

Hydrologic Conditions in Massachusetts During Water Year 2014

Open-File Report 2015–1056

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By Richard J. Verdi

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

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Hydrologic Conditions in Massachusetts During Water Year 2014

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Abstract

Hydrologic data and conditions throughout Massachusetts during water year 2014 (October 1, 2013, to September 30, 2014) are presented in this report. Stream discharge and groundwater levels during water year 2014 varied geographically across the State. The data are described as being above, below, or near normal in relation to long-term averages for the period of record.

Introduction

Before 1960, hydrologic data collected by the U.S. Geological Survey (USGS) in Massachusetts were published in various water-supply papers and included water-related data collected by USGS during a water year¹. In 1961, a series of annual reports titled “Water-Resources Data for Massachusetts” was introduced; these reports contained only surface-water data. In 1964, a similar report was introduced for the purpose of publishing water-quality data. In 1975, surface-water data, water-quality data, and groundwater levels were published in a single volume annual report. Formal publication of the annual report series was discontinued at the end of water year 2004. Reports describing data collected after water year 2004 through water year 2013 are available as site data sheets from the annual data report Web site (<http://wdr.water.usgs.gov/>), which facilitates the retrieval of reports for stations throughout the United States. Beginning with water year 2014, reports describing data collected during the water year are being published as annual water summaries and are available from the USGS National Water Information System (NWIS) Water Data for the Nation Web site (<http://waterdata.usgs.gov/ma/nwis/nwis>).

Current and historical data, including site information, daily values, statistics, and field measurements, are available for all monitoring stations on the USGS NWIS Web site. In this report, monitoring station refers to a streamgage, groundwater well, or precipitation gage. Instantaneous time-series data for the past 10 to 15 years are available for many characteristics, including gage height, discharge, water temperature, specific conductance, and other parameters, through the Instantaneous Data Archive (http://ida.water.usgs.gov/ida/index_usgs.cfm). As a result of the

evolution of electronic data loggers, computer systems have made it possible to store and provide access to such data for many USGS monitoring stations. These instantaneous time-series data are typically recorded at intervals of 60 minutes or less and are the basis for computations of daily values for discharge, water level, and other hydrologic variables.

This report summarizes hydrologic data and conditions at representative wells and stream sites throughout Massachusetts for water year 2014. Precipitation, discharge, and water-level values are shown in figures. Discharge values are listed in tables.

Funding for Hydrologic Data Collection in Massachusetts

Funding to provide hydrologic data to the public primarily comes from four sources: (1) the USGS Cooperative Water Program, in which the USGS, State, local, and municipal agencies share in the costs of the monitoring stations; (2) Federal, State, and local agencies and private entities without cost sharing; (3) the National Streamflow Information Program (NSIP); and (4) the Collection of Basic Records (CBR) Program. The USGS Cooperative Water Program funds most of the monitoring stations in Massachusetts through cost-sharing agreements with several State agencies and many local, county, and municipal governments. The NSIP provides some Federal funding for streamgages with one or more of the following critical interests: interstate and international waters, flood forecasts, large river-basin outflows, sentinel watersheds, and water quality. The CBR program provides some Federal funding for a basic network of groundwater monitoring wells across the Nation.

During water year 2014, funding was received for the collection of hydrologic data from 97 continuous-discharge streamgages, 13 stage-only streamgages and lake stations, 29 continuous-monitoring groundwater stations, 57 month-end groundwater-level stations in the USGS Climate Response Network, and 72 month-end groundwater-level stations in the USGS Active Water Level Network. Continuous water-quality data were collected at three stations. Real-time data for all of the continuous-record stations are available through NWIS (<http://waterdata.usgs.gov/ma/nwis/rt/>). The locations of the monitoring streamgages and groundwater stations referenced in this report are identified in figure 1.

¹A water year is the 12-month period beginning October 1 and ending September 30. It is designated by the year in which it ends.

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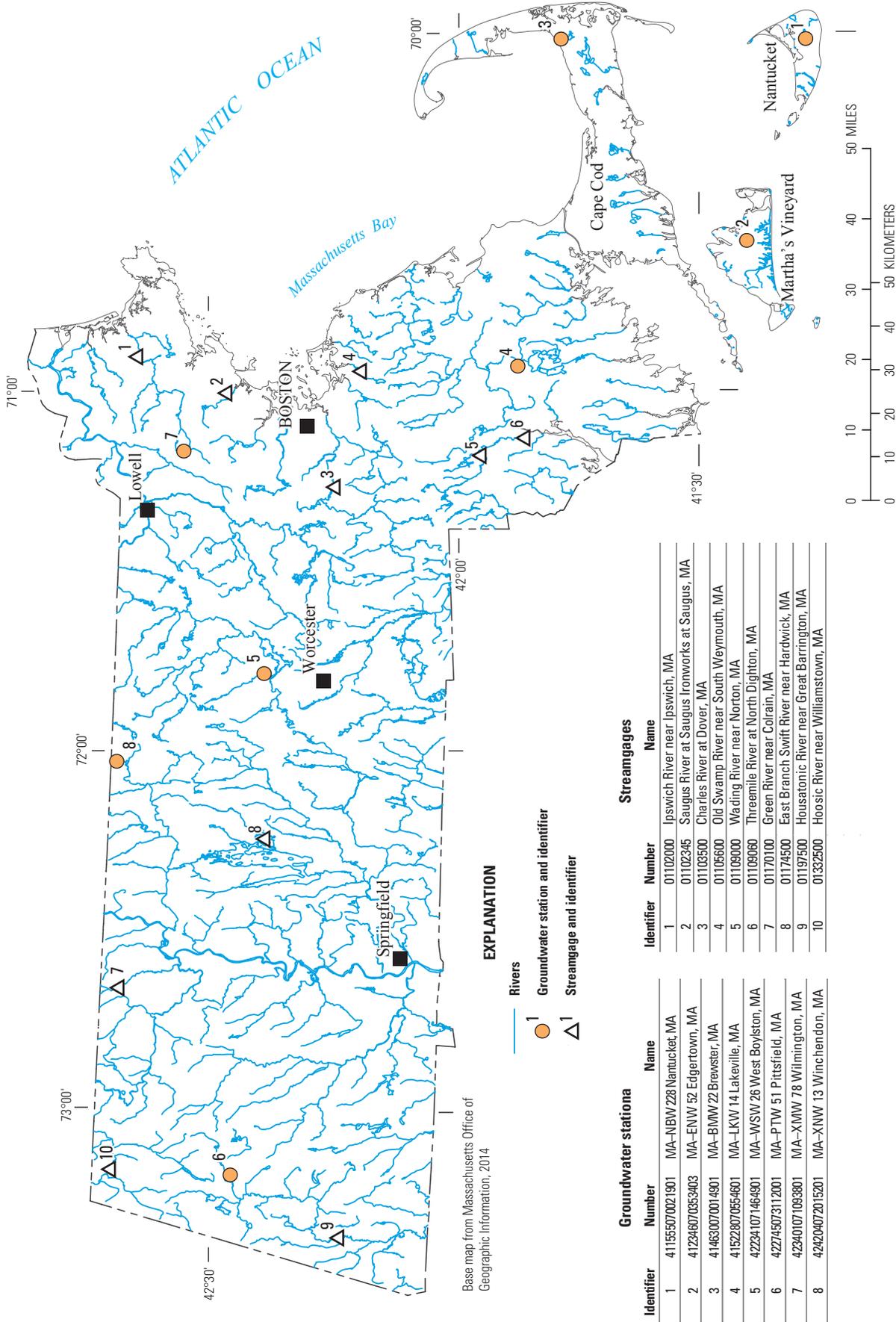


Figure 1. Massachusetts monitoring stations referenced in this report.

Hydrologic Conditions in Massachusetts

The hydrologic conditions in Massachusetts during water year 2014 are described in detail below, and comparisons are made to normal conditions. Normal conditions are defined in this report as the long-term average for the period of record. Analyses of data are made for precipitation, surface-water discharge, and groundwater levels.

Precipitation

The graphs in figures 2A–F show average annual cumulative precipitation and cumulative precipitation for water year 2014 in regions of Massachusetts. Figure 2G shows average annual cumulative precipitation and cumulative precipitation for water year 2014 for the State as a whole. The data presented in these figures were provided by the Massachusetts Department of Conservation and Recreation, Office of Water Resources (Linda Hutchins, written commun., 2014).

Cumulative precipitation throughout Massachusetts during water year 2014 ended below normal for the State as a whole (fig. 2G). Average annual cumulative precipitation in the Connecticut River Basin and the central and western regions of Massachusetts was about normal at the end of the water year (figs. 2A–C). The northeastern and southeastern regions of the State and Cape Cod ended the year below normal, cumulatively (figs. 2D–F). The effects of several consecutive months of lower than normal precipitation in these parts of the State recorded at numerous streamgages are discussed in the “Surface-Water Discharge” section.

Surface-Water Discharge

Discharge hydrographs for six representative streams in Massachusetts are shown in figures 3A–F. Each hydrograph shows the monthly mean discharge for water year 2014 and the monthly maximum, minimum, and mean discharges for the period of record for the station. Table 1 presents mean annual discharge for water years 2014 and 2013 (for comparison), expressed in units of cubic feet per second and as a percentage of the mean annual average for the period of record, for the six representative streams.

Monthly and annual rates of discharge in streams varied from below normal to above normal in Massachusetts during water year 2014 (figs. 3A–F; table 1). A new maximum monthly mean discharge, mostly caused by snowmelt and heavy localized precipitation, was recorded at East Branch Swift River near Hardwick during May 2014. The new record of 191 cubic feet per second (ft³/s) exceeds the previous record of 189 ft³/s set in 1984.

New minimum monthly mean discharges, caused by below normal precipitation, were recorded at four streamgages in the northeastern and southeastern regions of the State and Cape Cod (table 2). For example, a new minimum monthly mean discharge was recorded at Wading River near Norton during the month of September 2014. The new record of 0.84 ft³/s exceeds the previous record of 1.76 ft³/s set in 1930.

Groundwater Levels

Groundwater hydrographs for eight representative wells in Massachusetts are shown in figures 4A to H. Each hydrograph shows the water year 2014 month-end water level and the maximum, minimum, and monthly median water levels for the period of record at that site.

Groundwater levels across the State ranged from below normal to above normal. No new record water levels were reported for any well in the State. Daily mean groundwater-level data for the 29 continuous-recording wells in the State can be obtained by visiting the USGS annual data report Web site (<http://wdr.water.usgs.gov/>). Month-end water levels, water-level statistics, and well characteristics for the 57 wells in the State that are part of the Climate Response Network can be obtained from the USGS groundwater watch Web site (<http://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=crn&sc=25>). This information can also be obtained for the 72 wells in the State that are part of the Active Water Level Network (<http://groundwaterwatch.usgs.gov/statemap.asp?sc=25&sa=MA>).

Summary

Precipitation and water-level conditions varied across Massachusetts. Annual cumulative precipitation was below normal for the State as a whole. Stream discharges ranged from below normal to normal to above normal with several sites reaching record-minimum monthly mean discharges and one reaching record-maximum monthly mean discharge. Groundwater levels ranged from below normal to above normal with no sites reaching new records during the year.

Acknowledgments

The author acknowledges the contributions of senior hydrologist Roy Socolow, senior hydrographer Linda Comeau, and hydrographers Robert Bradley, Christopher Bruet, Josh Combs, Emilie Nobles, Steve O’Brien, and Lance Ramsbey of the U.S. Geological Survey Hydrologic Surveillance Unit in Northborough, Massachusetts, for their efforts in data collection and record computations.

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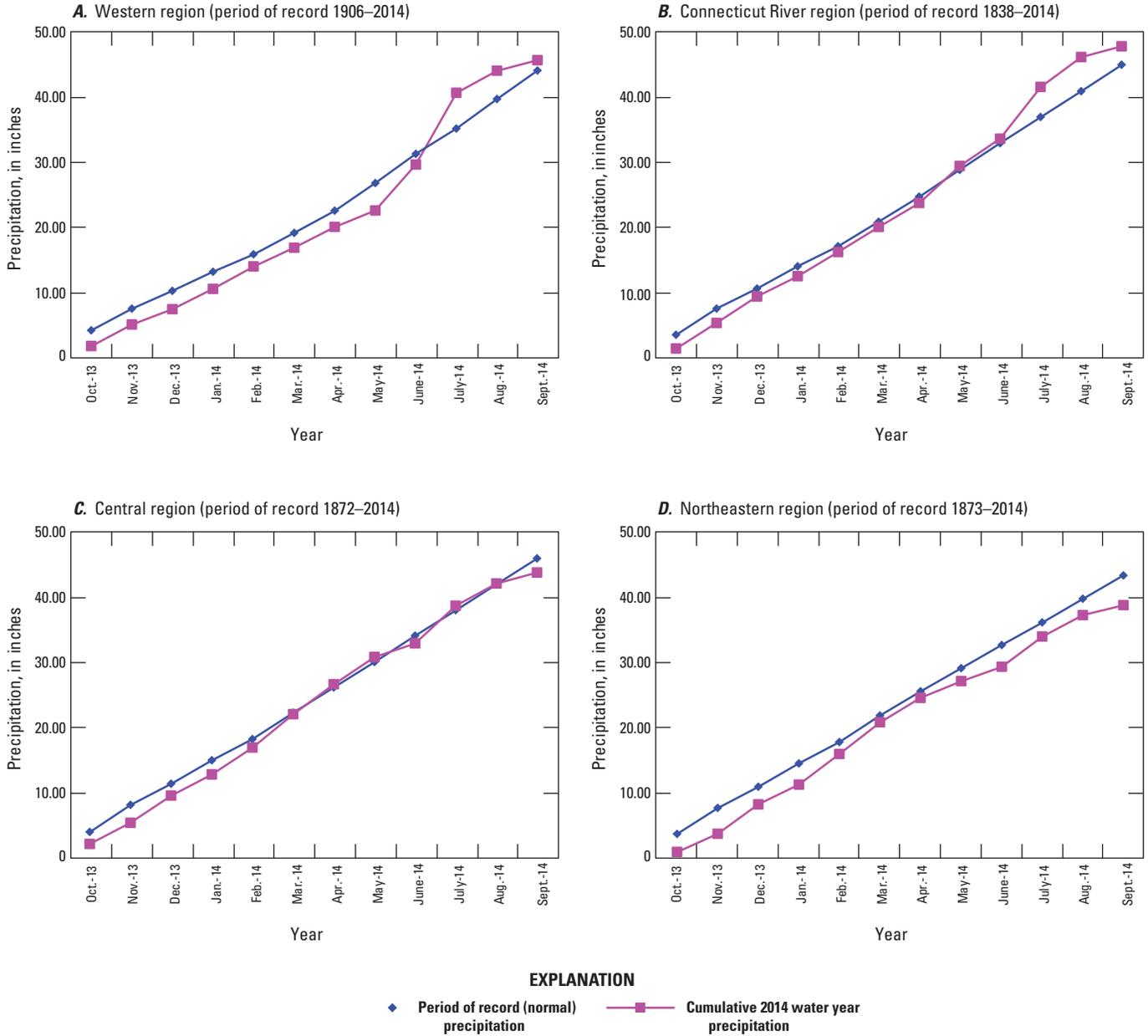


Figure 2. Average annual cumulative precipitation versus cumulative precipitation during water year 2014 for A–F, regions and G, the entire State of Massachusetts.

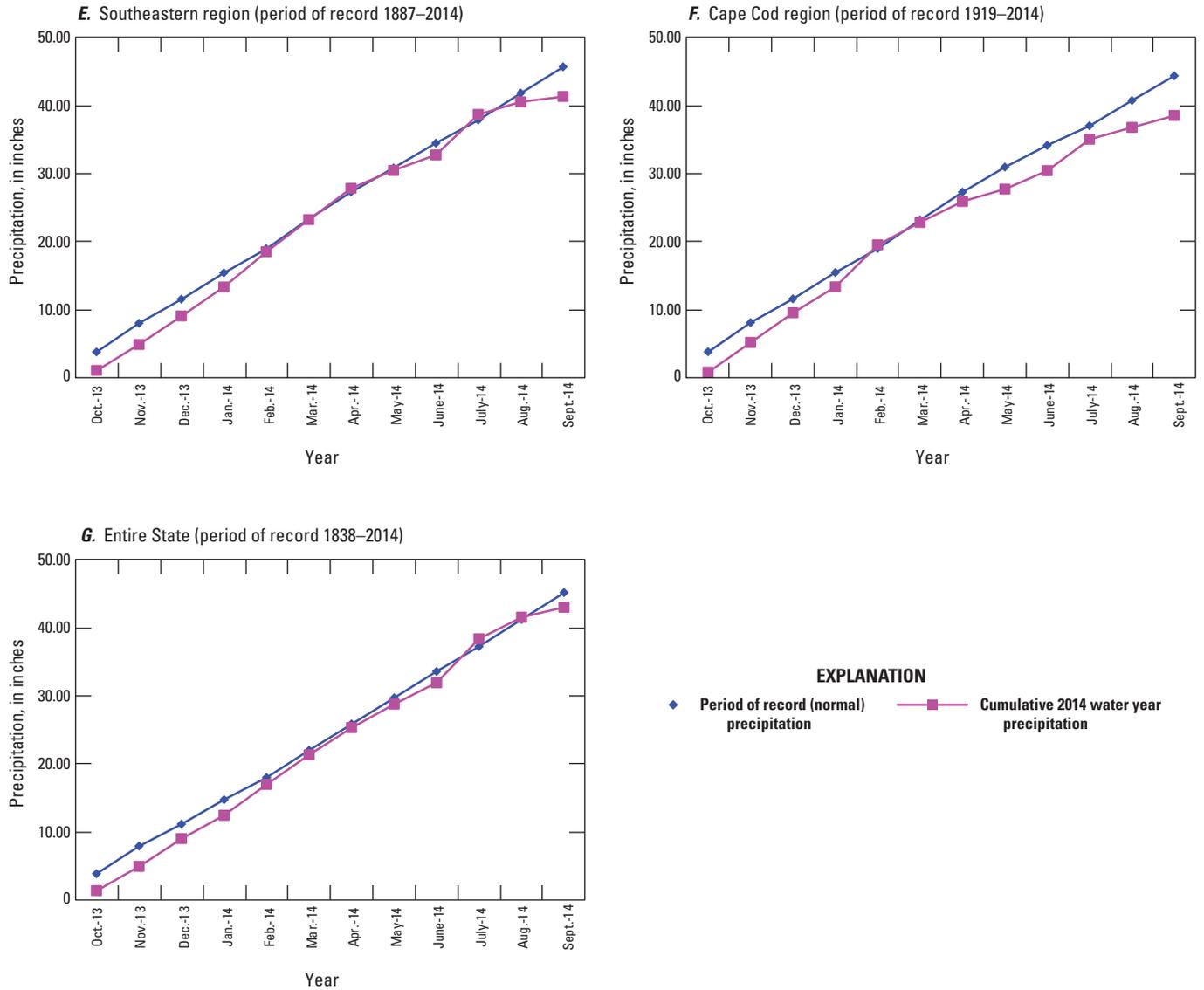


Figure 2. Average annual cumulative precipitation versus cumulative precipitation during water year 2014 for A–F, regions and G, the entire State of Massachusetts.—Continued

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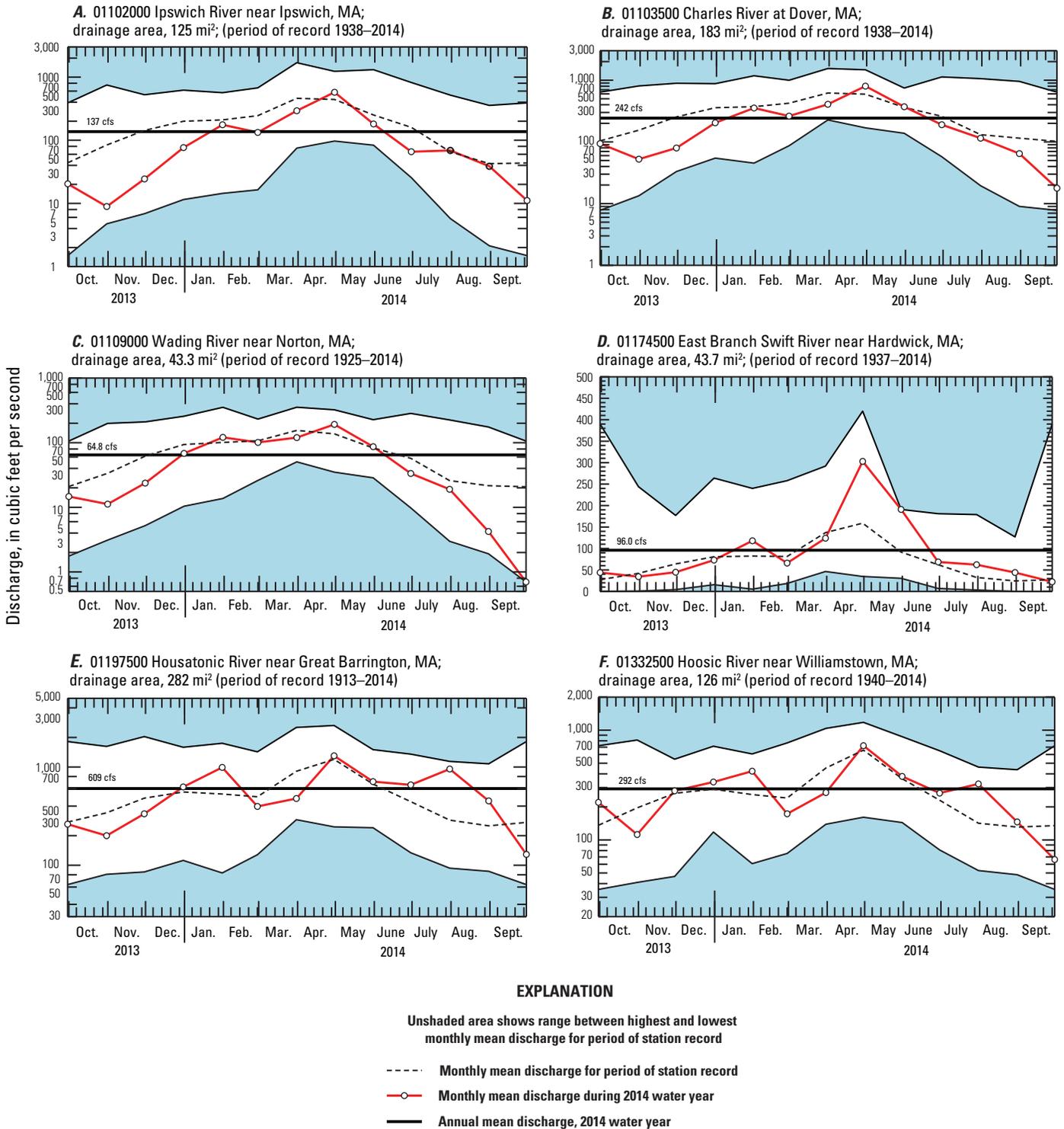


Figure 3. Discharge hydrographs for the six representative streams in Massachusetts. Each hydrograph shows the monthly mean discharge for water year 2014 compared with the monthly maximum, minimum, and mean discharges for the period of record for the site. mi², square miles.

Table 1. Mean annual discharge of selected streams in Massachusetts for water years 2014 and 2013 and for the period of record.

[USGS, U.S. Geological Survey]

USGS station number	USGS station name	Mean discharge				Mean annual discharge for period of record	
		Water year 2014		Water year 2013		Period of record	Discharge, in cubic feet per second
		Discharge, in cubic feet per second	Percentage of mean annual discharge for period of record	Discharge, in cubic feet per second	Percentage of mean annual discharge for period of record		
01102000	Ipswich River near Ipswich, MA	138	71	167	86	1938–2014	195
01103500	Charles River at Dover, MA	242	78	330	106	1938–2014	311
01109000	Wading River near Norton, MA	64.8	87	87.0	116	1925–2014	74.7
01174500	East Branch Swift River near Hardwick, MA	96.0	131	71.8	98	1937–2014	73.4
01197500	Housatonic River near Great Barrington, MA	609	113	525	98	1913–2014	537
01332500	Hoosic River near Williamstown, MA	292	104	283	101	1940–2014	280

Table 2. Record-minimum monthly mean discharges in Massachusetts during water year 2014 compared with the previous records for the period of record.

[USGS, U.S. Geological Survey]

USGS station number	USGS station name	Period of record	Month of record minimum	Water year 2014 minimum monthly mean discharge (cubic feet per second)	Year of previous record-minimum monthly mean discharge	Historical minimum monthly mean discharge (cubic feet per second)
01102345	Saugus River at Saugus Ironworks at Saugus, MA	1994–2014	October	1.57	1998	2.35
01105600	Old Swamp River near South Weymouth, MA	1966–2014	October	1.05	1998	1.14
Do.	Do.	Do.	September	0.15	1980	0.18
01109000	Wading River near Norton, MA	1925–2014	September	0.84	1930	1.76
01109060	Threemile River at North Dighton, MA	1966–2014	September	5.83	1993	10.9

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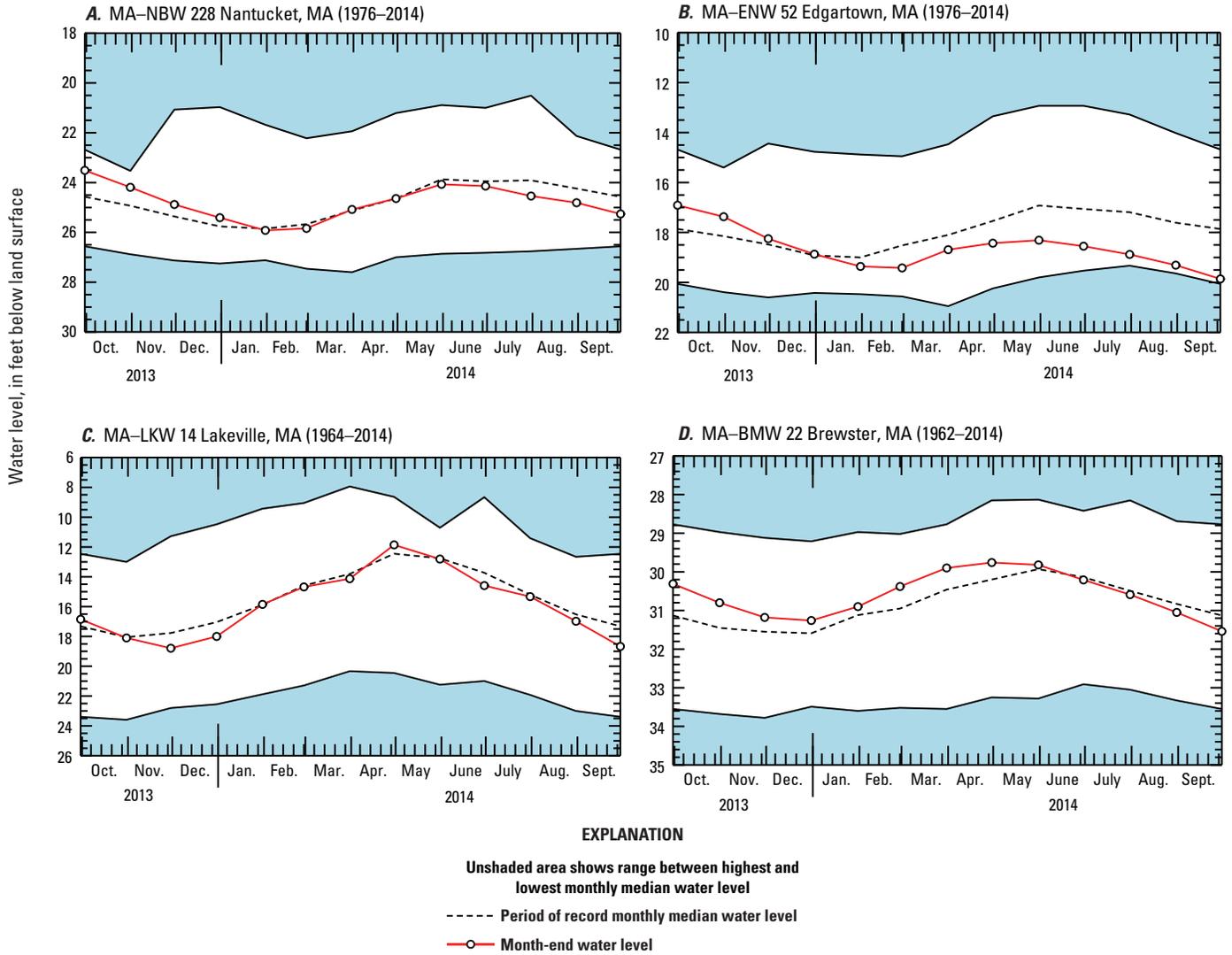


Figure 4. Groundwater hydrographs for the eight representative wells in Massachusetts. Each hydrograph shows the water year 2014 month-end water level compared to the maximum, minimum, and mean monthly median water level for the period of record at that site.

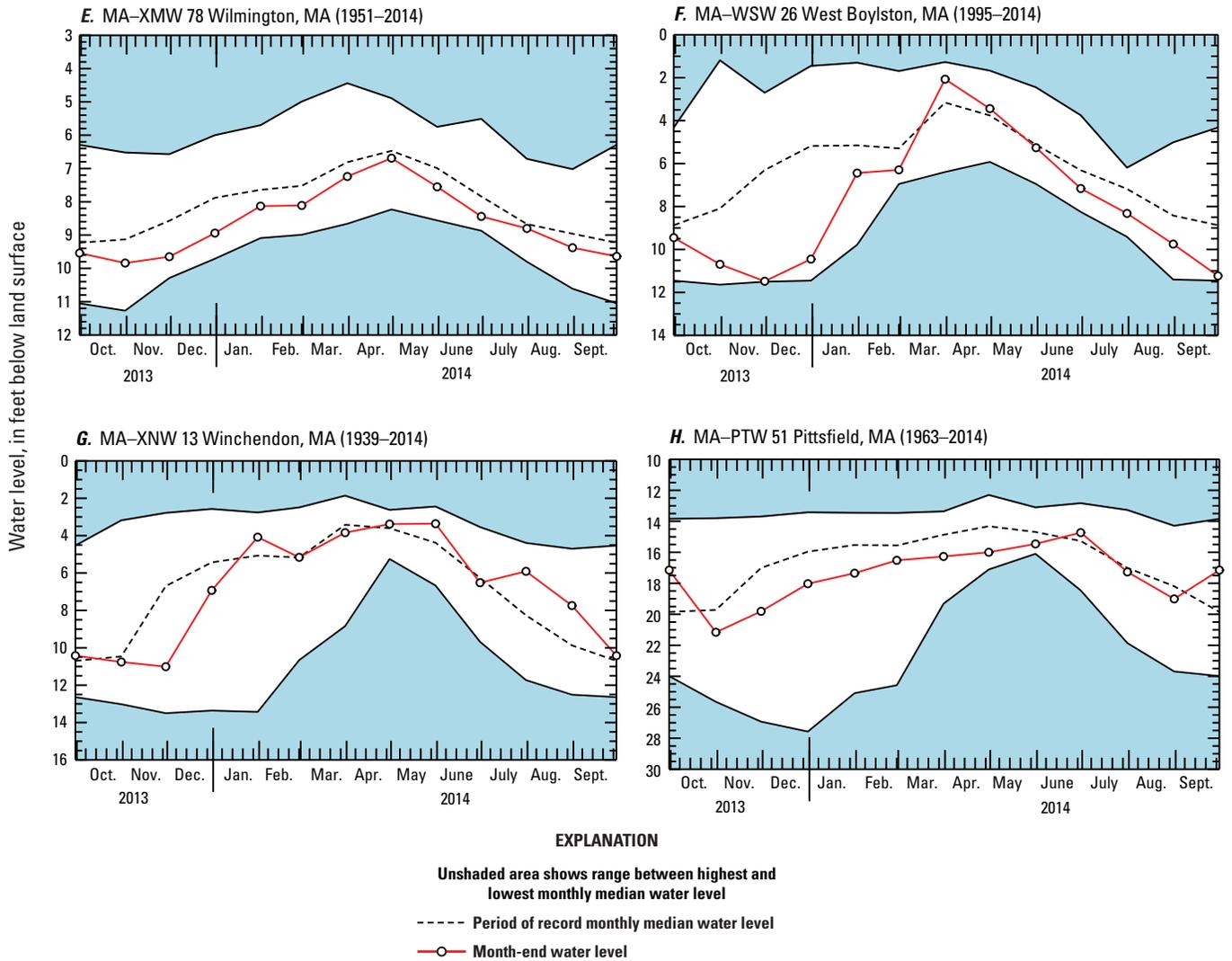


Figure 4. Groundwater hydrographs for the eight representative wells in Massachusetts. Each hydrograph shows the water year 2014 month-end water level compared to the maximum, minimum, and mean monthly median water level for the period of record at that site.—Continued

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