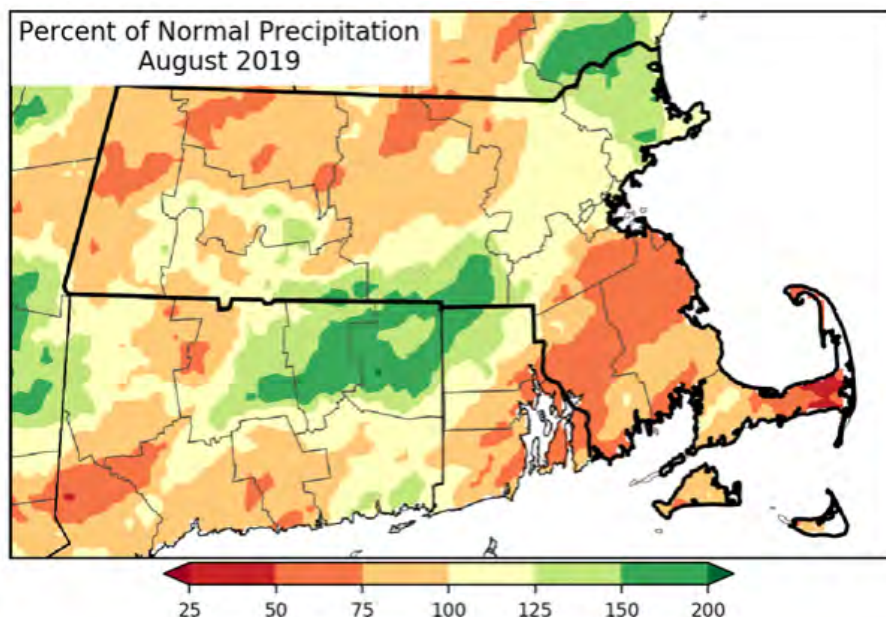


# August 2019 Hydrologic Conditions in Massachusetts

## SUMMARY OF CONDITIONS

- Temperatures were average to slightly above average for August.
- Precipitation ranged widely across the state but both Precipitation Indices are Normal for all regions.
- Streamflows and groundwater levels also ranged widely across the state but both Indices are 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 Cape and Islands.
- For September, NOAA projects equal chances for above normal, normal, or below normal temperatures and a 33-50% chance of above normal precipitation.
- Appendix I details additional precipitation data. Appendix II presents drought level thresholds for indices.

## PRECIPITATION



Precipitation ranged across the state from well below average to well above average in some pockets. Both drought indices for precipitation are 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 Aug. (inches) | MA Drought Plan Levels                 |                         |
|--------------------|----------------------------------|--------------------------------------|--|-------------------------|
|                    |                                  |                                      | Standardized Precipitation Index (SPI) | Percent of Normal Index |
| Western            | 3.91                             | -0.43                                | Normal                                 | Normal                  |
| CT River Valley    | 3.57                             | -0.28                                | Normal                                 | Normal                  |
| Central            | 4.12                             | -0.66                                | Normal                                 | Normal                  |
| Northeast          | 3.50                             | 0.04                                 | Normal                                 | Normal                  |
| Southeast          | 3.16                             | -0.07                                | Normal                                 | Normal                  |
| Cape Cod & Islands | 2.77                             | -1.20                                | Normal                                 | Normal                  |

### Key to Drought Plan Levels

|           |
|-----------|
| Normal    |
| Advisory  |
| Watch     |
| Warning   |
| Emergency |

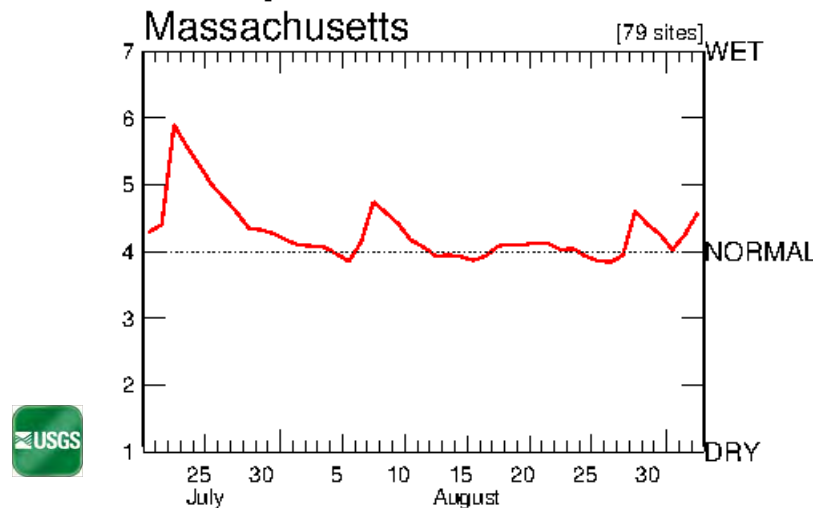
## STREAMFLOW

The statewide averages of daily streamflows were generally the same as average historical values. Monthly average streamflows at individual gages varied widely. Ten gages scattered across the state were below normal and five gages in the Northeast region were above normal. One gage was below the 10th percentile in the West region (Housatonic near Great Barrington).

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

#### KEY:

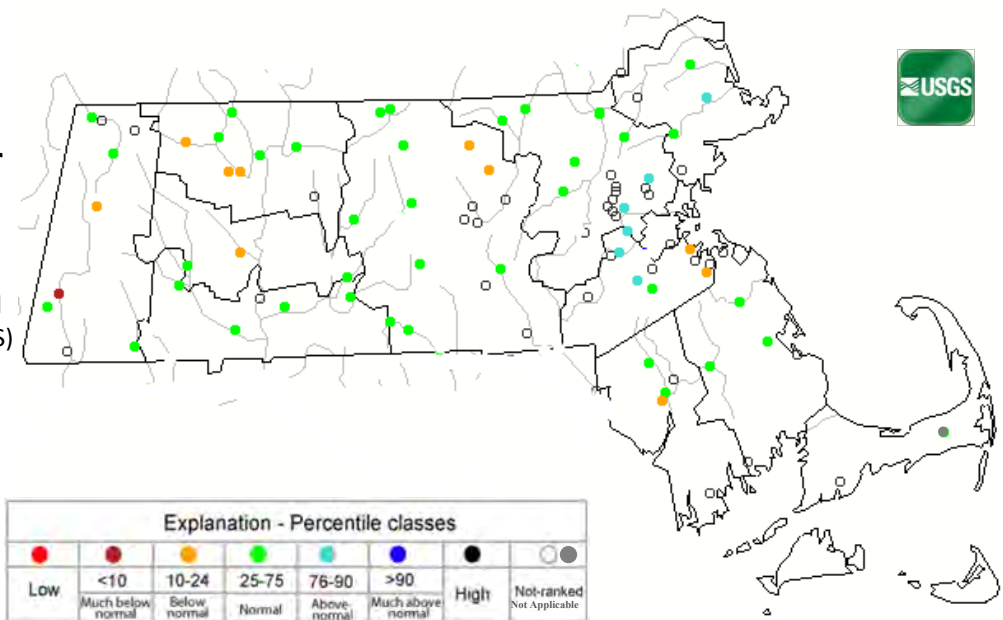
- 1 = New record low for day
- 2 = < 10<sup>th</sup> percentile
- 3 = 10<sup>th</sup> – 24<sup>th</sup> percentile
- 4 = 25<sup>th</sup> – 74<sup>th</sup> percentile
- 5 = 75<sup>th</sup> – 89<sup>th</sup> percentile
- 6 = > 90<sup>th</sup> percentile
- 7 = New record high for day



### Average August 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>



| Explanation - Percentile classes |                   |              |        |              |                   |      |                |
|----------------------------------|-------------------|--------------|--------|--------------|-------------------|------|----------------|
| Low                              | <10               | 10-24        | 25-75  | 76-90        | >90               | High | Not-ranked     |
|                                  | Much below normal | Below normal | Normal | Above normal | Much above normal |      | Not Applicable |

| Region          | Number of Gages            |                          |                                      |            | >90th percentile flow | MA Drought Plan Index/# of consecutive months majority below 25th percentile |
|-----------------|----------------------------|--------------------------|--------------------------------------|------------|-----------------------|--|
|                 | Total Reporting for August | <25th to 10th percentile | <10th percentile to above record low | Record low |                       |  |
| Western         | 6                          | 1                        | 1                                    | 0          | 0                     | Normal/0   |
| CT River Valley | 14                         | 4                        | 0                                    | 0          | 0                     | Normal/0   |
| Central         | 11                         | 2                        | 0                                    | 0          | 0                     | Normal/0   |
| Northeast       | 17                         | 2                        | 0                                    | 0          | 0                     | Normal/0   |
| Southeast       | 6                          | 1                        | 0                                    | 0          | 0                     | Normal/0   |

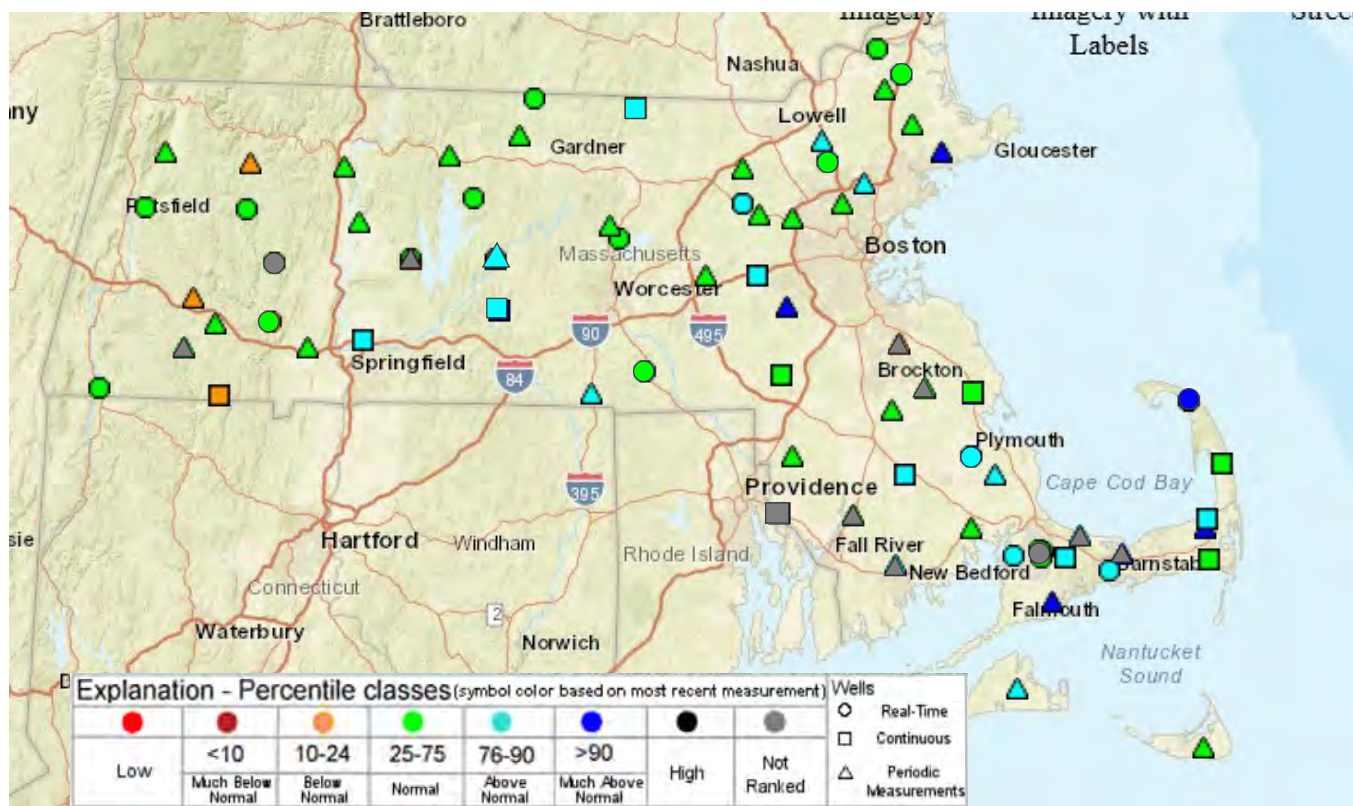
Notes: Gage counts are non-cumulative except for "total reporting". Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

## GROUNDWATER

In general, the West and CT River Valley regions experienced below normal and normal groundwater levels while the rest of the state experienced normal to well above normal levels.

### Groundwater Conditions in the Climate Response Network at the End of August

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



| Region           | Number of wells            |                          |                                      |            |                   | MA Drought Plan Index /# consecutive months majority below 25 <sup>th</sup> percentile |
|------------------|----------------------------|--------------------------|--------------------------------------|------------|-------------------|--|
|                  | Total Reporting for August | <25th to 10th percentile | <10th percentile to above record low | Record low | > 90th percentile |  |
| Western          | 4                          | 1                        | 0                                    | 0          | 0                 | Normal/0   |
| CT River Valley  | 9                          | 2                        | 0                                    | 0          | 0                 | Normal/0   |
| Central          | 10                         | 0                        | 0                                    | 0          | 0                 | Normal/0   |
| Northeast        | 16                         | 0                        | 0                                    | 0          | 2                 | Normal/0   |
| Southeast        | 8                          | 0                        | 0                                    | 0          | 0                 | Normal/0   |
| Cape and Islands | 11                         | 0                        | 0                                    | 0          | 3                 | 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 August, many reporting reservoirs were above average levels.

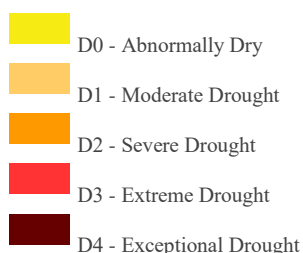
| Region             | Total Reporting for August | Reservoir Levels | MA Drought Management Plan Reservoir Index |
|--------------------|----------------------------|------------------|--|
| Western            | 2                          | Normal           | Normal                                     |
| CT River Valley    | 2                          | Normal           | Normal                                     |
| Central            | 2                          | 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 August 27, 2019

**Summary:** The USDM map shows most of MA as normal.

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



### NOAA Climate Prediction Center: Temperature and Precipitation Outlook

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

**September through November:** 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 Prediction Center: Monthly and Seasonal Drought Outlook

The monthly outlook for September and seasonal outlook valid through November 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 fire danger is at seasonal levels in the interior central, northeast, and western portions of the state where precipitation events have either missed reporting stations or have produced quick moving systems that produced limited amounts of rainfall. However, fire danger and fire activity remain low to medium due to the 3-4 day frequency of these weather systems keeping surface fuel moistures at acceptable levels to minimize ignition potential.

| Region             | KBDI value as of 9/10/19 | Drought Index |
|--------------------|--------------------------|---------------|
| Western            | 376                      | Advisory      |
| CT River Valley    | 409, 398, 372            | Watch         |
| Central            | 372, 230                 | Advisory      |
| Northeast          | 334, 330, 215            | Advisory      |
| Southeast          | 219, 196                 | Advisory      |
| Cape Cod & Islands | 95, 82, 17               | Normal        |

### Crop Moisture Index (CMI)

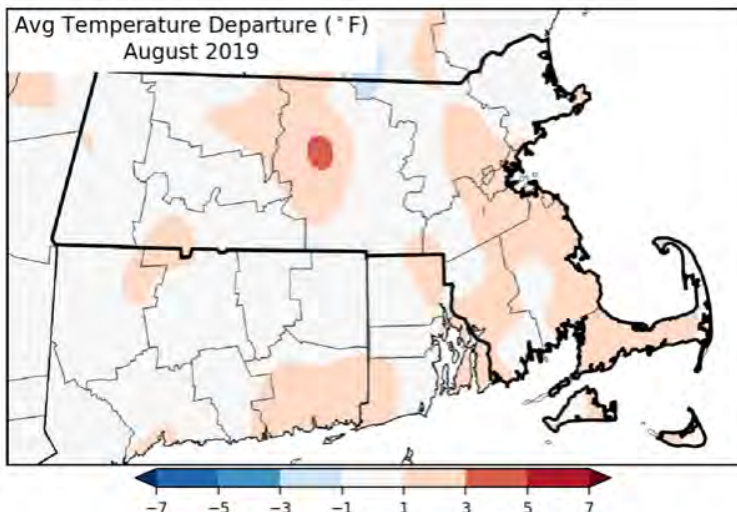
The CMI map for the week ending September 7, 2019 shows slightly dry to favorably moist conditions across the state, resulting in the Index being Normal for all regions.

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](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 ranged from average to slightly above average across the state for this time of the year. <http://www.nrcc.cornell.edu/regional/monthly/monthly.html>

Boston daily temperatures ranged from 57° F to 95° F. Deviation from historical daily average temperatures were -6.3 to +12.6 ° F, respectively. <https://w2.weather.gov/climate/index.php?wfo=box>

According to the Northeast Regional Climate Center website, this summer was the 10th warmest on record for Massachusetts.

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

| August-19                 | Nor-<br>mal | Actu-<br>al | Per-<br>cent<br>Nor-<br>mal | Ex-<br>cess/<br>Deficit | -----Excess or Deficit Since Last----- |             |        |             |        |             |        |              |        |  |  |  |
|---------------------------|-------------|-------------|-----------------------------|-------------------------|--|-------------|--------|-------------|--------|-------------|--------|--------------|--------|--|--|--|
|                           |             |             |                             |                         | 10/1/201<br>8                          | 2<br>Months | % Norm | 3<br>Months | % Norm | 6<br>Months | % Norm | 12<br>Months | % Norm |  |  |  |
| State                     | 3.97        | 3.54        | 89                          | -0.43                   | 11.59                                  | 0.64        | 108    | 1.42        | 113    | 2.96        | 113    | 15.74        | 135    |  |  |  |
| Western                   | 4.19        | 3.91        | 93                          | -0.28                   | 8.22                                   | -1.25       | 85     | -1.08       | 91     | 0.35        | 101    | 12.90        | 129    |  |  |  |
| Connecticut River         | 4.23        | 3.57        | 84                          | -0.66                   | 8.21                                   | -1.21       | 86     | -1.62       | 87     | -0.94       | 96     | 13.18        | 129    |  |  |  |
| Central                   | 4.08        | 4.12        | 101                         | 0.04                    | 11.00                                  | 1.45        | 118    | 1.72        | 115    | 3.87        | 117    | 15.35        | 133    |  |  |  |
| Northeast                 | 3.57        | 3.50        | 98                          | -0.07                   | 11.90                                  | 2.03        | 129    | 3.07        | 129    | 4.53        | 121    | 15.53        | 136    |  |  |  |
| Southeast                 | 3.89        | 3.16        | 81                          | -0.73                   | 14.54                                  | 1.02        | 114    | 1.84        | 117    | 3.80        | 117    | 19.90        | 144    |  |  |  |
| Cape Cod and Is-<br>lands | 3.97        | 2.77        | 70                          | -1.20                   | 13.31                                  | -0.30       | 96     | 2.11        | 121    | 3.61        | 116    | 13.47        | 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 August 2019

| REGION                   | 3-Month SPI | 6-Month SPI | 12-Month SPI |
|--------------------------|-------------|-------------|--------------|
| Western Region           | -0.23       | 0.14        | 1.77         |
| Connecticut River Region | -0.35       | -0.16       | 1.78         |
| Central Region           | 0.58        | 0.86        | 1.97         |
| Northeast Region         | 0.98        | 0.99        | 2.04         |
| Southeast Region         | 0.61        | 0.80        | 2.36         |
| Cape & Islands           | 0.64        | 0.81        | 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 <u>or</u><br>6-month > -1.0 <u>or</u><br>12-month > -1.0                         | 0.0 to -1.0<br>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><br>6-month = -1.0 to -1.5 <u>or</u><br>12-month = -1.0 to -1.5 | -1.0 to -1.9<br>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<br>Reservoirs below normal                  |
| Watch         | 3-month < -2.0 <u>or</u><br>6-month = -1.5 to -3.0 <u>or</u><br>12-month = -1.5 to -2.0         | -2.0 to -2.9<br>excessively dry | 400-600                     | 1 of the following criteria met:<br>3 month cum < 65% <u>or</u><br>6 month cum < 70% <u>or</u><br>12 month cum < 70%   | 4-5 consecutive months below normal** | At least 4 out of 5 consecutive months below normal** | Medium index<br>Reservoirs below normal                 |
| Warning       | 6-month < -3.0 <u>or</u><br>12-month = -2.0 to -2.5   | < -2.9<br>severely dry          | 600-800                     | 1 of the following criteria met:<br>3 month cum < 65% and<br>6 month cum < 65% <u>or</u><br>6 month cum < 65% and<br>12 month cum < 65% <u>or</u><br>3 month cum < 65% and<br>12 month cum < 65% | 6-7 consecutive months below normal** | At least 6 out of 7 consecutive months below normal** | Large index<br>reservoirs below normal                  |
| Emergency     | 12-month < -2.5   | < -2.9<br>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 25<sup>th</sup> 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/wrc/droughtplan.pdf>).