Prepared in cooperation with the Missouri Department of Natural Resources

Quality of Surface Water in Missouri, Water Year 2019

Data Series 1132

U.S. Department of the Interior
U.S. Geological Survey

Cover Photo: Hydrologic technicians collecting a surface-water quality sample on the Big River in Missouri.

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U.S. Department of the Interior
DAVID BERNHARDT, Secretary

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Conversion Factors

U.S. customary units to the International System of Units

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Datum

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Supplemental Information

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Density population of bacteria is given in colonies per 100 milliliters (col/100 mL) of water.

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

A water year in U.S. Geological Survey reports is the 12-month period October 1 through September 30 and is designated by the calendar year in which it ends; thus, the year ending September 30, 2019, is called "water year 2019."

Abbreviations

ag	agriculture
AWQMN	Ambient Water-Quality Monitoring Network
DTPL	Dissected Till Plains
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
fo	forest
HAL	Health Advisory Level
LRL	laboratory reporting level
LT–MDL	long-term method detection level
MDL	method detection level
MDNR	Missouri Department of Natural Resources
MIAPL	Mississippi Alluvial Plain
MRL	minimum reporting level
NWIS	National Water Information System
NWQMP	National Water Quality Monitoring Program
NWQL	National Water Quality Laboratory
OSPL	Osage Plains
OZPLSA	Ozark Plateau Province, Salem Plateau
OZPLSP	Ozark Plateau Province, Springfield Plateau
pr	prairie
TMDL	total maximum daily load
USGS	U.S. Geological Survey
wi	watershed indicator

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Abstract

The U.S. Geological Survey, in cooperation with the Missouri Department of Natural Resources, designed and operates a network of monitoring stations on streams and springs throughout Missouri known as the Ambient Water-Quality Monitoring Network (AWQMN). During water year 2019 (October 1, 2018, through September 30, 2019), water-quality data were collected at 73 stations: 71 AWQMN and alternate AWQMN stations, and 2 U.S. Geological Survey National Water Quality Monitoring Program stations. Among the stations in this report, four stations have data presented from additional sampling performed in cooperation with the U.S. Army Corps of Engineers. Summaries of the concentrations of dissolved oxygen, specific conductance, water temperature, suspended solids, suspended sediment, *Escherichia coli* bacteria, fecal coliform bacteria, dissolved nitrate plus nitrite as nitrogen, total phosphorus, dissolved and total recoverable lead and zinc, and selected pesticides are presented. Most of the stations have been classified based on the physiographic province or primary land use in the watershed monitored by the station. Some stations have been classified based on the unique hydrologic characteristics of the waterbodies (springs, large rivers) they monitor. A summary of hydrologic conditions including peak streamflows, monthly mean streamflows, and 7-day low flows also are presented for representative streamflow-gaging stations in the State.

Introduction

The Missouri Department of Natural Resources (MDNR) is responsible for the implementation of the Federal Clean Water Act (33 U.S.C. §1251 et seq.) in Missouri. Section 305(b) of the Clean Water Act requires that each State develop a water-quality monitoring program and periodically generate a report providing a description of the water quality of all navigable waters in the State (U.S. Environmental Protection Agency, 1997). Water-quality status is described in terms of the suitability of these navigable waters for various uses, such as drinking, fishing, swimming, and supporting aquatic life. These uses formally were defined as "designated uses" in State and Federal regulations. Section 303(d) of the Clean Water Act requires States to identify impaired waters and determine the total maximum daily loads (TMDLs) of pollutants that can be present in these waters and still meet applicable water-quality standards for their designated uses (U.S. Environmental Protection Agency, 2019). A TMDL addresses a single pollutant for each waterbody.

Missouri has an area of about 69,000 square miles and an estimated population of about 6.13 million people (U.S. Census Bureau, 2019). Within Missouri, 115,772 miles (mi) of classified streams support a variety of uses including wildlife, recreation, agriculture, industry, transportation, and public utilities. Of the classified stream miles, 10,535 mi (about 9.1 percent) were considered monitored, whereas about 90.9 percent of classified stream miles were evaluated in the State's most recent water-quality report (Missouri Department of Natural Resources, 2020). Of these assessed stream miles, an estimated 4,898 mi (about 4.2 percent) fully support the designated uses, and an estimated 5,090 mi (about 4.4 percent) are impaired by various physical changes or chemical contaminants to the point that criteria for at least one of the designated uses no longer can be met (Missouri Department of Natural Resources, 2020).

The purpose of this report is to summarize surface-water quality data collected for the MDNR–U.S. Geological Survey (USGS) cooperative AWQMN for water year 2019 (October 1, 2018, through September 30, 2019). The annual summary of data for selected constituents provides the MDNR with current information to assess the quality of surface water within the State. This report is one in a series of annual summaries (Otero-Benitez and Davis, 2009a, 2009b; Barr, 2010, 2011, 2013, 2014, 2015; Barr and Schneider, 2014; Barr and Heimann, 2016; Barr and Bartels, 2018, 2019; Kay, 2019). Data on the physical characteristics and water-quality constituents in samples collected during the 2019 water year are presented in figures and tables for 73 surface-water stations located throughout the State.

The Ambient Water-Quality Monitoring Network

The USGS, in cooperation with the MDNR, collects surface-water quality data pertaining to water resources in Missouri each water year as part of the Missouri AWQMN. The MDNR and the USGS established the fixed-station AWQMN in 1964 with 18 stations, 5 of which were still being sampled during water year 2019. The number and location of stations that constitute the AWQMN at any particular time since 1964 have varied because of changes in the State's needs.

Data collected for the AWQMN are stored and maintained in the USGS National Water Information System (NWIS) database (U.S. Geological Survey, 2019). These data are a permanent source of accessible, accurate, impartial, and timely information.

The AWQMN data provide an understanding of the State's current water resources, as well as spatial and temporal trends in the water resources. Historical surface-water quality data were published annually in the Water-Data Report series from water years 1964 through 2005. An example of the data published during this period is available from Hauck and Harris (2006). Published data for water years 2006 through 2010 can be accessed at https://wdr.water.usgs.gov/ (U.S. Geological Survey, 2006b–2010). Beginning in water year 2011, discrete water-quality data were no longer published annually but can be accessed in the NWIS database (U.S. Geological Survey, 2019).

The objectives of the AWQMN are to (1) obtain sufficient data to provide an accurate representation of the quality and quantity of surface water throughout the State; (2) provide a database of water-quality data that can be accessed by the public, as well as private and government entities; and (3) provide for consistent methodology in data collection, laboratory analysis, and data reporting that allows for accurate comparison of data between sites and through time. Constituent concentration data from the AWQMN have been used to determine the statewide water-quality status, to identify long-term trends in water quality (Barr and Davis, 2010), and to identify anthropogenic effects (mining, agriculture, urban) on water resources (Missouri Department of Natural Resources, 2019). These data are critical to meeting information needs of the public as well as Federal, State, and local agencies involved in water-quality planning and management. The data provide support for the design, implementation, and evaluation of preventive and remediation programs.

Samples were collected from 70 primary AWQMN stations and 1 alternate sampling station during water year 2019. The alternate sampling station is located at a streamflow-gaging station near the primary AWQMN station and was sampled when the primary station was dry. Alternate sampling station Mussel Fork near Musselfork, Missouri (06906000), was sampled in October 2018 in place of the primary station at Mussel Fork near Mystic, Mo. (06905725). Sampling frequency at each station is determined by several factors, including drainage basin size, potential effects from anthropogenic activities (such as agriculture, mining, and urban), stability or volatility of chemical conditions through time, need for annual data, and cost. Each of the streams in the AWQMN is classified for one or more designated uses. For specific information on the designated uses applicable to the streams sampled in the AWQMN, refer to Missouri Department of Natural Resources (2019, 2020).

Constituents collected within the AWQMN have been established by the MDNR based on their data needs at each station. Samples were collected by USGS personnel; collection methods and techniques followed USGS protocol (U.S. Geological Survey, 2006a). Onsite measurements of dissolved oxygen, specific conductance, and water temperature were collected at each station according to procedures described in Wilde (variously dated). Water samples were collected and processed for fecal indicator bacteria (*Escherichia coli* [*E. coli*] and fecal coliform) densities using the membrane filtration procedure described in Myers and others (2014). Methods used by the USGS for collecting and processing representative samples for nutrients, primary chemical constituents, trace elements, suspended solids, suspended sediment, and pesticide analyses are presented in detail in U.S. Geological Survey (2006a), Guy (1969), Wilde and others (2004), and Sandstrom and Wilde (2014). All laboratory analyses were done by the USGS National Water Quality Laboratory (NWQL) in Lakewood, Colorado, according to procedures described in Garbarino and others (2006), Fishman (1993), Patton and Kryskalla (2011), Patton and Truitt (1992), Sandstrom and others (2001, 2015), and Zaugg and others (1995). Suspended-sediment concentrations were analyzed at the Central Midwest Water Science Center Sediment Laboratory in Rolla, Mo., and processed according to procedures described in Guy (1969).

In addition to the surface-water quality data collected from the stations that form the AWQMN, selected data collected as part of other cooperative efforts are included in this report to improve the summary of water-quality conditions across the State. Additional data-collection efforts include water samples collected by the USGS at two National Water Quality Monitoring Program (NWQMP; a national water-quality sampling network operated by the USGS) stations and suspended-sediment samples collected at four USGS streamflow-gaging stations on the Mississippi and Missouri Rivers. The suspended-sediment samples are collected as part of a larger monitoring effort in cooperation with the U.S. Army Corps of Engineers. The suspended-sediment concentration data in this report are provided for comparison to the State's total suspended solids criteria. The suspended-sediment data used in this report consist of composited cross-sectional concentrations and average cross-sectional concentrations computed from five depth-integrated samples within the cross section (Edwards and Glysson, 1999).

The unique eight-digit number used by the USGS to identify each surface-water station is assigned when a station is first established. The complete eight-digit number for each station includes a two-digit prefix that designates the primary river system (05 is the upper Mississippi River, 06 is the Missouri River, and 07 is the lower Mississippi River) plus a six-digit downstream-order number; for example, the station number 05587455 indicates the station is in the upper Mississippi River system (05), and the remaining six digits (587455) locate the station in downstream order. In this system, the station numbers increase downstream along the main stem. A station on a tributary that enters between two main stem stations is assigned a station number between the numbers on the main stem.

Laboratory Reporting Conventions

The USGS NWQL uses method reporting conventions (Childress and others, 1999) to establish the minimum concentration for which more than one qualitative measurement can be made. These reporting conventions are the minimum reporting level (MRL), the method detection level (MDL), and the laboratory reporting level (LRL). The MRL is defined by the NWQL as the smallest measured concentration of a substance that can be measured reliably using a given analytical method. The MDL is the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the concentration is greater than zero. A long-term method detection level (LT–MDL) is a detection level obtained by determining the standard deviation of 24 or more MDL spiked-sample measurements for an extended period. The LRL is computed as twice the LT–MDL.

Surface-Water Quality Data Analysis Methods

The distribution of data for selected constituents is displayed graphically using side-by-side boxplots (box and whiskers distributions). The plots show the center of the data (median, the center line of the boxplot), the variation (interquartile range [25th to 75th percentiles] or the height of the box), the skewness (quartile skew, which is the relative size of the box halves), the spread (upper and lower adjacent values are the vertical lines or whiskers and represent 1.5 times the interquartile range above the 75th and below the 25th percentiles), and the presence or absence of unusual values or outliers (denoted by open circles). If the median equals the 25th and 75th percentiles, the boxplot is represented by a single horizontal line. Boxplots with censored data (suspended solids, dissolved nitrate plus nitrite as nitrogen, total phosphorus, and dissolved and total recoverable lead and zinc) were modified by making the lower limit of the box equal to the MRL or MDL, as appropriate. All data collected from the stations during water year 2019 was obtained from the NWIS database (U.S. Geological Survey, 2019). These data can be compiled by the public from NWIS using search criteria such as USGS station identifiers (table 1) and the desired date range (October 1, 2018, through September 30, 2019).

Pesticide concentrations in some samples were detected at concentrations less than the LRL. The concentration of pesticides detected at less than the LRL are reported as estimated because of the uncertainty in quantifying the concentration at such low levels by the analytical method used. The reported value of the estimated concentration was used when these data were subjected to statistical analysis for consistency with previous reports. As a result, some pesticides had minimum or median concentrations that were less than the LRL.

Table 1. U.S. Geological Survey station number, name, contributing drainage area, sampling frequency, station class, and station type for selected surface-water quality monitoring stations in Missouri, water year 2019.

[Water year 2019 is defined as October 1, 2018, through September 30, 2019. USGS, U.S. Geological Survey; mi^2, square mile; DTPL, Dissected Till Plains; ag, agriculture; BRMIG, Big River—Mississippi River below Grafton, Illinois; wi, watershed indicator; BRMOSJ, Big River—Missouri River at St. Joseph, Missouri; BRMOS, Big River—Missouri River at Sibley, Missouri; MINING, mining; OSPL, Osage Plains; pr, prairie; OZPLSP, Ozark Province Plateau—Springfield Plateau; fo, forest; OZPLSA, Ozark Province Plateau—Salem Plateau; --, not applicable; SPRING, spring; BRMOH, Big River—Missouri River at Hermann, Missouri; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; MIALPL, Mississippi Alluvial Plain; OTHER, station does not fit into any category]

USGS station number (figs. 1 and 3)	Station name[a]	Contributing drainage area (mi^2)	Water year 2019 sampling frequency	Station class and type (fig. 1; table 2)
05495000	Fox River at Wayland, Missouri	400	6	DTPL ag
05496000	Wyaconda River above Canton, Missouri	393	6	DTPL ag
05497150	North Fabius River near Ewing, Missouri	471	6	DTPL ag
05500000	South Fabius River near Taylor, Missouri	620	12	DTPL ag
05514500[b]	Cuivre River near Troy, Missouri	903	6	OTHER
05587455[c]	Mississippi River below Grafton, Illinois	171,300	12	BRMIG
06817700	Nodaway River near Graham, Missouri	1,520	6	DTPL wi ag
06818000[c]	Missouri River at St. Joseph, Missouri	426,500	12	BRMOSJ
06821190	Platte River at Sharps Station, Missouri	2,380	6	DTPL wi ag
06894100	Missouri River at Sibley, Missouri	426,500	12	BRMOS
06896187	Middle Fork Grand River near Grant City, Missouri	82.4	6	DTPL ag
06898100	Thompson River at Mount Moriah, Missouri	891	6	DTPL ag
06898800	Weldon River near Princeton, Missouri	452	6	DTPL ag
06899580	No Creek near Dunlap, Missouri	34	12	DTPL ag
06899950	Medicine Creek near Harris, Missouri	192	12	DTPL ag
06900100	Little Medicine Creek near Harris, Missouri	66.5	12	DTPL ag
06900900	Locust Creek near Unionville, Missouri	77.5	12	DTPL ag
06902000	Grand River near Sumner, Missouri	6,880	12	DTPL wi ag
06905500	Chariton River near Prairie Hill, Missouri	1,870	6	DTPL wi ag
06905725	Mussel Fork near Mystic, Missouri	24	11	DTPL ag
06906000[d]	Mussel Fork near Musselfork, Missouri	267	1	DTPL ag
06906300	East Fork Little Chariton River near Huntsville, Missouri	220	6	MINING
06907300[b]	Lamine River near Pilot Grove, Missouri	949	9	OTHER
06917630	East Drywood Creek at Prairie State Park, Missouri	3.38	4	OSPL pr
06918070	Osage River above Schell City, Missouri	5,410	6	OSPL wi ag
06918600	Little Sac River near Walnut Grove, Missouri	119	12	OZPLSP ag/fo
06921070	Pomme de Terre River near Polk, Missouri	276	9	OZPLSA fo/ag
06921590	South Grand River at Archie, Missouri	356	7	OSPL ag
06923700	Niangua River at Bennett Spring, Missouri	441	5	OZPLSA fo/ag
06926510	Osage River below St. Thomas, Missouri	14,580	6	OZPLSA wi fo/ag
06927850	Osage Fork of the Gasconade River near Lebanon, Missouri	43.6	5	OZPLSA fo/ag
06928440	Roubidoux Spring at Waynesville, Missouri	--	5	SPRING
06930450	Big Piney River at Devil's Elbow, Missouri	746	7	OZPLSA fo/ag
06930800	Gasconade River above Jerome, Missouri	2,570	11	OZPLSA wi fo/ag
06934500[c,e]	Missouri River at Hermann, Missouri	522,500	14	BRMOH
07014000	Huzzah Creek near Steelville, Missouri	259	6	OZPLSA fo/ag
07014200	Courtois Creek at Berryman, Missouri	173	6	OZPLSA fo/ag
07014500	Meramec River near Sullivan, Missouri	1,475	12	OZPLSA wi fo/ag
07016400	Bourbeuse River above Union, Missouri	808	9	OZPLSA fo/ag
07018100	Big River near Richwoods, Missouri	735	9	MINING

Table 1. U.S. Geological Survey station number, name, contributing drainage area, sampling frequency, station class, and station type for selected surface-water quality monitoring stations in Missouri, water year 2019.—Continued

[Water year 2019 is defined as October 1, 2018, through September 30, 2019. USGS, U.S. Geological Survey; mi^2, square mile; DTPL, Dissected Till Plains; ag, agriculture; BRMIG, Big River—Mississippi River below Grafton, Illinois; wi, watershed indicator; BRMOSJ, Big River—Missouri River at St. Joseph, Missouri; BRMOS, Big River—Missouri River at Sibley, Missouri; MINING, mining; OSPL, Osage Plains; pr, prairie; OZPLSP, Ozark Province Plateau—Springfield Plateau; fo, forest; OZPLSA, Ozark Province Plateau—Salem Plateau; --, not applicable; SPRING, spring; BRMOH, Big River—Missouri River at Hermann, Missouri; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; MIALPL, Mississippi Alluvial Plain; OTHER, station does not fit into any category]

USGS station number (figs. 1 and 3)	Station name[a]	Contributing drainage area (mi^2)	Water year 2019 sampling frequency	Station class and type (fig. 1; table 2)
07019280	Meramec River at Paulina Hills, Missouri	3,920	12	URBAN wi
07020550	South Fork Saline Creek near Perryville, Missouri	55.3	6	OZPLSA fo/ag
07021020	Castor River at Greenbriar, Missouri	423	6	OZPLSA fo/ag
07022000[c,e]	Mississippi River at Thebes, Illinois	713,200	14	BRMIT
07036100	St. Francis River near Saco, Missouri	664	9	OZPLSA fo/ag
07037300	Big Creek at Sam A. Baker State Park, Missouri	189	6	OZPLSA fo/ag
07042450	St. Johns Ditch at Henderson Mound, Missouri	313	5	MIALPL
07046250	Little River Ditches near Rives, Missouri	1,620	12	MIALPL
07050150	Roaring River Spring at Cassville, Missouri	--	6	OZPLSP ag/fo
07052152	Wilson Creek near Brookline, Missouri	51	12	URBAN
07052160	Wilson Creek near Battlefield, Missouri	58	12	URBAN
07052250	James River near Boaz, Missouri	462	6	URBAN
07052345	Finley Creek below Riverdale, Missouri	261	12	OZPLSP ag/fo
07052500	James River at Galena, Missouri	987	12	URBAN
07052820	Flat Creek below Jenkins, Missouri	274	12	OZPLSP ag/fo
07053700[b]	Lake Taneycomo at Branson, Missouri	--	6	OTHER
07053900	Swan Creek near Swan, Missouri	148	6	OZPLSA fo/ag
07057500	North Fork River near Tecumseh, Missouri	561	7	OZPLSA fo/ag
07057750	Bryant Creek below Evans, Missouri	214	5	OZPLSA fo/ag
07061600	Black River below Annapolis, Missouri	493	5	OZPLSA fo/ag
07066110	Jacks Fork above Two River, Missouri	425	12	OZPLSA fo/ag
07067500	Big Spring near Van Buren, Missouri	--	4	SPRING
07068000	Current River at Doniphan, Missouri	2,040	12	OZPLSA wi fo/ag
07068510	Little Black River below Fairdealing, Missouri	194	6	OZPLSA fo/ag
07071000	Greer Spring at Greer, Missouri	--	4	SPRING
07071500	Eleven Point River near Bardley, Missouri	793	6	OZPLSA fo/ag
07185764	Spring River above Carthage, Missouri	425	12	OZPLSP ag/fo
07186480	Center Creek near Smithfield, Missouri	303	9	MINING
07186600	Turkey Creek near Joplin, Missouri	41.8	7	URBAN
07187000	Shoal Creek above Joplin, Missouri	427	12	OZPLSP ag/fo
07188838	Little Sugar Creek near Pineville, Missouri	195	12	OZPLSP ag/fo
07189000	Elk River near Tiff City, Missouri	872	12	OZPLSP ag/fo
07189100	Buffalo Creek at Tiff City, Missouri	60.8	12	OZPLSP ag/fo

[a]Station names were obtained from the U.S. Geological Survey National Water Information System database: https://nwis.waterdata.usgs.gov/mo/nwis/qwdata.

[b]Station data are not included in this report because this station does not fit within the classification system used for this report.

[c]Additional water temperature and suspended-sediment samples were collected at this station in cooperation with the U.S. Army Corps of Engineers.

[d]This station was sampled as an alternate station when Mussel Fork near Mystic, Missouri (06905725) was dry.

[e]Stations 06934500 and 07022000 are not part of the Ambient Water-Quality Monitoring Network but were used in this report. Stations 06934500 and 07022000 are funded by the U.S. Geological Survey National Stream Quality Assessment Network.

Station Classification for Data Analysis

The stations used in this report are located throughout the State (fig. 1) and monitor watersheds with a variety of geologic settings, land uses (fig. 2), and unique hydrologic systems. Most of the stations were grouped into first-order classifications according to the physiographic region (Fenneman, 1938; fig. 1) or the primary land use in the watershed monitored by the station (fig. 2). The remaining stations were grouped into first-order classifications according to the unique hydrologic characteristics of the waterbody they monitor (fig. 1).

The physiography-based stations monitor watersheds located in the Dissected Till Plains (DTPL) in the north, the Osage Plains (OSPL) in the west-central, the Mississippi Alluvial Plain (MIALPL) in the southeast, the Ozark Plateau Province, Salem Plateau (OZPLSA) in the middle of the State, and the Ozark Plateau Province, Springfield Plateau (OZPLSP) in the southwest (fig. 1). Water quality at the stations classified by physiography is expected to be substantially affected by natural chemical processes, including interactions with the geologic and biologic media.

Stations classified by the primary land use monitor watersheds with substantial amounts of mining (MINING) or urban (URBAN) land use. These stations are grouped separately from the physiography-based stations to assess the effects of mining and urban land use on water quality.

Stations classified based on the unique hydrologic characteristics of the waterbodies they monitor refer to springs (SPRING) and the stations on the Mississippi River (BRMIG and BRMIT) and the Missouri River (BRMOSJ, BRMOS, and BRMOH). Stations on the Mississippi and Missouri Rivers are referred to as the "Big River stations" (fig. 1) in this report. Water chemistry at the SPRING stations is expected to differ from the other stations because the SPRING stations reflect the chemistry of the groundwater source. Water chemistry of the Big River stations is expected to differ from other stations partly because of the large size of the watersheds they monitor.

Each station that was classified by physiographic province was further subdivided into second-order classifications (referred to as "station type" in table 1). Second-order classifications were based on contributing drainage area or land use within the watershed monitored by the station (figs. 1, 2; table 2). The second-order classifications include watershed indicator (wi) stations and land-use indicators. Stations with the wi classification are the most downstream stations in a watershed having a drainage area greater than 1,000 square miles. Water-quality data obtained from wi stations can be interpreted as being representative of the general condition of the watershed. Land-use indicator stations include stations where forest (fo), agriculture (ag), or prairie (pr) is the predominate land use in the watershed upstream from the station. Water quality at land-use indicator stations is likely to be affected by a specific land use. When stations were in watersheds where multiple land uses were present, the convention was to mention them in predominant order. The agriculture and forest (ag/fo) land-use indicator, for example, implies that the primary land use of the watershed is agriculture, although a substantial part of the land use is forest (fig. 2).

Three stations from the AWQMN did not fit in the station classifications used in this report (classified as "other" in table 2) and sampling results from these sites are not included. The three excluded stations were Cuivre River near Troy, Mo. (05514500), and Lamine River near Pilot Grove, Mo. (06907300), located in areas of transitional physiography and possible backwater flow from nearby major rivers; and Lake Taneycomo at Branson, Mo. (07053700), a station on a semiriverine system downstream from a major impoundment.

Figure 1. Physiographic regions of Missouri as well as location and class of selected surface-water quality monitoring stations, water year 2019.

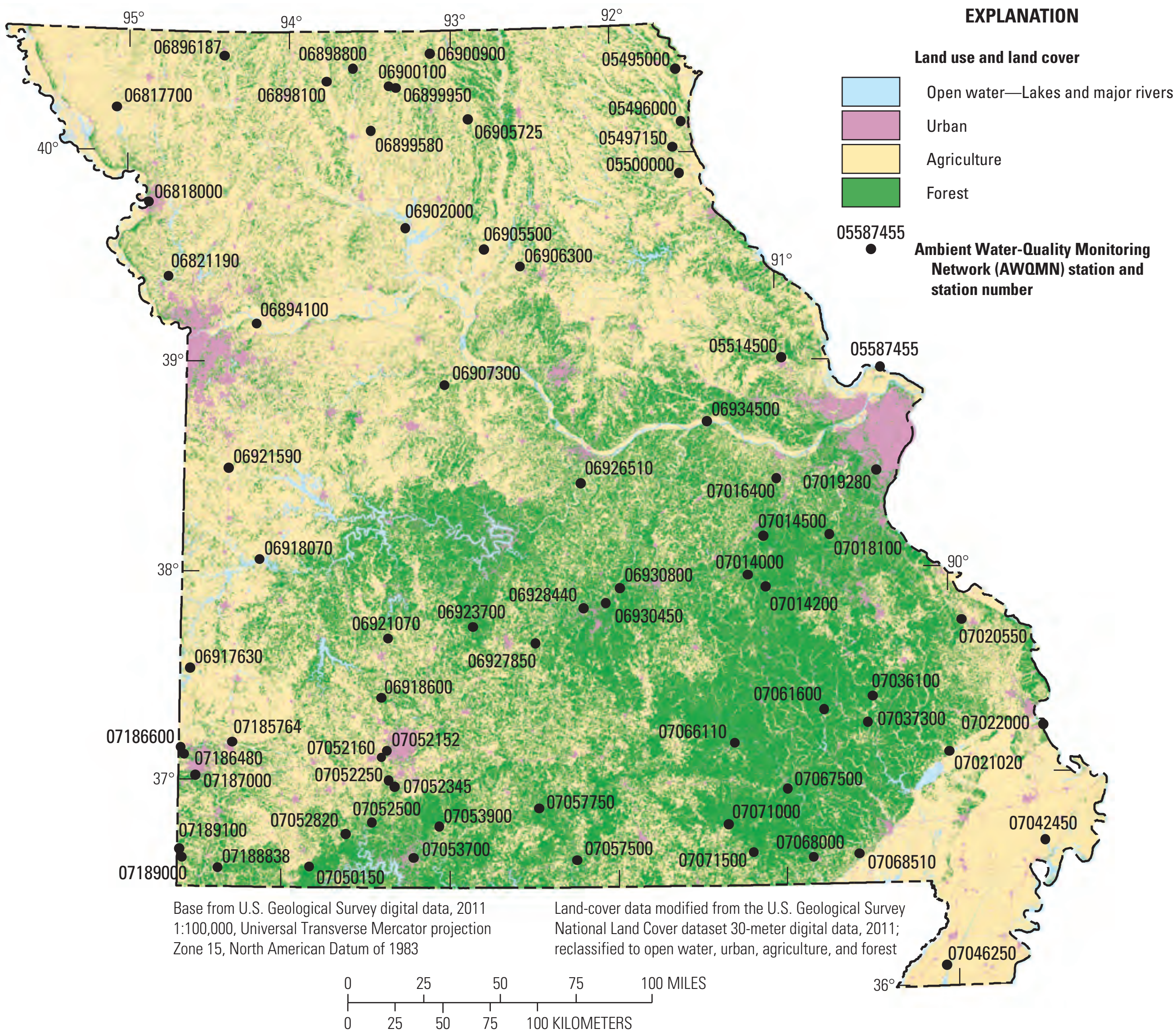

Figure 2. Land use in Missouri.

Table 2. Station classes and number of stations in each class and type for Missouri, water year 2019.

[Classification system is based on physiography of the State, primary and secondary land use and coverage, unique station type, and drainage area, as well as a station's representativeness to the general condition of the watershed. See the "Station Classification for Data Analysis" section of this report for the full explanation of station classes and types]

Station class and type (fig. 1)		Number of stations (table 1)[a]
Abbreviation	**Definition**	
BRMIG	Big River—Mississippi River below Grafton, Illinois	1
BRMIT[b]	Big River—Mississippi River at Thebes, Illinois	1
BRMOSJ	Big River—Missouri River at St. Joseph, Missouri	1
BRMOS	Big River—Missouri River at Sibley, Missouri	1
BRMOH[b]	Big River—Missouri River at Hermann, Missouri	1
MIALPL	Mississippi Alluvial Plain	2[c]
OZPLSA fo/ag	Ozark Plateaus—Salem Plateau forest and agriculture	18
OZPLSA wi fo/ag	Ozark Plateaus—Salem Plateau watershed indicator, forest and agriculture	4
OZPLSP ag/fo	Ozark Plateaus—Springfield Plateau agriculture and forest	9
DTPL ag	Dissected Till Plains agriculture	12
DTPL wi ag	Dissected Till Plains watershed indicator, agriculture	4
OSPL ag	Osage Plains agriculture	1
OSPL wi ag	Osage Plains watershed indicator, agriculture	1
OSPL pr	Osage Plains prairie	1
SPRING	Springs	3
MINING	Mining	3
OTHER	Stations not classified owing to unique conditions; data not analyzed	3
URBAN	Urban	5
URBAN wi	Urban watershed indicator	1

[a]Only primary sampling stations listed in table 1 are included in this analysis. Alternate stations are omitted.

[b]Stations BRMIT and BRMOH are not part of the Ambient Water-Quality Monitoring Network but were used in this report. Stations BRMIT and BRMOH are funded by the U.S. Geological Survey National Water Quality Monitoring Program.

[c]One station in this class, Little River Ditches near Rives, Missouri (07046250), has a drainage area greater than 1,000 square miles but is not considered a watershed indicator station because the manmade canals and ditches within its drainage area are not connected hydrologically.

Hydrologic Conditions

Streamflow varies seasonally in Missouri and tends to reflect precipitation patterns as well as land uses (Slater and Villarini, 2017). During water year 2019, the average annual precipitation of the conterminous United States was 6.52 inches (in.) greater than the 20th century average of 29.93 in. (National Oceanic and Atmospheric Administration, 2019a). Total precipitation across Missouri during water year 2019 was 55.32 in., which is 14.82 in. greater than the 20th century precipitation average of 40.50 in. for the State (National Oceanic and Atmospheric Administration, 2019b).

The streamflow-gaging stations whose data were used to identify the variation in hydrologic conditions described in this report, were selected based on their geographical distribution across the State (fig. 3) and long period of available streamflow information. Each streamflow-gaging station has a period of record of at least 47 years. This summary of statewide hydrologic condition data for the current (2019) water year in comparison to historical conditions is a legacy of information, including the streamflow-gaging stations used, that was previously provided in the annual Water-Data Reports.

Data from six streamflow-gaging stations distributed throughout the State (Fox River at Wayland, Mo. [05495000]; Grand River near Gallatin, Mo. [06897500]; South Grand River at Archie, Mo. [06921590]; Gasconade River at Jerome, Mo. [06933500]; James River at Galena, Mo. [07052500]; and Current River at Van Buren, Mo. [07067000]) were used to compare monthly mean streamflow during water year 2019 to the long-term monthly mean streamflow (fig. 4) and to demonstrate how streamflow can vary across the State. Monthly mean streamflow is the arithmetic mean of daily streamflow for a given month. For comparison to water year 2019, a long-term mean was attained from all monthly mean streamflows for the available period of record. Of these six streamflow-gaging stations, three (05495000, 06921590, and 07052500) are part of the AWQMN and three (06897500, 06933500, and 07067000) are not part of the AWQMN (table 1; figs. 3, 4). Monthly mean streamflows during water year 2019 typically were near the long-term mean for all six streamflow-gaging stations for most of the fall and summer, but typically exceeded the long-term mean for most of the winter and spring, with especially high streamflow during May 2019 (fig. 4).

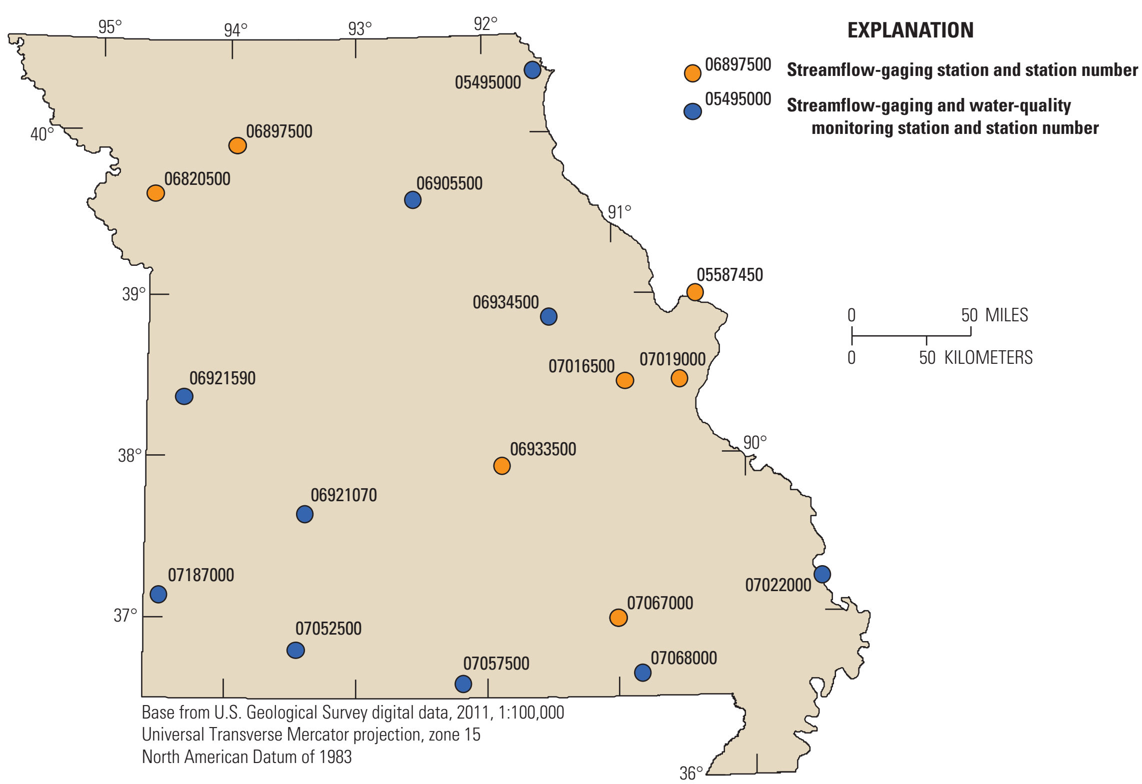

Figure 3. Location of selected streamflow-gaging stations used to provide a summary of hydrologic conditions within Missouri, water year 2019.

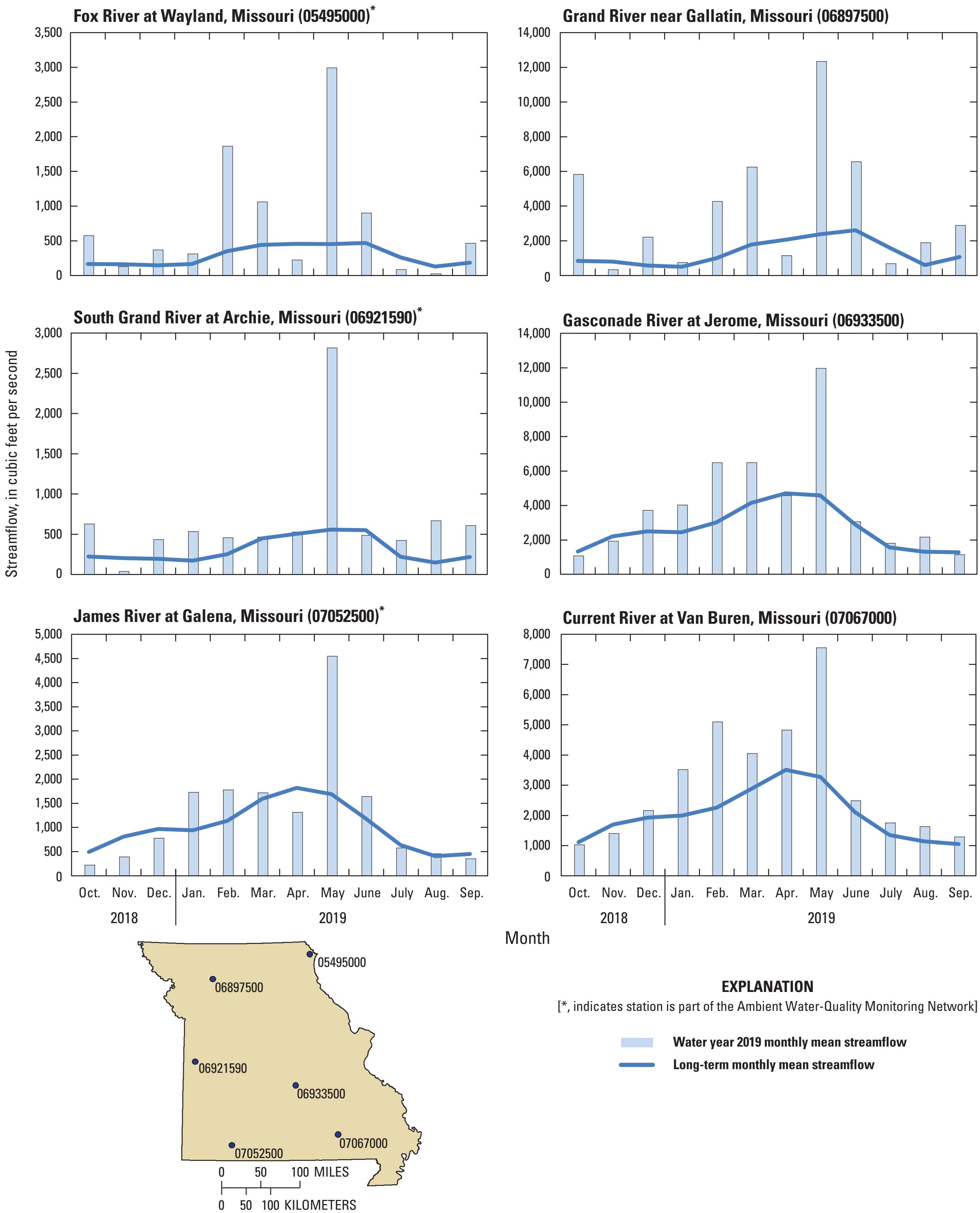

Figure 4. Monthly mean streamflow for water year 2019 and long-term monthly mean streamflow at six representative streamflow-gaging stations in Missouri.

Peak streamflow and 7-day low flow values (the smallest values of mean streamflow computed during any 7 consecutive days during the analysis period) for selected streamflow-gaging stations are presented in tables 3 and 4 for the 2019 water year. These tables include information on historic hydrologic conditions at the stations to provide context for the 2019 data. Peak streamflow during water year 2019 was less than the long-term period of record peak streamflow at every streamflow-gaging station except for the Chariton River near Prairie Hill, where it equaled the long-term period of record (table 3). The 7-day low flow and minimum daily mean streamflows recorded during water year 2019 were greater than the historical records for every station (table 4).

Table 3. Peak streamflow for water year 2019 and periods of record for selected streamflow-gaging stations in Missouri.

[Water year 2019 is defined as October 1, 2018, through September 30, 2019. USGS, U.S. Geological Survey; ft^3/s, cubic foot per second]

USGS station number[a] (figs. 1 and 3)	Station name[b] (period of record in years)	Water year 2019		Long-term period of record	
		Peak streamflow (ft^3/s)	Date	Peak streamflow (ft^3/s)	Date
05495000	Fox River at Wayland, Missouri (1922–2019)	14,300	May 30, 2019	26,400	April 22, 1973
05587450	Mississippi River at Grafton, Illinois (1933–2019)	522,000	June 7, 2019	598,000	August 1, 1993
06905500	Chariton River near Prairie Hill, Missouri (1929–2019)	43,300	May 31, 2019	43,300	May 31, 2019
06933500	Gasconade River at Jerome, Missouri (1903–2019)	36,900	May 3, 2019	183,000	May 1, 2018
06934500	Missouri River at Hermann, Missouri (1928–2019)	400,000	June 6–8, 2019	750,000	July 31, 1993
07019000	Meramec River near Eureka, Missouri (1903–2019)	40,000	May 4, 2019	175,000	August 22, 1915
07022000	Mississippi River at Thebes, Illinois (1933–2019)	939,000	June 10, 2019	1,050,000	January 2, 2016
07057500	North Fork River near Tecumseh, Missouri (1944–2019)	9,000	May 1, 2019	141,000	April 30, 2017
07068000	Current River at Doniphan, Missouri (1921–2019)	33,400	May 3, 2019	171,000	May 1, 2017

[a]Stations 05587450, 06933500, and 07019000 are streamflow-gaging stations only and are not part of the Ambient Water-Quality Monitoring Network.

[b]Station names were obtained from the U.S. Geological Survey National Water Information System database (U.S. Geological Survey, 2019).

Table 4. Seven-day low flow for water year 2019, period of record 7-day low flow, minimum daily mean streamflow for water year 2019, and period of record minimum daily mean streamflow for selected streamflow-gaging stations in Missouri.

[Water year 2019 defined as October 1, 2018, through September 30, 2019; USGS, U.S. Geological Survey; ft^3/s, cubic foot per second]

USGS station number[a] (figs. 1 and 3)	Station name[b] (period of record in years)	7-day low flow (ft^3/s)		Minimum daily mean streamflow (ft^3/s)		
		Water year 2019	Period of record	Water year 2019	Period of record	Date
05495000	Fox River at Wayland, Missouri (1922–2019)	12.2	0.00	7.01	0.00	September 10, 1930
06820500	Platte River near Agency, Missouri (1925–2019)	118	0.00	96.7	0.00	July 19, 1934
06921070	Pomme de Terre River near Polk, Missouri (1968–2019)	11.0	0.210	9.14	0.170	August 13, 2012
07016500	Bourbeuse River near Union, Missouri (1921–2019)	53.7	13.0	50.2	12.0	October 10, 1956
07067000	Current River at Van Buren, Missouri (1921–2019)	907	479	898	476	October 8, 1956
07187000	Shoal Creek above Joplin, Missouri (1941–2019)	127	15.9	99.8	15.0	September 7, 1954

[a]Stations 06820500, 07016500, and 07067000 are streamflow-gaging stations only and are not part of the Ambient Water-Quality Monitoring Network (AWQMN).

[b]Station names were obtained from the U.S. Geological Survey National Water Information System database (U.S. Geological Survey, 2019).

Distribution, Concentration, and Detection Frequency of Selected Constituents

This report presents results for dissolved oxygen, specific conductance, water temperature, suspended solids, suspended sediment, *E. coli* bacteria, fecal coliform bacteria, dissolved nitrate plus nitrite as nitrogen (hereafter referred to as “dissolved nitrate plus nitrite”), total phosphorus, dissolved and total recoverable lead and zinc, and selected pesticides. Boxplots of these constituents are presented for the surface-water stations according to their classification (figs. 5–8). Pesticide data are presented from seven stations from six classes (table 5).

There are a number of standards used to determine if water quality is acceptable for various uses (table 5). Water used for drinking must meet the U.S. Environmental Protection Agency (EPA) maximum contaminant level drinking-water standard (U.S. Environmental Protection Agency, 2012). The maximum contaminant level is the enforceable, health-based, maximum concentration of a constituent allowed in drinking water. The EPA secondary maximum contaminant level is the suggested maximum concentration of a constituent in drinking water based on aesthetic considerations (odor, taste, appearance). The secondary maximum contaminant level is not an enforceable standard. The health advisory level (HAL) is the concentration of a constituent in drinking water above which noncancer health effects are anticipated to occur for specific exposure scenarios; the HAL exposure scenario is lifetime exposure for an adult drinking 2 liters per day of water. HALs serve as informal technical guidance and are not legally enforceable. Applicable criteria from the Missouri Department of Natural Resources (2019) also are presented.

In addition to criteria developed for drinking water, a variety of ecological screening levels have been developed for water. The ecologically based water-quality standards used are the EPA national recommended water-quality criteria (table 5). The ecological criterion presented in table 5 is the maximum concentration of a constituent in freshwater that will not adversely affect aquatic life (U.S. Environmental Protection Agency, 2015). The standard for many of these constituents is dependent on the values of other constituents in the water and must be calculated.

Physical Properties, Suspended-Solids Concentration, Suspended-Sediment Concentration, and Fecal Indicator Bacteria Density

The physical properties analyzed for this report were dissolved oxygen, specific conductance, and water temperature. The median dissolved oxygen, in percent saturation, ranged from 76 to 107 percent (fig. 5). Samples from the OSPL wi ag station had the smallest median dissolved oxygen percent saturation values, whereas samples from URBAN stations had the largest median dissolved oxygen. Median specific conductance values varied substantially among the station classes, ranging from 121 microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C) at the OSPL pr station to 755 µS/cm at 25 °C at the BRMOSJ station. Median water temperature ranged from 10.3 to 22.0 degrees Celsius. The smallest median temperature was measured at the OSPL pr station, and the largest was measured at the BRMOSJ station. The interquartile range in water temperature at the SPRING stations was much smaller than for other station classes and types.

Suspended solids and suspended sediment are measures of the solid material suspended in the water column. These two measures are not considered directly comparable because of differences in collection and analytical techniques. Suspended-solids concentrations were determined for all station classes and types except BRMIT and BRMOH. Median suspended-solids concentrations ranged from the MRL (15) to 220 milligrams per liter (mg/L; fig. 5). Samples collected at the OZPL (SA fo/ag, SA wi fo/ag, and SP ag/fo), OSPL pr, SPRING, and URBAN stations had median concentrations at the MRL (15 mg/L). Because suspended-solids concentrations in most of the samples from these stations were below the MRL, the actual median concentration at these stations is less than 15 mg/L. The DTPL wi ag stations had the largest median suspended-solids concentration. Suspended-sediment concentrations were determined at four Big River stations (BRMIG, BRMIT, BRMOSJ, BRMOH; fig. 5). Median suspended-sediment concentrations ranged from 89 mg/L at BRMIG to 587 mg/L at BRMOH (fig. 5).

Median *E. coli* and fecal coliform bacteria densities varied considerably among all station classes and types (fig. 6). Median *E. coli* bacteria densities ranged from 11 to 1,000 colonies per 100 milliliters of water. Median fecal coliform bacteria densities ranged from 19 to 1,450 colonies per 100 milliliters of water. The smallest median *E. coli* and fecal coliform densities were in samples collected at SPRING stations. The largest median *E. coli* and fecal coliform densities were in samples collected at the BRMOS station (fig. 6).

Table 5. Selected water-quality criteria.

[Criteria are from U.S. Environmental Protection Agency (2012, 2015, 2019, 2020) and Missouri Department of Natural Resources (2019). EPA, U.S. Environmental Protection Agency; mg/L, milligram per liter; *E. coli*, *Escherichia coli*; col/100 mL, colony per 100 milliliters; MCL, maximum contaminant level; µg/L, microgram per liter; SMCL, secondary maximum contaminant level; HHBP, human health benchmark for pesticides; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine; HAL, health advisory level]

Constituent and units	EPA Human Health Standard	Missouri	EPA aquatic life acute threshold	EPA aquatic life chronic threshold
Ammonia as nitrogen (mg/L)	None	4.1[a]	17[b]	1.9[b]
Dissolved oxygen (mg/L)	None	5[c]	3.0	None
E. coli (col/100 mL)	None	126[d]	None	None
Fecal coliform (col/100 mL)	0 (MCL goal)	200[d]	None	None
Lead (µg/L)	0 (MCL goal)	15[e]	3.2	82
Nitrate and nitrite as nitrogen (mg/L)	10 (MCL)	10[e]	None	None
Total phosphorus (µg/L)	None	None	10–128[f]	None
Suspended solids (mg/L)	None	30	Calculated	Calculated
Zinc (µg/L)	5,000 (SMCL)	5,000[e]	120	120
Acetochlor (µg/L)	100 (HHPB)	None	1.43[g]	None
Atrazine (µg/L)	3 (MCL)	3[e]	<1[g]	None
CIAT (µg/L)	1 (HAL)	None	None	None
cis-propiconazole (µg/L)	None	None	None	None
3,4-dichloroaniline (µg/L)	None	None	None	None
Dicrotophos (µg/L)	0.2 (HHBP)	None	6.3[h]	1.7[h]
Metalaxyl (µg/L)	None	None	14,000[h]	1,200[h]
Metolachlor (µg/L)	700 (HAL)	70[e](HAL)	550[h]	1[g]
Metribuzin (µg/L)	None	100[e](HAL)	130[h]	None
Prometon (µg/L)	None	None	98[g]	None
Prometryn (µg/L)	300 (HHBP)	None	1.04[g]	None
Propanil (µg/L)	60 (HHBP)	None	1150[i]	9.1[i]
Simazine (µg/L)	4 (MCL)	4[e]	500[h]	40[h]
Tebuthiuron (µg/L)	None	500[e](HAL)	130[g]	None
Terbuthylazine (µg/L)	None	None	1800[i]	None

[a]Cool and warm water fishery, assumed pH=7.0.

[b]Assumed pH=7.0 and temperature=20 degrees Celsius.

[c]Cool and warm water fishery.

[d]Whole body contact.

[e]Drinking water standard.

[f]Ecoregion VI, IX, X, and XI standards for rivers and streams.

[g]Vascular plants.

[h]Invertebrates.

[i]Fish.

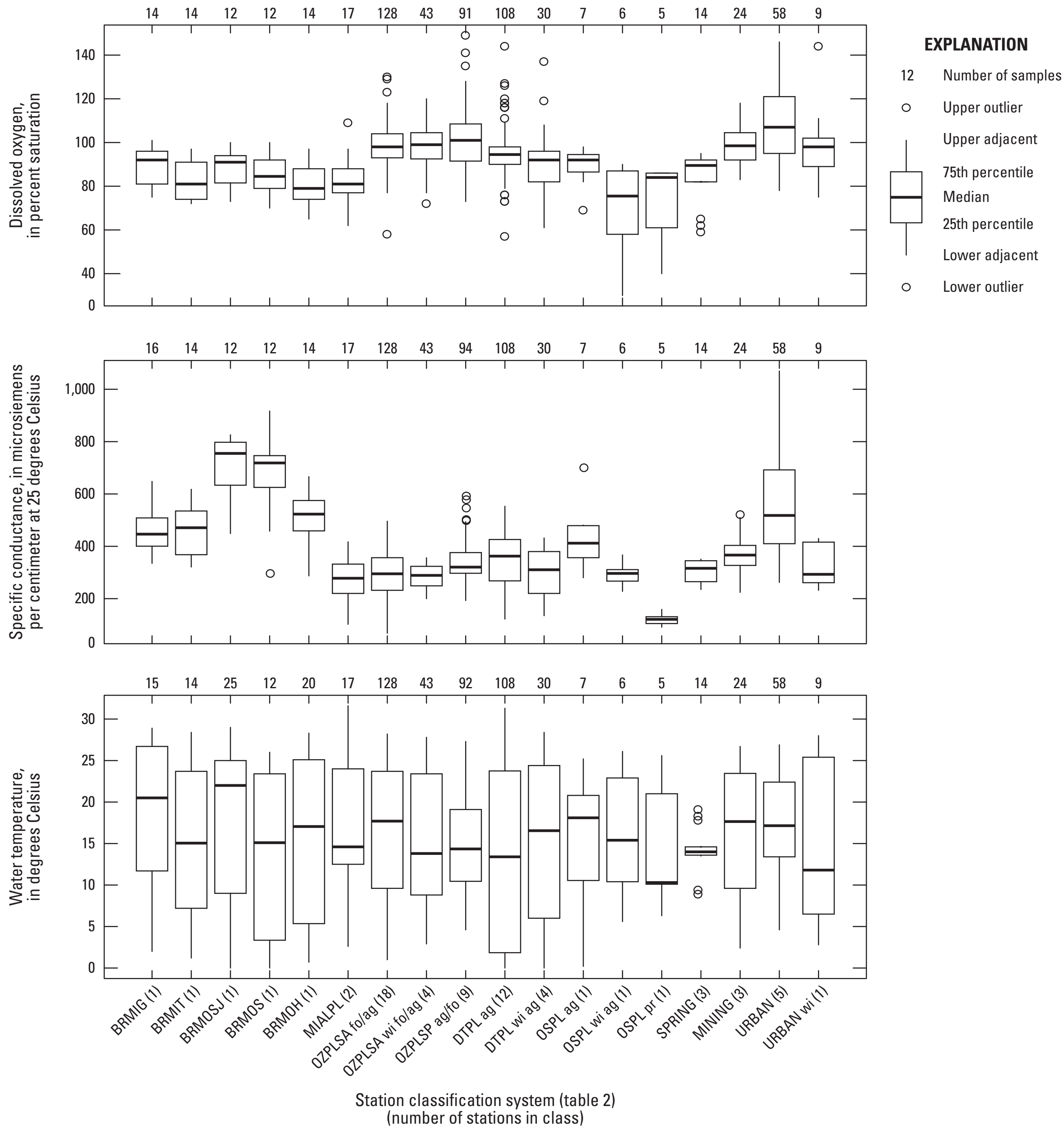

Figure 5. Distribution of physical properties, suspended-solids concentrations, and suspended-sediment concentrations from surface-water quality stations in Missouri, water year 2019.

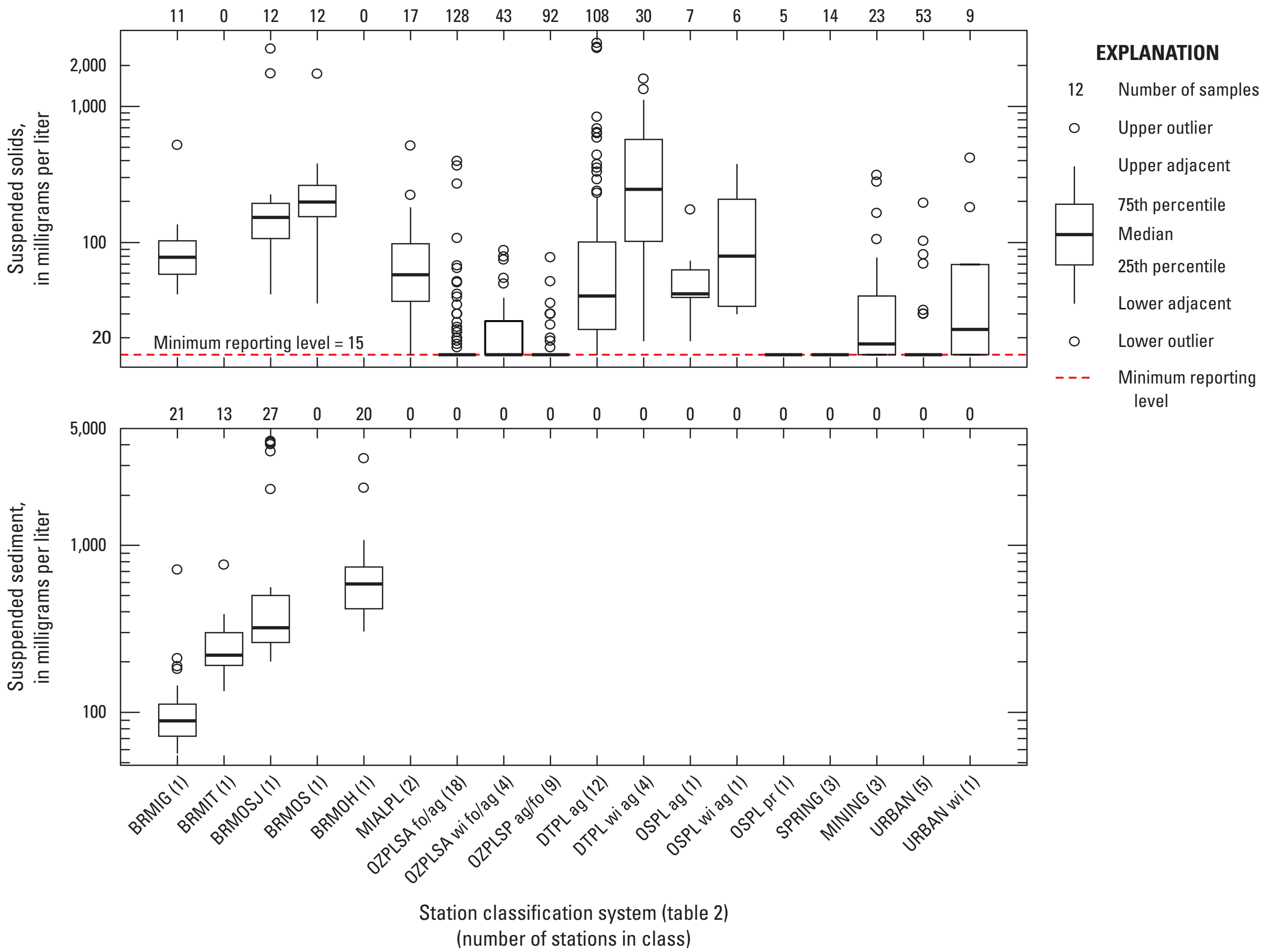

Figure 5. —Continued

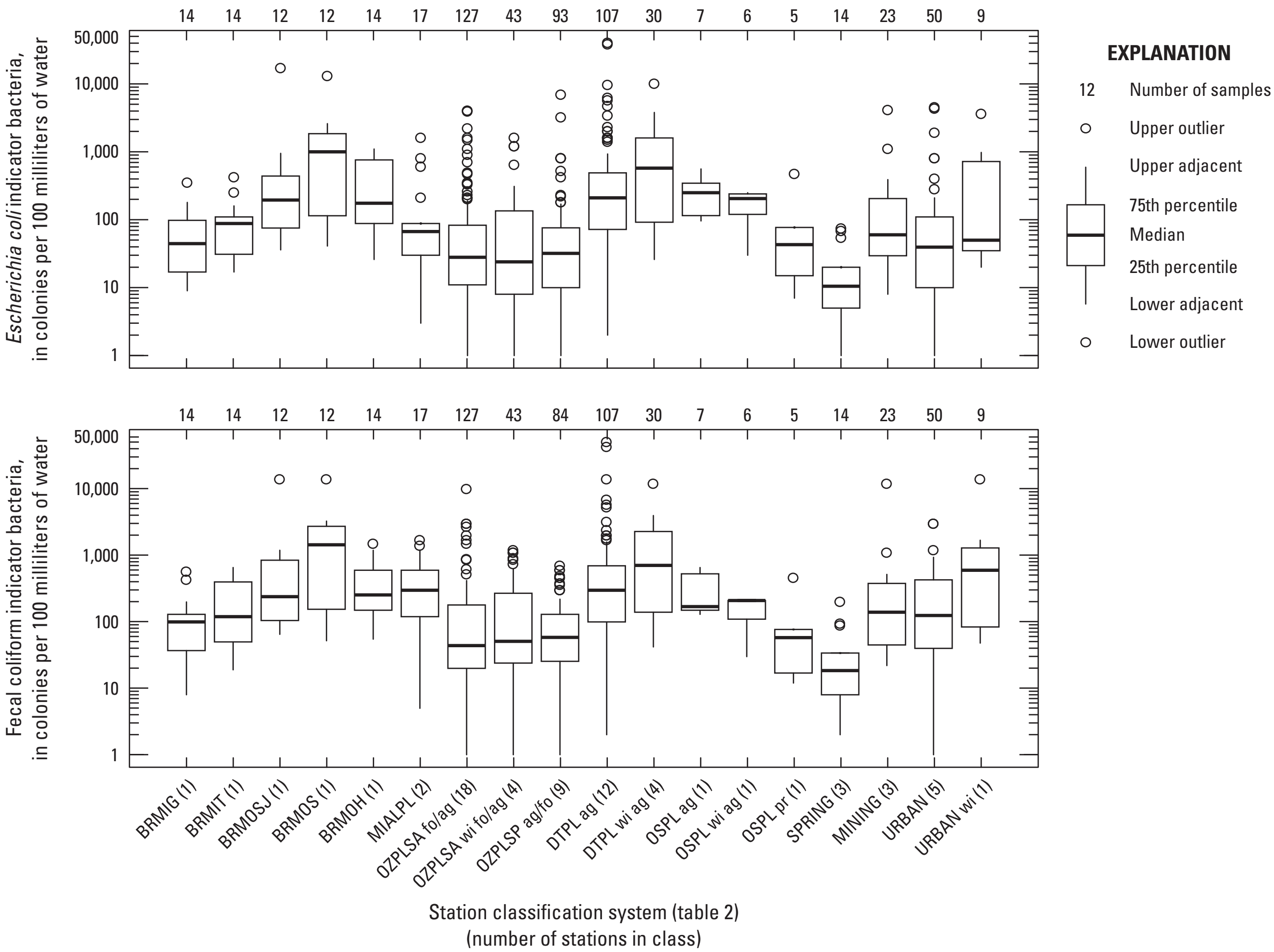

Figure 6. Distribution of fecal indicator bacteria density in samples from surface-water quality stations in Missouri, water year 2019.

Dissolved Nitrate plus Nitrite and Total Phosphorus Concentrations

Samples were collected at all stations for the analysis of nutrients, including dissolved nitrate plus nitrite and total phosphorus. Median dissolved nitrate plus nitrite and total phosphorus concentrations varied considerably among all station classes and types (fig. 7), ranging from the LT–MDL (0.04) to 3.45 mg/L for dissolved nitrate plus nitrite and from the LT–MDL (0.02) to 0.48 mg/L for total phosphorus. The smallest median dissolved nitrate plus nitrite concentrations (at the LT–MDL) were computed at the OSPL pr station. Dissolved nitrate plus nitrite concentrations in all of the samples from this station were below the LT–MDL, indicating the true median concentration is less than 0.04 mg/L. The largest median concentration was measured at the URBAN station (fig. 7). The smallest median total phosphorus concentrations were computed at the OZPLSA fo/ag and SPRING stations, which had median values calculated to be equal to the LT–MDL (0.02 mg/L). Most of the samples from these stations had total phosphorous concentrations below the LT–MDL, indicating that the true median concentration at these stations is less than 0.02 mg/L. The largest median concentration was detected at the BRMOH station (fig. 7).

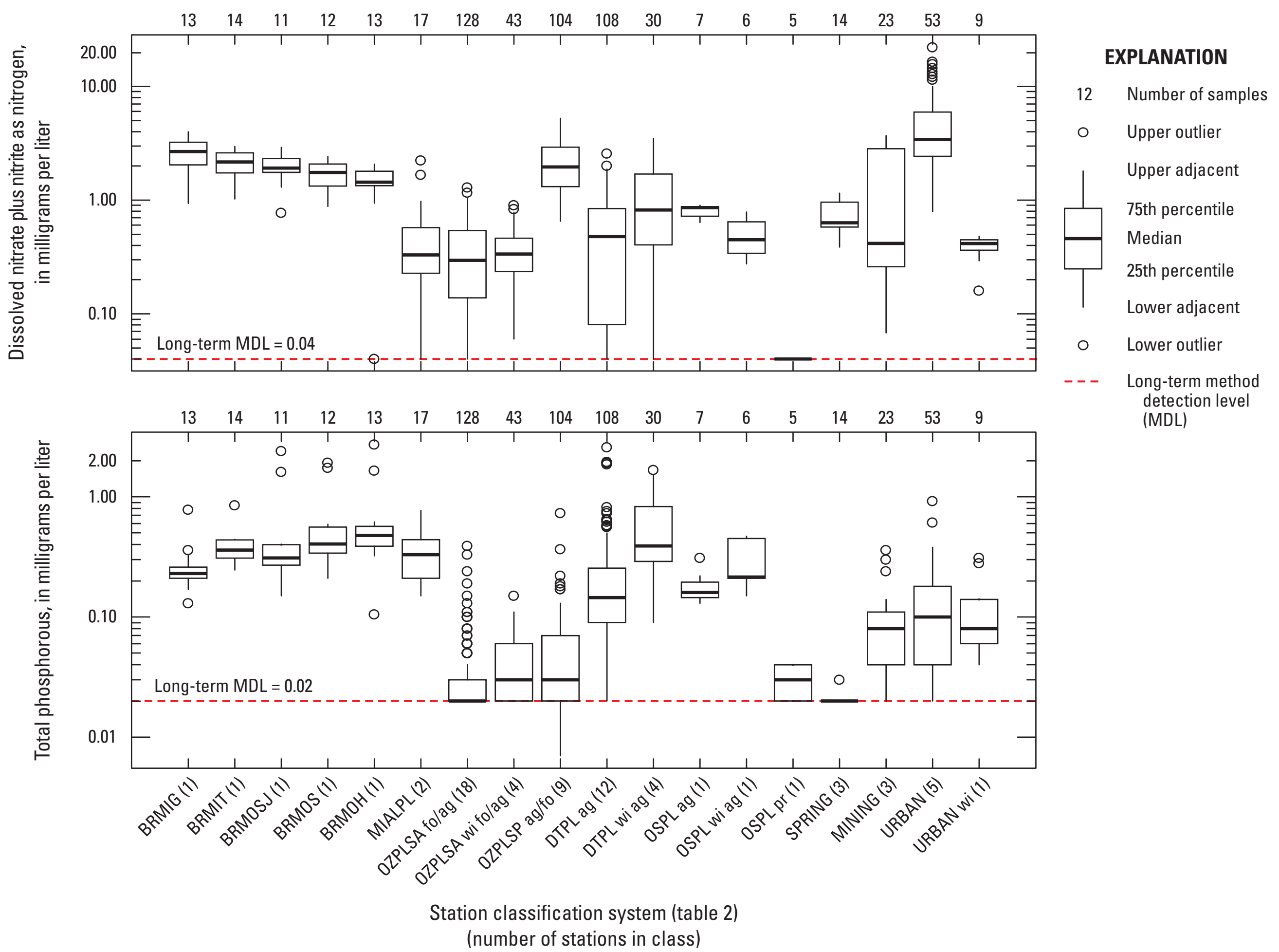

Figure 7. Distribution of dissolved nitrate plus nitrite as nitrogen and total phosphorus concentrations in samples from surface-water quality stations in Missouri, water year 2019.

Dissolved and Total Recoverable Lead and Zinc Concentrations

No dissolved or total recoverable lead or zinc samples were collected at the BRMIT and BRMOH stations. Where samples were collected, median concentrations ranged from the LT–MDL of 0.020 to 0.40 microgram per liter (µg/L) for dissolved lead, 0.09 to 9.5 µg/L for total recoverable lead, the LT–MDL of 2.0 to 9.9 µg/L for dissolved zinc, and the LT–MDL of 2.0 to 25 µg/L for total recoverable zinc (fig. 8).

The smallest calculated median concentrations of dissolved lead were at the LT–MDL (0.02 µg/L) in samples collected at the MIALPL, OZPLSA (fo/ag and wi fo/ag), OZPLSP ag/fo, OSPL wi/ag, and SPRING stations. Most of the samples collected from these stations had dissolved lead concentrations below the LT–MDL, so the actual median concentration of dissolved lead at these locations is less than 0.02 µg/L. Samples from the MINING stations had the largest median concentration of dissolved lead (fig. 8).

The smallest median concentrations of total recoverable lead were at the SPRING stations. The largest median total recoverable lead concentration was at the MINING stations.

Median dissolved zinc concentrations were calculated to be at the LT–MDL (2.0 µg/L) for all stations, except the OSPL pr, MINING, and URBAN stations. URBAN stations had the largest median concentration of dissolved zinc.

The smallest median concentrations of total recoverable zinc were at the LT–MDL of 2.0 µg/L at the OZPLSA (fo/ag and wi fo/ag), OZPLSP ag/fo, and SPRING stations. Most of the samples collected from these stations had total recoverable zinc concentrations below the LT–MDL, so the actual median concentration of total recoverable zinc at these locations is less than 2.0 µg/L. The largest median concentration of total recoverable zinc was at the MINING stations (25 µg/L).

Selected Pesticide Concentrations and Detection Frequencies

Samples collected for the analysis of dissolved pesticides during the 2019 water year are presented in this report for seven stations. The AWQMN and the NWQMP sampling efforts use different pesticide analytical methods and the detection limits are somewhat different. Samples from four stations were analyzed for a suite of 85 pesticides (both stations in the MIALPL, one OSPL wi ag station, and one URBAN station). An expanded list of 228 pesticides were analyzed in samples from three Big River stations (BRMIG, BRMIT, and BRMOH) as part of the NWQMP. For the sake of consistency with previous reports, this report will only discuss the results of sampling for the 85 pesticides tested for as part of the AWQMN. The NWQMP pesticides that overlap with the AWQMN pesticides tested as part of the sampling also are discussed. Note that analysis of pesticide data provided in table 6 includes analysis of detections at concentrations below the LRL if at least one sample had a detection above the LRL for that pesticide.

Fifteen pesticides were detected above their LRL in at least one sample during the 2019 water year. The 15 pesticides are acetochlor, atrazine, 2-chloro-4-isopropylamino-6-amino-*s*-triazine (more commonly referred to as CIAT, a degradation product of atrazine), *cis*-propiconazole, 3,4-dichloroaniline, dicrotophos, metalaxyl, metolachlor, metribuzin, prometon, prometryn, propanil, simazine, tebuthiuron, and terbuthylazine (table 6). Eight pesticides were detected in more than half of the samples analyzed. These pesticides were metolachlor (95-percent detection), atrazine (90-percent detection), CIAT (84-percent detection), acetochlor (79-percent detection), tebuthiuron (63-percent detection), prometon (62-percent detection), metalaxyl (54-percent detection), and metribuzin (52-percent detection). The median concentrations for all pesticides shown in table 6 were less than 1.00 µg/L. Every station had a detection of at least 1 pesticide greater than the LRL. OSPL wi ag, and URBAN stations had the least amount of detections greater than the LRL among the 15 pesticides.

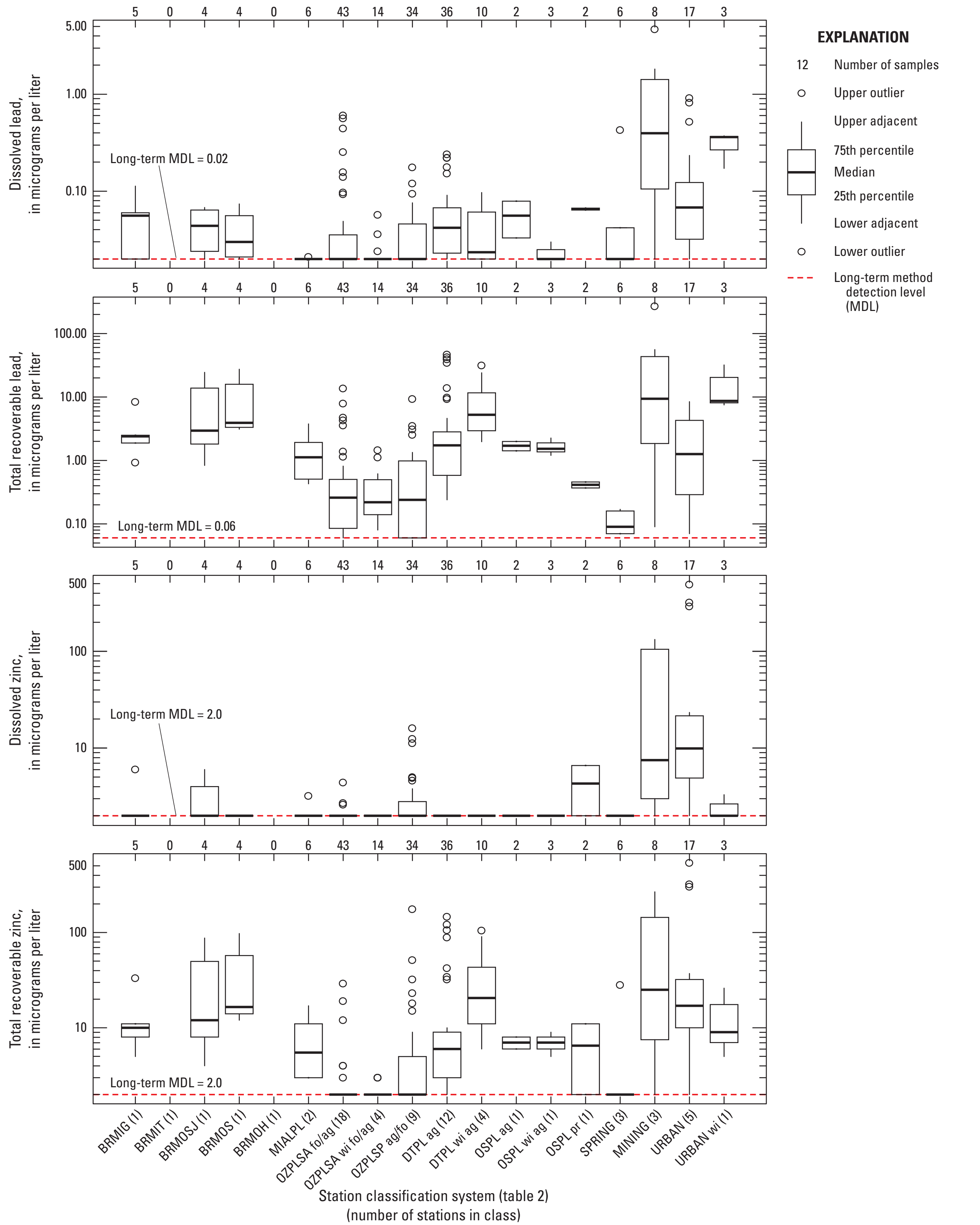

Figure 8. Distribution of dissolved and total recoverable lead and zinc concentrations from surface-water quality stations in Missouri, water year 2019.

Table 6. Summary of detections of selected pesticides for water year 2019 in Missouri.

[Water year 2019 defined as October 1, 2018, through September 30, 2019. µg/L, microgram per liter; MIALPL, Mississippi Alluvial Plain; <, less than; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine; OSPL wi ag, Osage Plains watershed indicator, agriculture; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; NA, not analyzed; BRMIG, Big River—Mississippi River below Grafton, Illinois; BRMOH, Big River—Missouri River at Hermann, Missouri]

Analyte	Number of samples	Number of detections	Laboratory reporting level (µg/L)	Percent detections	Minimum concentration (µg/L)	Maximum concentration (µg/L)	Median concentration (µg/L)
Station classification MIALPL (station numbers 07042450 and 07046250)							
Acetochlor	8	6	0.010–0.012	75	<0.010	2.6	0.076
Atrazine	8	6	0.011–0.023	75	<0.011	15.5	0.068
CIAT	8	5	0.014	63	0.011	0.274	0.024
cis-propiconazole	8	1	0.008–0.040	13	<0.008	0.006	<0.008
3,4-dichloroaniline	8	2	0.008	25	<0.008	0.371	<0.008
Dicrotophos	8	2	0.004–0.014	25	<0.004	0.015	<0.014
Metalaxyl	3	1	0.014–1.42	25	<0.014	1.57	<1.42
Metolachlor	8	8	0.012	100	0.049	8.28	0.409
Metribuzin	8	7	0.012	88	0.007	1.2	0.022
Prometon	8	1	0.012	13	<0.012	0.014	<0.012
Prometryn	8	2	0.010	25	<0.010	0.332	<0.010
Propanil	8	1	0.008–0.010	13	<0.008	0.011	<0.008
Simazine	8	0	0.008	0	<0.008	<0.008	<0.008
Tebuthiuron	8	0	0.028–0.072	0	<0.028	<0.072	<0.028
Terbuthylazine	8	0	0.008–0.009	0	<0.008	<0.009	<0.008
Station classification OSPL wi ag (station number 06918070)							
Acetochlor	6	5	0.010	83	0.005	0.186	0.073
Atrazine	6	6	0.008	100	0.030	3.16	0.739
CIAT	6	5	0.014	83	<0.014	0.26	0.097
cis-propiconazole	6	0	0.008	0	<0.008	<0.008	<0.008
3,4-dichloroaniline	6	0	0.008	0	<0.008	<0.008	<0.008
Dicrotophos	6	0	0.004–0.014	0	<0.004	<0.014	<0.014
Metalaxyl	1	0	0.014	0	<0.014	<0.014	<0.014
Metolachlor	6	6	0.012	100	0.015	0.635	0.208
Metribuzin	6	4	0.012	67	<0.012	0.091	0.030
Prometon	6	2	0.012	33	0.008	0.011	<0.012
Prometryn	6	0	0.010	0	<0.010	<0.010	<0.010
Propanil	6	0	0.008–0.010	0	<0.008	<0.010	<0.010
Simazine	6	0	0.008–0.022	0	<0.008	<0.022	<0.014
Tebuthiuron	6	1	0.028–0.072	17	<0.028	0.018	<0.028
Terbuthylazine	6	0	0.008	0	<0.008	<0.008	<0.008
Station classification URBAN (station number 07052250)							
Acetochlor	8	1	0.010	13	<0.010	0.006	<0.010
Atrazine	8	5	0.008	63	<0.008	0.076	0.0135
CIAT	8	5	0.014	63	0.006	0.018	<0.014
cis-propiconazole	8	0	0.008–0.040	0	<0.008	<0.040	<0.008
3,4-dichloroaniline	8	0	0.008	0	<0.008	<0.008	<0.008
Dicrotophos	8	0	0.004–0.014	0	<0.004	<0.014	<0.014

Table 6. Summary of detections of selected pesticides for water year 2019 in Missouri.—Continued

[Water year 2019 defined as October 1, 2018, through September 30, 2019. µg/L, microgram per liter; MIALPL, Mississippi Alluvial Plain; <, less than; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine; OSPL wi ag, Osage Plains watershed indicator, agriculture; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; NA, not analyzed; BRMIG, Big River—Mississippi River below Grafton, Illinois; BRMOH, Big River—Missouri River at Hermann, Missouri]

Analyte	Number of samples	Number of detections	Laboratory reporting level (µg/L)	Percent detections	Minimum concentration (µg/L)	Maximum concentration (µg/L)	Median concentration (µg/L)
Station classification URBAN (station number 07052250)—Continued							
Metalaxyl	1	0	0.258	0	<0.258	<0.258	<0.258
Metolachlor	8	5	0.012–0.019	63	0.007	0.017	<0.012
Metribuzin	8	0	0.008–0.012	0	<0.008	<0.012	<0.012
Prometon	8	8	0.008	100	0.004	0.060	0.0115
Prometryn	8	0	0.010	0	<0.010	<0.010	<0.010
Propanil	8	0	0.008–0.010	0	<0.008	<0.010	<0.010
Simazine	8	0	0.008	0	<0.008	<0.008	<0.008
Tebuthiuron	8	8	0.028	100	0.026	0.205	0.052
Terbuthylazine	8	1	0.008	13	<0.008	0.011	<0.008
Station classification BRMIT (station number 07022000)							
Acetochlor	14	14	0.010	100	0.0185	0.851	0.0308
Atrazine	14	13	0.0559	93	0.0549	3.77	0.213
CIAT	14	12	0.050	86	0.0237	0.205	0.0637
cis-propiconazole	NA	NA	NA	NA	NA	NA	NA
3,4-dichloroaniline	NA	NA	NA	NA	NA	NA	NA
Dicrotophos	13	0	0.004–0.005	0	<0.004	<0.005	<0.004
Metalaxyl	14	9	0.006	64	0.0022	0.0062	<0.006
Metolachlor	14	14	0.0032	100	0.0598	1.33	0.177
Metribuzin	14	7	0.020–0.025	50	0.012	0.089	<0.020
Prometon	14	10	0.004	71	0.001	0.0041	<0.004
Prometryn	14	4	0.0042	29	0.0012	0.0031	<0.0042
Propanil	14	0	0.012	0	<0.012	<0.012	<0.012
Simazine	14	12	0.0010	86	0.0030	0.107	0.025
Tebuthiuron	14	12	0.003	86	0.0014	0.0053	<0.003
Terbuthylazine	14	2	0.001–0.0036	14	0.0014	0.0014	<0.0036
Station classification BRMIG (station number 05587455)							
Acetochlor	14	14	0.010	100	0.012	0.950	0.058
Atrazine	14	14	0.0068	100	0.020	2.83	0.233
CIAT	14	13	0.025	93	0.018	0.337	0.084
cis-propiconazole	NA	NA	NA	NA	NA	NA	NA
3,4-dichloroaniline	NA	NA	NA	NA	NA	NA	NA
Dicrotophos	13	0	0.004–0.0010	0	<0.004	<0.010	<0.004
Metalaxyl	14	9	0.006	64	0.003	0.010	<0.006
Metolachlor	14	14	0.0032	100	0.048	2.61	0.286
Metribuzin	14	6	0.020	43	<0.020	0.134	<0.020
Prometon	14	11	0.004	79	0.0008	0.006	<0.004
Prometryn	14	0	0.0042	0	<0.0042	<0.0042	<0.0042
Propanil	14	0	0.012–0.025	0	<0.012	<0.025	<0.012

Table 6. Summary of detections of selected pesticides for water year 2019 in Missouri.—Continued

[Water year 2019 defined as October 1, 2018, through September 30, 2019. µg/L, microgram per liter; MIALPL, Mississippi Alluvial Plain; <, less than; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine; OSPL wi ag, Osage Plains watershed indicator, agriculture; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; NA, not analyzed; BRMIG, Big River—Mississippi River below Grafton, Illinois; BRMOH, Big River—Missouri River at Hermann, Missouri]

Analyte	Number of samples	Number of detections	Laboratory reporting level (µg/L)	Percent detections	Minimum concentration (µg/L)	Maximum concentration (µg/L)	Median concentration (µg/L)
Station classification BRMIG (station number 05587455)—Continued							
Simazine	14	8	0.0072–0.025	57	0.007	0.036	<0.010
Tebuthiuron	14	9	0.003	64	0.002	0.003	<0.003
Terbuthylazine	14	3	0.0036–0.025	21	0.002	<0.025	<0.0036
Station classification BRMOH (station number 06934500)							
Acetochlor	13	10	0.010–0.014	77	<0.010	0.650	0.065
Atrazine	13	13	0.007	100	0.063	4.14	0.606
CIAT	13	13	0.011	100	0.022	0.277	0.107
cis-propiconazole	NA	NA	NA	NA	NA	NA	NA
3,4-dichloroaniline	NA	NA	NA	NA	NA	NA	NA
Dicrotophos	13	0	0.004–0.005	0	<0.004	<0.005	<0.004
Metalaxyl	13	6	0.006–0.025	46	0.002	0.010	<0.006
Metolachlor	13	13	0.0032	100	0.025	1.94	0.443
Metribuzin	13	9	0.020–0.025	69	0.011	0.123	<0.025
Prometon	13	7	0.004	54	0.001	0.006	<0.004
Prometryn	13	5	0.004	38	0.0027	0.0068	<0.004
Propanil	13	0	0.012–0.025	0	<0.012	<0.025	<0.012
Simazine	13	9	0.007–0.025	63	<0.007	0.043	0.010
Tebuthiuron	13	10	0.003–0.025	77	0.001	0.007	0.003
Terbuthylazine	12	0	0.004–0.025	77	<0.004	<0.025	<0.004

Summary

The U.S. Geological Survey (USGS), in cooperation with the Missouri Department of Natural Resources, collects surface-water quality data in Missouri each water year (October 1 through September 30). These data, stored and maintained in the USGS National Water Information System database, are collected as part of the Missouri Ambient Water-Quality Monitoring Network (AWQMN) and constitute a permanent, accessible source of representative, reliable, impartial, and timely information for developing an enhanced understanding of the State's water resources. In addition to the AWQMN, the USGS also collects data at two USGS National Water Quality Monitoring Program stations and, in cooperation with the U.S. Army Corps of Engineers, routinely collects suspended-sediment concentration data on the Missouri and Mississippi Rivers.

Surface-water quality data collected during water year 2019 at 73 stations (71 AWQMN and AWQMN alternate stations as well as 2 National Water Quality Monitoring Program stations) are summarized in this report, among which are 4 stations with suspended-sediment data collected in cooperation with the U.S. Army Corps of Engineers. Stations were classified corresponding to physiographic province, primary land use, or unique hydrologic characteristics of the stations. The annual summary of selected constituents provides Missouri Department of Natural Resources with current information to assess the quality of surface water within the State and ensure the objectives of the AWQMN are being met. The data collected also provide support for the design, implementation, and evaluation of preventive and remediation programs.

A comparison of 2019 water year streamflow data to long-term streamflow and a summary of hydrologic conditions, including peak streamflows, monthly mean streamflows, and 7-day low flows are presented for selected streamflow-gaging stations in the State. The water-quality analyses presented in this report are for dissolved oxygen, specific conductance, water temperature, suspended solids, suspended sediment, *Escherichia coli* bacteria, fecal coliform bacteria, dissolved nitrate plus nitrite as nitrogen, total phosphorus, and dissolved and total recoverable lead and zinc. Plots of the concentrations of these constituents are presented by the different station classes. In addition, summary data for 15 pesticides are presented for 7 stations.

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