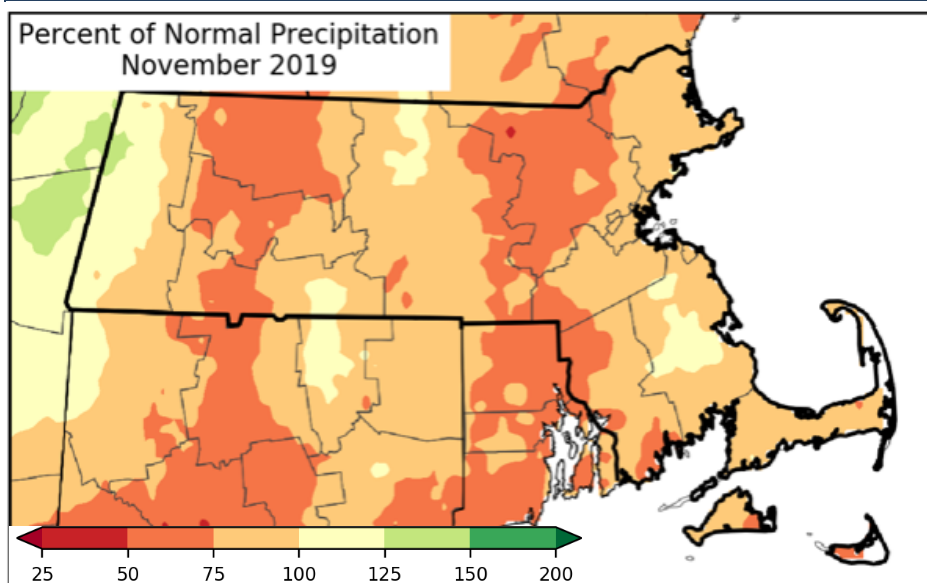


November 2019 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Temperatures were below average for November.
- Precipitation for the month of November was below average. SPI remains at index severity level 0 except for the Islands which is at level 1 for the month.
- Streamflow and groundwater are at severity level 0 for all regions.
- Lakes and Impoundments index is at index severity level 0 for all regions.
- The season's snowfall is running 1-3" below average through the end of November for most of the state.
- For December, NOAA projects 33% -40% probability for above-normal temperatures and 33-40% probability of above-normal precipitation.
- Appendices I and II provide additional information on precipitation data and the Massachusetts Drought Management Plan (DMP), respectively.

PRECIPITATION



Precipitation was below normal for the month of November. All look-back periods for the SPI are at Severity Level 0 except for the 1-month for the Islands, which is at level 1.

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

Region	Number of Sites	November Average (inches)	Departure from Historical (inches)	DMP SPI 1-month	DMP SPI 2-month	DMP SPI 3-month
Western	4	3.93	0.34	0.35	0.93	0.28
CT River Valley	12	2.88	-0.71	-0.22	0.3	-0.31
Central	13	3.23	-1.07	-0.36	0.69	0.02
Northeast	14	3.33	-0.96	-0.14	0.47	-0.18
Southeast	16	3.88	-0.47	0.01	0.51	-0.05
Cape Cod	4	3.44	-0.55	-0.16	0.74	0.57
Islands	2	2.41	-1.64	-0.78	0.47	0.34

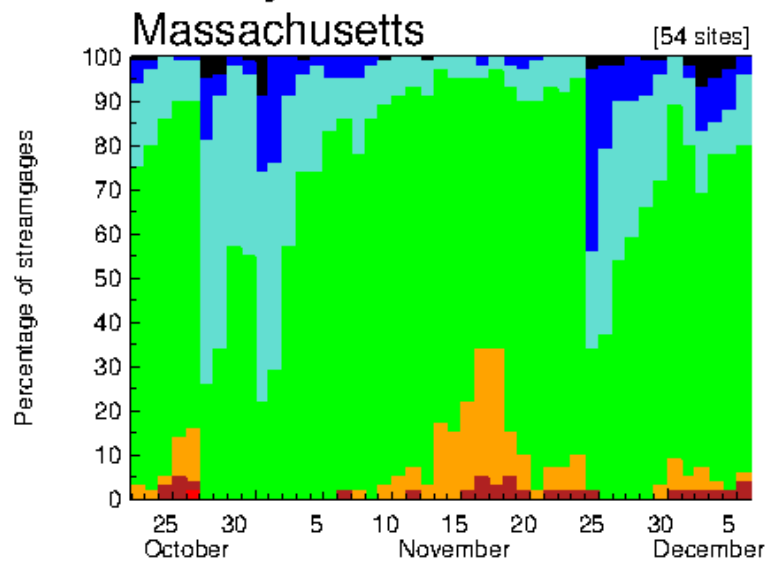
STREAMFLOW

Streamflows were mostly within the normal range for the month of November. Two gages had median monthly flows below the 30th percentile and one greater than 90th percentile.

Time Series of Daily Streamflows Compared to Historical Values

https://waterwatch.usgs.gov/index.php?id=real&sid=w_plot_sum&r=ma

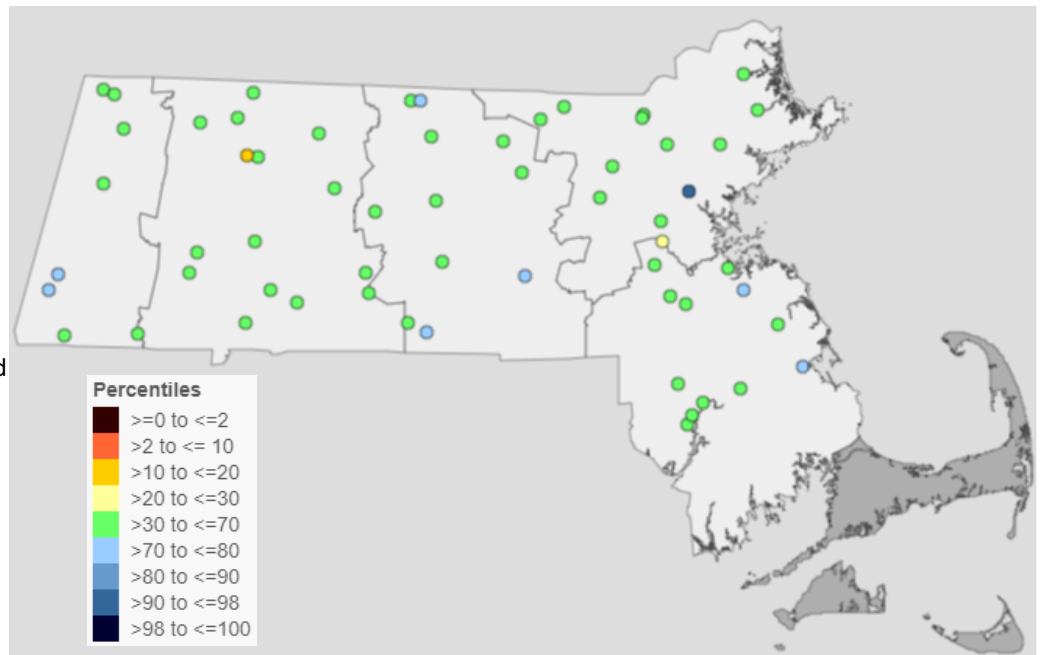
Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



Median Monthly Streamflows Compared to Historical Values

Streamflow is monitored by the Commonwealth of Massachusetts and United States Geological Survey (USGS) cooperative stream gaging program.

<https://waterdata.usgs.gov/nwis/sw>



Region	Number of Gages						Median of Individual Gage Percentiles	DMP Index Severity
	Total Reporting for Nov.	≥0 to ≤2 Percentile	>2 to ≤10 Percentile	>10 to ≤20 Percentile	>20 to ≤30 Percentile	>90th Percentile		
Western	8	0	0	0	0	0	68	0
CT River Valley	15	0	0	1	0	0	51	0
Central	11	0	0	0	0	0	65	0
Northeast	13	0	0	1	0	1	53	0
Southeast	12	0	0	0	0	0	57	0

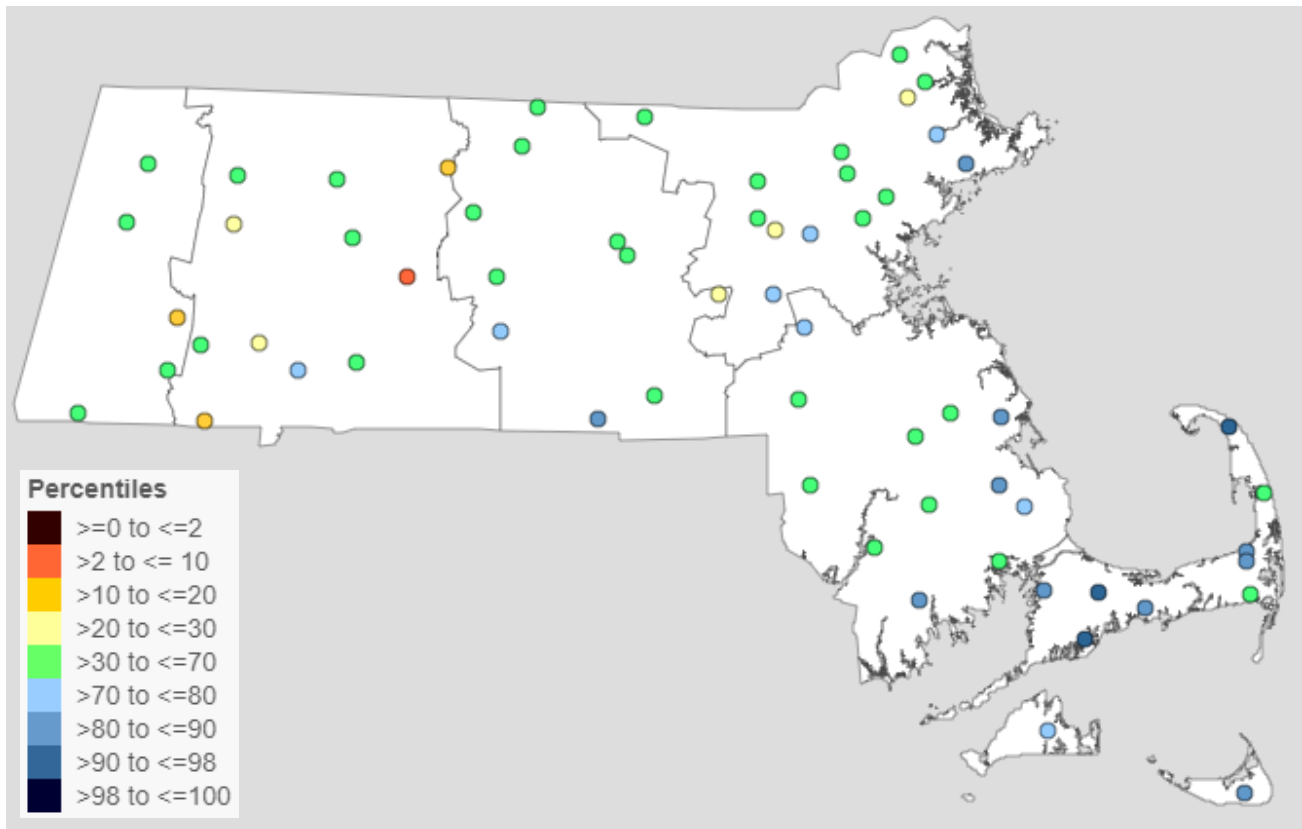
Notes: Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

GROUNDWATER

Groundwater levels continue to show some below 30th percentile values. Some of these wells have been below that threshold since the previous dry period that peaked in September and some have relapsed with this month's precipitation deficit.

End of November Groundwater Values Compared to Historical in the Climate Response Network

<https://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=crn&sc=25>



Region	Number of Wells						Median of Individual Percentiles	DMP Index Severity
	Total Reporting for Nov.	≥0 to ≤2 Percentile	>2 to ≤10 Percentile	>10 to ≤20 Percentile	>20 to ≤30 Percentile	>90th Percentile		
Western	5	0	0	1	0	0	38	0
CT River Valley	11	0	1	2	2	0	39	0
Central	10	0	0	0	1	0	46	0
Northeast	15	0	0	0	2	0	55	0
Southeast	12	0	0	0	0	0	64	0
Cape Cod	9	0	0	0	0	3	86	0
Islands	2	0	0	0	0	0	79	0

LAKES and IMPOUNDMENTS

At the end of November, all drought regions were at Index Severity 0.

Region	Total Reporting for Nov.	Median of Lakes and Impoundments Percentiles	DMP Index Severity
Western	2	51	0
CT River Valley	2	42	0
Central	1	63	0
Northeast	7	53	0
Southeast	2	61	0
Cape Cod	1	82	0
Islands	N/A	N/A	N/A

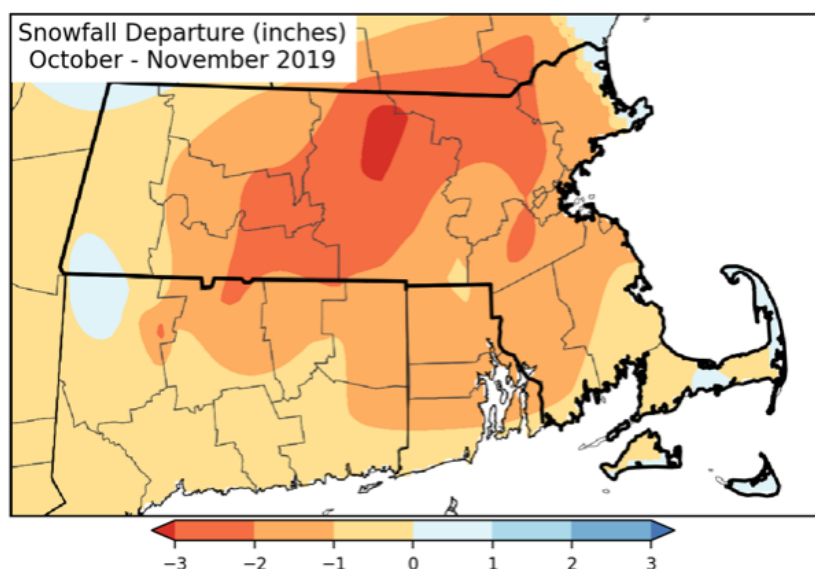
KEETCH BYRAM INDEX (KBDI)

Keetch Byram Index is reported seasonally.

CROP MOISTURE INDEX (CMI)

Crop Moisture Index is provided seasonally.

Season-to-date Snowfall Departure and Snow Cover

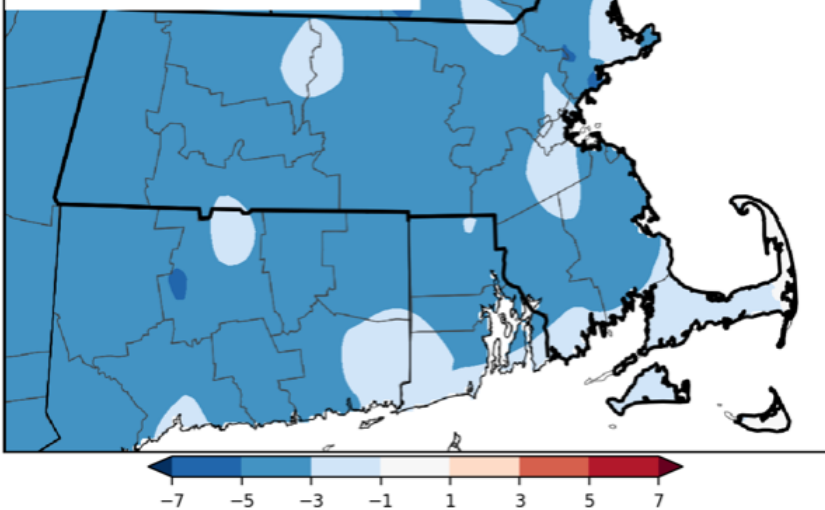


Season-to-date snowfall departure: Through November, snowfall is running 1-3 inches below normal for the majority of the state.
<http://www.nrcc.cornell.edu/regional/monthly/monthly.html>

Snow cover
 At the end of November, there was only a trace amount in a northwestern pocket of the state.
<https://www.nohrsc.noaa.gov/interactive/html/map.html>

TEMPERATURE

Avg Temperature Departure (°F)
November 2019



Temperature

Monthly average temperatures were below average for this time of the year. <http://www.nrcc.cornell.edu/regional/monthly/monthly.html>

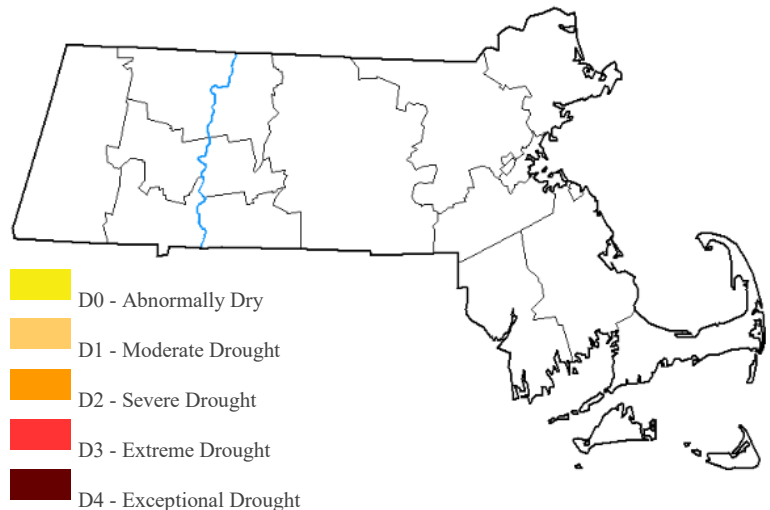
Boston daily temperatures ranged from 21° F to 72° F. Deviation from historical daily average temperatures ranged from -18.6 to +10° F. <https://w2.weather.gov/climate/index.php?wfo=box>
According to NOAA, Worcester had its 10th coldest November on record.

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor as of November 26, 2019

Summary: The USDM does not show drought conditions at the end of November.

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 33% -40% probability for above-normal temperatures and 33-40% probability of above-normal precipitation.

December through February: The outlook projects 33-40% probability of above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.

<https://www.cpc.ncep.noaa.gov/>

Monthly and Seasonal Drought Outlook

The monthly outlook for December and seasonal outlook valid through February do not project drought conditions. <http://www.cpc.ncep.noaa.gov/products/Drought/>

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Additional information, previous reports, and drought management information can be found at <https://www.mass.gov/water-data-tracking>.

Appendix I— Additional Precipitation Data

Standardized Precipitation Index November 2019

Drought Region	Number of Sites	SPI1	SPI2	SPI3	SPI6	SPI9	SPI12	SPI24	SPI36	Key to Drought Plan SPI Severity Levels	
										0	>-0.52
Western	4	0.35	0.93	0.28	-0.07	-0.25	0.15	0.93	0.76		
Connecticut River	12	-0.22	0.30	-0.31	-0.38	-0.22	0.10	1.29	1.08		
Central	13	-0.36	0.69	0.02	0.36	0.58	0.60	1.67	1.47	1	≤ -0.52 and > -0.84
Northeast	14	-0.14	0.47	-0.18	0.36	0.49	0.39	1.15	1.03	2	≤ -0.84 and > -1.28
Southeast	16	0.01	0.51	-0.05	0.22	0.57	0.57	1.48	1.08	3	≤ -1.28 and > -2.05
Cape Cod	4	-0.16	0.74	0.57	0.53	0.72	0.81	1.33	1.37		
Islands	2	-0.78	0.47	0.34	0.64	0.85	1.42	0.83	1.04	4	≤ -2.05

Percent of Average Historical Precipitation

Major Basin	Number of Sites	Historical Average (inches)	November Average (inches)	Departure from Historical (inches)	Percent of Historical
Western	4	3.48	3.93	0.34	110
Connecticut River	12	3.68	2.88	-0.71	81
Central	13	4.07	3.23	-1.07	77
Northeast	14	4.07	3.33	-0.96	77
Southeast	16	4.32	3.88	-0.47	89
Cape Cod	4	4.26	3.44	-0.55	86
Islands	2	4.05	2.41	-1.64	59

DCR Precipitation Reports are available at: <https://www.mass.gov/service-details/precipitation-composite-estimates-1> and <https://www.mass.gov/service-details/standardized-precipitation-index-spi-0>

Appendix II— Drought Management Plan Information

The Massachusetts Drought Management Plan (DMP) can be found at <https://www.mass.gov/doc/massachusetts-drought-management-plan/download>. The document provides details on the Drought Indices, how Drought Levels are determined, and actions associated with each drought level.

Drought Levels (Section 3.1 of the DMP)

Level 0 - Normal
 Level 1 - Mild Drought
 Level 2 - Significant Drought
 Level 3 - Critical Drought
 Level 4 - Emergency Drought

Index Severity Levels (Section 3.4 of the DMP)

Severity Level	Standardized Precipitation	Stream-flow	Lakes and Impoundments	Ground-water	Keetch-Byram Drought	Crop Moisture
0	>30 th percentile				< 200	> -1.0
1	≤30 and >20				200-400	≤-1.0 and > -2.0
2	≤20 and >10				400-600	≤-2.0 and < -3.0
3	≤10 and >2				600-700	≤ -3.0 and > -4.0
4	≤2				700-800	≤-4.0