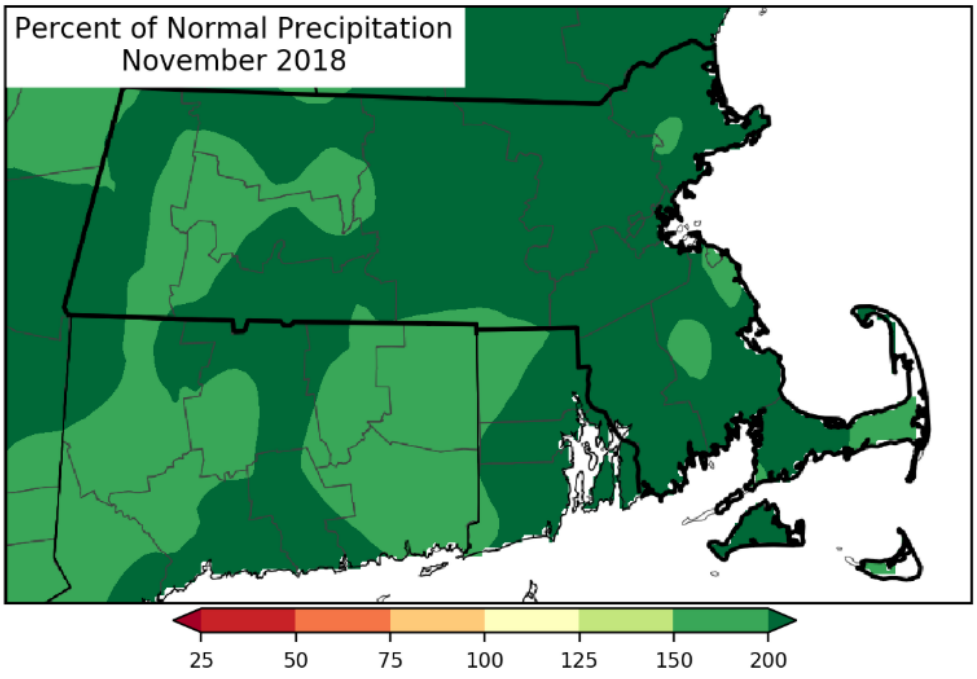
MASSACHUSETTS WATER RESOURCES COMMISSION

November 2018 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Temperatures were 2-4 degrees lower than the average November values. It was the 10th coldest November in Worcester with record lows set in Worcester (on 11/22 and 11/23) and in Boston (on 11/ 22).
- Both Precipitation Indices are Normal for all regions. Precipitation has fallen about 50% of the days since mid-July with record high one-month, three-month and annual totals set at multiple locations.
- Streamflow, Groundwater, and Reservoir Indices are Normal for all regions with numerous record highs.
- Crop Moisture Index indicates wet conditions. Data for the Fire Index is not collected during the winter.
- NOAA's forecast for December projects equal chances for below normal, normal, or above normal temperatures and precipitation.
- Appendix I presents indices not shown in the main report and additional details about precipitation. Appendix II presents the drought level thresholds for all indices.

PRECIPITATION



Precipitation was over 200% of average for November. Multiple records were broken, for example, this is already the wettest year on record in Chicopee and the wettest November and September to November in Walpole.

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

Region	Estimated Rainfall (inches)	Departure from Average Nov. (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	7.34	3.73	Normal	Normal
CT River Valley	8.16	4.32	Normal	Normal
Central	8.96	4.94	Normal	Normal
Northeast	9.73	5.85	Normal	Normal
Southeast	10.31	6.22	Normal	Normal
Cape Cod & Islands	8.95	4.65	Normal	Normal

Key to Drought Plan Levels
Normal
Advisory
Watch
Warning
Emergency

STREAMFLOW

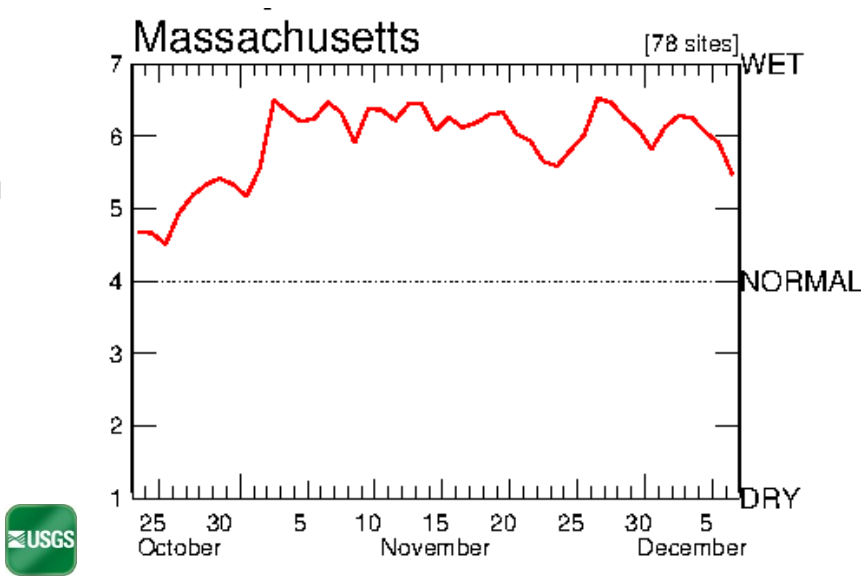
Streamflows were historically high for November. New record highs were recorded for average monthly streamflow at 45 of 56 gages . The other 11 gages were at or greater than 90th percentile flows.

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

This plot depicts data for the 45-day period ending December 9.
http://waterwatch.usgs.gov/index.php?id=real&sid=w__plot&r=ma

KEY:

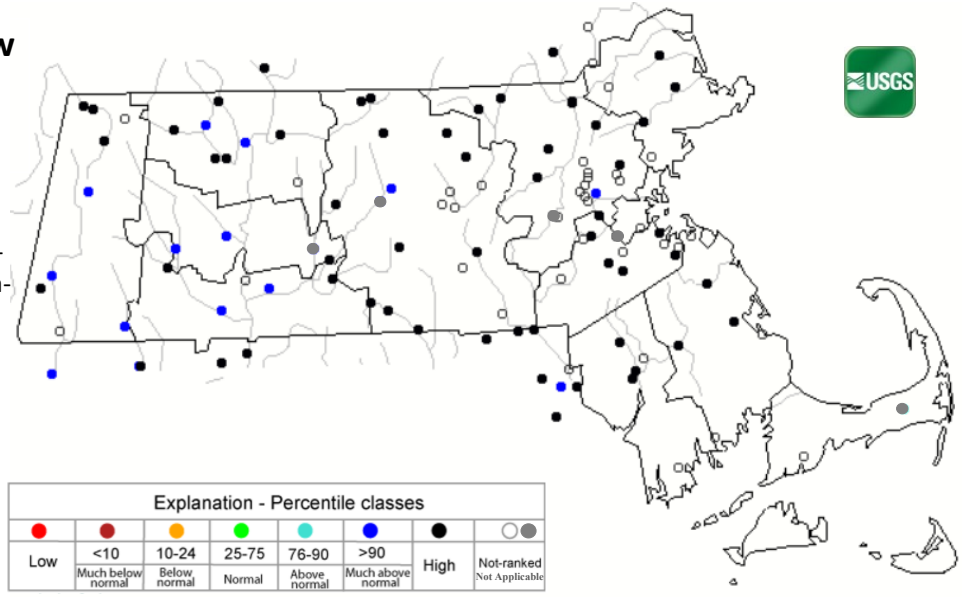
1 = New record low for day
2 = < 10th percentile
3 = 10th – 24th percentile
4 = 25th – 74th percentile
5 = 75th – 89th percentile
6 = > 90th percentile
7 = New record high for day



Average November 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 November	<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	**14**	Normal/0
Central	11	0	0	0	**11**	Normal/0
Northeast	18	0	0	0	**18**	Normal/0
Southeast	6	0	0	0	**6**	Normal/0

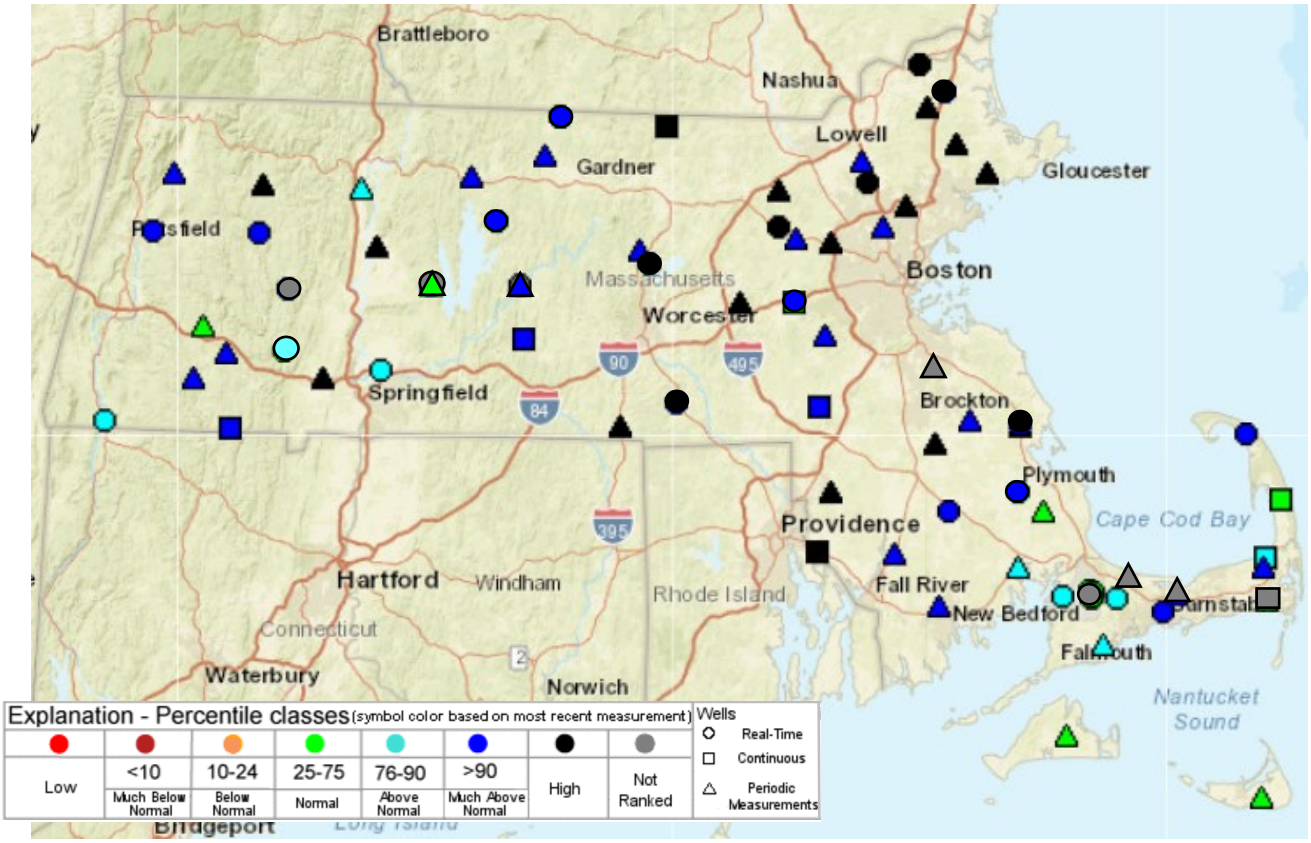
Notes: Gage counts are non-cumulative except for "total reporting". Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

GROUNDWATER

The majority of wells continue to show high groundwater levels relative to average November conditions. 50 of 64 wells are at or higher than their 90th percentile level with 23 record highs.

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

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 November	<25th to 10th percentile	<10th percentile to above record low	Record low	> 90th percentile	
Western	5	0	0	0	**3**	Normal/0
CT River Valley	11	0	0	0	**7**	Normal/0
Central	10	0	0	0	**10**	Normal/0
Northeast	16	0	0	0	**16**	Normal/0
Southeast	12	0	0	0	**10**	Normal/0
Cape and Islands	10	0	0	0	**4**	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 November all reporting reservoirs were significantly above the threshold of one-standard-deviation-below-average with some reservoirs spilling.

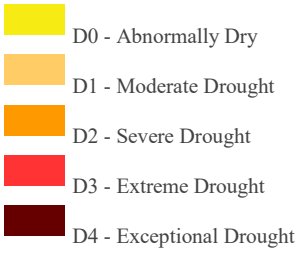
Region	Total Reporting for November	Reservoir Levels	MA Drought Management Plan Reservoir Index
Western	2	Normal	Normal
CT River Valley	2	Normal	Normal
Central	3	Normal	Normal
Northeast	7	Normal	Normal
Southeast	2	Normal	Normal
Cape Cod & Islands	1	Normal	Normal

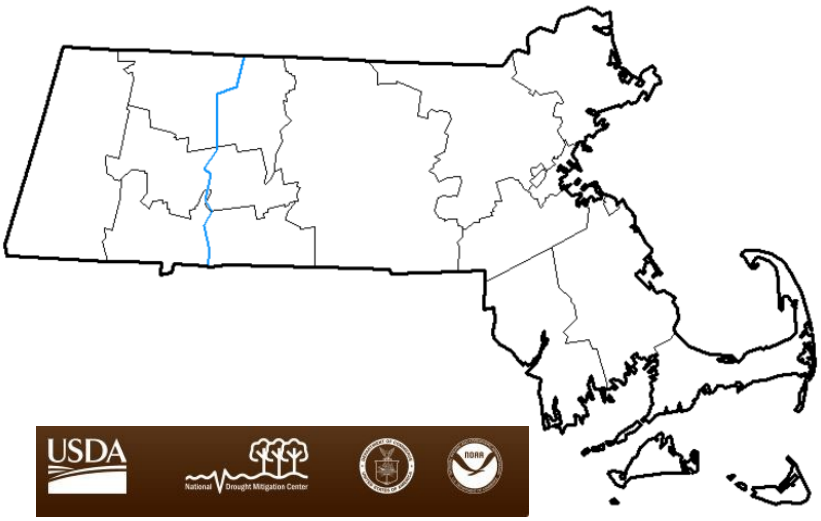
DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of November 27, 2018

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





NOAA Climate Prediction Center: Temperature and Precipitation Outlook

December: The outlook projects equal chances for below normal, normal, or above normal temperatures and precipitation across the State.

December through February: The outlook projects equal chances for below normal, normal, or above normal temperatures and precipitation.

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

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS, cont.

NOAA Climate Predication Center: 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 December 2018

Valid November 15 2018 - February 28, 2019

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

Data for the Fire Index is not collected during the winter.

Crop Moisture Index

The CMI map for the week of December 8 shows abnormally moist to wet conditions.

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 November 2018

November-18	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	3.96	9.06	229	5.10	6.68	6.68	186	10.83	194	14.51	164	16.57	137
Western	3.61	7.34	203	3.73	21.03	5.11	171	9.79	187	16.70	170	20.29	146
Connecticut River	3.84	8.16	213	4.32	19.68	5.16	167	10.13	187	19.15	180	18.53	141
Central	4.02	8.96	223	4.94	19.90	5.79	173	10.14	186	16.93	172	16.83	136
Northeast	3.88	9.73	251	5.85	14.45	6.62	188	10.25	193	12.48	158	14.20	133
Southeast	4.09	10.31	252	6.22	17.16	9.49	220	14.85	228	13.37	160	17.57	139
Cape Cod and Islands	4.30	8.95	208	4.65	13.05	7.70	194	7.86	166	4.66	121	11.38	125

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 November 2018

REGION	3-Month SPI	6-Month SPI	12-Month SPI
Western Region	2.30	2.74	2.77
Connecticut River Region	2.31	2.92	2.52
Central Region	2.26	2.81	2.28
Northeast Region	2.36	2.36	1.99
Southeast Region	2.97	2.31	2.23
Cape & Islands	1.76	0.93	1.70

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).