.

3. Toxics Monitoring Program

Monitoring of toxics is not a separable part of the monitoring program. The fixed station network and many of our intensive studies monitor for toxic chemicals. In addition, major municipal and industrial dischargers must monitor for toxicity in their effluents as a condition of their NPDES permits.

4. Biological Monitoring Program

- A. Objective: To develop numeric criteria describing “reference” aquatic macroinvertebrate communities in Missouri’s wadeable streams. To implement these criteria within state water quality standards and begin a statewide aquatic invertebrate monitoring program in 2003 as part of a DNR/MDC cooperative statewide biological monitoring program. This program would sample fish and benthic macroinvertebrates in at least 50 stream locations annually.

The network would include long-term fixed station sites, sites believed to be impaired by specific point or nonpoint stressors and randomly selected sites.

- B. Design Methodology: Development of Biocriteria for Invertebrates involves identification of 45 “reference” streams divided among Missouri’s three aquatic ecoregions. Intensive sampling of invertebrate communities to quantify temporal and spatial variation in reference streams within ecoregions and variation between ecoregions. Sampling of chemically and physically impaired streams to test sensitivity of various community metrics to differences in stream quality.

The statewide biological monitoring program that will begin in 2003 will run on a three-year cycle. Each year at least 50 sites will be monitored for fish and aquatic macroinvertebrates. Some water chemistry sampling and a physical habitat assessment will be done at each site. Two-thirds of the work done in a cycle will be monitoring of a combination of fixed stream sites and sites of special interest (those suspected of being impaired by point or nonpoint stressors such as streams on the state 303(d) list). The remaining third of this sampling effort in each cycle will consist of randomly selected stream sites that should assist in making probability-based statements about biological condition in Missouri streams generally.

- C. Number of Sites, Sampling Methods, Sampling Frequency, Parameters:
Biocriteria Development for Aquatic Invertebrates 1991-2000: 45 reference sites, 40 other sites with varying degrees of physical or chemical impairment, modified EPA Rapid Bioassessment Protocol for Invertebrates Sites have been sampled 2-6 times over the last ten years for aquatic invertebrates, temperature, dissolved oxygen, specific conductance and nutrient ions.

Biomonitoring Network (beginning 2003): at least 50 sites annually. Fish communities will be sampled once, aquatic invertebrates twice (spring and fall) annually. Aquatic invertebrate monitoring will follow protocols established during the biocriteria development process. The Department of Conservation has initiated a pilot fish sampling study in 1999 that will result in codification of fish sampling protocols by 2003.

5. Fish Tissue

- A. Objective: Measure levels of bioaccumulative toxicants in fish.
- B. Design Methodology. Sites were chosen based on one of the following criteria:
- site is believed to have water and sediment quality representative of many neighboring streams of similar size due to similarity in geology, hydrology and land use, and the absence of any known impact from a local point source or discrete nonpoint water pollution source.
 - site is downstream of a significant point source or localized nonpoint source area.
- C. Number of Sites, Sampling Methods, Sampling Frequency, Parameters:
15 sites, fish taken by electroshocking, ideally a sample is composed of five whole carp Cyprinus carpio of equal size (fish of approximately 18" length are preferred). Sites are sampled once every two years and are analyzed for several chlorinated hydrocarbon insecticides, PCBs, lead, cadmium, mercury and fat content.

6. Volunteer Monitoring Program

Two volunteer monitoring programs are now generating water quality data in Missouri. The first is a cooperative program between the Department of Natural Resources, the University of Missouri and volunteers that monitor approximately 16 lakes, including Lake Taneycomo, Table Rock Lake and several lakes in the Kansas City area. Data from this program is used by the University as part of a long-term study on the limnology of midwestern reservoirs.

The second program monitors water quality of streams throughout Missouri. It is a cooperative project of the Department of Natural Resources, the Department of Conservation and the Conservation Federation of Missouri. By the end of 1997, this program had provided initial training, equipment and supplies to about 971 volunteers, provided secondary training and quality assurance-quality control ratings for 153 members of this group and established a database for all data reported by the volunteers. In 1998-99 an additional 831 persons had received training. The program now has 321 people who have a Level 2 or higher data quality assurance rating. This rating allows any data they provide to be used in the Department of Natural Resources' water quality assessment database. During the period 1997 through 1999, level 2 or higher rated volunteers submitted at least three sets of aquatic invertebrate data at 69 stream sites and at least three sets of chemical data on 105 stream sites.

Laboratory Analytical Support

1. Laboratories used:

- USGS/DNR Cooperative Fixed Station Network: USGS Lab, Denver, Colorado
- Crowder College Network: Crowder College, Neosho, Missouri
- DNR Public Drinking Water Reservoir Network: Missouri DNR Environmental Lab
- Intensive Surveys: Varies, many are done by Missouri DNR Environmental Lab
- Toxicity Testing of Effluents: many commercial labs
- Biological Criteria for Aquatic Invertebrates: Missouri DNR Environmental Lab and University of Missouri, Columbia
- Fish Tissue: USEPA Region VII Lab, Kansas City, Kansas and Miscellaneous contract labs (Missouri Department of Conservation)
- NPDES self-monitoring: commercial labs
- DNR Public Drinking Water Monitoring: Missouri DNR and commercial labs
- Agricultural Research Service: ARS lab

B. Identification of All Existing and Readily Available Water Quality Data Sources

Data sources, which have been used to assess water quality conditions in Missouri and to aid in the compilation of the Missouri 305(b) report and the Section 303(d) list, include:

1. Fixed station water quality and sediment data collected and analyzed by Missouri DNR personnel in the Missouri DNR Lab.
2. Fixed station water quality data collected by the U.S. Geological Survey and Crowder College under contractual agreements with Missouri DNR.
3. Fixed station water quality data collected by the U.S. Geological Survey under contractual agreements to agencies or organizations other than Missouri DNR.

4. Fixed station water quality, sediment quality and aquatic biological information collected by the U.S. Geological Survey under their NASQAN and NAWQA monitoring programs.
5. Fixed station raw water quality data collected by the Kansas City Water and Wastewater Department, the St. Louis City Water Company, St. Louis County Water Company, Springfield City Utilities and Springfield Department of Public Works.
6. Fixed station water quality data collected by the U.S. Army Corps of Engineers, the Arkansas Department of Pollution Control and Ecology, the Kansas Department of Health and Environment and the Iowa Department of Natural Resources.
7. Fixed station water quality and aquatic invertebrate monitoring by volunteers.
8. Fixed station water quality monitoring by corporations.
9. Annual fish tissue monitoring programs by USEPA/Missouri Department of Natural Resources (RAFTMP program) and annual monitoring by the Missouri Department of Conservation.
10. Special Water Quality Surveys conducted by Missouri Department of Natural Resources. Most of these surveys are focused on the water quality impacts of specific point source wastewater discharges. Some surveys are of well-delimited nonpoint sources such as abandoned mined lands. These surveys often include physical habitat evaluation and monitoring of aquatic invertebrates as well as water chemistry monitoring.
11. Special Water Quality Surveys conducted by the U.S. Geological Survey, including but not limited to:
 - a) geological, hydrological and water quality of various hazardous waste sites
 - b) geological, hydrological and water quality of various abandoned mining areas
 - c) hydrology and water quality of urban nonpoint source runoff in St. Louis, Kansas City and Springfield, Missouri
 - d) Bacterial and nutrient contamination of streams in southern Missouri
12. Special water quality studies by other agencies such as the Missouri Department of Conservation, the U.S. Public Health Service, the Missouri Department of Health.
13. Monitoring of fish occurrence and distribution in Missouri as published by the Department of Conservation in Fishes of Missouri, and any available unpublished data collected by the Missouri Department of Conservation since the last revision of this publication.
14. Fish Management Basin Plans published by the Missouri Department of Conservation.
15. Fish Kill and Water Pollution Investigations Reports published by the Missouri Department of Conservation.
16. Fish Consumption Advisories published annually by the Missouri Department of Health.
17. Selected graduate research projects pertaining to water quality and/or aquatic biology at the University of Missouri that is directed by these professors: a) Dr. Charles Rabeni; b) Dr. John Jones; c) Drs. Nord Gale and Bobby Wixson; d) Dr. Gary Patterson; e) Dr. Robert Mantei.
18. Water quality, sediment and aquatic biological data collected by USEPA or its contractors done during Remedial Investigations and Feasibility (RI/FS) studies at hazardous waste sites in Missouri.
19. Self-monitoring of wastewaters and receiving streams by cities and industries that have significant wastewater discharges. This monitoring includes chemical and sometimes toxicity monitoring of some of the larger wastewater dischargers, particularly those that discharge to smaller streams and have the greatest potential to affect instream water quality.
20. Compliance monitoring of wastewaters and receiving waters by Missouri Department of Natural Resources and USEPA. This can include chemical and toxicity monitoring.
21. Bacterial monitoring of streams and lakes by county health departments, community lake associations and other organizations using acceptable analytical methods.

The department will accept data on any new sources that meet our proposed data quality requirements.

C. Data Quality Considerations

Quality Assurance/Quality Control Programs

1. Missouri Department of Natural Resources Quality Assurance/Quality Control Program

Missouri DNR and USEPA Region VII have completed a Total Quality Management Plan. All environmental data generated directly by the department or through contracts funded by the department or EPA now require a quality assurance project plan (QAPP). The agency or organization responsible for collection or collection and analysis of the environmental sampling must write and adhere to a QAPP approved by the Missouri Department of Natural Resources' Quality Assurance Project Officer, Mr. Earl Pabst. Data sources 1, 2, 7, 9, 17 and 19 are wholly covered under the Missouri Department of Natural Resources approved QAPP. Those parts of sources 3, 8 and 16 funded by the Missouri Department of Natural Resources or USEPA Region VII are also covered under Missouri Department of Natural Resources approved QAPP.

2. Other Quality Assurance/Quality Control Programs

Sources 3, 4 and 10 are all covered under a U.S. Geological Survey internal quality assurance program that has been reviewed and approved by Missouri Department of Natural Resources.

Other Data Quality Considerations

1. Data Age

Following a USEPA suggestion (USEPA 1997²), Missouri rates its waters as either “monitored,” if data is less than 5 years old, or “evaluated” if the data is more than 5 years old. The “monitored” category carries the assumption of a better quality of data because it is more current. A second consideration is the age of the data relative to significant events that may have an effect on water quality. Data collected prior to the initiation of a new significant wastewater discharge, a large spill event, the major upgrade of an existing wastewater treatment facility or the reclamation of mining or hazardous waste site, could not be assumed to be representative of present conditions, and therefore, would not be used in making the current assessment of that stream or lake. Such “pre-event” data is used to determine changes in water quality before and after the “event”.

2. Data Type, Amount and Information Content

² Guidelines for the Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates. EPA-841-B-97-002B, Sept. 1997. USEPA, Office of Water, Washington D.C. 20460

The USEPA recommends establishing a data quality code and rating data quality by the kind and amount of data present at a particular location (USEPA 1997³). The code is a single digit number from one to four, indicating the degree of assurance the user has in the accuracy of a particular piece of environmental data. Level One indicates the least assurance and Level Four the greatest. Based on EPA's guidance, the Missouri Department of Natural Resources uses the following rules to assign a quality codes to data.

- Level One: - Small amounts of chemical data, generally quarterly or less for three or less years, qualitative sampling of invertebrates or fish, visual observation of streams. This includes university and agencies' data as well as data reported by volunteers that have successfully demonstrated adequate quality assurance at a state-sponsored quality assurance workshop. In Missouri, the primary purpose of Level One data is to provide a rapid and inexpensive method of screening large numbers of waterbodies for obvious water quality problems and to determine where more intensive monitoring is needed.
- Level Two: - Larger amounts of chemical data, generally collected quarterly to bimonthly for at least three years and sufficient to characterize typical water quality. This would include intensive studies that monitor several nearby sites repeatedly over short periods of time.
-Quantitative biological monitoring of one major aquatic assemblage (fish, macroinvertebrates or algae) at one site, once during the year.
- Fish tissue analysis.
- Level Three: - Large amounts of chemical data with at least monthly sampling for more than three years and providing data on a wide variety of water quality constituents including heavy metals and pesticides.
- Quantitative biological monitoring of at least one major aquatic assemblage at multiple sites.
- Level Four: - Large amounts of chemical data with at least monthly sampling for more than three years and providing data on a wide variety of water quality constituents including heavy metals and pesticides and including chemical sampling of sediments and fish tissue.
- Quantitative biological monitoring of at least two major aquatic assemblage at multiple sites.

In the preparation of the state 305(b) report, data from all four data quality levels are used. Most of the data is of Level One quality, and without Level One data staff would not be able to assess a majority of the state's waters.

In general, selecting waterbodies for the Missouri 303(d) list, only Level Two or higher data are used, unless the problem can be accurately characterized by Level One data^{4*}. The reason is that Level Two data provides a higher level of assurance that a water quality standard is actually being exceeded and that a TMDL study is necessary. All waterbodies excluded from the 303(d) list due to

³ ibid. Tables 3-1 through 3-4.

⁴ Where sample variances of key water quality constituents are low enough to offset the small sample size.

inadequate data, receive high priority for additional monitoring so that data quality is upgraded to at least Level Two.

D. How Water Quality Data is Evaluated to Determine Whether or Not Waters are Impaired

Physical, Chemical, Biological and Toxicity Data

USEPA provides guidelines to the states in how to evaluate water quality data in order to determine if waters are impaired (USEPA 1997⁵). These guidelines are used by the Missouri Department of Natural Resources to write the state 305(b) report, which is a status report on water quality written by the department every two years, and to develop the 303(d) list. These guidelines are summarized in the following table.

Table 1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE*	COMPLIANCE WITH WATER QUALITY STANDARDS
Overall use protection	No data-- evaluated based on similar land use/ geology as stream with water quality data.		Given same rating as monitored stream with same land use and geology.
	Visual observation of stream and qualitative evaluation of aquatic macroinvertebrates.	1	<u>Full</u> : Stream appearance and aquatic invertebrates typical of reference streams in this region of the state. <u>Partial</u> : Odor, turbidity, objectionable, suspended matter or bottom deposits that would interfere with beneficial uses or reduced diversity of aquatic macroinvertebrates. <u>Non-Attainment</u> : Odor, turbidity, or objectionable suspended matter bottom deposits severe enough to prohibit beneficial use or only pollution tolerant aquatic invertebrates found.
Protection of Aquatic Life	Chemical (toxics)	1-2	<u>Full</u> : No more than 1 exceedence of acute criterion in 3 years; less than 10% of all samples exceed chronic criterion. <u>Partial</u> : More than 1 exceedence of acute criterion in 3 years; less than 10% of all samples exceed chronic criterion. <u>Non-Attainment</u> : More than 10% of all samples exceed chronic criterion.
	Chemical (conventional)	1-2	<u>Full</u> : Less than 10% of all samples exceed criterion. <u>Partial</u> : 10-25% of all samples exceed criterion. <u>Non-Attainment</u> : More than 25% of all samples exceed criterion.
	Biological	3	<u>Full</u> : Fauna very similar to regional reference streams. <u>Partial</u> : Diversity or number of intolerant taxa

⁵ Ibid, Chapter 3.

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE*	COMPLIANCE WITH WATER QUALITY STANDARDS
			slightly to moderately less than reference streams. <u>Non-Attainment</u> : Diversity or number of intolerant taxa much less than reference stream.
	Toxicity testing of effluent	2	<u>Full</u> : No more than one test result of statistically significant mortality in either of two test species at the AEC*** or the AEC must be less than 30% of the LC ₅₀ ** for both test species, in a 3-year period. <u>Non-Attainment</u> : Conditions for full attainment not met.
	Toxicity testing of streams or lakes	3	<u>Full</u> : No more than one test result of statistically significant deviation from controls in acute test endpoints in at least two representative species, in a 3-year period. <u>Non-Attainment</u> : [Statistically significant mortality in at least one of two representative test species] Conditions for full attainment not met.
Fish Consumption	Chemicals (water) Chemicals (tissue)	1-2	<u>Full</u> : Water quality criteria not exceeded as a long-term average; fish consumption advisories allow typical or average fish consumption rates for all commonly eaten species. <u>Partial</u> : Fish consumption advisories allow less than typical or average consumption rate for at least one commonly eaten species. <u>Non-Attainment</u> : Water quality criteria exceeded as long-term average or consumption banned for at least one commonly eaten species.
Drinking Water Supply	Physical, chemical (nutrients)	1-2	<u>Full</u> : Very little loss of lake volume due to sedimentation, low levels of nutrients, no history of taste or odor problems due to algae. <u>Threatened</u> : Rate of sedimentation moderate and no taste and odor problems known but nutrient or algae levels similar to lakes with taste and odor problems. <u>Partial</u> : Water supply may be inadequate in dry years due to loss of volume to sedimentation or supply has infrequent taste and odor problems. <u>Non-Attainment</u> : Water supply has chronic water shortage due to loss of storage volume to sedimentation or frequent taste and odor problems or supply causes infrequent gastrointestinal problems in users.
	Chemical (toxics, raw water)	1-2	<u>Full</u> : Mean values do not exceed . <u>Threatened</u> : Chemical use patterns in watershed are similar to watersheds with non-attainment. <u>Non-Attainment</u> : One or more contaminants have mean values in excess of water quality criteria.

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE*	COMPLIANCE WITH WATER QUALITY STANDARDS
	Chemical (Iron, Manganese, Total Dissolved Solids, Raw Water)	1-2	<u>Full</u> : Mean values do not exceed criterion. <u>Threatened</u> : Mean values do not exceed criterion but time trends suggest mean may be exceeded in future. <u>Non-Attainment</u> : Mean values exceed criterion.
	Chemical (toxics, finished water)	1-2	<u>Full</u> : No MCLs or Water Quality Standards criteria exceeded or significant taste and odor problems using only convention treatment (sedimentation-disinfection). <u>Threatened</u> : Chemical use patterns in watershed are similar to watersheds not in full attainment. <u>Partial</u> : Additional treatment needed to meet MCLs or Water Quality Standards criterion. <u>Non-Attainment</u> : At least one contaminant has annual average exceeding MCL or Water Quality Standards criterion or supply has been closed during the past 2 years due to contamination of raw water entering the plant. NOTE: water quality problems caused by the drinking water treatment process such as the formation of Trihalomethanes (THMs) are not included.
Whole-Body-Contact Recreation	Fecal Coliform count	1-2	<u>Full</u> : Water Quality Standards not exceeded as a geometric mean for samples collected during the recreation season and at times not influenced by storm water flows. <u>Non-Attainment</u> : Geometric mean does exceed Water Quality Standard criterion during recreation season at times not influenced by storm water flows.
Irrigation, Livestock and Wildlife Water	Chemical (boron, cobalt)	1-2	<u>Full</u> : Mean value does not exceed water quality criteria. <u>Non-Attainment</u> : Mean value does exceed water quality criteria.

* Data quality codes have been established by EPA to rate the quality and quantity of data from a specific source. Level One data is the lowest level of useable data and includes infrequent chemical monitoring or qualitative biological monitoring. Level Two data would include intensive water chemistry studies, long-term water chemistry monitoring sites and fish tissue analysis. Levels Three and Four are for detailed biological studies of fish, aquatic invertebrates and toxicity testing of waters.

** LC₅₀ The concentration of a contaminant that kills 50% of test organisms.

*** AEC = Acceptable Effluent Concentration. This is the percentage of effluent in a solution of effluent at the effluent design (max.) Flow mixed with 2.5% of the 7Q₁₀ low flow of the receiving stream. This would simulate the instream toxicity potential of the discharge during dry weather.

**** All individual exceedences of a water quality criterion will be treated equally regardless of degree or magnitude of the exceedence.

Other Types of Information

1. Observation and evaluation of waters for noncompliance with state narrative water quality criteria. These narrative criteria apply to both classified and unclassified waters and prohibit the following in waters of the state:
 - a. unsightly, putrescent or harmful bottom deposits
 - b. oil, scum and floating debris
 - c. unsightly color, turbidity or odor
 - d. substances causing toxicity to human, animal or aquatic life
 - e. human health hazard due to incidental contact
 - f. acute toxicity to livestock or wildlife when used as a drinking water supply
 - g. physical, chemical or hydrologic changes that impair the natural biological community
 - h. used tires, car bodies, appliances, demolition debris, used vehicles or equipment and any solid waste as defined by Missouri's Solid Waste Law
2. Habitat Assessments. Habitat assessment protocols for wadeable streams have been established and are made in conjunction with sampling of aquatic invertebrates and the analysis of aquatic invertebrates data. Missouri Department of Natural Resources does not use habitat assessment data independently of biological sampling at this time.
3. Drinking water susceptibility analyses and other projections of water quality based on geology and land use. In watersheds that do not have monitoring data, the presence or absence of certain types of water quality impairment may be judged to occur based on actual monitoring data from a nearby stream draining a watershed with very similar geology and land use.

E. 303(d) Listing Considerations

1. Adding to the Existing List or Expanding the Scope of Impairment to a Previously Listed Water

New waterbodies are added to the list when the data following the guidelines in Table 1 shows either "partial attainment" or "nonattainment," or evaluation of a stream indicates noncompliance with state narrative water quality criteria. Likewise, the size of an impaired water on the list can be increased based on recent monitoring data following the same guidelines. Likewise one or more new pollutants can be added to a water already on the list based on recent monitoring data following the same guidelines.

Example 1: The Department of Natural Resources conducted a study of McKenzie Creek at the city of Piedmont in 2000 and found substantial water quality impairment of that stream, including early morning dissolved oxygen levels below 2 mg/l, due to discharges from the city wastewater lagoon. Prior to that survey this portion of McKenzie Creek did not appear on the 1998 303(d) list. Based on the 2000 survey, the department will recommend adding the lower two miles of McKenzie Creek to the 2002 303(d) list.

Example 2: On the 1998 303(d) list, two miles of Cedar Creek on the Boone-Callaway county line was listed as impaired due to instream acidity problems. During 2000, after additional water quality data was collected and additional historical data was analyzed, it was apparent that approximately three miles of stream, not two, appeared to be periodically affected by acidity. Based on this additional information, the department will recommend

amending the present listing of Cedar Creek to show that three miles of stream are believed to be impaired by acidity.

2. Deleting from the Existing List or Decreasing the Scope of Impairment to a Previously Listed Water

Waterbodies are deleted from the list when the data following the guidelines in Table 1 shows “full attainment” or is judged to be in compliance with state narrative water quality criteria. Likewise, the size of an impaired water on the list can be decreased based on recent monitoring data following these same guidelines. Likewise, one or more pollutants can be deleted from a water already on the list based on recent monitoring data following these same guidelines.

Example 1. Rush Creek in Platte County was listed in 1998 as impaired due to deposits of sewage sludge in the receiving stream due to discharges from the wastewater treatment plant serving El Dorado Apartments. In 2000, DNR confirmed this wastewater plant had been removed and wastewater had been routed to a large wastewater treatment facility on another stream. Inspection of the stream showed it no longer contained sewage sludge deposits. DNR will recommend removal of Rush Creek from the list in 2002.

Example 2: Trace Creek in Madison County was on the 1998 303(d) list for acidity in 5.5 miles of stream due to natural geologic condition aggravated by leachate from sawdust piles. Because of recent improvements in sawdust management at a sawmill in the watershed, department staff and a local volunteer monitored water quality in Trace Creek several times in 2000. The results showed significant improvement in Trace Creek and virtually no acidity coming from the sawmill area. Based on this additional sampling, the department will recommend retaining Trace Creek on the 2002 303(d) list but reducing the length of stream impaired from 5.5 miles down to 0.5 miles.

3. Placement of Waters Within the Four 303(d) List Categories

Section 303d, Part 130.27 requires all waters on 303d lists subsequent to the 2000 list, to be partitioned into four parts. Missouri will partition waters in the following way:

Part One: a) numeric water quality criteria for one or more discrete pollutants cause the water to be rated as “partial attainment” or “nonattainment” as per Table 1 guidelines; b) observed water quality conditions are judged to exceed state narrative water quality criteria (i.e., taste, odor, unsightly or harmful bottom deposits) due to a one or more discrete pollutants.

Examples of Waters Included in Part One of the List:

1. Public drinking water supply source waters with long-term average herbicide levels above water quality standards or federal health advisory levels.
2. Recreational waters with bacterial levels above state standards for swimming.
3. Waters that do not meet state standards for protection of aquatic life due to exceedence of state standards for dissolved oxygen, ammonia, chlorine, heavy metals such as zinc, copper or chromium.
4. Waters that are impaired by wastewater discharges that impart color or odor to the water, or discharge materials that float in or on the water or form bottom deposits.

Part Two: Those waters for which no specific discrete pollutant is listed as the cause of the impairment. This would include waters where the cause is listed as “unknown” or waters where the cause of the impairment is a condition such as “aquatic habitat degradation” and no discrete pollutant is listed.

Examples of Waters Included in Part Two of the List:

1. Waters subjected to channel alteration (channel straightening) or other physical alteration of the sides and or bottom of the stream channel such as paving, rip-rapping or confining the stream within a large pipe.
2. Waters where more intensive agricultural or urban land uses, or impoundment have caused significant changes in the amount and timing of water movement through the watershed.

Part Three: Waters for which a TMDL has been established and approved by USEPA but the water quality impairment has not yet been corrected. A water can remain on this list only as long as the state and USEPA determine that substantial progress is being made to meet the water quality standards. If substantial progress is not being made to meet water quality standards, the water must be returned to Part One of the list.

Example of Waters Included in Part Three of the List:

1. Rock Creek in Jefferson County has a completed TMDL. At present the wastewater discharges which are causing impairment of Rock Creek are still in operation but these facilities are planned for elimination in the next two years after the completion of a large, new wastewater treatment plant which will serve this entire area and discharge to the Mississippi River.

Part Four: Waters which are expected to be returned to compliance with state water quality standards prior to the issuance of the next 303d list, as a result of the implementation of technology based effluent limitations required under Sections 301(b), 306 or 307 of the federal Clean Water Act, or other controls enforceable by state law or regulation. Any water listed under Part Four that does not meet state water quality standards by the issuance of the next 303(d) list, will be moved to Part One of the list.

Examples of Waters Included in Part Four of the List:

1. The City of Willow Springs has implemented changes in the disinfection facilities at the Willow Springs WWTP which should eliminate the chlorine toxicity problem in the Eleven Point River.
4. Prioritization of Waters for TMDL Development

Within the first paragraph of section 303(d), the statute requires a priority ranking for listed waters, taking into account the severity of the pollution and the uses to be made of such waters. The following describes how priorities among the section 303(d) waters are selected.

1. Waters with human health use impairment, or more than one use impairment rank as high priority pending application of Criteria 4.
2. Waters with a single use impairment other than a human health use or an aesthetic use rank as medium priority pending application of Criteria 4.
3. Waters with only an aesthetic use impairment rank as low priority.
4. If a water initially ranked as medium priority is impaired by a source that is judged to be highly treatable, it is ranked high priority. If a water initially ranked as high priority is impaired by a source that is judged to be impractical to treat, it is ranked as medium priority.

With regard to the number of beneficial uses impaired, all classified waters in Missouri are protected for at least three beneficial uses: livestock and wildlife watering, protection of aquatic life and human consumption of fish. In addition, some waters are protected for other uses if those uses are expected of particular waters. These other uses include drinking water supply, irrigation, and whole body contact recreation (swimming, water skiing).

With regard to treatability of the impairment, some water quality problems are more amenable to being successfully treated than others. In addition, some problems are inherently more expensive to treat than others and some problems have economic impacts only at a very local scale while others will affect regional economies. Last, some water quality problems can be treated with economic consequences only, but for others there will be environmental trade-offs as well.

Examples of Prioritization of Selected Waters:

Water	Priority	Criteria
Big River	High	Fish consumption advisory for lead (human health), sediment deposition also affects aq.life (multiple use impairments). Reclamation of abandoned tailings piles would be effective in correcting this problem (highly treatable).
Dog Creek	High	Aquatic life use impairment (one use), problem could effectively treated by improved stormwater controls at limestone quarry.
Sugar Creek	Medium	Aquatic life use impairment (one use), subsurface acid mine drainage would be very difficult to treat.
S. Wyaconda River	Low	Only impairment is of an aesthetic water quality standard.

5. Resolution of Interstate/International Disagreements

The Missouri Department of Natural Resources will review the draft 303(d) lists of all other states with which we share border waters (Missouri River, Mississippi River, Des Moines River and the St. Francis River). Where the listing in another state is different than in Missouri, the department will request the data responsible for the listing in the other state. These data will be reviewed following all data evaluation guidelines previously discussed in

this document and the Missouri list will or will not be changed pending the evaluation of this additional data.

For waters which cross the Missouri state line going to or coming from another state, when the 303(d) listing changes at the state line, Missouri Department of Natural Resources will, upon request of the bordering state, USEPA or other interested party, review and evaluate data supplied for the other state. These data will be reviewed following all data evaluation guidelines previously discussed in this document and the Missouri list will or will not be changed pending the evaluation of this additional data.