

MASSACHUSETTS WATER RESOURCES COMMISSION

NOVEMBER 2021 HYDROLOGIC CONDITIONS IN MASSACHUSETTS



The Commonwealth of Massachusetts
Charles D. Baker, Governor

Kathleen A. Theoharides, Secretary, Executive Office of Energy and Environmental Affairs

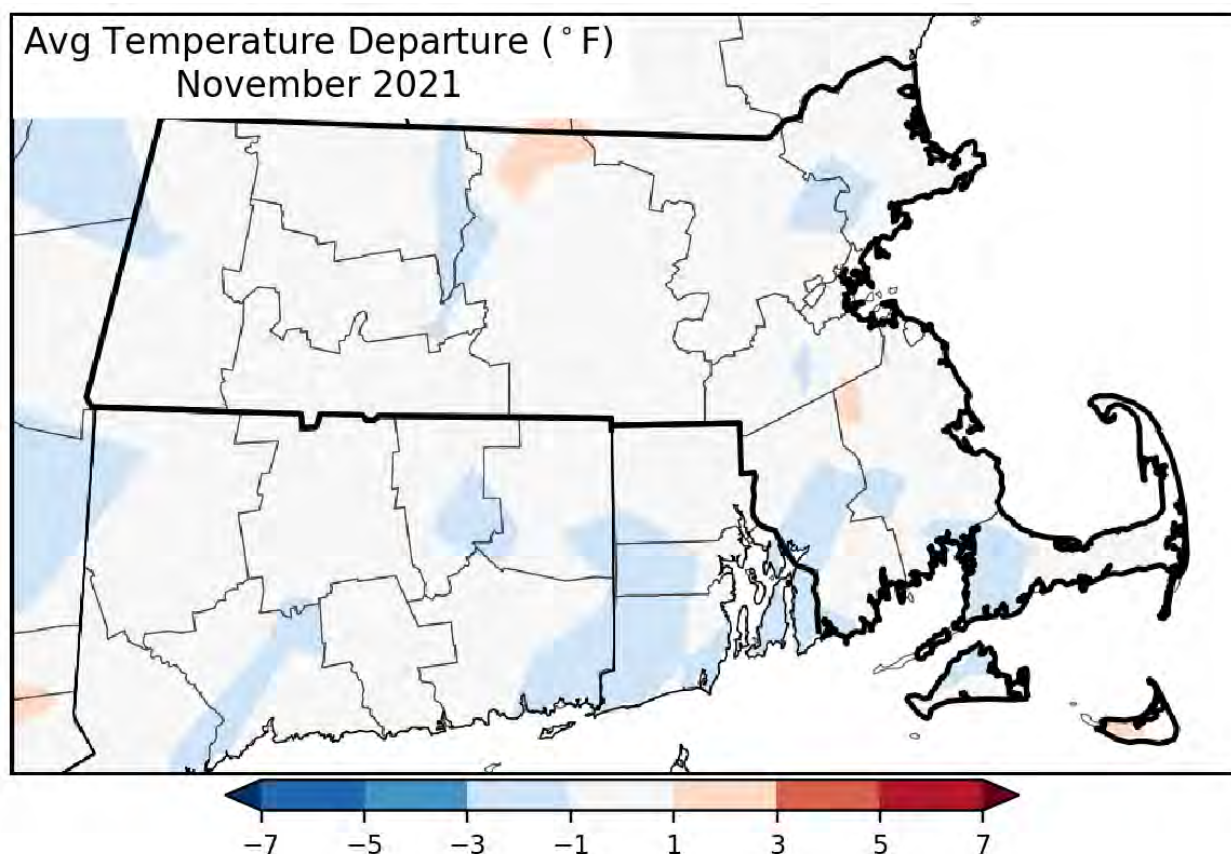
NOVEMBER 2021 HYDROLOGIC CONDITIONS SUMMARY OF CONDITIONS

- Monthly average temperatures were near normal.
- Monthly precipitation was below normal across much of the state. The 1-month SPI Index Severity is at Level 0 for the Western region; at Level 1 for the Connecticut River Valley, Central, Northeast, Cape Cod, and Islands regions; and at Level 2 for the Southeast region.
- Snowfall is a few inches below normal for the season with minor snow cover at the end of the month in the central and western parts of the state.
- Streamflow was mostly above normal across the state. All regions are at Index Severity Level 0.
- Groundwater levels were mostly above normal across the State. All regions are at Index Severity Level 0 except for the Islands, which is at Level 1.
- Lakes & Impoundments were mostly much above normal.
- NOAA's December outlook shows equal chances of below-normal, normal, or above-normal temperatures and precipitation.
- NOAA's 3-month outlook shows chances likely for above-normal temperatures and equal chances of below-normal, normal, or above-normal precipitation.
- Appendices I and II provide additional precipitation data and information on the Massachusetts Drought Management Plan (DMP), respectively.

TEMPERATURE

Monthly average temperatures were near normal.

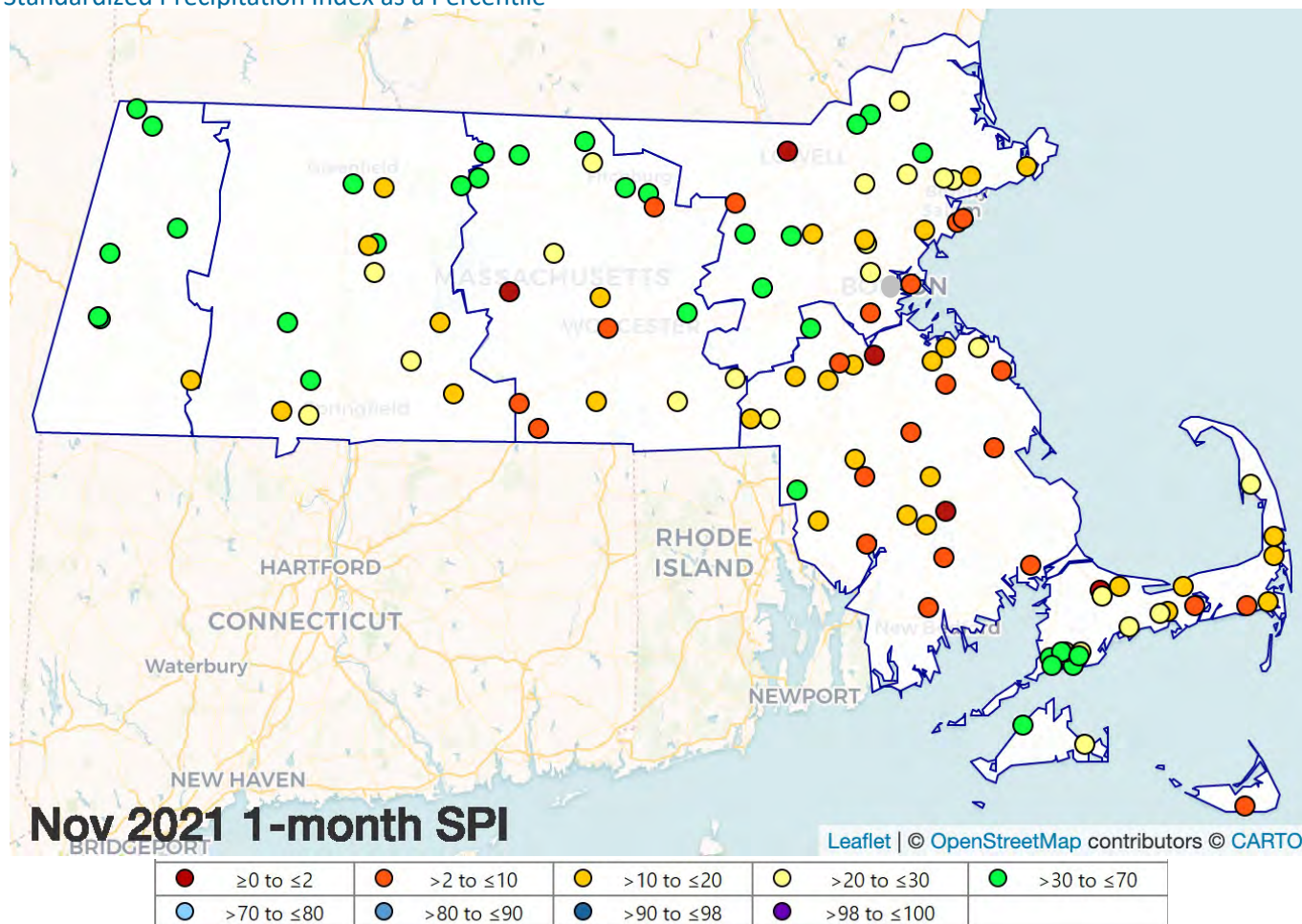
<http://www.nrcc.cornell.edu/regional/monthly/monthly.html>



PRECIPITATION

November precipitation was below normal especially in the central to eastern parts of the state. The 1-month SPI Index Severity is at Level 0 for the Western region; at Level 1 for the Connecticut River Valley, Central, Northeast, Cape Cod, and Islands regions; and at Level 2 for the Southeast region. However, longer periods from the two-month to 12-month look-back are above-normal. Appendix I provides additional details for precipitation data, including longer look-back periods.

Standardized Precipitation Index as a Percentile



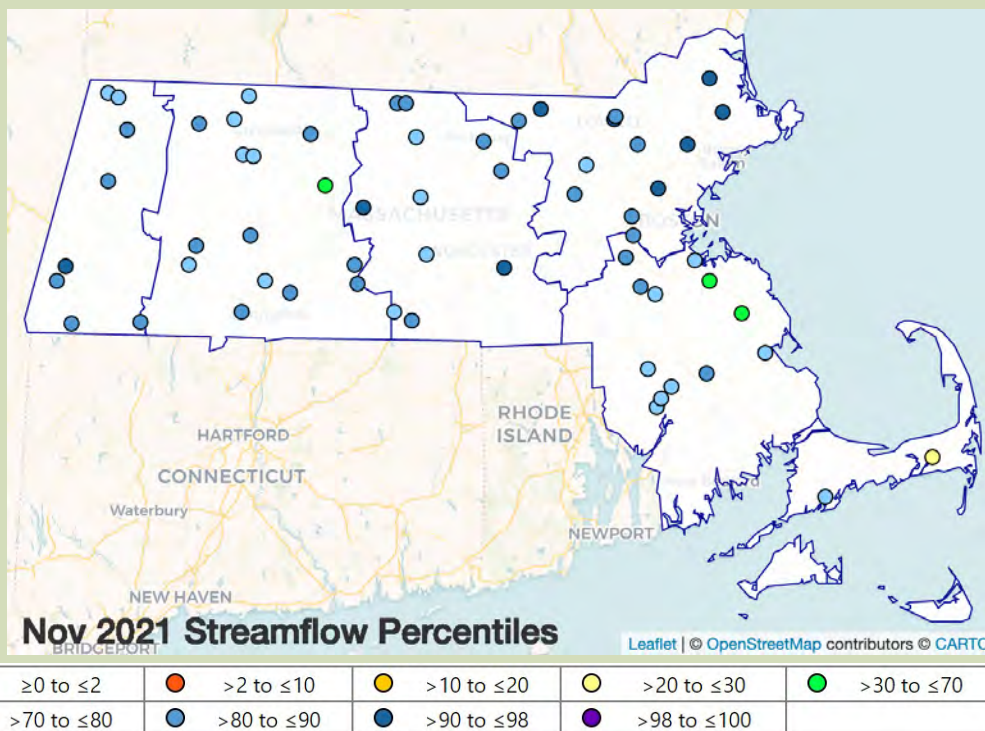
REGION	NUMBER OF SITES REPORTING	NOVEMBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	7	2.67	-1.01	37	85	98
CTRV	13	2.30	-1.32	28	68	91
CENTRAL	18	2.31	-1.68	23	84	96
NORTHEAST	25	2.16	-1.84	21	89	98
SOUTHEAST	27	1.99	-2.31	12	83	96
CAPE COD	20	2.61	-1.57	26	96	86
ISLANDS	3	2.72	-1.45	22	83	77

DMP Index Severity Levels			
1	2	3	4

STREAMFLOW

Streamflow was above normal during much of November for most of the state. All regional monthly streamflow medians were above the 70th percentile except for the Cape Cod region, which was in the normal range. All regions are at Index Severity Level 0.

Median Monthly Streamflow Percentiles Compared to Historical Values



REGION	TOTAL GAGES REPORTING FOR NOV	≥ 0 TO ≤ 2 PERCENTILE	> 2 TO ≤ 10 PERCENTILE	> 10 TO ≤ 20 PERCENTILE	> 20 TO ≤ 30 PERCENTILE	> 90 PERCENTILE	MEDIAN OF INDIVIDUAL GAGE PERCENTILES
WESTERN	8	0	0	0	0	1	86
CTRV	15	0	0	0	0	0	81
CENTRAL	11	0	0	0	0	2	82
NORTHEAST	13	0	0	0	0	6	88
SOUTHEAST	12	0	0	0	0	0	78
CAPE COD	2	0	0	0	1	0	52

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

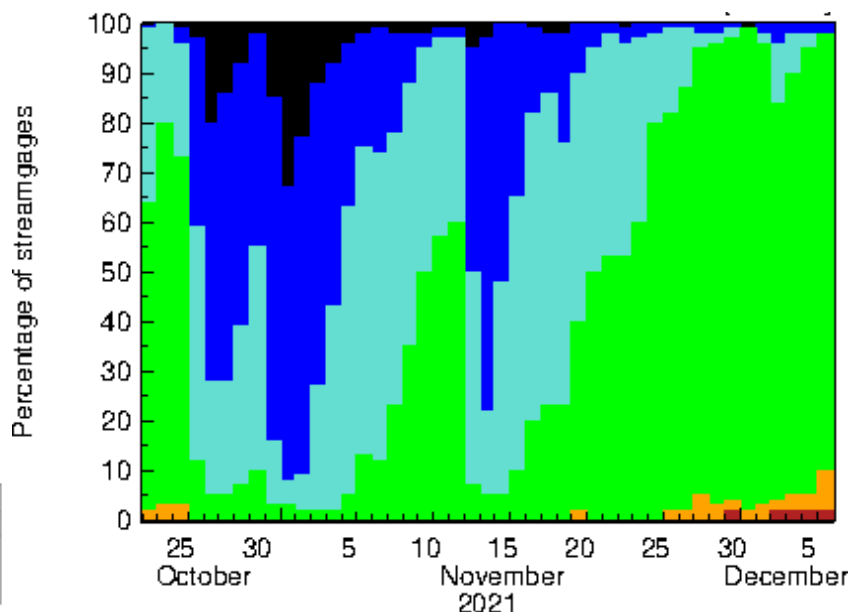
DMP Index Severity Levels			
1	2	3	4

Time Series of the Percent of Gages at Their Respective Percentile Flows for Average Daily Streamflows Compared to Historical Values

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

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

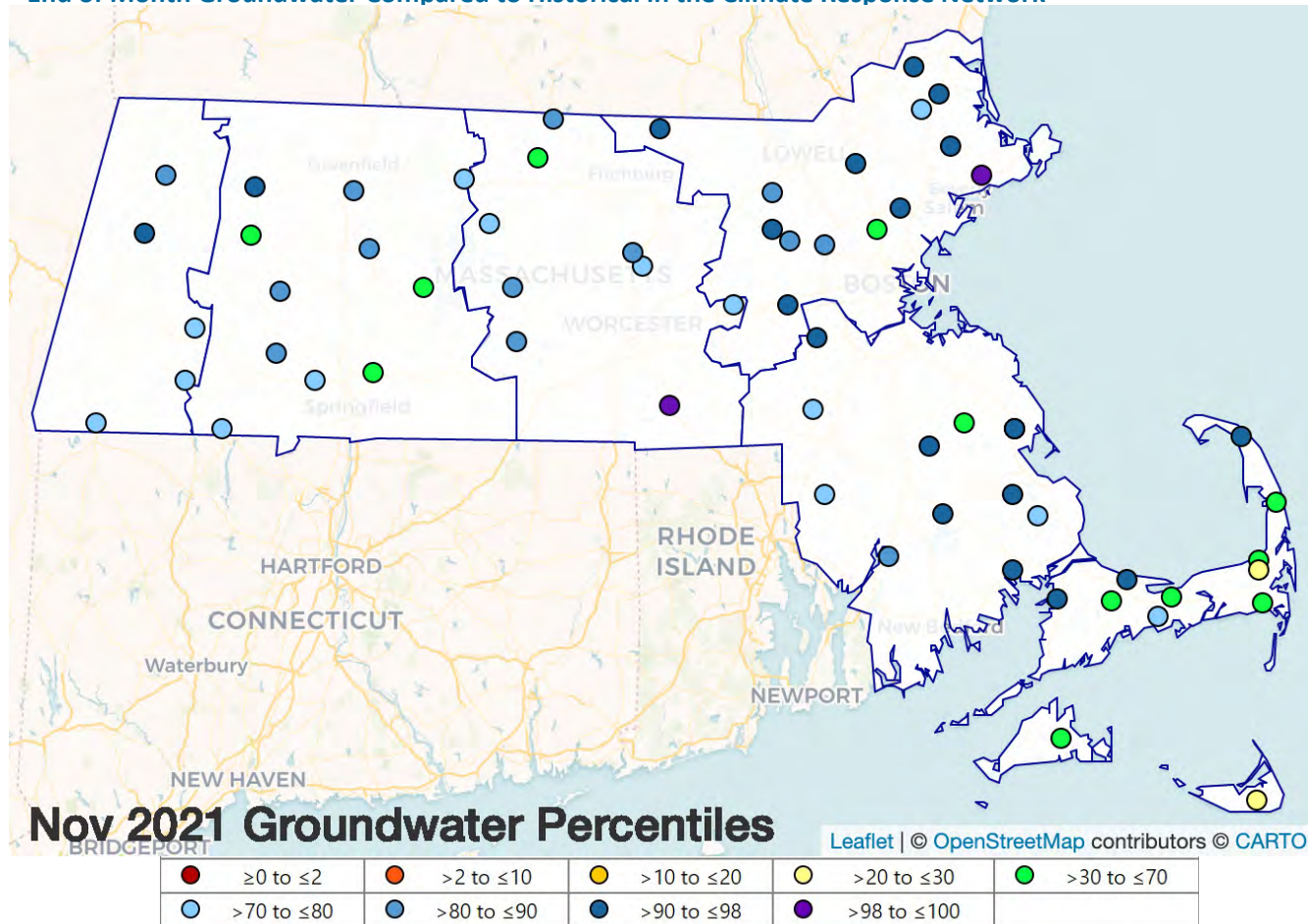
Explanation - Percentile classes							
Low	< 10	10-24	25-75	76-90	> 90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



GROUNDWATER

Percentiles of individual groundwater wells continued to be high throughout the state. The regional medians of individual well percentiles were well above normal for all regions except the Cape Cod and Islands regions, where Cape Cod was in the normal range and the Islands is at Index Severity Level 1. The well on Nantucket has not recovered from the 2020 drought. All regions except the Islands are at Index Severity Level 0.

End of Month Groundwater Compared to Historical in the Climate Response Network



REGION	TOTAL WELLS REPORTING FOR NOV	≥ 0 TO ≤ 2 PERCENTILE	> 2 TO ≤ 10 PERCENTILE	> 10 TO ≤ 20 PERCENTILE	> 20 TO ≤ 30 PERCENTILE	> 90 PERCENTILE	MEDIAN OF INDIVIDUAL WELL PERCENTILES
WESTERN	5	0	0	0	0	1	71
CTRV	11	0	0	0	0	1	80
CENTRAL	9	0	0	0	0	1	81
NORTHEAST	14	0	0	0	0	9	91
SOUTHEAST	12	0	0	0	0	6	90
CAPE COD	10	0	0	0	1	3	52
ISLANDS	2	0	0	0	1	0	28

DMP Index Severity Levels			
1	2	3	4

LAKE AND IMPOUNDMENTS

REGION	TOTAL REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	100
CTRV	2	88
CENTRAL	2	83
NORTHEAST	6	94
SOUTHEAST	1	99.2% full
CAPE COD	1	58

At the end of November, most lake and impoundment levels were much greater than their 30th percentile values and/or at or near 100% full. All regions are at Index Severity Level 0.

DMP Index Severity Levels do not necessarily reflect water supply status.

DMP Index Severity Levels			
1	2	3	4

KEETCH BYRAM DROUGHT INDEX (KBDI)

At the end of November, KBDI values were below 200. All regions are at Index Severity Level 0.

CROP MOISTURE INDEX (CMI)

CMI weekly values for the week ending November 27th were all in the Slightly Dry/Favorable Moist range. All MA drought regions are at Index Severity Level 0.

https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

SNOWFALL

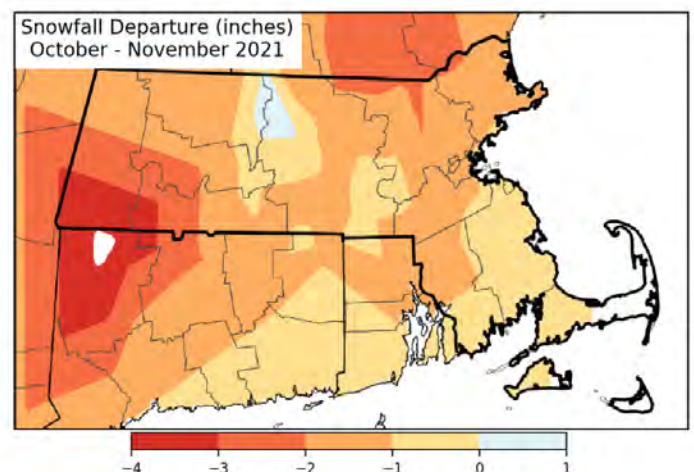
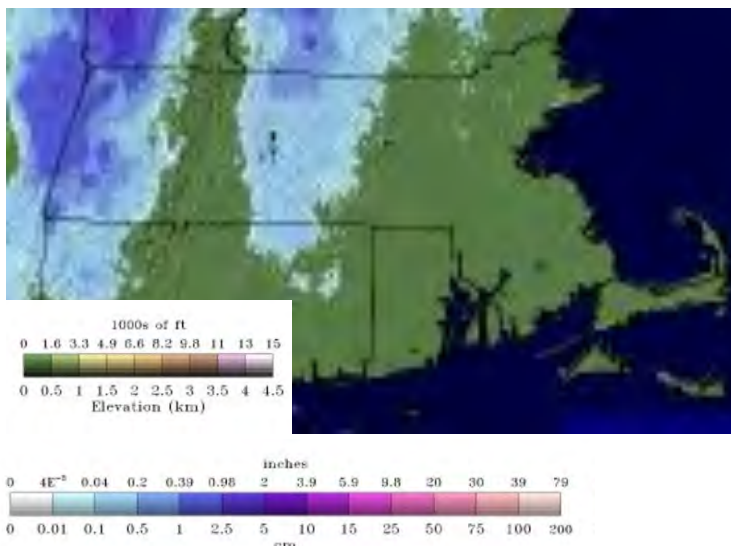
Snowfall is a few inches below normal for the season with minor snow cover at the end of the month in the central and western parts of the state.

Modeled Snow Water Equivalent at the End of the Month in Inches:

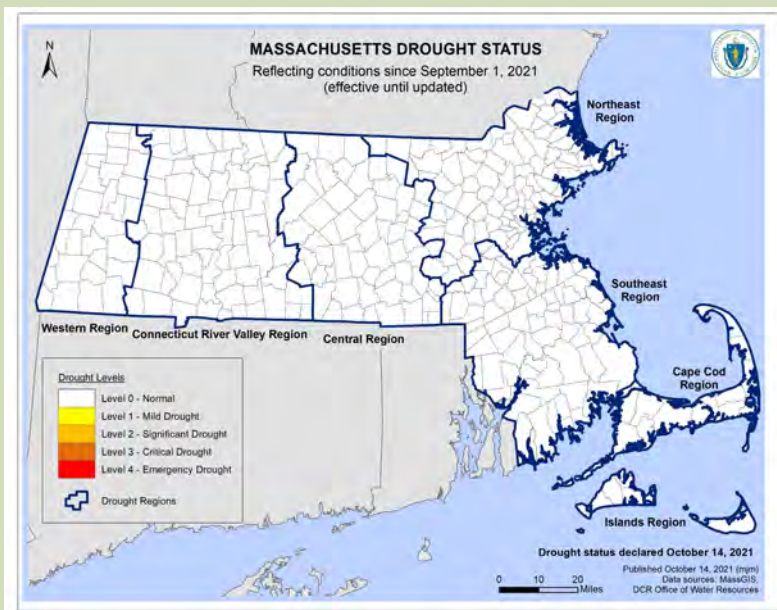
<https://www.nohrsc.noaa.gov/technology/>

Snowfall Departure:

<https://www.nrcc.cornell.edu/regional/monthly/monthly.html>



DROUGHT CONDITIONS AND FORECASTS



Massachusetts Drought Status

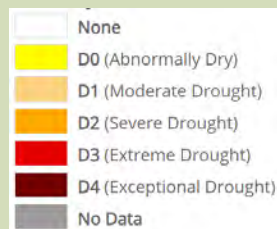
On October 14, 2021 Massachusetts Energy and Environmental Affairs (EEA) Secretary Kathleen Theoharides declared Level 0-Normal Conditions in the Cape Cod Region as well as the Western, Connecticut River Valley, Central, Northeast, Southeast, and Islands Regions. This status remains in effect until further updates.

Data through November 30, 2021; map released December 2, 2021

U.S. Drought Monitor (USDM)

At the end of November, the USDM showed no drought conditions in Massachusetts.

USDM maps are produced by the National Drought Mitigation Center (NDMC). For methods, weekly updates, and past maps see: <https://droughtmonitor.unl.edu>



NOAA Climate Prediction Center

Temperature and Precipitation Outlook

December: The outlook released 11/30 shows equal chances of below-normal, normal, or above-normal temperatures and precipitation.

December through February: The outlook released 11/18 shows a 50-60% probability of above-normal temperatures, and equal chances of below-normal, normal, or above-normal precipitation. <https://www.cpc.ncep.noaa.gov/>

The November 2021 NOAA Northeast Regional Quarterly Climate Impacts and Outlook focusing on winter climate patterns & outlook can be found at: <https://www.nrcc.cornell.edu/services/special/reports/lanina2021.pdf>

Monthly and Seasonal Drought Outlook

The monthly outlook for December released on 11/30 shows no drought development in the state. The seasonal outlook released on 11/18 and valid through February shows no drought development in the state.

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

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 12/07/2021. 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 2021 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	7	37	79	85	98	97	94	80	79
CTRV	13	28	58	68	91	90	90	70	71
CENTRAL	18	23	61	84	96	95	93	83	85
NORTHEAST	25	21	69	89	98	97	97	84	86
SOUTHEAST	27	12	61	83	96	92	94	80	82
CAPE COD	20	26	73	96	86	71	77	30	53
ISLANDS	3	22	56	83	77	62	80	52	75

DMP Index Severity Levels			
1	2	3	4

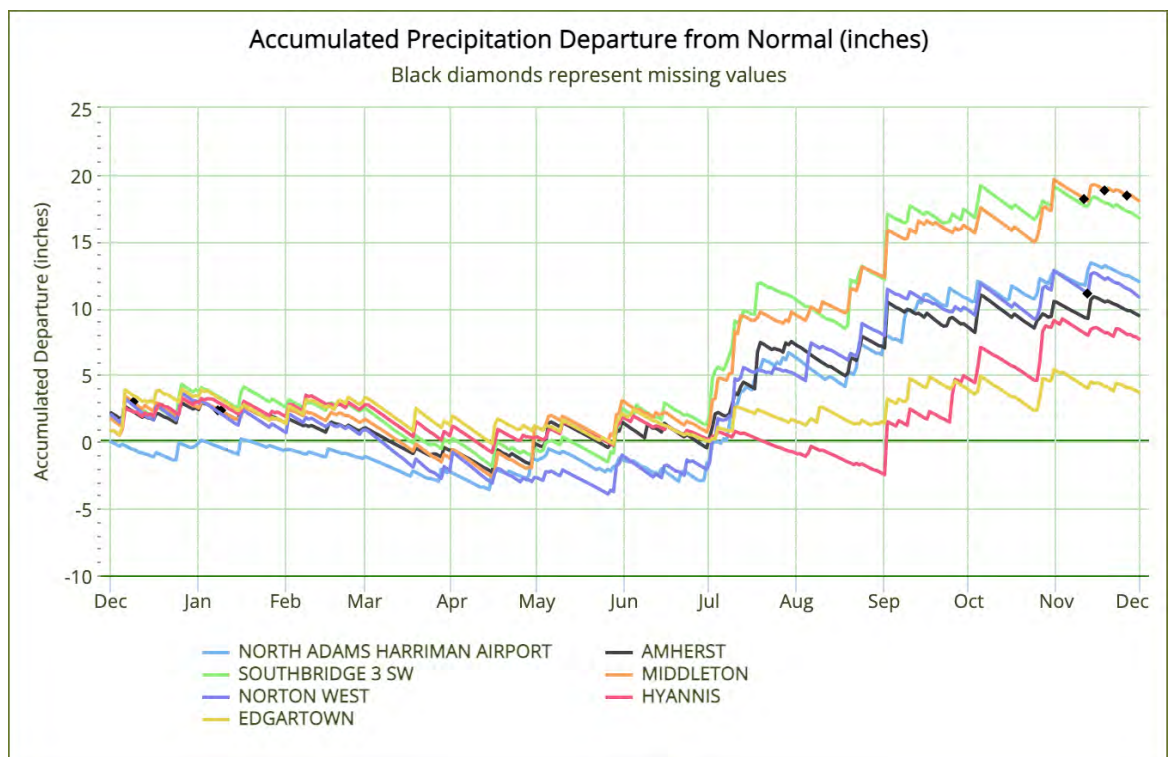
Percent of Average Historical Precipitation November 2021

REGION	NUMBER OF SITES	HISTORICAL AVERAGE	NOVEMBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	7	3.68	2.67	-1.01	73%
CTRV	13	3.62	2.30	-1.32	64%
CENTRAL	18	3.99	2.31	-1.68	58%
NORTHEAST	25	4.00	2.16	-1.84	54%
SOUTHEAST	27	4.30	1.99	-2.31	46%
CAPE COD	20	4.18	2.61	-1.57	62%
ISLANDS	3	4.17	2.72	-1.45	65%

Accumulated Precipitation Departure

Graph does not consider starting condition's wetness/dryness; does not show summer heat waves with high evapotranspiration; only one station per Drought Region is shown.

<https://xmacis.rcc-acis.org/>



APPENDIX II – DROUGHT MANAGEMENT PLAN INFOR-

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 INDEX (SPI)	STREAMFLOW	LAKES AND IMPOUNDMENTS	GROUNDWATER	KEETCH-BRYAM DROUGHT INDEX (KBDI)	CROP MOISTURE INDEX
0	> 30th 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

