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Quality of Surface Water in Missouri, Water Year 2018

Data Series 1119

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

Cover. Hydrologic technicians collecting a surface-water quality sample on the Missouri River at Hermann, Missouri. Photograph by Kelly Brady, hydrologic technician, U.S. Geological Survey.

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By Robert T. Kay

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DAVID BERNHARDT, Secretary

U.S. Geological Survey
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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:

$$°F=(1.8×°C)+32$$

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

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, 2018, is called “water year 2018.”

Abbreviations

ag	agriculture
AWQMN	Ambient Water-Quality Monitoring Network
DTPL	Dissected Till Plain
E. coli	*Escherichia coli*
fo/ag	forest and agriculture
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
Mo.	Missouri
MRL	minimum reporting level
NASQAN	National Stream Quality Assessment Network
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
OSPL	Osage Plains
OZPLSA	Ozark Plateau Salem Plateau
OZPLSP	Ozark Plateau Springfield Plateau
pr	prairie
TMDL	total maximum daily load
USGS	U.S. Geological Survey
wi	watershed indicator

Quality of Surface Water in Missouri, Water Year 2018

By Robert T. Kay

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. During water year 2018 (October 1, 2017, through September 30, 2018), water-quality data were collected at 76 stations: 74 Ambient Water-Quality Monitoring Network stations and 2 U.S. Geological Survey National Stream Quality Assessment Network stations. Among the 76 stations in this report, 4 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 pesticide compounds 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, 2018). 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 6.09 million people (U.S. Census Bureau, 2016). 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, only 8,880 mi (or about 7.7 percent) were considered monitored (2009–16 data were available), whereas about 92.3 percent of classified stream miles were evaluated in the State’s most recent water-quality report (Missouri Department of Natural Resources, 2018). Of these assessed stream miles, an estimated 5,740 mi fully support the designated uses, and an estimated 5,676 mi 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, 2018).

The purpose of this report is to summarize surface-water quality data collected for the MDNR–U.S. Geological Survey (USGS) cooperative Ambient Water-Quality Monitoring Network (AWQMN) for water year 2018 (October 1, 2017, through September 30, 2018). 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). Data on the physical characteristics and water-quality constituents in samples collected during the 2018 water year are presented in figures and tables for 76 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 2018. The number and location of stations that constitute the AWQMN at any particular time since 1964 has 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. 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 4 alternate sampling stations during water year 2018. The alternate sampling stations are located at streamflow-gaging stations near the primary AWQMN stations and were sampled when the primary stations were dry. Alternate sampling station Dry Wood Creek near Deerfield, Missouri (06917680), was sampled in January and July 2018 in place of the primary station at East Drywood Creek at Prairie State Park, Mo. (06917630). Alternate sampling station No Creek at Farmersville, Mo. (06899585), was sampled in July 2018 in place of the primary station at No Creek near Dunlap, Mo. (06899580). Alternate sampling station Locust Creek near Linneus, Mo. (06901500), was sampled in July 2018 in place of the primary station at Locust Creek near Unionville, Mo. (06900900). Alternate sampling station Mussel Fork near Musselfork, Mo. (06906000), was sampled in October, November, and December 2017 and January, July, and August 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 (2016, 2018).

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.

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 computed according to procedures described in Guy (1969).

In addition to the surface-water quality data collected from the 70 stations that form the AWQMN and the 4 alternate stations sampled when the primary stations were dry, 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 USGS

National Stream Quality Assessment Network (NASQAN; a national water-quality sampling network operated by the USGS, see https://cida.usgs.gov/quality/rivers/home) stations and suspended-sediment samples collected at four USGS streamflow-gaging stations. 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).

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; Helsel and Hirsch, 2002). 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 the presence or absence of unusual values or outliers. 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 used to generate the boxplots can be 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, 2017, through September 30, 2018).

Pesticide concentrations in some samples were detected at concentrations less than the LRL. The concentration of compounds 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. As a result, some pesticides had minimum or median concentrations that were less than the LRL.

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 environments, 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 Salem Plateau (OZPLSA) in the middle of the State, and the 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 very large size of the watersheds they monitor.

Each station that was classified by physiographic province was further subdivided into second-order classifications

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 2018.

[Water year 2018 is defined as October 1, 2017, through September 30, 2018. USGS, U.S. Geological Survey; mi^2, square mile; DTPL, Dissected Till Plains; ag, agriculture; --, not applicable; 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 Plateaus—Springfield Plateau; fo, forest; OZPLSA, Ozark Plateaus—Salem Plateau; SPRING, spring; BRMOH, Big River—Missouri River at Hermann, Missouri; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; MIALPL, Mississippi Alluvial Plain]

USGS station number (figs. 1 and 3)	Station name[a]	Contributing drainage area (mi^2)	Water year 2018 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	--
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	11	DTPL ag
06899585[d]	No Creek at Farmersville, Missouri	67	1	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	10	DTPL ag
06901500[e]	Locust Creek near Linneus, Missouri	550	1	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	6	DTPL ag
06906000[f]	Mussel Fork near Musselfork, Missouri	267	6	DTPL ag
06906300	East Fork Little Chariton River near Huntsville, Missouri	220	6	MINING
06907300[b]	Lamine River near Pilot Grove, Missouri	949	9	--
06917630	East Drywood Creek at Prairie State Park, Missouri	3.38	4	OSPL pr
06917680[g]	Dry Wood Creek near Deerfield, Missouri	358	2	OSPL ag
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	6	OSPL ag

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 2018.—Continued

[Water year 2018 is defined as October 1, 2017, through September 30, 2018. USGS, U.S. Geological Survey; mi^2, square mile; DTPL, Dissected Till Plains; ag, agriculture; --, not applicable; 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 Plateaus—Springfield Plateau; fo, forest; OZPLSA, Ozark Plateaus—Salem Plateau; SPRING, spring; BRMOH, Big River—Missouri River at Hermann, Missouri; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; MIALPL, Mississippi Alluvial Plain]

USGS station number (figs. 1 and 3)	Station name[a]	Contributing drainage area (mi^2)	Water year 2018 sampling frequency	Station class and type (fig. 1; table 2)
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,h]	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
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,h]	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	--
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

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 2018.—Continued

[Water year 2018 is defined as October 1, 2017, through September 30, 2018. USGS, U.S. Geological Survey; mi², square mile; DTPL, Dissected Till Plains; ag, agriculture; --, not applicable; 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 Plateaus—Springfield Plateau; fo, forest; OZPLSA, Ozark Plateaus—Salem Plateau; SPRING, spring; BRMOH, Big River—Missouri River at Hermann, Missouri; URBAN, urban; BRMIT, Big River—Mississippi River at Thebes, Illinois; MIALPL, Mississippi Alluvial Plain]

USGS station number (figs. 1 and 3)	Station name[a]	Contributing drainage area (mi^2)	Water year 2018 sampling frequency	Station class and type (fig. 1; table 2)
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 USGS National Water Information System database (U.S. Geological Survey, 2019).

[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 No Creek near Dunlap, Missouri (06899580), was dry.

[e]This station was sampled as an alternate station when Locust Creek near Unionville, Missouri (0600900), was dry.

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

[g]This station was sampled as an alternate station when East Drywood Creek at Prairie State Park, Missouri (06917630), was dry.

[h]Stations 06934500 and 07022000 are not part of the Ambient Water-Quality Monitoring Network but were used in the report. Stations 06934500 and 07022000 are funded by the USGS National Stream Quality Assessment Network.

EXPLANATION

Physiographic regions of Missouri—Modified from Fenneman (1938)

- Central Lowland Province—Dissected Till Plains (DTPL)
- Central Lowland Province—Osage Plains (OSPL)
- Coastal Plain Province—Mississippi Alluvial Plain (MIALPL)
- Ozark Plateaus Province—Salem Plateau (OZPLSA)
- Ozark Plateaus Province—Springfield Plateau (OZPLSP)

Ambient Water-Quality Monitoring Network (AWQMN) class and type (table 2) and station number (05500000)

- Big River (BRMIG, BRMIT, BRMOSJ, BRMOS, and BRMOH)
- Mississippi Alluvial Plain (MIALPL)
- Ozark Plateaus - Salem Plateau forest and agriculture (OZPLSA fo/ag)
- Ozark Plateaus - Salem Plateau watershed indicator, forest and agriculture (OZPLSA wi fo/ag)
- Ozark Plateaus - Springfield Plateau agriculture and forest (OZPLSP ag/fo)
- Dissected Till Plains agriculture (DTPL ag)
- Dissected Till Plains watershed indicator, agriculture (DTPL wi ag)
- Osage Plains agriculture (OSPL ag)
- Osage Plains watershed indicator, agriculture (OSPL wi ag)
- Osage Plains prairie (OSPL pr)
- Springs (SPRING)
- Mining (MINING)
- Urban (URBAN)
- Urban watershed indicator (URBAN wi)

Figure 1. Physiographic regions of Missouri as well as location and class of selected surface-water quality monitoring stations, water year 2018. Modified from Barr and Bartels (2018).

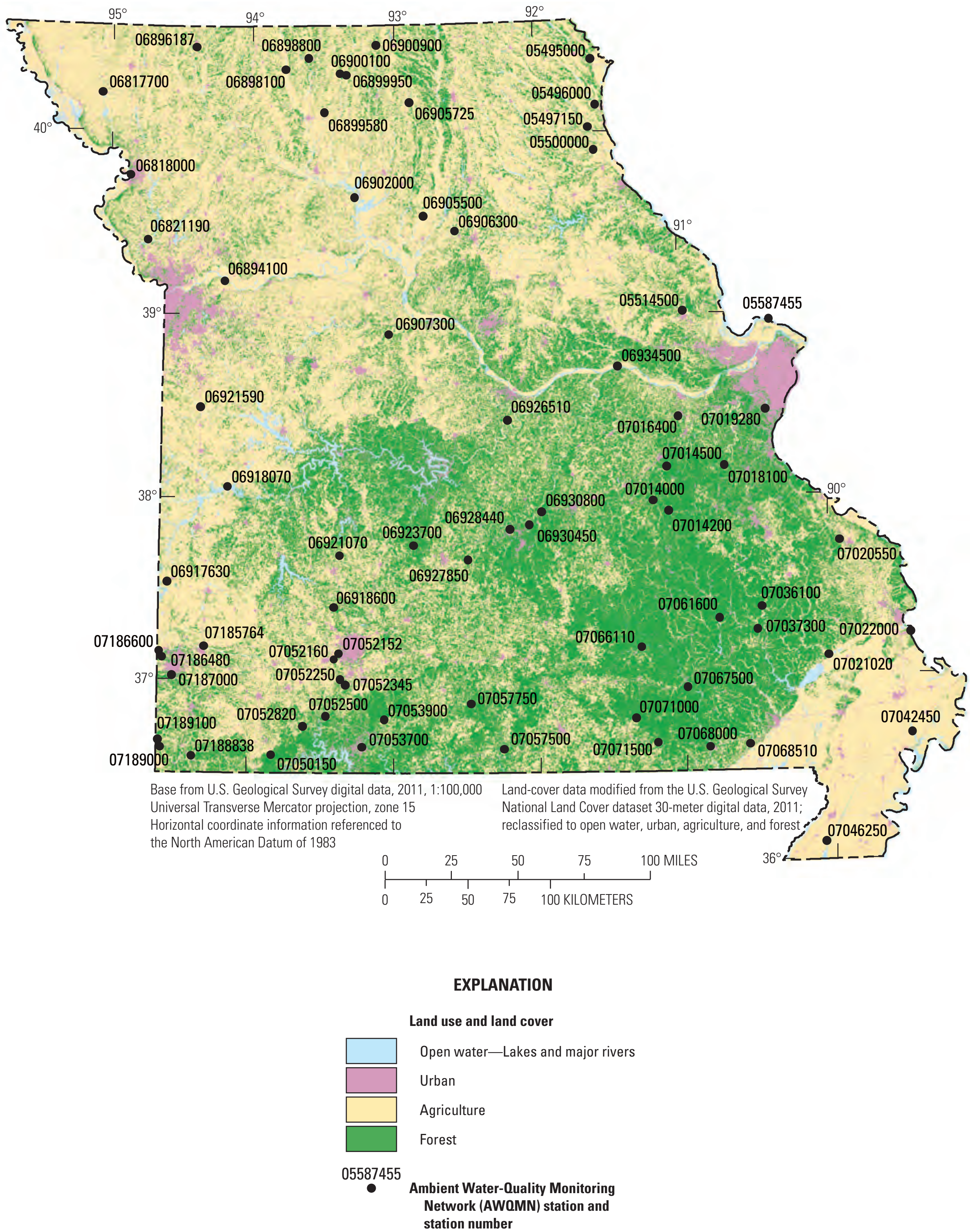

Figure 2. Land use in Missouri. Modified from Barr and Bartels (2018).

(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 (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), both within the Ozark Plateaus Province; and Lake Taneycomo at Branson, Mo. (07053700), a station on a semiriverine system downstream from a major impoundment.

Table 2. Station classes and number of stations in each class and type for Missouri, water year 2018.

[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]

Abbreviation	Station class and type (fig. 1) Definition	Number of stations (table 1)[a]
BRMIG	Big River—Mississippi River below Grafton, Illinois	1
BRMIT	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	Big River—Missouri River at Hermann, Missouri	1
MIALPL	Mississippi Alluvial Plain	2[b]
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	15
DTPL wi ag	Dissected Till Plains watershed indicator, agriculture	4
OSPL ag	Osage Plains agriculture	2
OSPL wi ag	Osage Plains watershed indicator, agriculture	1
OSPL pr	Osage Plains prairie	1
SPRING	Springs	3
MINING	Mining	3
URBAN	Urban	5
URBAN wi	Urban watershed indicator	1

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

[b]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 2018, the average annual precipitation of the conterminous United States was 1.14 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 2018 was 37.59 in., which is 2.91 in. less 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 (2018) 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 2018 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 2018, 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 2018 typically were lower than the long-term mean for all six streamflow-gaging stations (fig. 4). The four southernmost streamflow-gaging stations used for the legacy streamflow information (06921590, 06933500, 07052500, and 07067000) had monthly mean streamflows in parts of February through June 2018 that were greater than the long-term monthly mean streamflows. Streamflow at the two northernmost gages (05495000 and 06897500) exceeded the long-term monthly mean streamflow during September 2018.

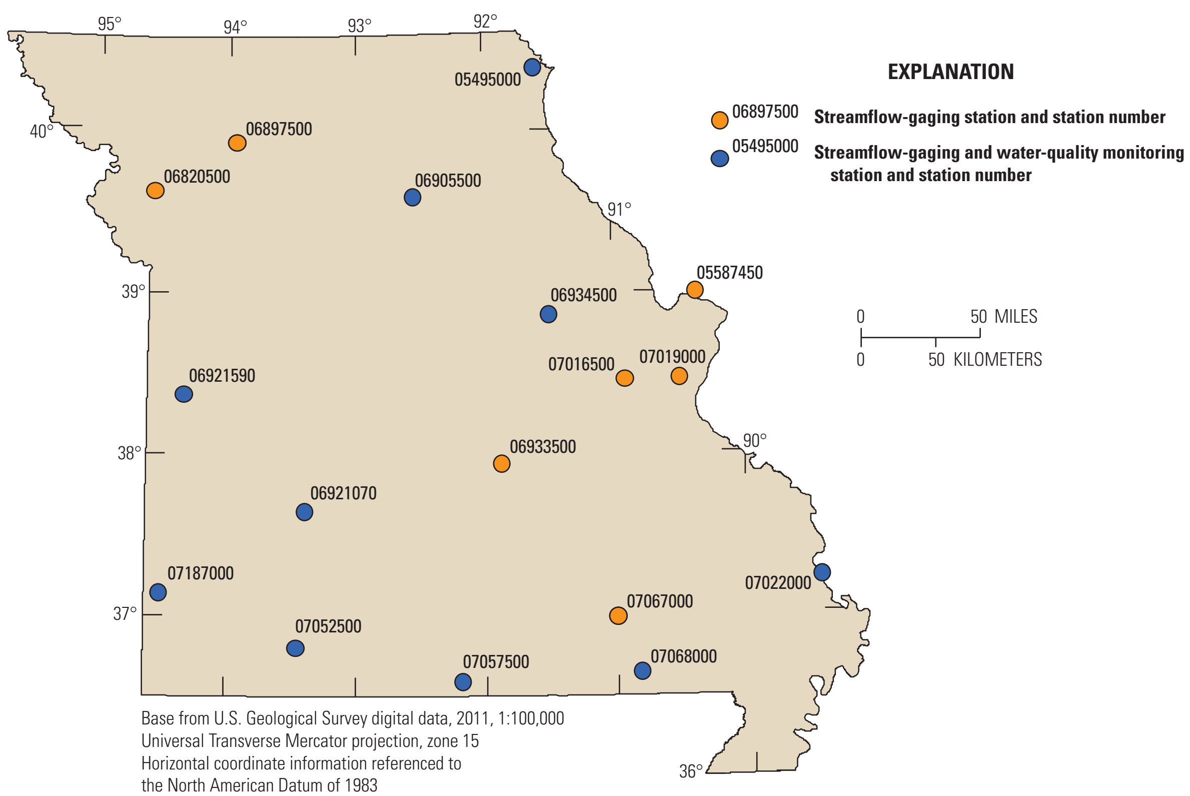

Figure 3. Location of selected streamflow-gaging stations used to provide a summary of hydrologic conditions within Missouri, water year 2018. Modified from Barr and Bartels (2018).

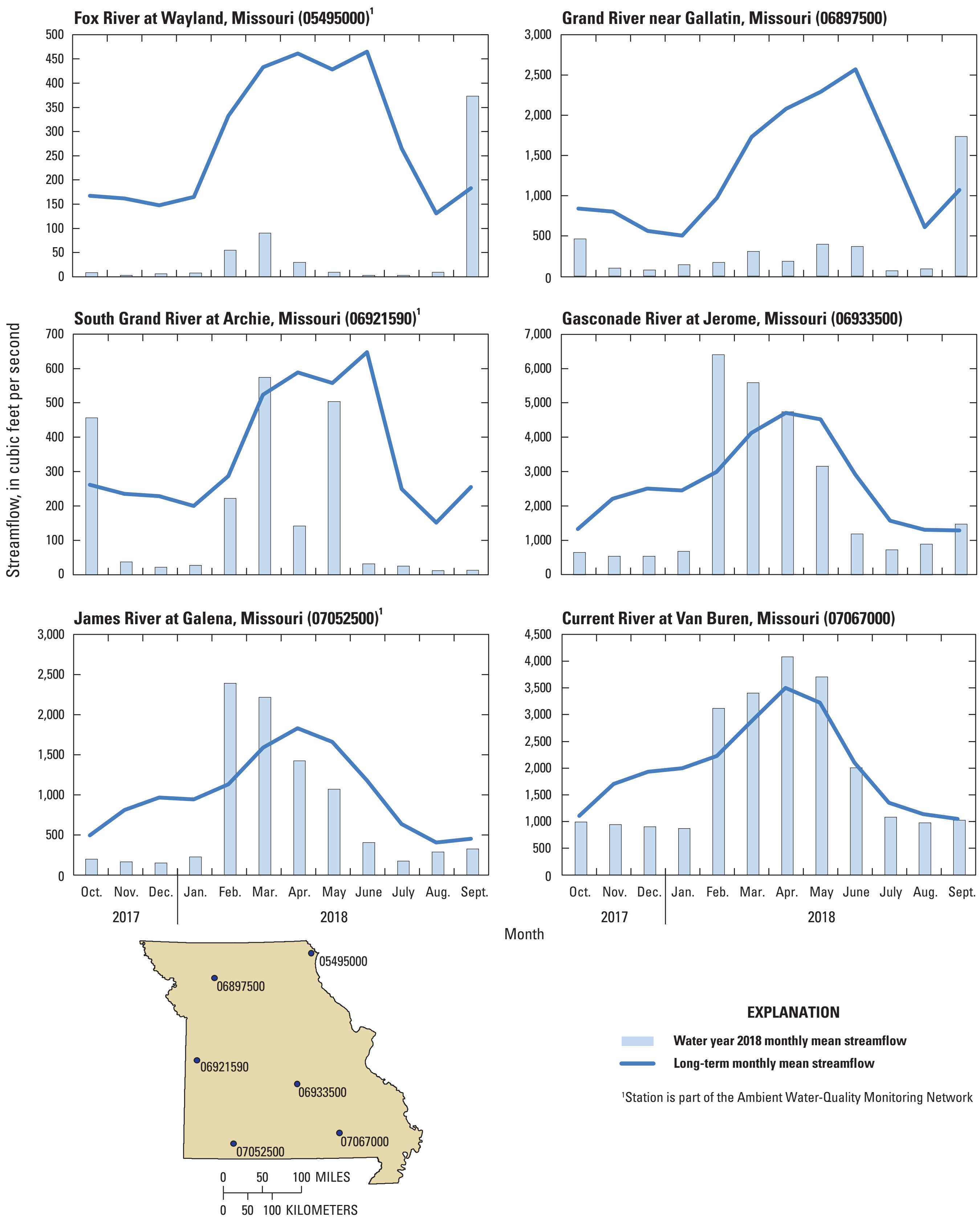

Figure 4. Monthly mean streamflow for water year 2018 and long-term monthly mean streamflow at six representative streamflow-gaging stations in Missouri.

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 2018 water year. These tables include information on historic hydrologic conditions at the stations to provide context for the 2018 data. Peak streamflow during water year 2018 was substantially below the long-term period of record peak streamflow at every streamflow-gaging station (table 3). The 7-day low flow and minimum daily mean streamflows recorded during water year 2018 were greater than historical records for every station (table 4).

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 “nitrate plus nitrite”), total phosphorus, dissolved and total recoverable lead and zinc, and selected pesticide compounds. Boxplots of these constituents are presented for 76 surface-water stations according to their classification (figs. 5–8). Pesticide data are presented from seven stations from six classes (table 5). For specific information on Missouri water-quality standards, refer to Missouri Department of Natural Resources (2016).

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 111 percent (fig. 5). Samples from OSPL pr and OSPL wi ag stations 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 146 microsiemens per centimeter at 25 degrees Celsius (μS/cm at 25 °C) at the OSPL pr station to about 820 μS/cm at 25 °C at the BRMOS and BRMOSJ stations. Median water temperature ranged from 11.0 to 21.5 degrees Celsius. The smallest median temperature was measured at the BRMOSJ station, and the largest was measured at the MINING stations, followed closely by the OSPL wi ag stations. 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.

Table 3. Peak streamflow for water year 2018 and periods of record for selected streamflow-gaging stations in Missouri.

[Water year 2018 is defined as October 1, 2017, through September 30, 2018. 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 2018		Long-term period of record	
		Peak streamflow (ft^3/s)	Date	Peak streamflow (ft^3/s)	Date
05495000	Fox River at Wayland, Missouri (1922–2018)	4,050	September 7, 2018	26,400	April 22, 1973
05587450	Mississippi River at Grafton, Illinois (1933–2018)	285,000	September 12, 2018	598,000	August 1, 1993
06905500	Chariton River near Prairie Hill, Missouri (1929–2018)	4,420	September 7, 2018	38,400	July 27, 2008
06933500	Gasconade River at Jerome, Missouri (1903–2018)	46,100	February 26, 2018	183,000	May 1, 2018
06934500	Missouri River at Hermann, Missouri (1928–2018)	175,000	September 9, 2018	750,000	July 31, 1993
07019000	Meramec River near Eureka, Missouri (1903–2018)	51,200	February 27, 2018	175,000	August 22,1915
07022000	Mississippi River at Thebes, Illinois (1933–2018)	485,000	September 12, 2018	1,050,000	January 2, 2016
07057500	North Fork River near Tecumseh, Missouri (1944–2018)	6,380	February 25, 2018	141,000	April 30, 2017
07068000	Current River at Doniphan, Missouri (1921–2018)	27,400	February 26, 2018	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 USGS National Water Information System database (U.S. Geological Survey, 2019).

Table 4. Seven-day low flow for water year 2018, period of record 7-day low flow, minimum daily mean streamflow for water year 2018, and period of record minimum daily mean streamflow for selected streamflow-gaging stations in Missouri.

[Water year 2018 defined as October 1, 2017, through September 30, 2018; 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 2018	Period of record	Water year 2018	Period of record	Date
05495000	Fox River at Wayland, Missouri (1922–2018)	0.0960	0.0	0.080	0.0	September 10, 1930
06820500	Platte River near Agency, Missouri (1925–2018)	337	0.0	420	0.0	July 19, 1934
06921070	Pomme de Terre River near Polk, Missouri (1968–2018)	12.4	0.210	11.6	0.170	August 13, 2012
07016500	Bourbeuse River near Union, Missouri (1921–2018)	438	113	336	112	October 10, 1956
07067000	Current River at Van Buren, Missouri (1921–2018)	9,800	4,480	9,790	4,480	October 8, 1956
07187000	Shoal Creek above Joplin, Missouri (1941–2018)	780	116	773	115	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 USGS National Water Information System database (U.S. Geological Survey, 2019).

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 188 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, DTPL ag, SPRING, MINING, 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 BRMOS station 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 85 mg/L at BRMIG to 413 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 13 to 735 colonies per 100 milliliters of water. Median fecal coliform bacteria densities ranged from 21 to 800 colonies per 100 milliliters of water. The smallest median *E. coli* densities were in samples collected at SPRING stations and smallest median fecal coliform densities were in samples collected from the SPRING and OZPLSA wi fo/ag stations. The largest median *E. coli* and fecal coliform densities were in samples collected at the BRMOS station (fig. 6).

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 6.28 mg/L for dissolved nitrate plus nitrite and from the LT–MDL (0.02) to 0.38 mg/L for total phosphorus. The smallest median dissolved nitrate plus nitrite concentrations (at the LT–MDL) were computed at the OSPL pr and DTPL ag stations. Nitrate plus nitrite concentrations in most of the samples from these stations were below the LT–MDL, indicating the true median concentration at these stations 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 wi 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 concentrations were at the BRMIT, BRMOH, and DTPL wi ag stations (fig. 7).

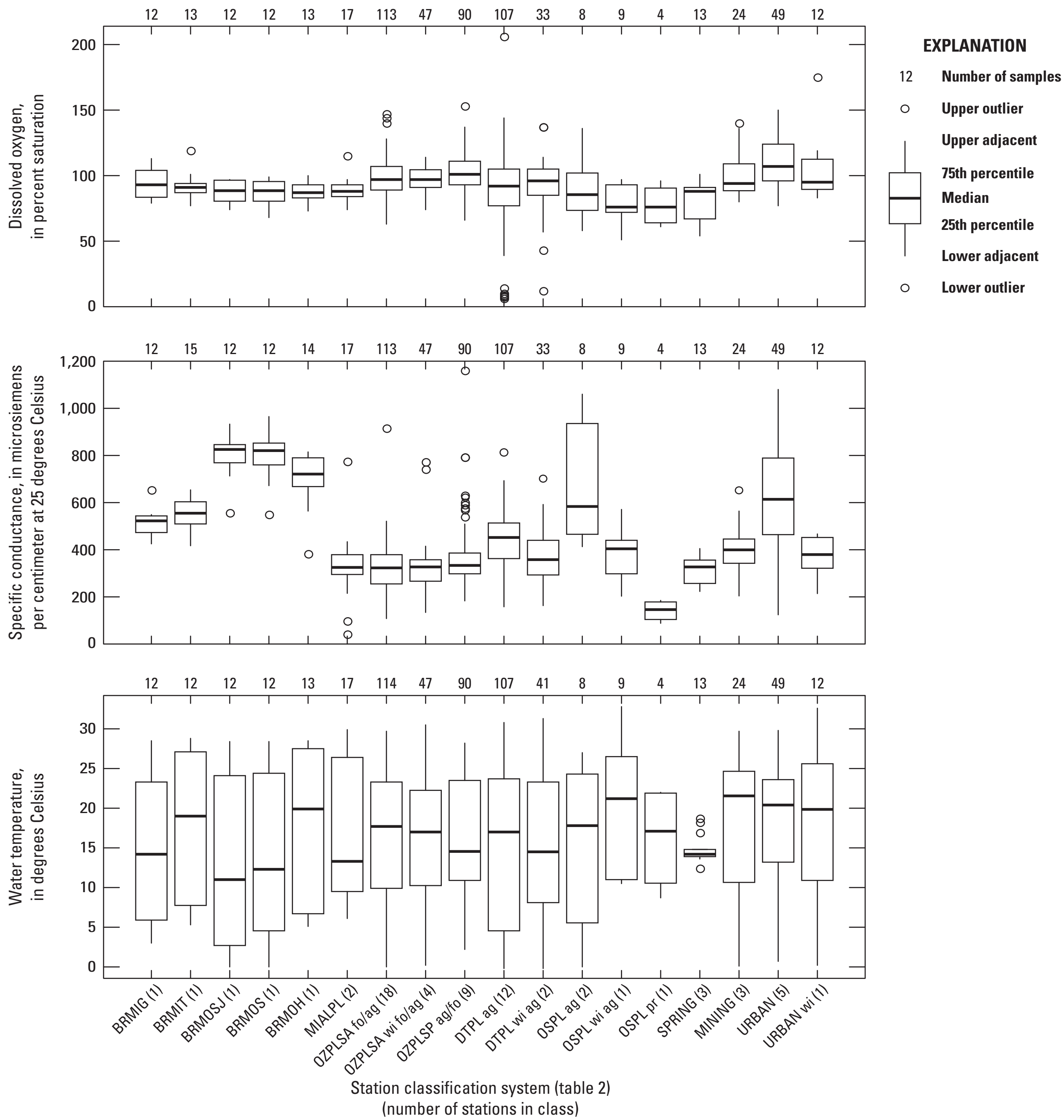

Figure 5. Distribution of physical properties, suspended-solids concentrations, and suspended-sediment concentrations from surface-water quality stations in Missouri, water year 2018.

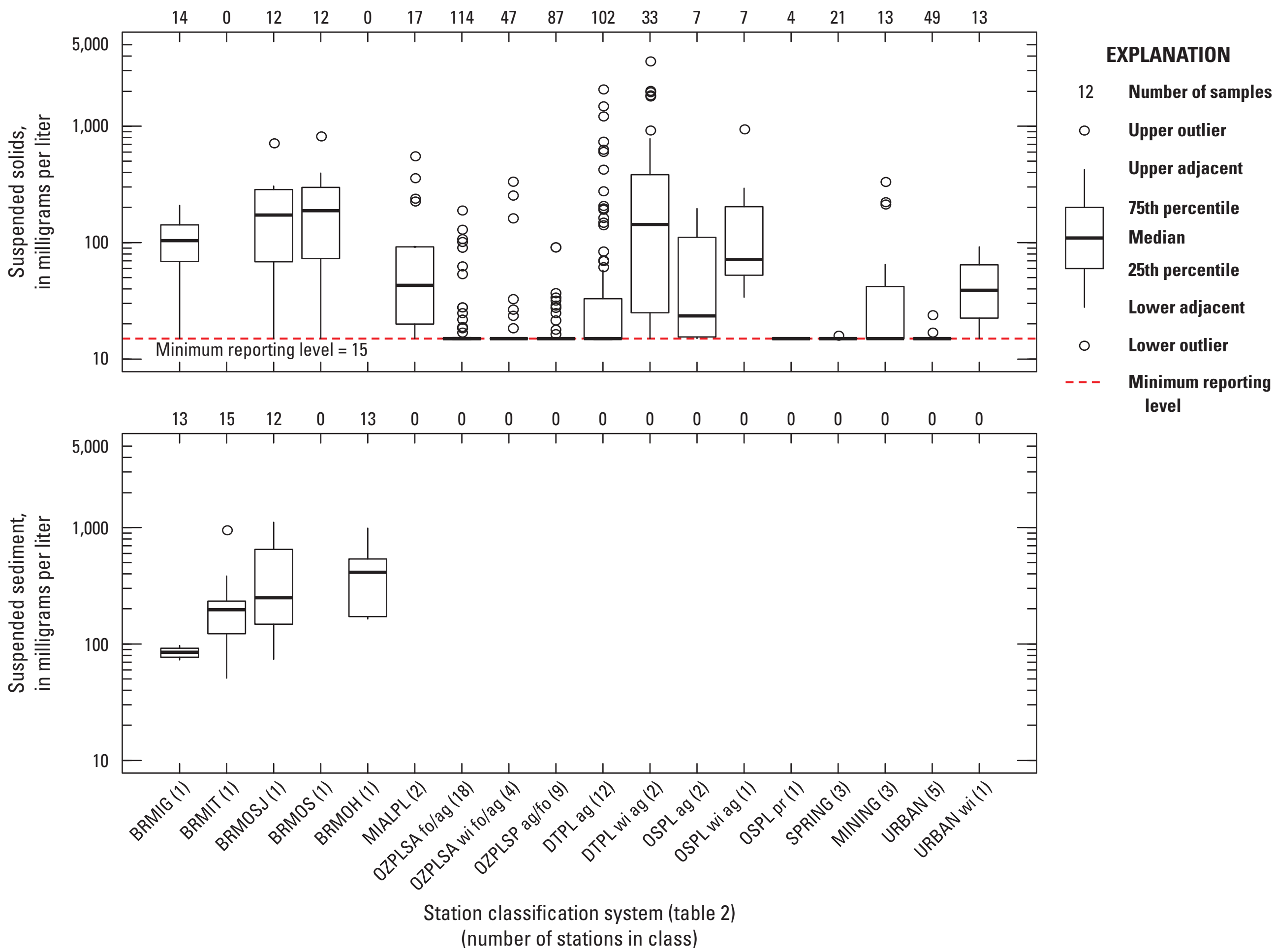

Figure 5. Distribution of physical properties, suspended-solids concentrations, and suspended-sediment concentrations from surface-water quality stations in Missouri, water year 2018.—Continued

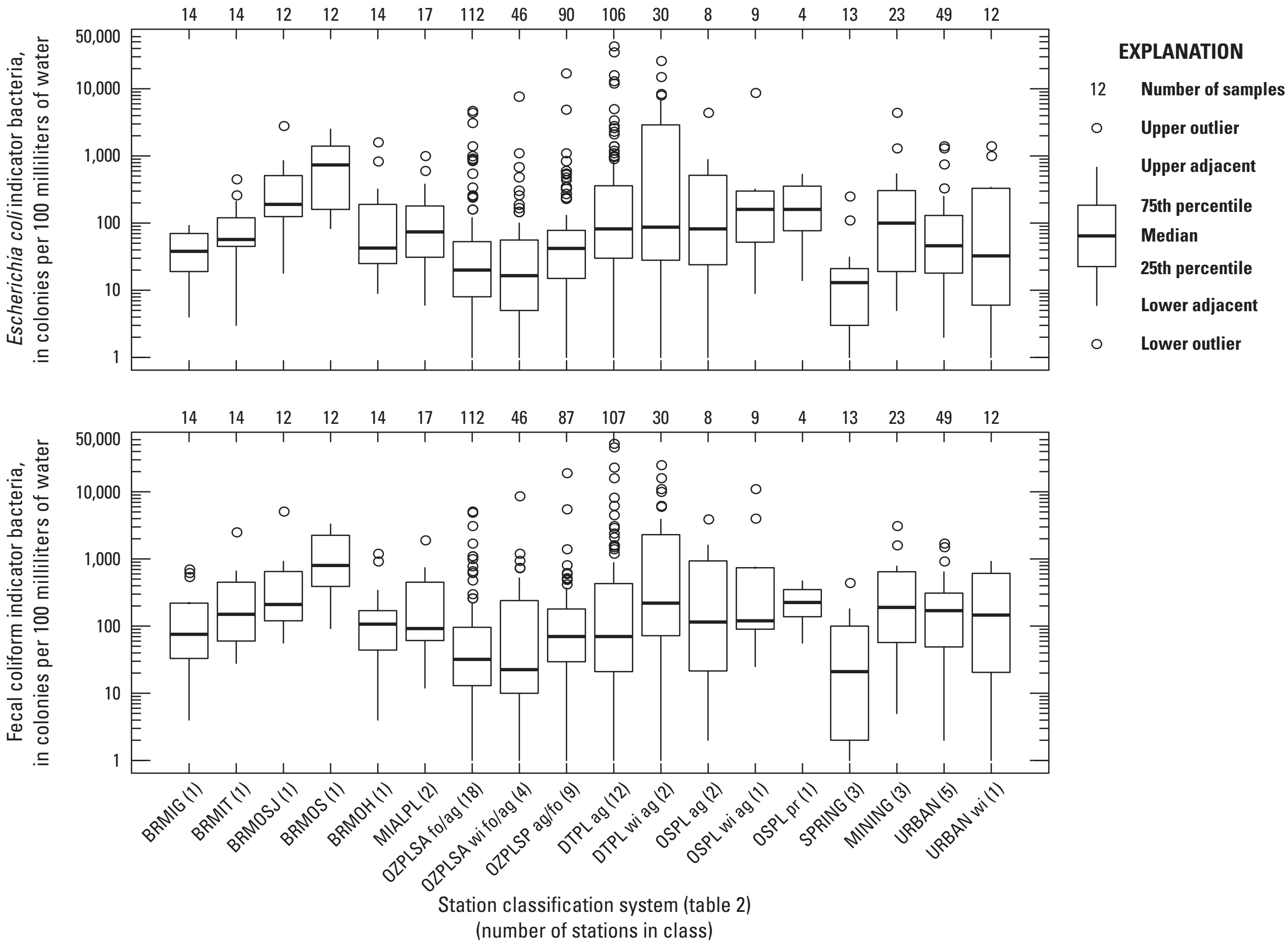

Figure 6. Distribution of fecal indicator bacteria density in samples from surface-water quality stations in Missouri, water year 2018.

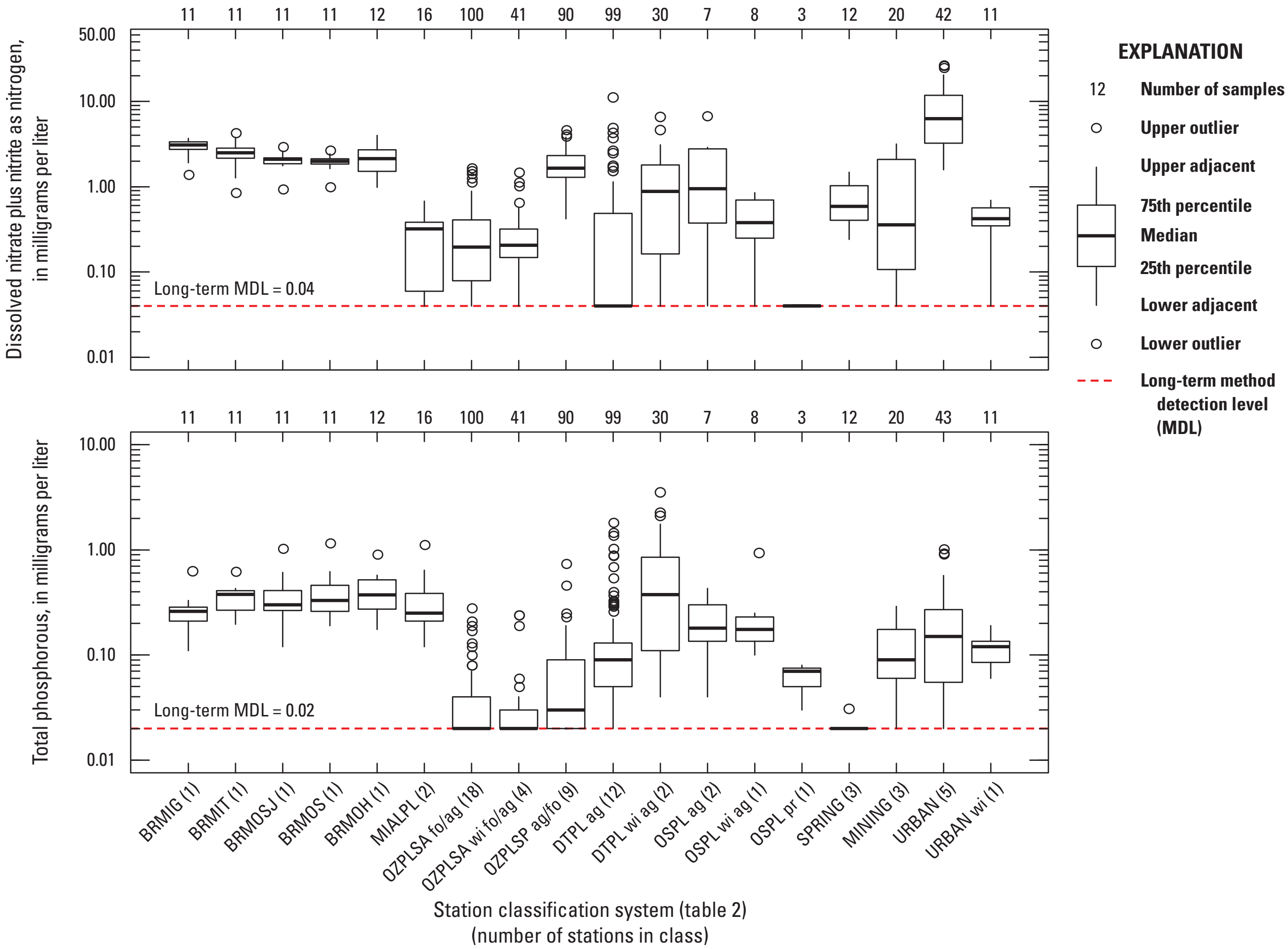

Figure 7. Distribution of dissolved nitrate plus nitrite as nitrogen and total phosphorus concentrations in samples from surface-water quality stations in Missouri, water year 2018.

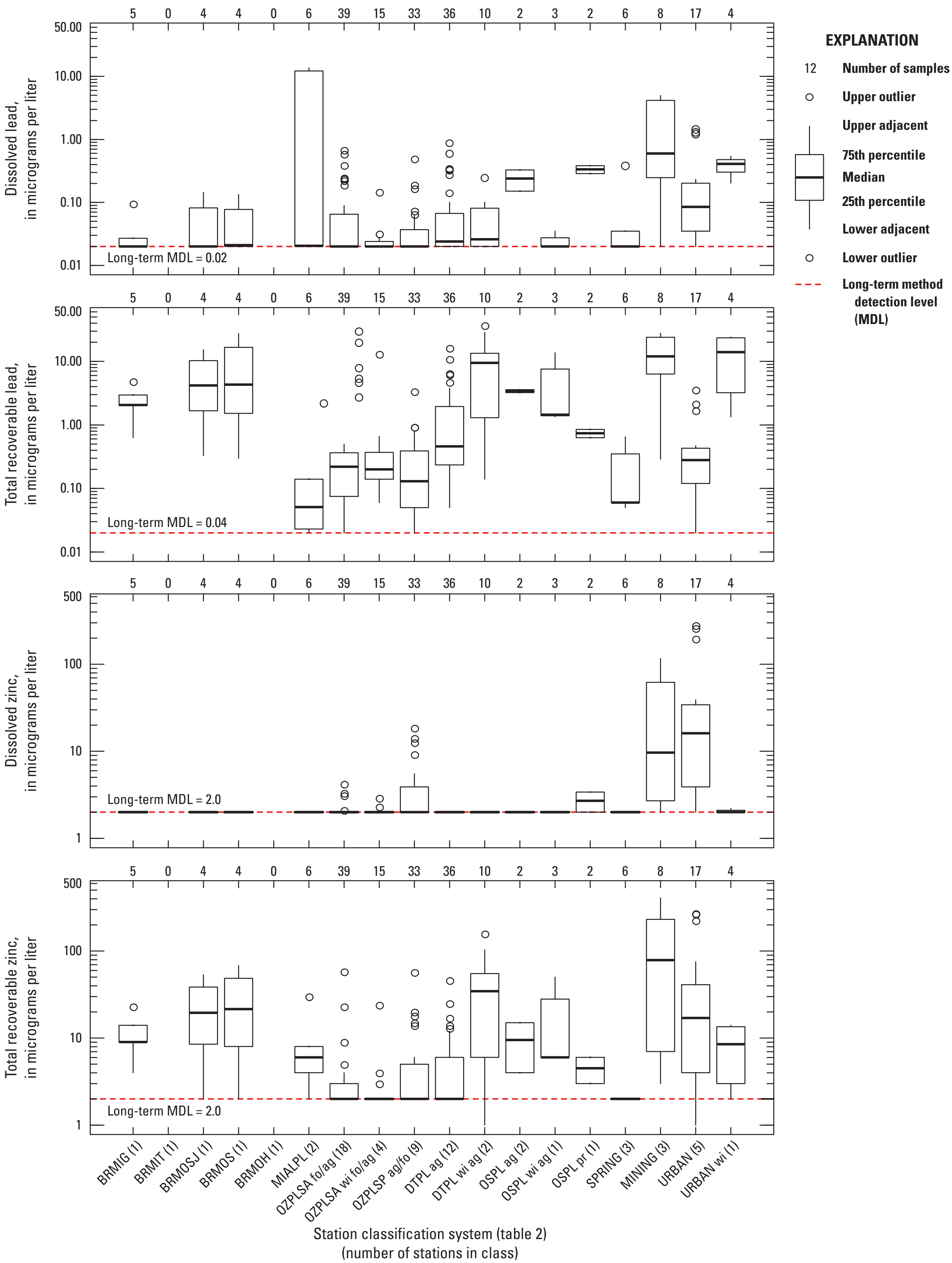

Figure 8. Distribution of dissolved and total recoverable lead and zinc concentrations from surface-water quality stations in Missouri, water year 2018.

Table 5. Summary of detections of selected pesticides for water year 2018 in Missouri.

[Water year 2018 defined as October 1, 2017, through September 30, 2018; MIALPL, Mississippi Alluvial Plain; µg/L, microgram per liter; <, 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	9	7	0.010	78	<0.01	0.322	0.034
Alachlor	9	1	0.008	11	<0.008	0.009	<0.008
Atrazine	9	9	0.008	100	0.009	9.45	0.177
CIAT	9	6	0.014	66	0.007	0.145	0.012
Cis-propiconazole	9	3	0.008	33	0.003	0.060	<0.008
3,4-dichloroaniline	9	2	0.008	22	0.006	0.0296	<0.008
Metalaxyl	4	1	0.014	25	<0.014	0.019	<0.014
Metolachlor	9	9	0.012	100	0.010	3.75	0.224
Metribuzin	9	5	0.012	55	<0.012	0.162	0.009
Prometon	9	0	0.012	0	<0.012	<0.012	<0.012
Prometryn	9	2	0.010	22	0.007	0.010	<0.010
Simazine	9	1	0.008	11	<0.008	0.007	<0.008
Tebuthiuron	9	0	0.028	0	<0.028	<0.028	<0.028
Terbuthylazine	9	1	0.008	11	<0.008	0.007	<0.008
Trans-propiconazole	9	3	0.018	33	0.006	0.067	<0.018
Station classification OSPL wi ag—Station number 06918070							
Acetochlor	5	4	0.010	80	0.004	0.231	0.018
Alachlor	5	0	0.008	0	<0.008	<0.008	<0.008
Atrazine	5	5	0.008	100	0.062	2.62	0.695
CIAT	5	4	0.014	80	<0.014	0.256	0.044
Cis-propiconazole	5	0	0.008	0	<0.008	<0.008	<0.008
3,4-dichloroaniline	5	0	0.008	0	<0.008	<0.008	<0.008
Metalaxyl	3	0	0.014	0	<0.014	<0.014	<0.014
Metolachlor	5	5	0.012	100	0.043	1.84	0.111
Metribuzin	5	3	0.012	60	<0.012	0.142	0.012
Prometon	5	3	0.012	60	0.007	0.012	0.007
Prometryn	5	0	0.010	0	<0.010	<0.010	<0.010
Simazine	5	0	0.008	0	<0.008	<0.008	<0.008
Tebuthiuron	5	2	0.028	40	<0.028	0.144	<0.028
Terbuthylazine	5	0	0.008	0	<0.008	<0.008	<0.008
Trans-propiconazole	5	0	0.018	0	<0.018	<0.018	<0.018

Table 5. Summary of detections of selected pesticides for water year 2018 in Missouri.—Continued

[Water year 2018 defined as October 1, 2017, through September 30, 2018; MIALPA, Mississippi Alluvial Plain; µg/L, microgram per liter; <, 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							
Acetochlor	4	0	0.010	0	<0.010	<0.010	<0.010
Alachlor	4	0	0.008	0	<0.008	<0.008	<0.008
Atrazine	4	1	0.008	25	<0.008	0.017	<0.008
CIAT	4	1	0.014	25	<0.014	0.007	<0.014
Cis-propiconazole	4	0	0.008	0	<0.008	<0.008	<0.008
3,4-dichloroaniline	4	0	0.008	0	<0.008	<0.008	<0.008
Metalaxyl	3	0	0.014	0	<0.014	<0.014	<0.014
Metolachlor	4	1	0.012	25	<0.012	0.012	<0.012
Metribuzin	4	0	0.012	0	<0.012	<0.012	<0.012
Prometon	4	4	0.010	100	0.006	0.019	0.0075
Prometryn	4	0	0.010	0	<0.010	<0.010	<0.010
Simazine	4	0	0.008	0	<0.008	<0.008	<0.008
Tebuthiuron	4	3	0.028	75	0.013	0.157	0.059
Terbuthylazine	4	1	0.008	25	0.006	<0.008	<0.008
Trans-propiconazole	4	0	0.018	0	<0.018	<0.018	<0.018
Station classification BRMIT—Station number 07022000							
Acetochlor	13	13	0.010	100	0.007	0.332	0.0367
Alachlor	13	0	0.027	0	<0.027	<0.027	<0.027
Atrazine	13	13	0.0068	100	0.062	1.57	0.217
CIAT	13	13	0.011	100	0.026	0.267	0.047
Cis-propiconazole	NA	NA	NA	NA	NA	NA	NA
3,4-dichloroaniline	NA	NA	NA	NA	NA	NA	NA
Metalaxyl	13	6	0.006	46	<0.006	0.011	<0.006
Metolachlor	13	13	0.0032	100	0.045	1.62	0.148
Metribuzin	13	7	0.020	54	0.014	0.085	0.014
Prometon	13	12	0.004	92	0.003	0.007	0.0035
Prometryn	13	0	0.0042	0	<0.0042	<0.0042	<0.0042
Simazine	13	11	0.0072	85	<0.0072	0.256	0.046
Tebuthiuron	13	9	0.003	69	0.0025	0.184	0.0043
Terbuthylazine	13	6	0.0036	46	0.002	0.005	<0.0036
Trans-propiconazole	NA	NA	NA	NA	NA	NA	NA

Table 5. Summary of detections of selected pesticides for water year 2018 in Missouri.—Continued

[Water year 2018 defined as October 1, 2017, through September 30, 2018; MIALPA, Mississippi Alluvial Plain; µg/L, microgram per liter; <, 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							
Acetochlor	12	11	0.010	92	0.025	0.308	0.064
Alachlor	12	0	0.027	0	<0.027	<0.027	<0.027
Atrazine	12	12	0.0068	100	0.049	0.93	0.13
CIAT	12	11	0.011	92	<0.011	0.147	0.040
Cis-propiconazole	NA	NA	NA	NA	NA	NA	NA
3,4-dichloroaniline	NA	NA	NA	NA	NA	NA	NA
Metalaxyl	12	5	0.006	42	<0.006	0.011	<0.006
Metolachlor	12	12	0.0032	100	0.048	0.68	0.144
Metribuzin	12	5	0.020	42	0.010	0.040	<0.020
Prometon	12	6	0.004	50	0.002	0.007	<0.004
Prometryn	12	0	0.0042	0	<0.0042	<0.0042	<0.0042
Simazine	12	9	0.0072	75	0.005	0.133	0.012
Tebuthiuron	12	8	0.003	66	0.0001	0.006	<0.003
Terbuthylazine	12	6	0.0036	50	0.002	0.005	<0.0036
Trans-propiconazole	NA	NA	NA	NA	NA	NA	NA
Station classification BRMOH—Station number 06934500							
Acetochlor	12	10	0.010	83	0.011	0.178	0.027
Alachlor	12	0	0.025	0	<0.025	<0.025	<0.025
Atrazine	12	12	0.007	100	0.288	1.04	0.16
CIAT	12	12	0.011	100	0.021	0.286	0.043
Cis-propiconazole	NA	NA	NA	NA	NA	NA	NA
3,4-dichloroaniline	NA	NA	NA	NA	NA	NA	NA
Metalaxyl	12	8	0.006	75	0.002	0.007	<0.006
Metolachlor	12	12	0.0032	100	0.051	1.18	0.143
Metribuzin	12	6	0.020	50	0.008	0.130	<0.020
Prometon	12	8	0.004	75	0.002	0.009	<0.004
Prometryn	12	0	0.004	0	<0.0044	<0.004	<0.004
Simazine	12	6	0.007	50	0.003	0.068	<0.007
Tebuthiuron	12	9	0.003	75	0.0001	0.029	<0.003
Terbuthylazine	12	0	0.004	50	<0.004	<0.004	<0.004
Trans-propiconazole	NA	NA	NA	NA	NA	NA	NA

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 0.598 micrograms per liter (µg/L) for dissolved lead, 0.051 to 13.99 µg/L for total recoverable lead, the LT–MDL of 2.0 to 16.1 µg/L for dissolved zinc, and the LT–MDL of 2.0 to 78.5 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 BRMIG, BRMOS, BRMOSJ, OSPL wi/ag, OZPLSA (wi fo/ag), OZPLSP ag/fo, 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. Median dissolved lead concentrations from the DTPL (ag, wi ag), MIALPL, OSPL ag, and OZPLSA fo/ag stations are based on detections, so the true median value for dissolved lead at these stations is at or near 0.02 µg/L (fig. 8). Samples from the MINING stations had the largest median concentration (fig. 8).

The smallest median concentrations of total recoverable lead were at the MIALPL stations. The largest median total recoverable lead concentration was at the URBAN wi station.

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), 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. Median total recoverable zinc concentrations from the OZPLSP ag/fo and DTPL ag stations are based on detections, so the true median value for total recoverable zinc at these stations is 2.0 µg/L (fig. 8). The largest median concentration of total recoverable zinc was at the MINING stations (78.5 µg/L).

Selected Pesticide Concentrations and Detection Frequencies

Samples collected for the analysis of dissolved pesticide compounds during the 2018 water year are presented in this report for seven stations. The AWQMN and NASQAN pesticide programs use different 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 NASQAN program. For the sake of consistency with previous reports, this report will only discuss the results of sampling for the 85 pesticide compounds tested for as part of the AWQMN. The NASQAN pesticides that overlap with the AWQMN pesticide compounds tested as part of the sampling also are discussed. Note that analysis of pesticide data provided in table 5 includes analysis of detections at concentrations below the LRL if at least one sample had a detection above the LRL for that compound.

Fifteen pesticide compounds were detected above their LRL in at least one sample during the 2018 water year. The 15 compounds are acetochlor, alachlor, 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, metalaxyl, metolachlor, metribuzin, prometon, prometryn, simazine, tebuthiuron, terbuthylazine, and *trans*-propiconazole (table 5). CIAT (detected in 85 percent of the samples collected), acetochlor (80-percent detection), atrazine (94-percent detection), and metolachlor (94-percent detection) were detected in more than one-half of the samples analyzed. The median concentrations for pesticide compounds shown in table 5 were less than 1.00 µg/L for all compounds. Every sample from each of the Big River stations had a detection of at least one pesticide (typically atrazine) at a concentration greater that its LRL. Every sample from each of the OSPL wi ag and MIALPL stations also had a detection of at least one pesticide (typically atrazine) greater than the LRL.

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 Stream Quality Assessment Network 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 2018 at 76 stations (74 AWQMN and AWQMN alternate stations as well as 2 National Stream Quality Assessment Network 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 2018 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 pesticide compounds are presented for seven stations.

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