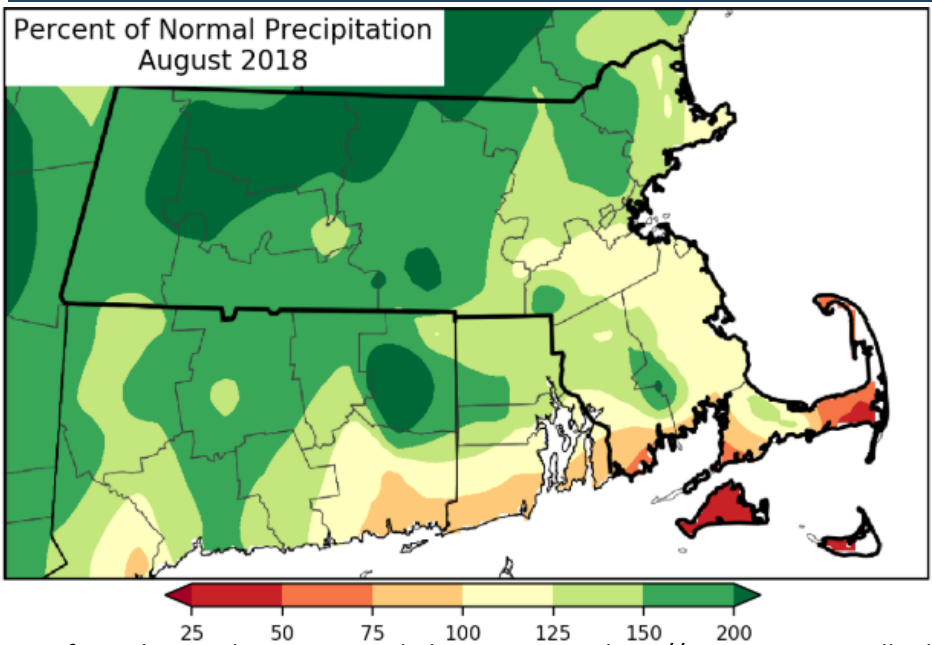


August 2018 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Rain storms that began in the second half of July continued throughout August across the State except for part of the Southeast and the Cape and Islands. All precipitation indices are Normal except for the two-month Percent of Normal which is at the Advisory level for the Cape and Islands.
- Streamflow, Groundwater, and Reservoir Indices are Normal for all regions with many record high values.
- The Fire Index is at the Advisory Level for all regions except the Northeast and Cape and Islands which are at Watch level. However, the Fire Chief reports little to no fire activity.
- The Crop Moisture Index is at the Advisory level for the Northeast, Southeast and Cape and Islands.
- NOAA’s forecast for September projects 60-70 percent probability of above normal temperatures and equal chances for below normal, normal, or above normal precipitation.
- Appendix I presents indices not shown in the main report. Appendix II presents the indices and their drought level thresholds.

PRECIPITATION



August precipitation was significantly above normal across the State except on the Cape and Islands. The Town of Royalston in Worcester County recorded 12.5” for the month. On August 12, localized daily totals of ~8 inches resulted in significant urban flooding in the Northeast.

The 2-month Percent of Normal triggers Advisory level for the Cape and Islands where Edgartown, for example, received only 1.1 inches for the month. (Additional precipitation data are in Appendix I.)

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

Region	Estimated Rainfall (inches)	Departure from Average August (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	8.25	4.10	Normal	Normal
CT River Valley	8.61	4.40	Normal	Normal
Central	7.85	3.79	Normal	Normal
Northeast	4.86	1.30	Normal	Normal
Southeast	4.54	0.65	Normal	Normal
Cape Cod & Islands	2.69	-1.30	Normal	Advisory

Key to Drought Levels
Normal
Advisory
Watch
Warning
Emergency

STREAMFLOW

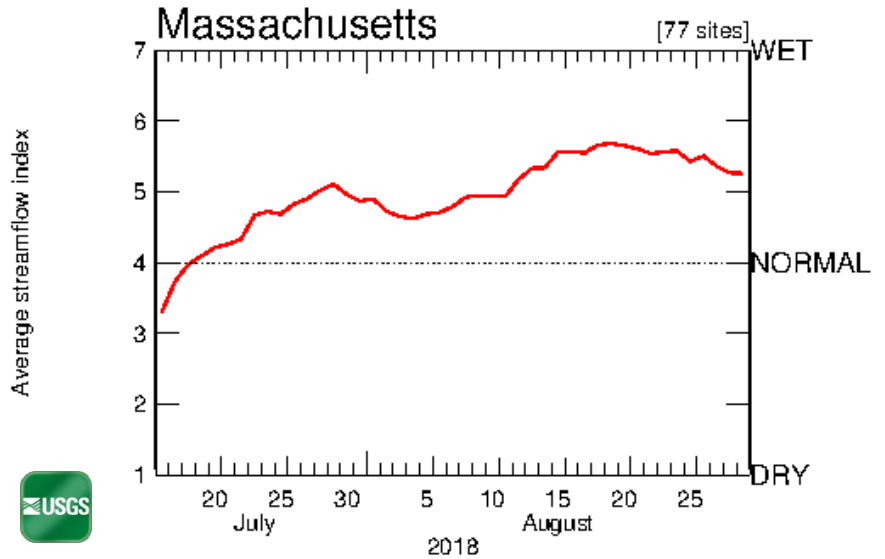
Streamflows were above normal the first half of the month and rose to significantly above normal the second half of the month. 34 gages averaged 90th percentile or greater flows for August. Only the Southeast did not have above normal flows.

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

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

KEY:

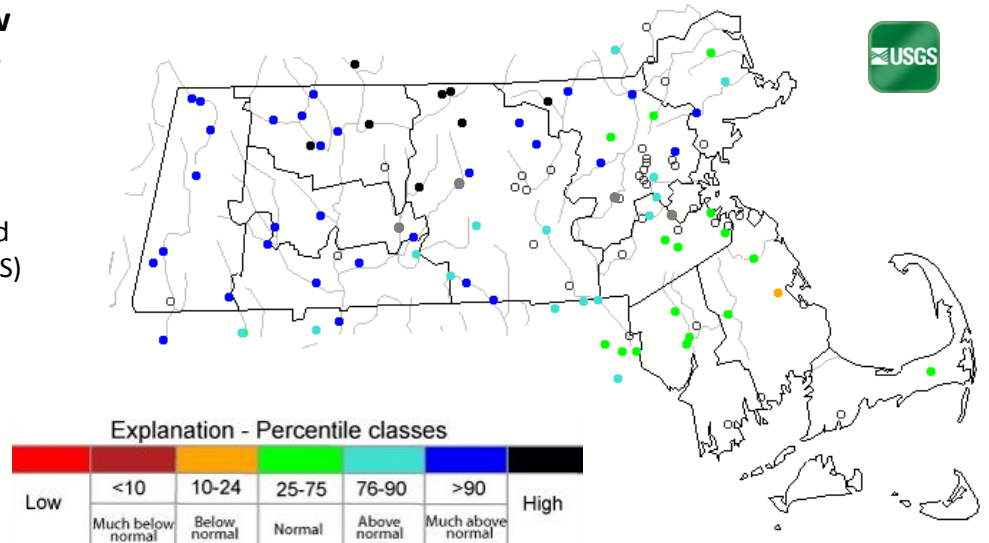
- 1 = New record low for day
- 2 = < 10th percentile
- 3 = 10th – 24th percentile
- 4 = 25th – 74th percentile
- 5 = 75th – 89th percentile
- 6 = > 90th percentile
- 7 = New record high for day



Average 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>



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	7	0	0	0	7	Normal/0
CT River Valley	14	0	0	0	13	Normal/0
Central	11	0	0	0	8	Normal/0
Northeast	18	0	0	0	6	Normal/0
Southeast	6	1	0	0	0	Normal/0

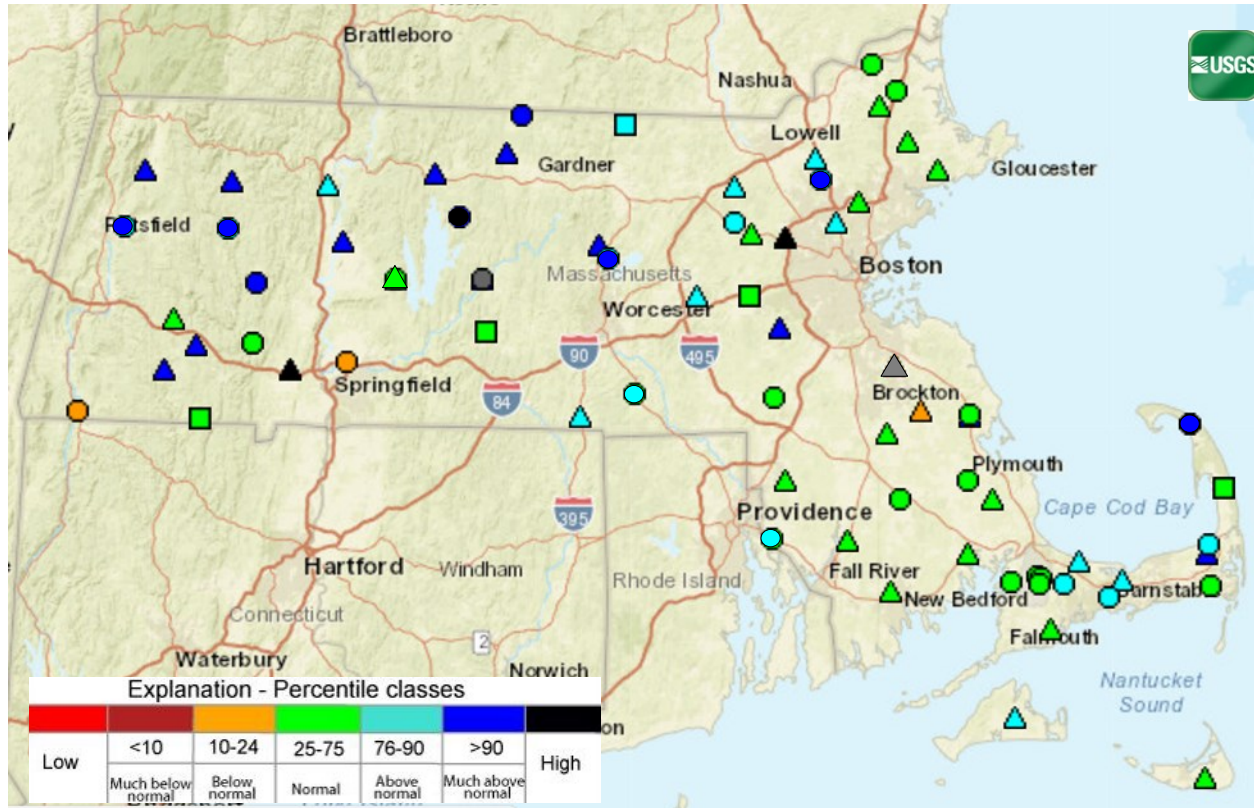
Notes: Gage counts are non-cumulative except for "total reporting". Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

GROUNDWATER

Groundwater levels are showing recharge from continued storm events since mid-July. Recharge in July and August is unusual, and as such 20 wells are at or higher than the 90th percentile water level for August.

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 th percentile
	Total Reporting for August	<25th to 10th percentile	<10th percentile to above record low	Record low	> 90th percentile	
Western	5	1	0	0	3	Normal/0
CT River Valley	11	1	0	0	6	Normal/0
Central	10	0	0	0	5	Normal/0
Northeast	10	0	0	0	2	Normal/0
Southeast	12	1	0	0	1	Normal/0
Cape and Islands	10	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, all reporting reservoirs were above the threshold of one-standard-deviation-below-average .

Region	Total Reporting for August	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	2	Normal	Normal
Cape Cod & Islands	1	Normal	Normal

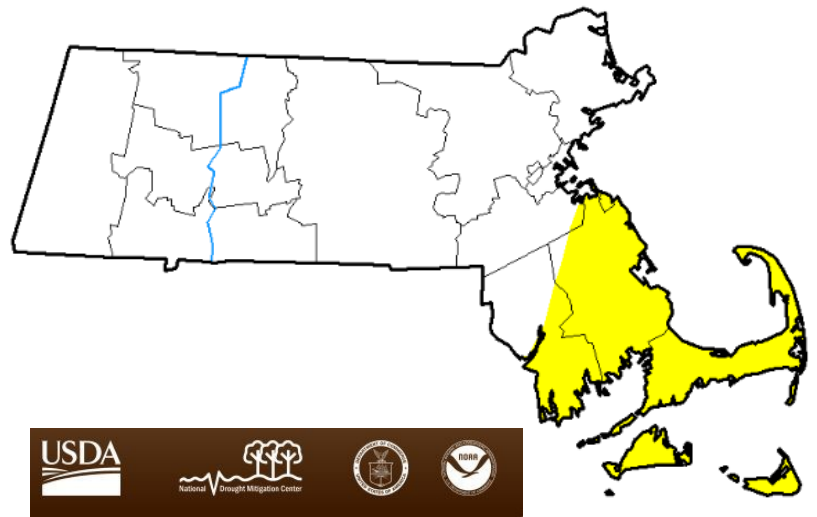
DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of September 4, 2018

Summary: The USDM map continues to show Abnormally Dry conditions in the Southeast and the Cape and Islands regions. All other regions remain 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

September: The outlook projects a 60-70 percent probability of above normal temperatures and equal chances for below normal, normal, or above normal precipitation in Massachusetts.

September through November: 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.

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

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS, cont.

NOAA CPC: Monthly and Seasonal Drought Outlook

The outlooks do not project drought conditions.

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

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

Valid for September 2018

Valid August 16 through November 30, 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 September 9, 2018 showed all regions at Advisory level except the Northeast and Southeast which are at a Watch level. The Fire Chief reported that although some districts' numbers are moderate, overall fire danger has remained low to moderate with short periods of high for the most part, due to high humidity levels resulting in high fuel moistures. There has been little to no fire activity because fuels remain green and live with some curing just starting to be noticed in grasses.

<u>Region</u>	<u>KBDI</u>	<u>Fire Index Level</u>
West	200	Advisory
CT River Valley	257, 262	Advisory
Central	245, 234	Advisory
Northeast	392, 491, 494	Watch
Southeast	230, 334, 302	Advisory
Cape and Islands	508, 423, 348	Watch

Crop Moisture Index for the Week Ending September 8, 2018: The index is Normal for all regions except a part of the Northeast and the Southeast and Cape and Islands which are at the Advisory level.

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 August 2018

August-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 Months	% Norm
State	3.96	6.27	158	2.31	7.06	3.43	145	3.94	135	4.62	120	6.88	115
Western	4.15	8.25	199	4.10	11.24	5.89	170	6.91	155	6.50	128	10.42	124
Connecticut River	4.21	8.61	205	4.40	10.01	7.97	195	9.48	177	7.40	131	8.70	119
Central	4.06	7.85	193	3.79	9.88	6.14	178	6.91	159	6.31	127	9.42	120
Northeast	3.56	4.86	137	1.30	3.96	1.71	124	1.99	119	3.94	118	4.03	109
Southeast	3.89	4.54	117	0.65	3.09	-0.15	98	-0.70	93	2.08	109	3.02	107
Cape Cod and Islands	3.99	2.69	67	-1.30	5.46	-2.97	57	-2.93	71	0.25	101	8.01	118

Standardized Precipitation Index for August 2018

REGION	3-Month SPI	6-Month SPI	12-Month SPI
Western Region	1.79	1.40	1.47
Connecticut River Region	2.09	1.41	1.22
Central Region	1.83	1.31	1.28
Northeast Region	0.69	0.88	0.61
Southeast Region	-0.09	0.48	0.45
Cape & Islands	-0.74	0.12	1.15

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>).