

MASSACHUSETTS WATER RESOURCES COMMISSION

Hydrologic Conditions in Massachusetts



SUMMARY OF CONDITIONS

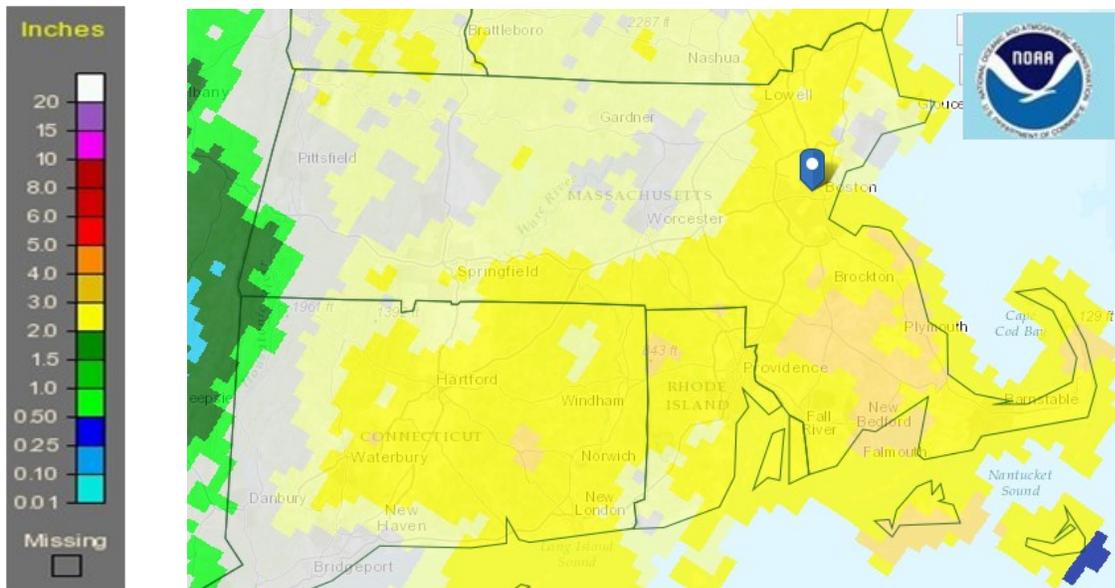
- November precipitation ranged from normal in the West to 2-3 inches below normal in the Southeast.
- November average streamflows were mostly below or significantly below normal and have been for 6 to 8 months in every drought region. Recovery of flows was seen at the end of the month.
- November groundwater levels continue to be below normal except for two regions. The majority of wells on Cape Cod and the Islands have been consistently above 25th percentile levels. The majority of wells in the Northeast have recovered above 25th percentile levels this month. Other regions have been below 25th percentile levels for 7 to 9 months.
- November reservoir levels were below normal for all regions.
- NOAA projects an easing of drought conditions for December but drought persistence for the three month forecast.

PRECIPITATION CONDITIONS

Region	Estimated Rainfall (inches)	Departure from Average November (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	3.12	-0.51	Normal	Normal
CT River Valley	2.24	-1.63	Watch	Watch
Central	2.79	-1.25	Advisory	Normal
Northeast	3.09	-0.81	Advisory	Normal
Southeast	2.36	-1.73	Advisory	Normal
Cape Cod & Islands	2.43	-1.91	Advisory	Watch

November 2016 Precipitation Departure from Normal

Map from the National Weather Service (NWS) Advanced Hydrologic Prediction Center (<http://water.weather.gov/precip/>)
 The map is generated based on radar data correlated to NWS rainfall gauge reports



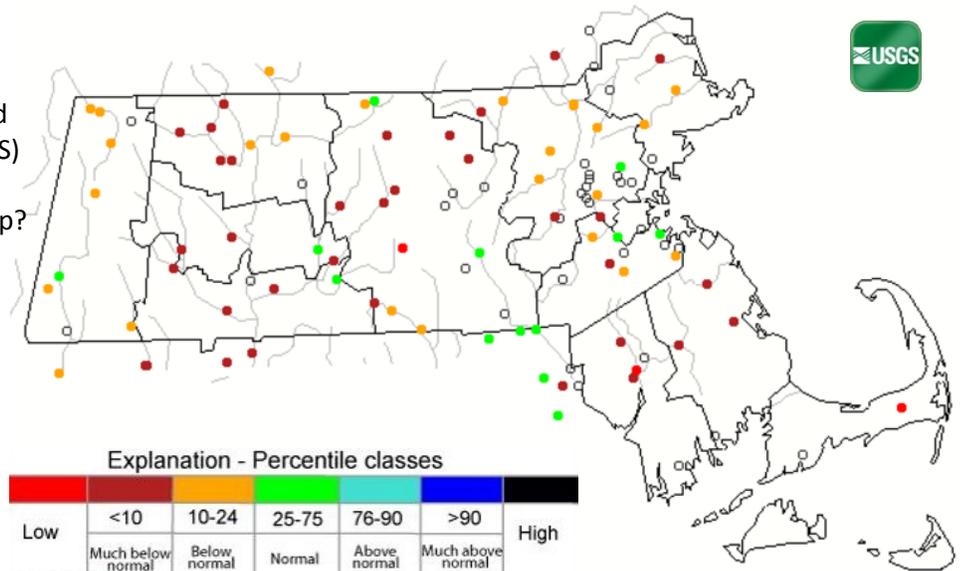
STREAMFLOW CONDITIONS

Region	Number of Gages				MA Drought Plan Index (# months majority below 25th percentile)
	Total	Below 25th percentile	Below 10th percentile	At Record Low	
Western	7	6	0	0	6 of 7
CT River Valley	16	14	12	0	8 of 8
Central	16	11	8	1	8 of 8
Northeast	19	16	5	0	6 of 7
Southeast	6	6	6	1	7 of 7

Note: Streamflow conditions for individual streamflow-gaging stations may differ from general conditions.

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>

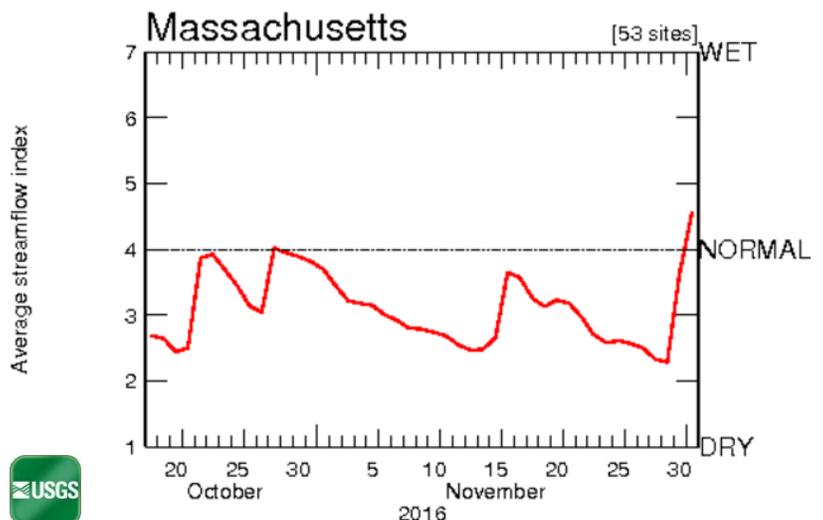


Average Daily Streamflow Compared to Historical for the Day of the Year

This plot depicts data for the 45-day period ending December 2. 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



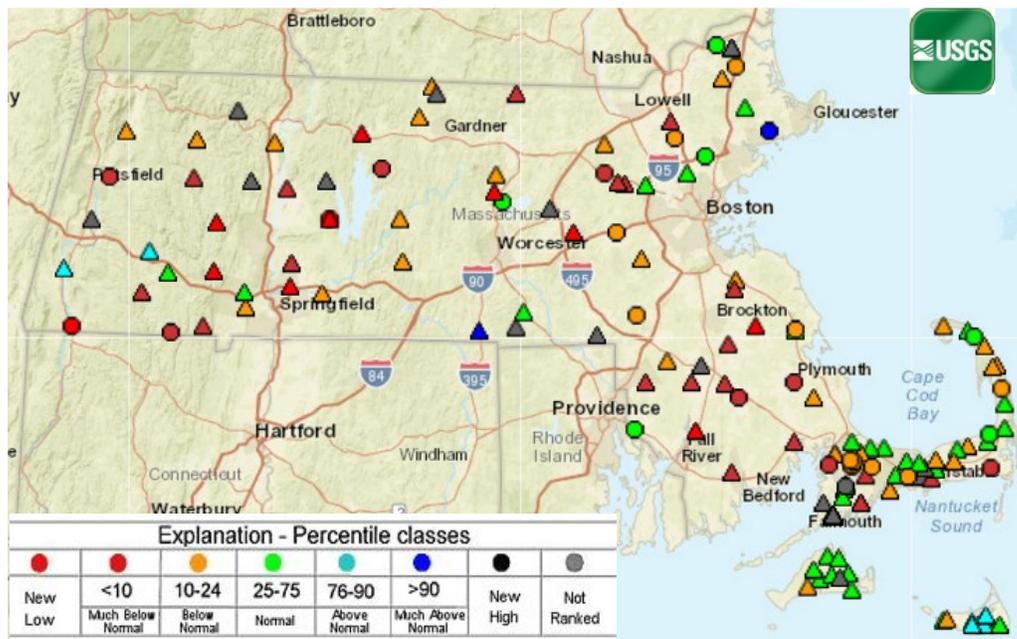
GROUNDWATER LEVELS

Region	Number of wells			MA Drought Plan Index (# consecutive months majority below 25 th percentile)	
	Total	Below 25 th percentile	Below 10 th percentile		At Record Low
Western	5	4	3	1	9
CT River Valley	11	9	7	4	8
Central	10	7	2	1	8
Northeast	17	8	3	0	0
Southeast	12	11	9	2	7
Cape and Islands	13	6	2	0	0

Note: Groundwater levels at individual wells may differ from general conditions for a region.

Groundwater Conditions ending November 2016

from USGS <http://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncl=rtn&sc=25>



RESERVOIR LEVELS

Region	Reservoir Levels	MA Drought Plan Reservoir Index
Western	Below	Watch
CT River Valley	Below	Warning*
Central	Below	Watch
Northeast	Below	Watch
Southeast	Below	Watch
Cape Cod & Islands	Below	Advisory

* Quabbin reservoir is slightly below normal. This is a large reservoir which jumps the index from normal to warning. The other monitored reservoir in the CT River Valley region is normal.

DROUGHT CONDITIONS AND FORECASTS by NOAA AND PARTNERS

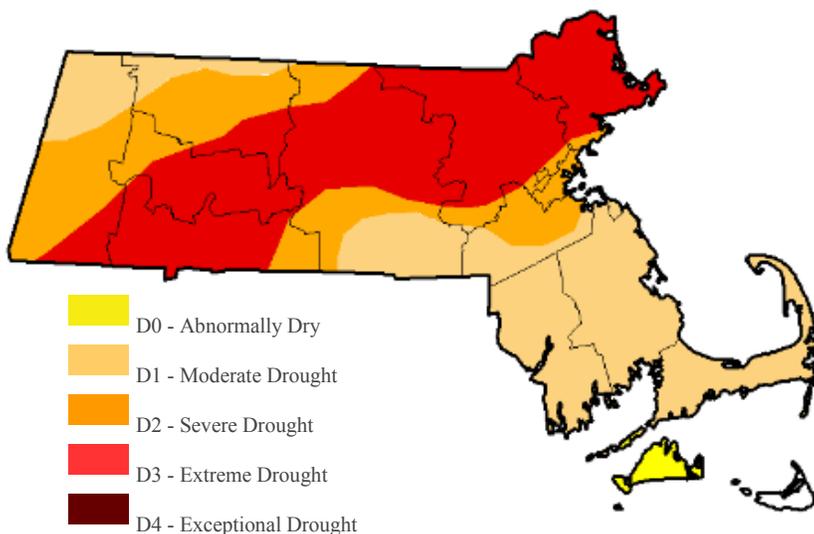
U.S. Drought Monitor: Massachusetts, November 29, 2016

Summary: As of November 29, 2016, the U.S. Drought Monitor shows that 99 percent of Massachusetts is in a drought with 64 percent in a severe or extreme drought.

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>

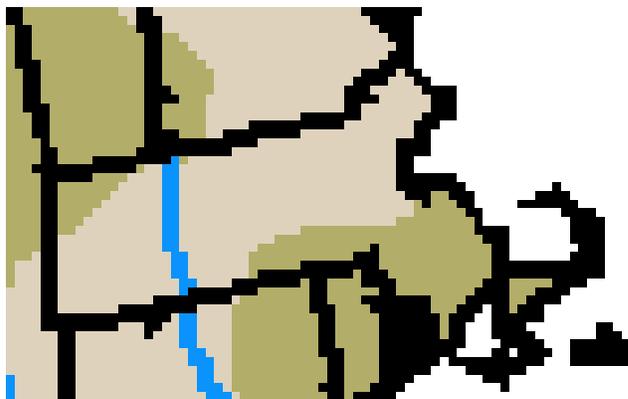


U.S. Monthly Drought Outlook: Drought Tendency for December 2016

The Outlook projects drought improvement in drought conditions for December in Massachusetts.

http://www.cpc.ncep.noaa.gov/products/expert_assessment/mdo_summary.php

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



U.S. Seasonal Drought Outlook: Drought Tendency During November 17, 2016 - February 28, 2017

The Outlook projects drought persistence and/or intensification in Massachusetts for over the next 3 months.

http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php

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



DROUGHT CONDITIONS AND FORECASTS by NOAA AND PARTNERS, continued

NOAA National Weather Service Climate Prediction Center

The Climate Prediction Center 6-10 day Outlook for December 7 to 11 indicates a 33-40 percent chance of above normal temperatures and precipitation for Massachusetts (<http://www.cpc.noaa.gov/products/predictions/610day/>).

The Center's three-month outlook (December through February) shows a 33-40 percent probability of above normal temperatures and likely normal precipitation (i.e., equal chances for above normal, normal and above normal) (http://www.cpc.noaa.gov/products/predictions/long_range/seasonal.php?lead=1). More information is available at (http://www.cpc.noaa.gov/products/predictions/long_range/seasonal.php?lead=1).

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 by DCR Forest Fire Control Districts

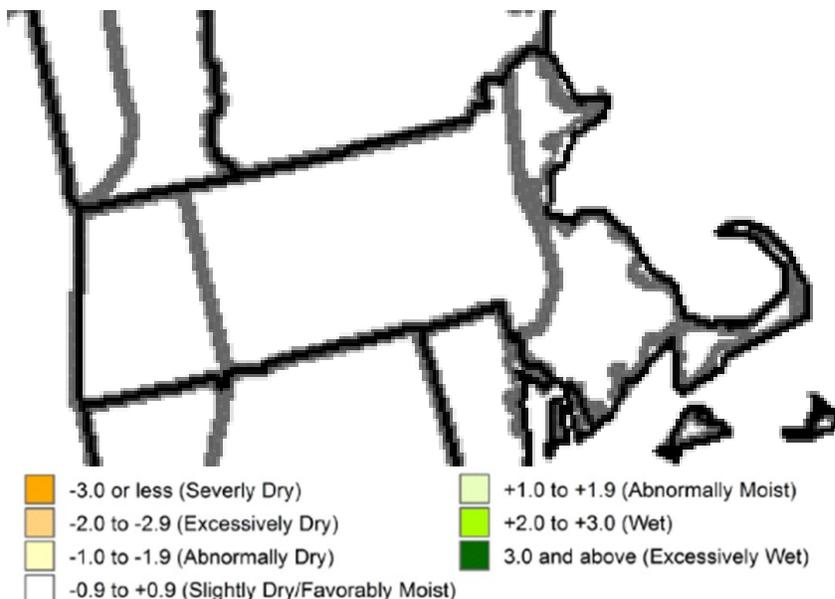
The fire index was below 100 in all drought regions the second half of November which indicates "normal" conditions according to the Massachusetts Drought Management Plan.



Crop Moisture Index for the Week Ending November 26, 2016

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 subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level.

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.