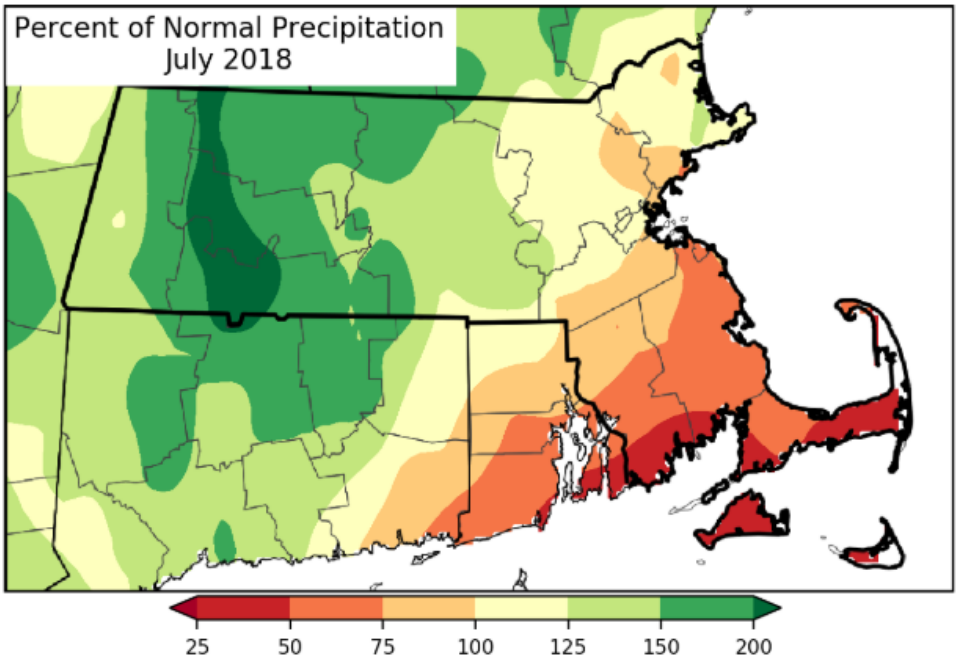
MASSACHUSETTS WATER RESOURCES COMMISSION

# July 2018 Hydrologic Conditions in Massachusetts

## SUMMARY OF CONDITIONS

- Rain storms in the second half of July eased depressed streamflows and groundwater levels across the State.
- Precipitation, Streamflow, Groundwater, Reservoir and Crop Moisture Indices are Normal for all regions.
- The Fire Index is at the Advisory Level for all regions except the Connecticut River Valley region which is Normal.
- NOAA's forecast for August projects 50-60 percent probability of above normal temperatures and equal chances for below normal, normal, or above normal precipitation in Massachusetts.
- 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




July precipitation was at or above average across all regions except for the Southeast and Cape and Islands regions. Precipitation Indices which encompass the 2-month and greater time periods remain Normal.

Additional precipitation data are in Appendix I.

Map from the Northeast Regional Climate Center's Monthly Maps.

http://www.nrcc.cornell.edu/regional/monthly/monthly.html

| Region | Estimated Rainfall (inches) | Departure from Average July (inches) | MA Drought Plan Levels | |
|---|---|---|---|---|
| | | | Standardized Precipitation Index (SPI) | Percent of Normal Index |
| **Western** | 6.02 | 1.75 | Normal | Normal |
| **CT River Valley** | 7.65 | 3.45 | Normal | Normal |
| **Central** | 5.71 | 1.90 | Normal | Normal |
| **Northeast** | 3.98 | 0.52 | Normal | Normal |
| **Southeast** | 2.61 | -0.72 | Normal | Normal |
| **Cape Cod & Islands** | 1.25 | -1.67 | Normal | Normal |

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

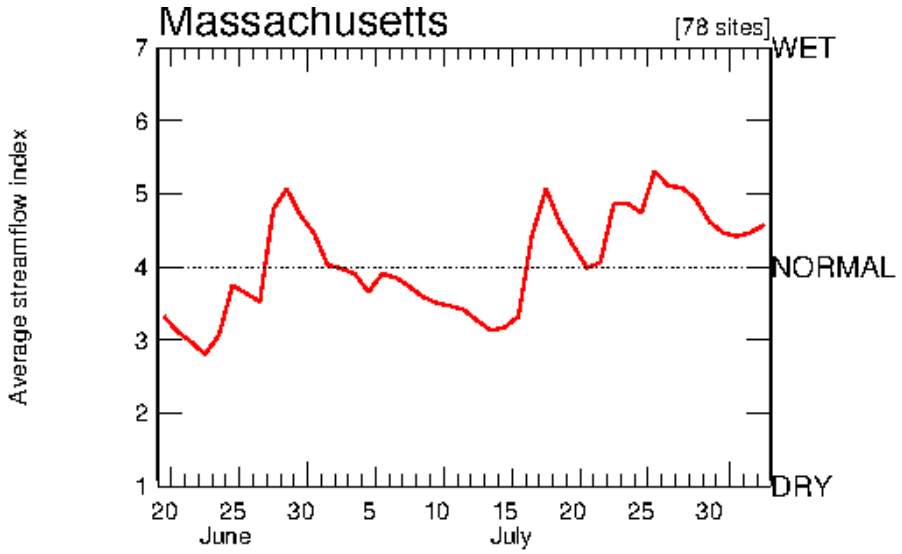
# STREAMFLOW

Streamflows were below normal the first half of the month. Rain storms in the second half of the month bolstered streamflows and they have remained normal or above normal.

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

This plot depicts data for the 45-day period ending at the beginning of August.

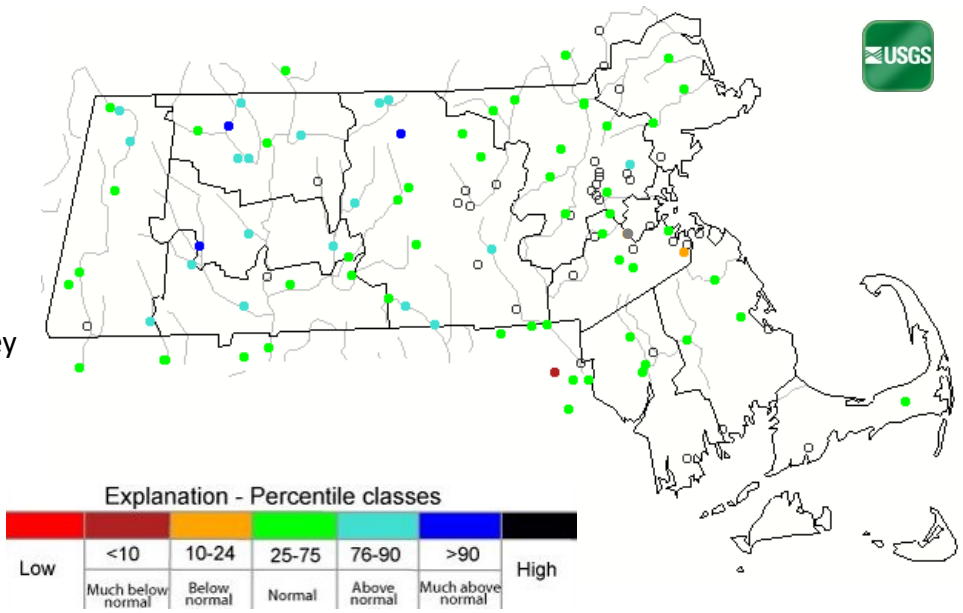
**KEY:**
1 = New record low for day
2 = < 10th percentile
3 = 10th – 24th percentile
4 = 25th – 74th percentile
5 = 75th – 89th percentile
6 = > 90th percentile
7 = New record high for day




## 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** | 7 | 0 | 0 | 0 | 0 | Normal/0 |
| **CT River Valley** | 14 | 0 | 0 | 0 | **2** | Normal/0 |
| **Central** | 11 | 0 | 0 | 0 | **1** | Normal/0 |
| **Northeast** | 19 | 0 | 0 | 0 | 0 | Normal/0 |
| **Southeast** | 6 | **1** | 0 | 0 | 0 | Normal/0 |

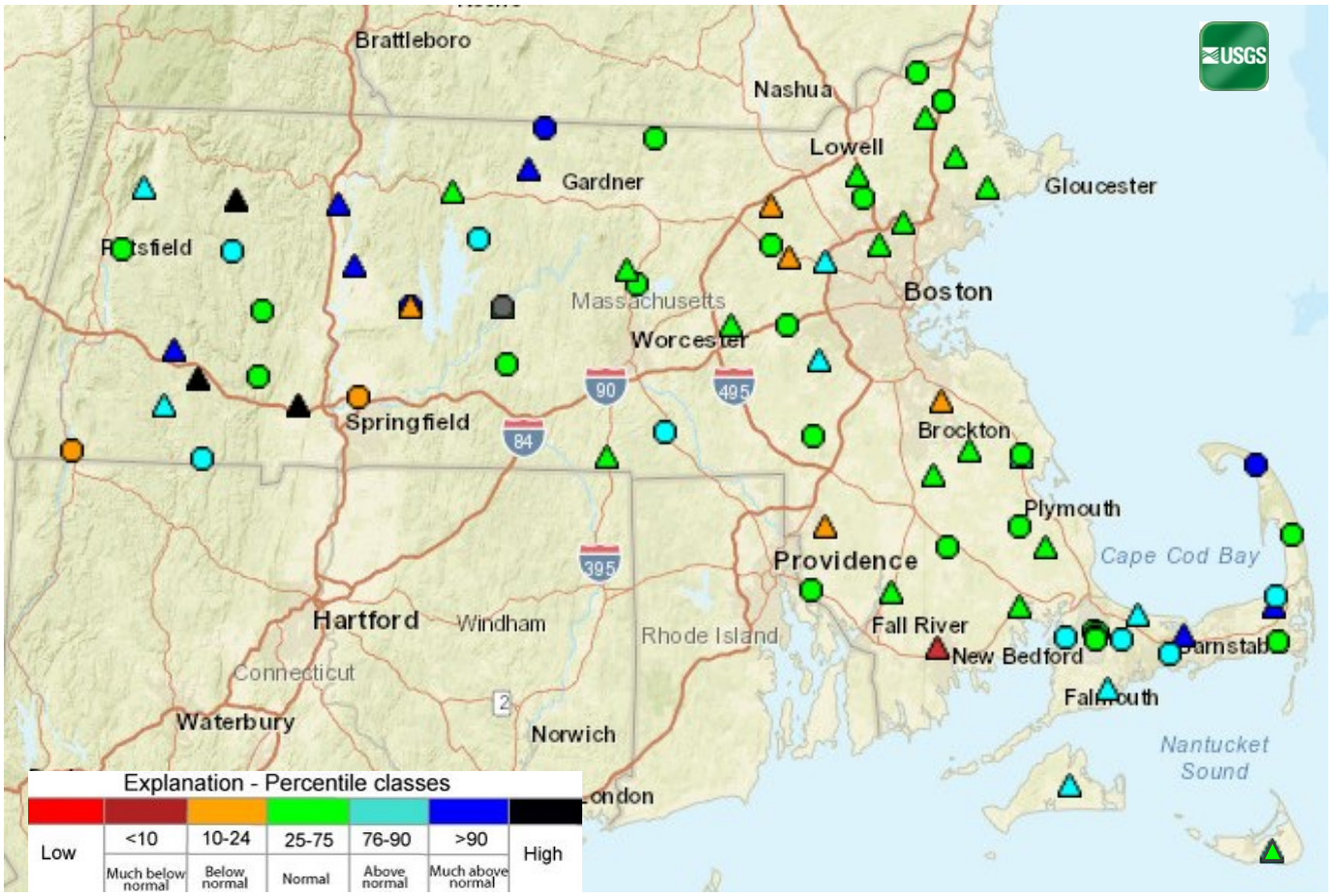
Notes: Gage counts are non-cumulative except for "total reporting". Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

# GROUNDWATER

Groundwater levels are showing recharge from the storm events in the second half of the month. Across the State, eight wells remain below normal while eleven wells are higher than the 90th percentile.

## 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 25th percentile |
|---|---|---|---|---|---|---|
| | Total Reporting for July | <25th to 10th percentile | <10th percentile to above record low | Record low | > 90th percentile | |
| **Western** | 5 | **1** | 0 | 0 | **1** | Normal/0 |
| **CT River Valley** | 11 | **2** | 0 | 0 | **5** | Normal/0 |
| **Central** | 10 | 0 | 0 | 0 | **2** | Normal/0 |
| **Northeast** | 16 | **3** | 0 | 0 | 0 | Normal/0 |
| **Southeast** | 12 | **1** | **1** | 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 July, all reporting reservoirs were above the threshold of one-standard-deviation-below-average .

| Region | Total Reporting for July | Reservoir Levels | MA Drought Management Plan Reservoir Index |
|---|---|---|---|
| **Western** | 1 | 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 |

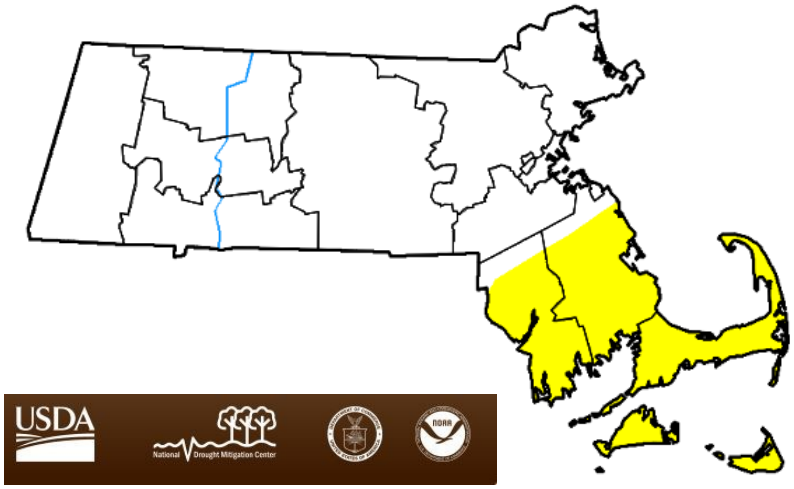
## DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

### U.S. Drought Monitor: Drought Conditions as of July 31, 2018

**Summary:** The USDM map shows Abnormally Dry conditions in the Southeast and the Cape and Islands regions. All other regions have returned to 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 (CPC): Temperature and Precipitation Outlook

**August:** The outlook projects a 50-60 percent probability of above normal temperatures and equal chances for below normal, normal, or above normal precipitation in Massachusetts.

**August through October**: The outlook projects the same as the August monthly, mainly, a 50-60 percent probability of above normal temperatures and equal chances for below normal, normal, or above normal precipitation in Massachusetts.

# DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS, cont.

## NOAA CPC: Monthly and Seasonal Drought Outlook

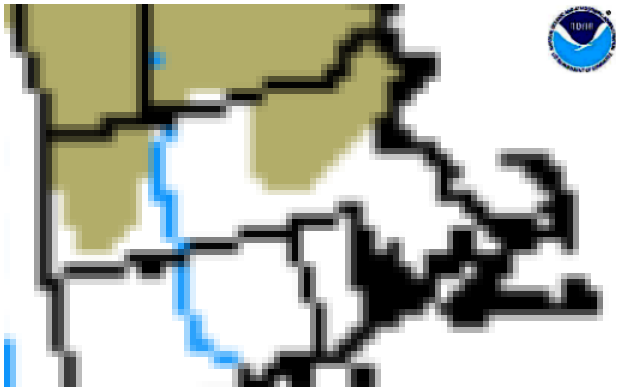
The outlooks project the removal drought.

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

Drought persists
Drought remains but improves
Drought removal likely
Drought development likely

**Valid for August 2018**

**Valid July 19 through October 31, 2018**



**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
https://www.mass.gov/service-details/precipitation-composite-estimates-1
https://www.mass.gov/service-details/standardized-precipitation-index-spi-0
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:
https://www.mass.gov/water-data-tracking

# Appendix I: Additional Information

## Keetch-Byram Drought Index

DCR data as of August 6, 2018 showed all regions at Advisory level except the Connecticut River Valley which is Normal.

| Region | KBDI | Fire Index Level |
|---|---|---|
| West | 312 | Advisory |
| CT River Valley | 54, 21 | Normal |
| Central | 201, 240 | Advisory |
| Northeast | 392, 369 | Advisory |
| Southeast | 236, 254 | Advisory |
| Cape and Islands | 316, 195, 220 | Advisory |

## Crop Moisture Index for the Week Ending July 28, 2018

At the end of July, the index is Normal for all regions. 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

# Appendix I: Additional Information, continued

## Percent of Average Historical Precipitation for July 2018

| July-18 | Normal | Actual | Percent Normal | Excess/ Deficit | Excess or Deficit Since Last-------- 10/1/2017 | 2 Months | % Norm | 3 Months | % Norm | 6 Months | % Norm | 12 | % Norm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **State** | 3.68 | 4.72 | 128 | 1.04 | 4.41 | 1.31 | 118 | -0.26 | 98 | 3.57 | 116 | 2.92 | 106 |
| **Western** | 4.27 | 6.02 | 141 | 1.75 | 7.05 | 2.77 | 133 | 1.50 | 112 | 4.73 | 121 | 5.69 | 113 |
| **Connecticut River** | 4.20 | 7.65 | 182 | 3.45 | 5.49 | 4.96 | 161 | 2.86 | 124 | 4.57 | 120 | 2.85 | 106 |
| **Central** | 3.81 | 5.71 | 150 | 1.90 | 5.13 | 2.16 | 129 | 0.45 | 104 | 2.78 | 112 | 3.33 | 107 |
| **Northeast** | 3.46 | 3.98 | 115 | 0.52 | 2.77 | 0.80 | 112 | -0.53 | 95 | 3.48 | 116 | 0.74 | 102 |
| **Southeast** | 3.33 | 2.61 | 78 | -0.72 | 2.52 | -1.27 | 81 | -2.53 | 75 | 2.79 | 113 | 0.19 | 100 |
| **Cape Cod and Islands** | 2.92 | 1.25 | 43 | -1.67 | 6.76 | -1.63 | 74 | -3.10 | 69 | 5.35 | 125 | 10.83 | 124 |

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 2018

| REGION | 3-Month SPI | 6-Month SPI | 12-Month SPI |
|---|---|---|---|
| Western Region | 0.49 | 1.11 | 0.86 |
| Connecticut River Region | 0.80 | 0.94 | 0.42 |
| Central Region | 0.23 | 0.69 | 0.50 |
| Northeast Region | -0.06 | 0.82 | 0.15 |
| Southeast Region | -0.71 | 0.64 | 0.08 |
| Cape & Islands | -0.91 | 1.20 | 1.55 |

# 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**<br>6-month > -1.0 **or**<br>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**<br>6-month = -1.0 to -1.5 **or**<br>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**<br>6-month = -1.5 to -3.0 **or**<br>12-month = -1.5 to -2.0 | -2.0 to –2.9 excessively dry | 400-600 | 1 of the following criteria met:<br>3 month cum. < 65% **or**<br>6 month cum. < 70% **or**<br>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**<br>12-month = -2.0 to -2.5 | < -2.9 severely dry | 600-800 | 1 of the following criteria met:<br>3 month cum. < 65% and<br>6 month cum. <65%, **or**<br>6 month cum. <65% and<br>12 month cum. <65%, **or**<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 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 25$^{th}$ 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 ).