

June 2017 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

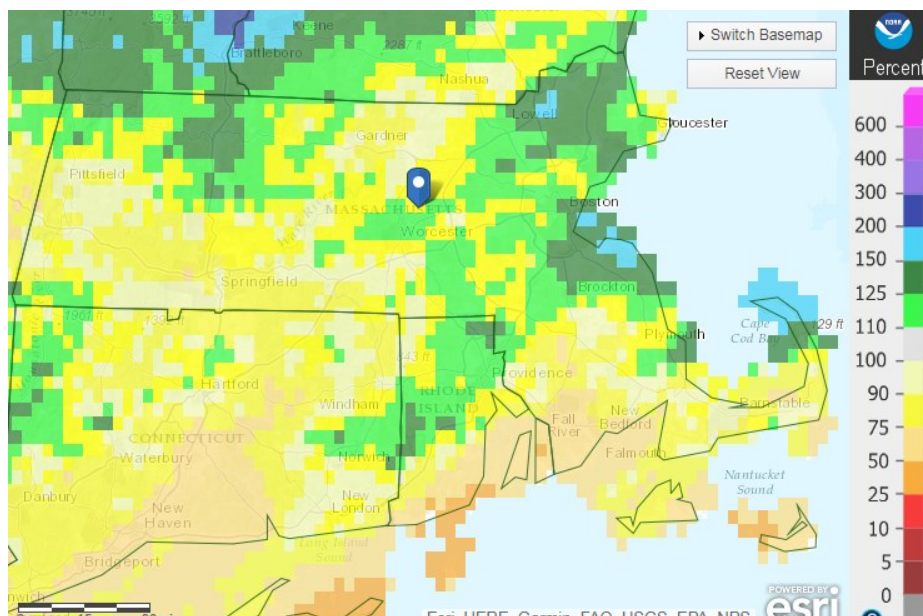
- Precipitation for the month was above normal for all regions except the Cape & Islands.
- Average monthly streamflows were normal or above normal.
- Groundwater levels are mostly normal with 3 or fewer wells below normal per region.
- Reservoirs are normal.
- NOAA projects above normal temperatures and equal chances for above or below normal precipitation for July.
- Appendix I provides values of indices not presented in the main report. Appendix II provides a description of the indices from the Drought Management Plan.

PRECIPITATION

| Region | Estimated Rainfall (inches) | Departure from Average June (inches) | MA Drought Plan Levels | |
|--------------------|-----------------------------|--------------------------------------|--|-------------------------|
| | | | Standardized Precipitation Index (SPI) | Percent of Normal Index |
| Western | 4.91 | 0.77 | Normal | Normal |
| CT River Valley | 4.50 | 0.56 | Normal | Normal |
| Central | 4.04 | 0.28 | Normal | Normal |
| Northeast | 5.17 | 1.75 | Normal | Normal |
| Southeast | 4.36 | 1.00 | Normal | Normal |
| Cape Cod & Islands | 3.20 | -0.17 | Normal | Normal |

June 2017 Precipitation, Percent of Normal

Map from National Weather Service's Quantitative Precipitation Estimates. <http://water.weather.gov/precip/>



STREAMFLOW

| Region | Number of Gages | | | | MA Drought Plan Index (# consecutive months majority below 25th percentile) |
|-----------------|-----------------|--------------------------|--------------------------------------|------------|--|
| | Total Reporting | <25th to 10th percentile | <10th percentile to above record low | Record low | |
| Western | 7 | 0 | 0 | 0 | 0/Normal |
| CT River Valley | 14 | 0 | 0 | 0 | 0/Normal |
| Central | 11 | 0 | 0 | 0 | 0/Normal |
| Northeast | 18 | 0 | 0 | 0 | 0/Normal |
| Southeast | 6 | 0 | 0 | 0 | 0/Normal |

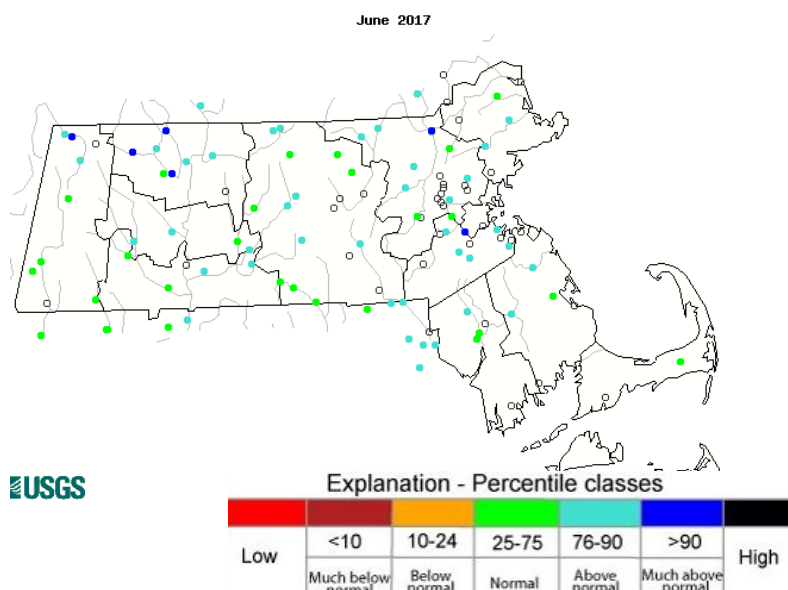
| Key to Drought Levels |
|-----------------------|
| Normal |
| Advisory |
| Watch |
| Warning |
| Emergency |

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.

Average Monthly 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>



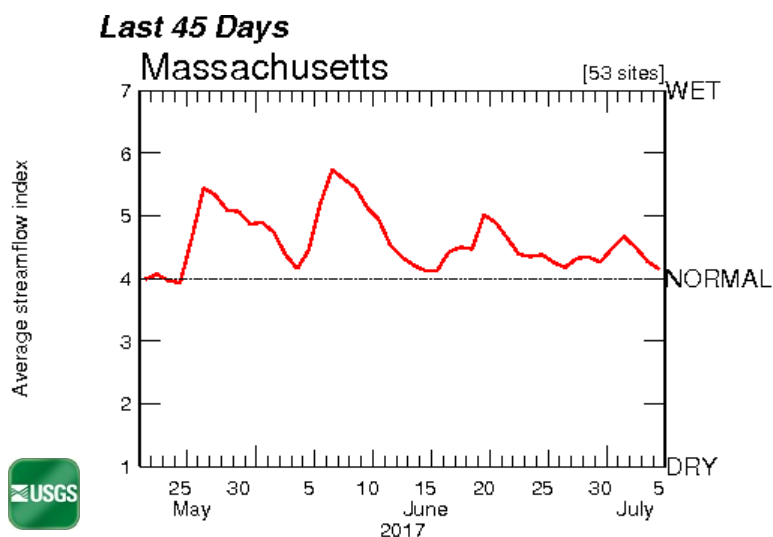
Average Daily Streamflow Compared to Historical for the Day of the Year

This plot depicts data for the 45-day period ending in early July.

http://waterwatch.usgs.gov/index.php?id=real&sid=w__plot&r=ma

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



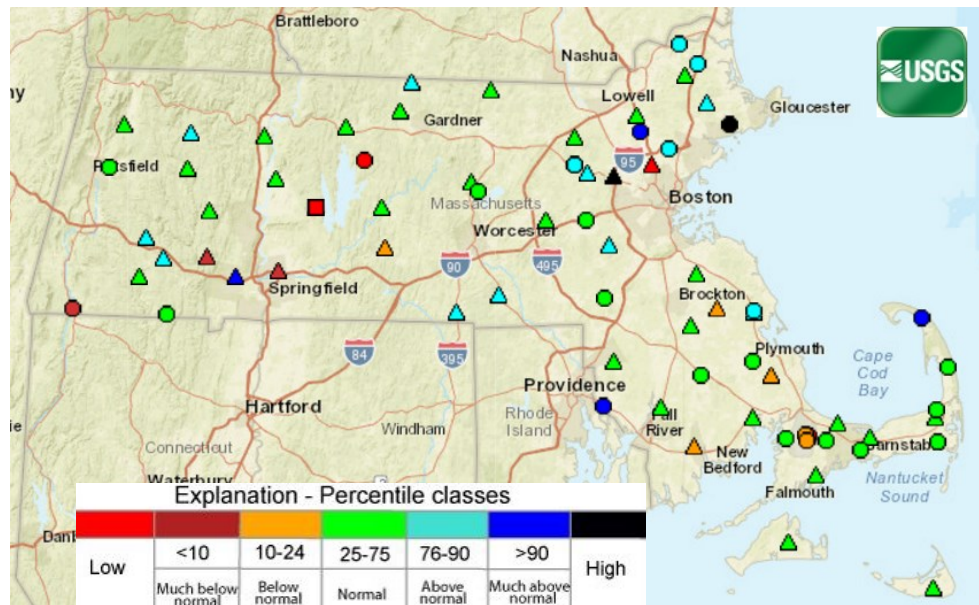
GROUNDWATER

| Region | Number of wells | | | | MA Drought Plan Index (# consecutive months majority below) |
|------------------|-----------------|--------------------------|--------------------------------------|------------|---|
| | Total Reporting | <25th to 10th percentile | <10th percentile to above record low | Record low | |
| Western | 5 | 0 | 1* | 0 | 0/Normal |
| CT River Valley | 10 | 0 | 2* | 0 | 0/Normal |
| Central | 10 | 1* | 1 | 0 | 0/Normal |
| Northeast | 17 | 0 | 0 | 1 | 0/Normal |
| Southeast | 12 | 3 | 0 | 0 | 0/Normal |
| Cape and Islands | 12 | 2 | 0 | 0 | 0/Normal |

Notes: Well counts are non-cumulative except for “total reporting”. Not all data are available in time for reporting. *Wells are recovering but not fast enough relative to past years. These wells will be investigated to confirm connection with the aquifer.

Groundwater Conditions in the Climate Response Network at end of June 2017

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



RESERVOIRS

| Region | Number of Reservoirs Reporting | Reservoir Levels | MA Drought Management Plan Reservoir Index |
|--------------------|--------------------------------|------------------|--|
| Western | 2 | Normal | Normal |
| CT River Valley | 2 | Near Normal | Warning ¹ |
| Central | 2 | Normal | Normal |
| Northeast | 6 | Normal | Normal |
| Southeast | 3 | Normal | Normal |
| Cape Cod & Islands | 1 | Normal | Normal |

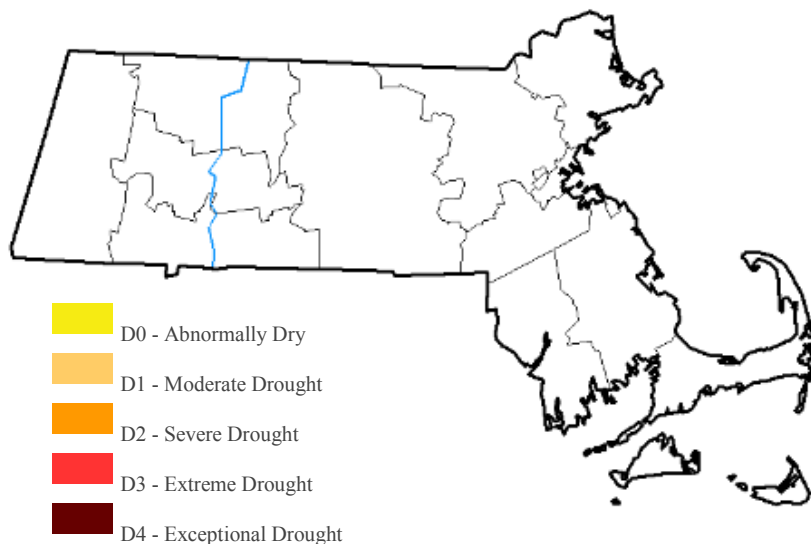
¹ Quabbin reservoir is below average by more than one standard deviation. This is a large reservoir which jumps the index to warning. However, the other monitored reservoir in the CT River Valley region has returned to and remains normal. It is a medium reservoir system. Quabbin is in the normal operating range according to its own drought management plan.

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of July 4, 2017

Summary: The USDM shows normal conditions across Massachusetts.

Produced by the National Drought Mitigation Center (NDMC). Intensity based on NDMC criteria. For a weekly updated map see: <http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?MA>



NOAA: Monthly and Seasonal Temperature and Precipitation Outlook

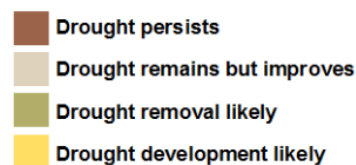
The Climate Prediction Center's outlook for July projects above normal temperatures and equal chances for below normal, normal, and above normal precipitation for Massachusetts. (<http://www.cpc.noaa.gov/products/predictions/30day/>).

The Center's outlook for July through September projects above normal temperatures and equal chances for below normal, normal and above normal precipitation (<http://www.cpc.ncep.noaa.gov/products/predictions/>

NOAA: Monthly and Seasonal Drought Outlook

The July and three-month projections do not show drought conditions.

<http://www.cpc.ncep.noaa.gov/products/Drought/>



July 2017



June 15 - September 30, 2017



Key Links: Massachusetts Drought Management: <http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/drought-status.html>

DCR Precipitation Monitoring Composite Reports and SPI

<http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/rainfall-program.html>

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary in nature. Additional information, previous hydrological conditions reports, and drought management information can be found on our web site:

<http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/>

Appendix I: Additional Information

Keetch-Byram Drought Index

The fire index was not available as of the time of this report.

Crop Moisture Index for the Week Ending July 1, 2017

The Crop Moisture Index shows the short-term need versus available water in a shallow soil profile. This index responds quickly to changing conditions and is subject to frequent change. 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. http://www.cpc.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif

| Region | MA Drought Plan Index |
|------------------|-----------------------|
| Western | Normal |
| CT River Valley | Normal |
| Central | Normal |
| Northeast | Normal |
| Southeast | Normal |
| Cape and Islands | Normal |



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 <u>or</u> 6-month > -1.0 <u>or</u> 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 <u>or</u> 6-month = -1.0 to -1.5 <u>or</u> 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 <u>or</u> 6-month = -1.5 to -3.0 <u>or</u> 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% <u>or</u> 6 month cum. < 70% <u>or</u> 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 <u>or</u> 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%, <u>or</u> 6 month cum. < 65% and 12 month cum. < 65%, <u>or</u> 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>).