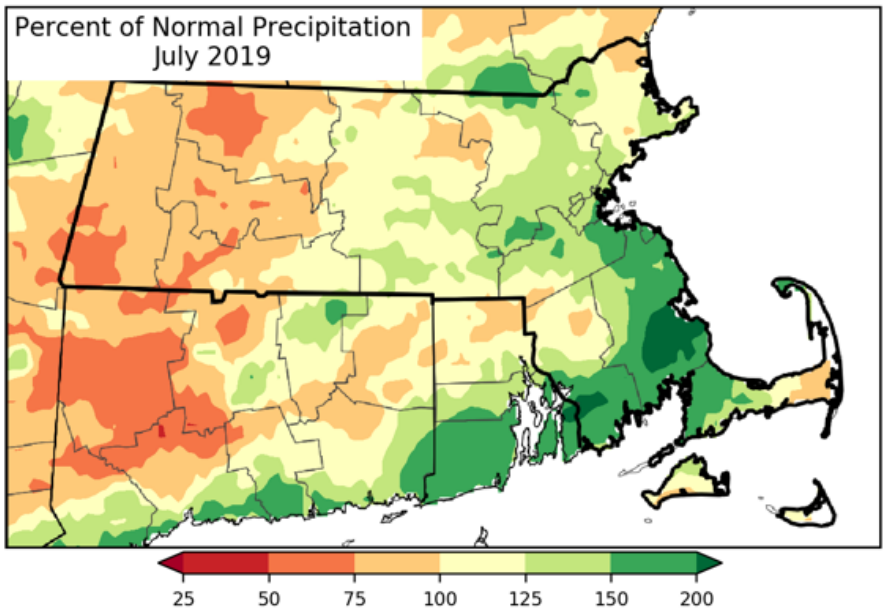
MASSACHUSETTS WATER RESOURCES COMMISSION

July 2019 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Multiple record high temperatures were set such as the all-time hottest month on record for Boston.
- Precipitation ranged from below average to above average; however, both Precipitation Indices remain Normal for all regions.
- Streamflows and groundwater levels varied widely across the state from below to above normal; however, both Indices remain Normal for all regions.
- Reservoir and Crop Moisture Indices are Normal for all regions.
- At the end of the month, Keetch-Byram Drought Index was at an elevated level for all regions except the Southeast.
- For August, NOAA projects 33-50% chance for above average temperatures and equal chances for above normal, normal, or below normal for precipitation
- Appendix I details additional precipitation data. Appendix II presents drought level thresholds for indices.

PRECIPITATION



Precipitation ranged from below average in the western portion of the state to well above average in the southeast. Despite month-to-month variability in rainfall since February, both drought indices for precipitation remain Normal for all regions.

Map from the Northeast Regional Climate Center. http://www.nrcc.cornell.edu/regional/monthly/monthly.html

Region	Estimated Precipitation (inches)	Departure from Average July (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	3.36	-0.93	Normal	Normal
CT River Valley	3.67	-0.55	Normal	Normal
Central	5.13	1.30	Normal	Normal
Northeast	5.56	2.10	Normal	Normal
Southeast	5.87	2.54	Normal	Normal
Cape Cod & Islands	3.80	0.90	Normal	Normal

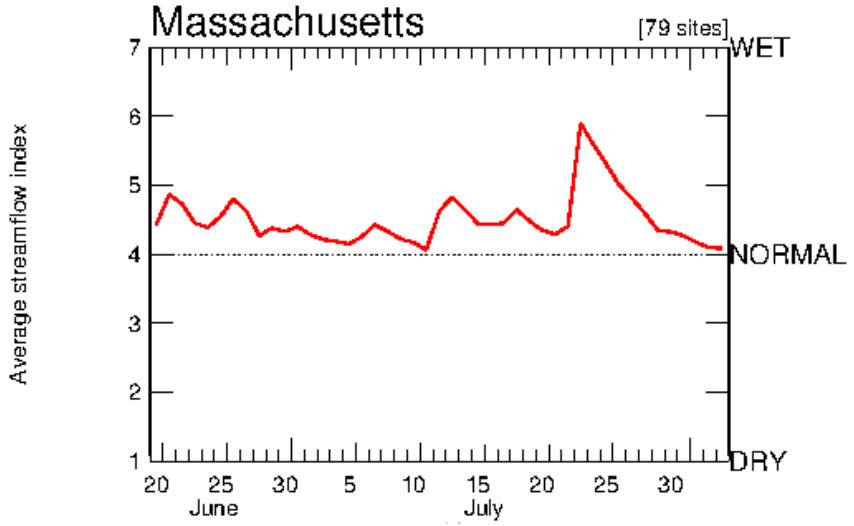
Key to Drought Plan Levels
Normal
Advisory
Watch
Warning
Emergency

STREAMFLOW

The statewide averages of daily streamflows were slightly above average historical values. Monthly average streamflows at individual gages were mostly normal to above normal. A few gages were at greater than their respective 90th percentile value for the month and one gage was below its 25th percentile value.

Average Daily Streamflow Compared to Historical for the Day of the Year

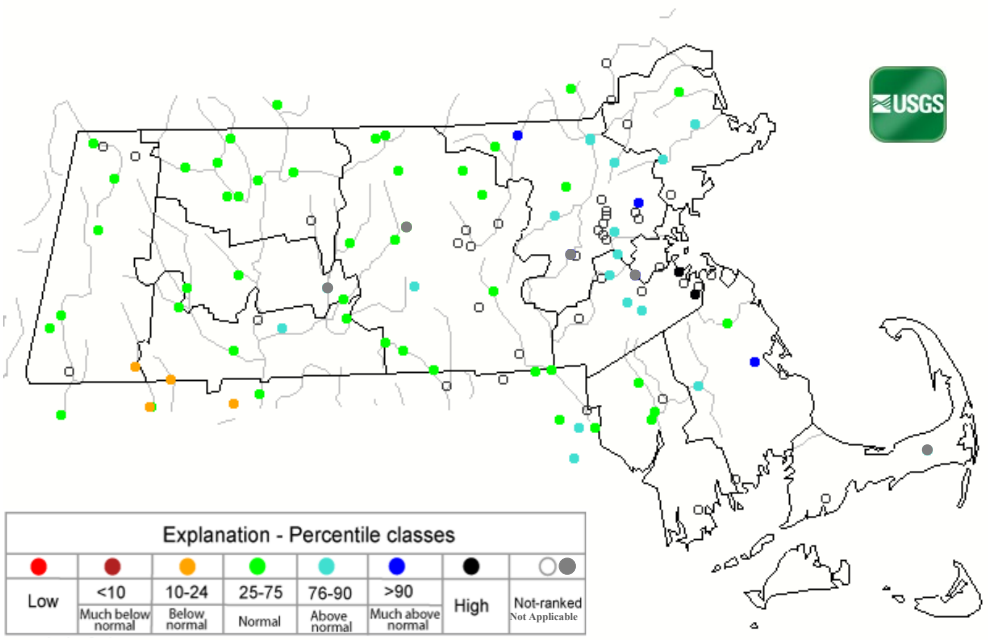
KEY:
1 = New record low for day
2 = < 10th percentile
3 = 10th – 24th percentile
4 = 25th – 74th percentile
5 = 75th – 89th percentile
6 = > 90th percentile
7 = New record high for day



Average July Streamflow Compared to Historical for the Month of the Year

Streamflow is monitored by the Commonwealth of Massachusetts and United States Geological Survey (USGS) cooperative stream gaging program.

http://waterwatch.usgs.gov/index.php?r=ma&id=mv01d



Region	Number of Gages				>90th percentile flow	MA Drought Plan Index/# of consecutive months majority below 25th percentile
	Total Reporting for July	<25th to 10th percentile	<10th percentile to above record low	Record low		
Western	6	1	0	0	0	Normal/0
CT River Valley	14	0	0	0	0	Normal/0
Central	11	0	0	0	0	Normal/0
Northeast	17	0	0	0	4	Normal/0
Southeast	6	0	0	0	1	Normal/0

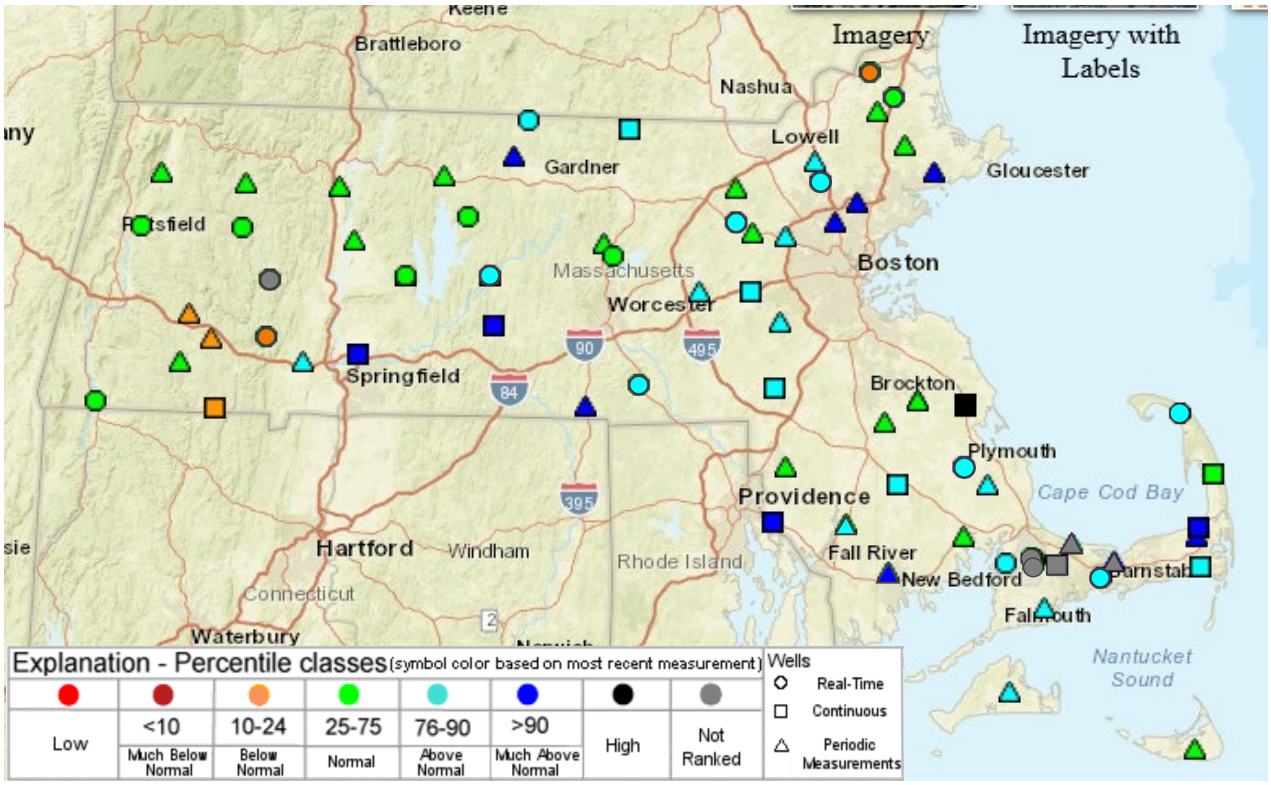
Notes: Gage counts are non-cumulative except for "total reporting". Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

GROUNDWATER

In general, groundwater levels were at or above average historical levels. The CT River Valley and Northeast regions, however, had a wide range of values from below the 25th percentile to greater than 90th percentile. The Southeast Region had one record high.

Groundwater Conditions in the Climate Response Network at the End of July

https://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=crn&sc=25



Region	Number of wells					MA Drought Plan Index /# consecutive months majority below
	Total Reporting for July	<25th to 10th percentile	<10th percentile to above record low	Record low	> 90th percentile	
Western	5	**1**	0	0	0	Normal/0
CT River Valley	9	**3**	0	0	**1**	Normal/0
Central	10	0	0	0	**3**	Normal/0
Northeast	16	**1**	0	0	**3**	Normal/0
Southeast	12	0	0	0	**3**	Normal/0
Cape and Islands	10	0	0	0	**2**	Normal/0

Notes: Well counts are non-cumulative except for “total reporting”. Not all data are available in time for reporting.

RESERVOIRS

At the end of July, most reporting reservoirs were above average levels. Quabbin stopped spilling after 261 consecutive days.

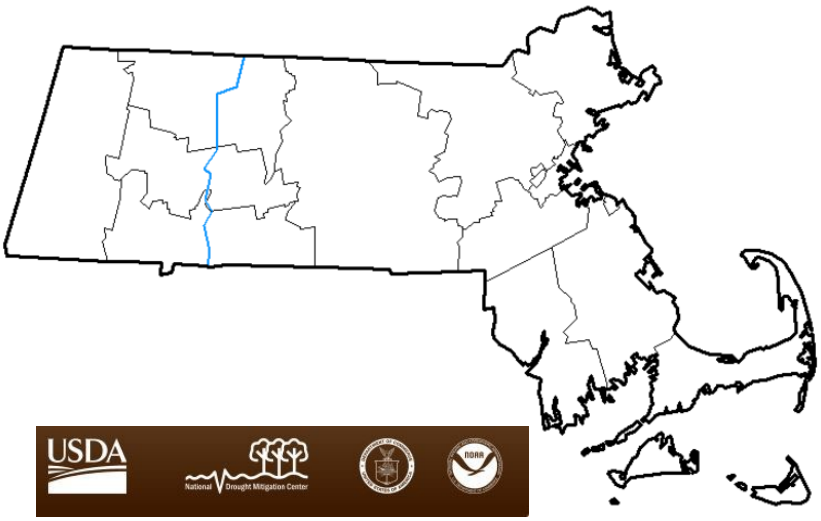
Region	Total Reporting for July	Reservoir Levels	MA Drought Management Plan Reservoir Index
Western	2	Normal	Normal
CT River Valley	2	Normal	Normal
Central	3	Normal	Normal
Northeast	6	Normal	Normal
Southeast	3	Normal	Normal
Cape Cod & Islands	1	Normal	Normal

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of July 30, 2019

Summary: The USDM map shows all regions as normal.

USDM maps are produced by the National Drought Mitigation Center (NDMC). For methods and weekly updates see: http://droughtmonitor.unl.edu



D0 - Abnormally Dry
D1 - Moderate Drought
D2 - Severe Drought
D3 - Extreme Drought
D4 - Exceptional Drought

NOAA Climate Prediction Center: Temperature and Precipitation Outlook

August: The outlook projects 33-50% chance for above average temperatures and equal chances for above normal, normal, or below normal for precipitation.

August through October: The outlook projects 60-70% chance of above normal temperatures and equal chances for below normal, normal, or above normal precipitation.
https://www.cpc.ncep.noaa.gov/

NOAA Climate Predication Center: Monthly and Seasonal Drought Outlook

The monthly outlook for August and seasonal outlook valid through October do not project drought conditions. http://www.cpc.ncep.noaa.gov/products/Drought/

Appendix I: Additional Information

Keetch-Byram Drought Index (KBDI)

Five regions have reached an elevated level for the Drought Index. The DCR Fire Chief reports that although there has been some fire activity, there are no serious concerns about fire danger.

Region	July KBDI value	Drought Index
Western	263	Advisory
CT River Valley	247, 247, 175	Advisory
Central	425, 330	Watch
Northeast	292, 498, 275	Watch
Southeast	127, 130	Normal
Cape Cod & Islands	153, 204, 168	Advisory

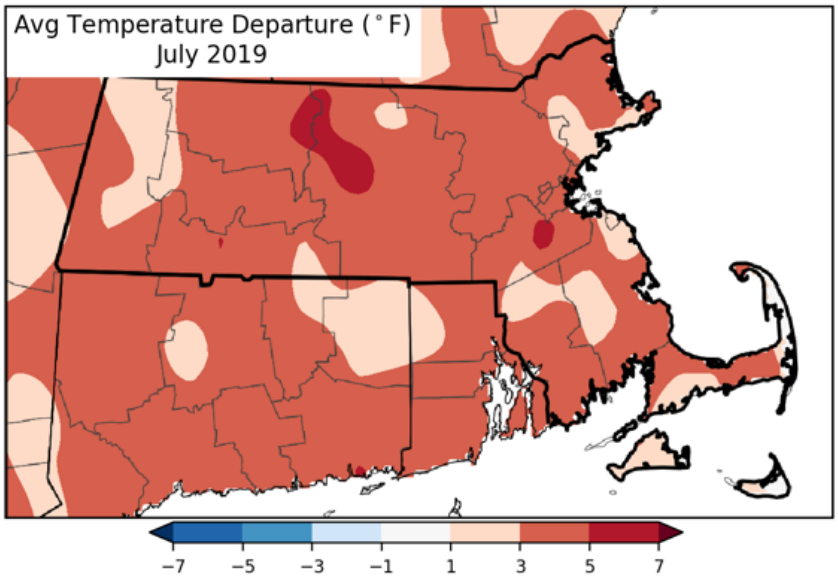
Crop Moisture Index (CMI)

The CMI map for the week ending August 3, 2019 shows slightly dry to favorably moist conditions across the state, resulting in the Index being Normal for all regions.

The CMI shows the short-term need versus available water in a shallow soil profile and responds quickly to changing conditions. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level. This indicator is most relevant during growing season. https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif

Season-to-date Snowfall Departure and Snow Cover

Information provided seasonally.



Temperature

Monthly average temperatures were significantly above historical average across the state for this time of the year. http://www.nrcc.cornell.edu/regional/monthly/monthly.html

Boston daily temperatures ranged from 63° F to 98° F. Deviation from historical daily average temperatures were –6.9 to +16.6 ° F, respectively. https://w2.weather.gov/climate/index.php?wfo=box

According to the Northeast Regional Climate Center website, this July was the all-time hottest month on record for Boston. Both maximum and minimum temperatures were extremely warm. The average minimum temperature was the all-time warmest for any month on record. Boston also had its greatest number of days with a minimum temperature of 70° F or higher for any month on record.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Additional information, previous reports, and drought management information can be found at https://www.mass.gov/water-data-tracking.

Appendix I: Additional Information, continued

Percent of Average Historical Precipitation

July-19	Normal	Actual	Percent Normal	Excess/ Deficit	Excess or Deficit Since Last 10/1/2018	2 Months	% Norm	3 Months	% Norm	6 Months	% Norm	12 Months	% Norm
State	3.69	4.76	129	1.07	12.02	1.85	125	1.81	116	3.43	116	18.22	140
Western	4.29	3.36	78	-0.93	9.10	-0.21	98	0.74	106	1.51	107	17.88	141
Connecticut River	4.22	3.67	87	-0.55	8.87	-0.96	88	-1.71	86	0.08	100	17.78	139
Central	3.83	5.13	134	1.30	10.85	1.57	121	1.41	113	3.34	115	18.87	141
Northeast	3.46	5.56	161	2.10	11.97	3.14	146	3.00	129	4.92	123	17.14	140
Southeast	3.33	5.87	176	2.54	16.06	3.36	150	3.86	138	5.30	124	21.29	147
Cape Cod and Islands	2.90	3.80	131	0.90	14.51	3.31	153	3.33	134	4.36	120	13.10	129

Note: Precipitation values are total rainfall and melted snow in inches.
Values are estimated pending receipt of additional data and final calculations.

Standardized Precipitation Index for July 2019

REGION	3-Month SPI	6-Month SPI	12-Month SPI
Western Region	0.30	0.41	2.36
Connecticut River Region	-0.43	0.03	2.30
Central Region	0.52	0.81	2.37
Northeast Region	0.94	1.11	2.25
Southeast Region	1.13	1.13	2.54
Cape & Islands	1.00	1.00	1.81

DCR Precipitation Monitoring Composite Reports and SPI are available at:
https://www.mass.gov/service-details/precipitation-composite-estimates-1

https://www.mass.gov/service-details/standardized-precipitation-index-spi-0

Appendix II: Description of Drought Indices

(from Table 3 of Massachusetts Drought Management Plan).

Drought Level	Standardized Precipitation Index	Crop Moisture Index*	Keetch-Byram Drought Index*	Precipitation	Groundwater	Streamflow	Reservoir***
Normal	3-month > -1.5 **or** 6-month > -1.0 **or** 12-month > -1.0	0.0 to -1.0 slightly dry	< 200	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for the time of year
Advisory	3-month = -1.5 to -2.0 **or** 6-month = -1.0 to -1.5 **or** 12-month = -1.0 to –1.5	-1.0 to -1.9 abnormally dry	200-400	2 month cumulative below 65% of normal	3 consecutive months below normal**	At least 2 out of 3 consecutive months below normal**	Small index Reservoirs below normal
Watch	3-month < -2.0 **or** 6-month = -1.5 to -3.0 **or** 12-month = -1.5 to -2.0	-2.0 to –2.9 excessively dry	400-600	1 of the following criteria met: 3 month cum. < 65% **or** 6 month cum. < 70% **or** 12 month cum. < 70%	4-5 consecutive months below normal**	At least 4 out of 5 consecutive months below normal**	Medium index Reservoirs below normal
Warning	6-month < -3.0 **or** 12-month = -2.0 to -2.5	< -2.9 severely dry	600-800	1 of the following criteria met: 3 month cum. < 65% and 6 month cum. <65%, **or** 6 month cum. <65% and 12 month cum. <65%, **or** 3 month cum. <65% and 12 month cum. <65%	6-7 consecutive months below normal**	At least 6 out of 7 consecutive months below normal**	Large index reservoirs below normal
Emergency	12-month < -2.5	<-2.9 severely dry	600-800	Same criteria as Warning and previous month was Warning or Emergency	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions

* The Crop Moisture Index is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level.

** Below normal for groundwater and streamflow are defined as being within the lowest 25th percentile of the period of record.

*** Water suppliers should be consulted to determine if below normal reservoir conditions are due to operational issues.

Source: Massachusetts Drought Management Plan. May 2013 (http://www.mass.gov/eea/docs/eea/wrc/droughtplan.pdf).