MASSACHUSETTS WATER RESOURCES COMMISSION

December 2016 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

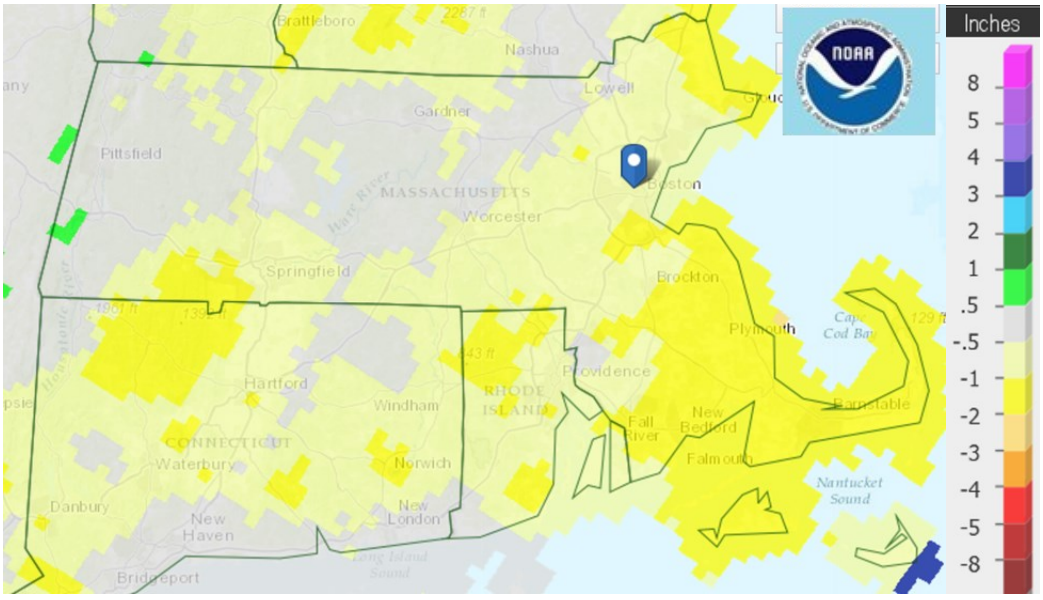
- Precipitation was mainly normal in the West and Central regions and 1-2 inches below normal in the East.
- Average streamflows continue to recover except for the Southeast region. All but the Northeast region continue to be in some stage of drought due to the number of months below-normal conditions have persisted.
- Groundwater levels are showing recovery in Central and Northeast regions. The remaining regions continue to have a significant number of wells below normal. Of these, all but Cape and Islands have seen these below-normal conditions for 8 to 10 months.
- Reservoir levels were below normal for all regions.

PRECIPITATION CONDITIONS

Region	Estimated Rainfall (inches)	Departure from Average December (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	3.38	-0.02	Normal	Normal
CT River Valley	4.60	0.88	Watch	Normal
Central	3.65	-0.23	Advisory	Normal
Northeast	3.34	-0.38	Advisory	Normal
Southeast	3.11	-1.01	Advisory	Normal
Cape Cod & Islands	2.41	-1.77	Advisory	Advisory

December 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 Reporting	Below 25th percentile	Below 10th percentile	At Record Low	
Western	5	1	1	1	2 of 3
CT River Valley	11	3	0	0	6 of 7
Central	16	8	1	0	6 of 7
Northeast	19	7	1	0	0
Southeast	6	6	6	0	8 of 8

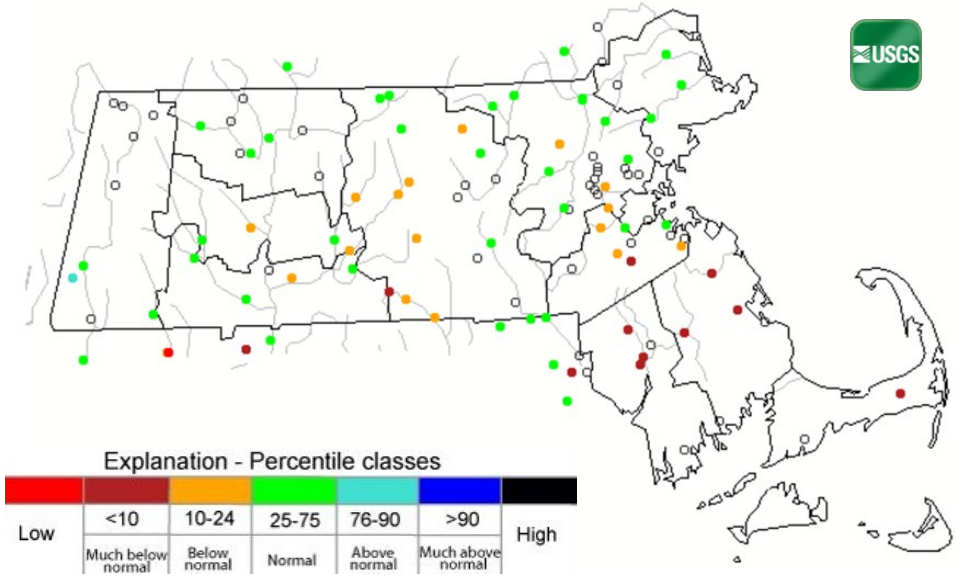
Note: Light grey shading indicates that some gages did not report average monthly flow values due to ice conditions. These gages are excluded from the table.

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

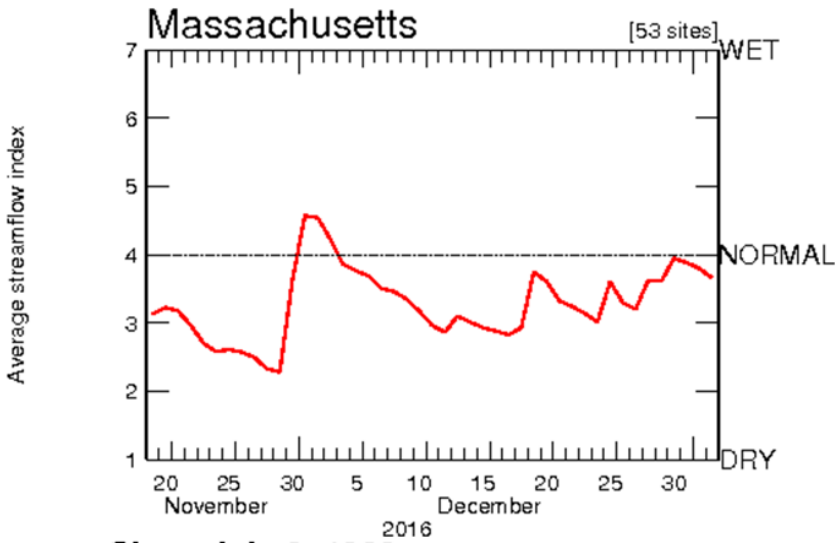
Some gages in the Northwest are not reporting due to ice conditions.



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

This plot depicts data for the 45-day period ending January 3.
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



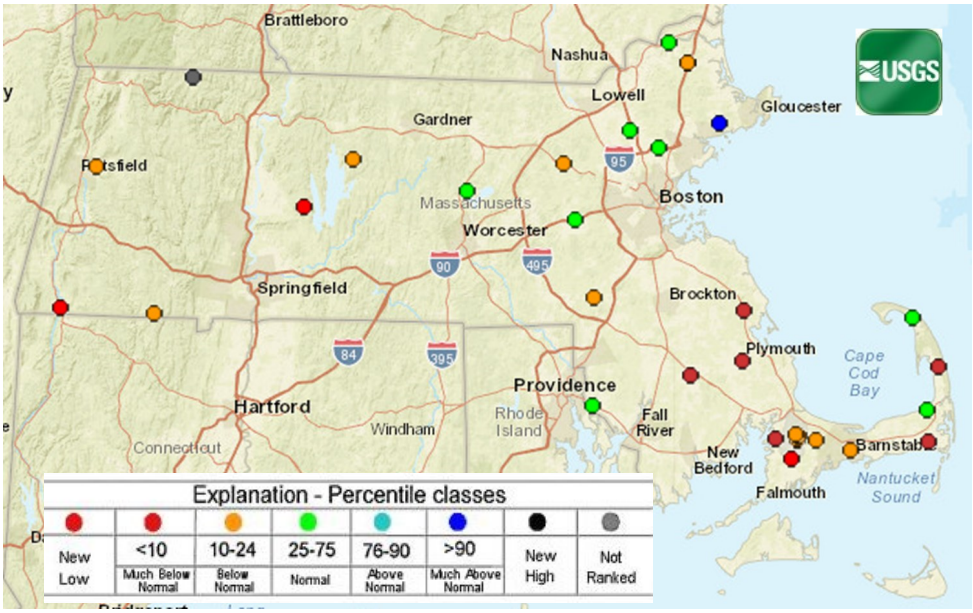
GROUNDWATER LEVELS

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

Note: Groundwater levels at individual wells may differ from general conditions for a region. Light grey shading indicates that not all wells for the region have data. The one missing well in Cape and Islands is borderline but based on trend may end up below normal.

Groundwater Conditions ending December 2016

Only real-time data wells were available at the time of publishing,



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

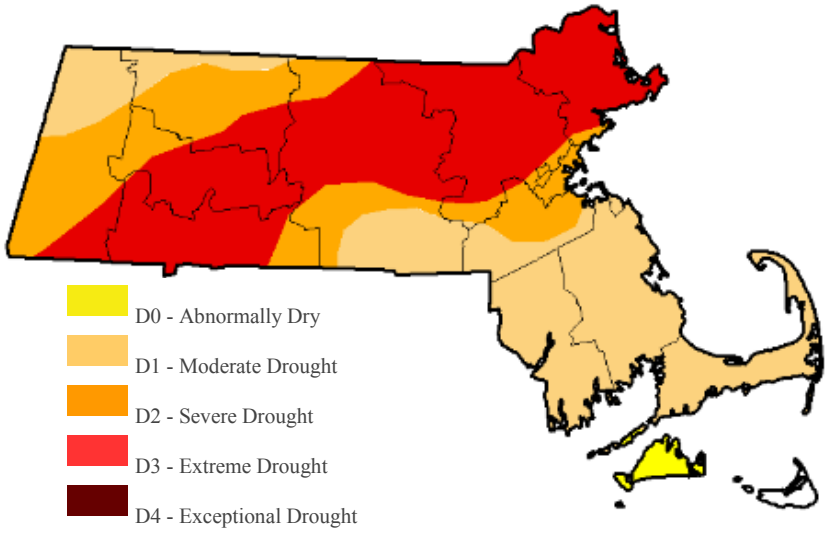
* Quabbin reservoir is slightly below normal. This is a large reservoir which jumps the index to warning. The other monitored reservoir in the CT River Valley region is below normal, a medium reservoir and, therefore, indicates a watch drought level.

DROUGHT CONDITIONS AND FORECASTS by NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of December 27, 2016

Summary: Massachusetts has 99 percent of its area in a drought with 69 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



NOAA: Monthly and Seasonal Drought Outlook

The January projection shows drought persistence in the West and improvement in the East, especially the Southeast. However, the three-month outlook suggests the opposite trend with drought persistence for most of the state, especially the Southeast and only a small area of improvement in the Northwest.
http://www.cpc.ncep.noaa.gov/products/Drought/

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

January 2017

December 15, 2016 - March 31, 2017

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

DROUGHT CONDITIONS AND FORECASTS by NOAA AND PARTNERS, continued

NOAA: Monthly and Seasonal Temperature and Precipitation Outlook

The Climate Prediction Center one-month outlook for January indicates a 40 percent chance of above normal temperatures and equal chances for below normal, normal and above normal precipitation for Massachusetts (http://www.cpc.noaa.gov/products/predictions/30day/).

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 below normal, normal and above normal) (http://www.cpc.noaa.gov/products/predictions/long_range/seasonal.php?lead=1)

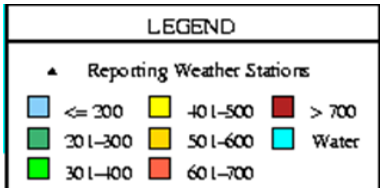
Key Links: Massachusetts Drought Management: http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/drought-status.html
DCR Precipitation Monitoring Composite Reports and SPI
http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/rainfall-program.html

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 300 in all drought regions which indicates "normal" conditions according to the Massachusetts Drought Management Plan.
http://www.wfas.net/index.php/keetch-byram-index-moisture--drought-49



Crop Moisture Index for the Week Ending December 31, 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 determine based on the repeated or extend 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

Region	MA Drought Plan Index
Western	Normal
CT River Valley	Normal
Central	Normal
Northeast	Normal
Southeast	Normal
Cape and Islands	Normal

-3.0 or less (Severly Dry)
-2.0 to -2.9 (Excessively Dry)
-1.0 to -1.9 (Abnormally Dry)
-0.9 to +0.9 (Slightly Dry/Favorably Moist)
+1.0 to +1.9 (Abnormally Moist)
+2.0 to +3.0 (Wet)
3.0 and above (Excessively Wet)

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).