

MASSACHUSETTS WATER RESOURCES COMMISSION

NOVEMBER **HYDROLOGIC CONDITIONS**
2022 IN MASSACHUSETTS



The Commonwealth of Massachusetts
Charles D. Baker, Governor

Bethany A. Card, Secretary, Executive Office of Energy and Environmental Affairs

NOVEMBER 2022 HYDROLOGIC CONDITIONS

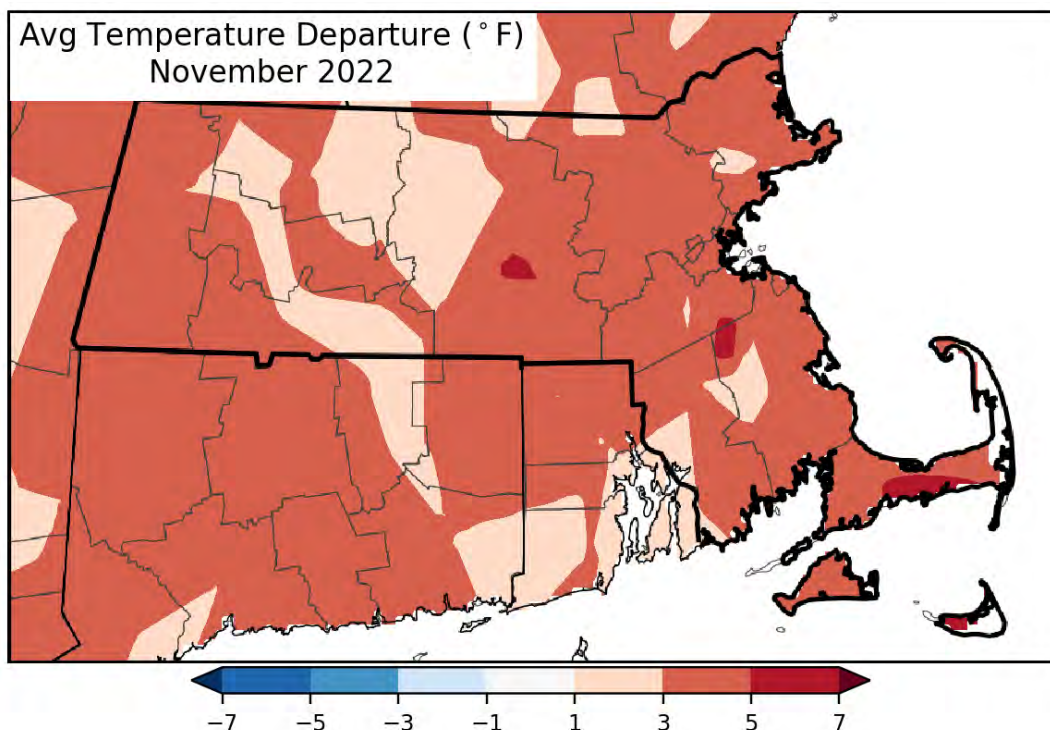
SUMMARY OF CONDITIONS

- Monthly average temperatures were above normal.
- Precipitation was mostly normal to below normal in November. Regionally, the Southeast received below-normal precipitation. Index Severity Levels (ISLs) remain elevated at look-back periods beyond 3-months for multiple Regions.
- Streamflow varied with numerous gages still below normal. However, on a regional basis, only the Cape Cod Region is elevated at ISL 1.
- Groundwater levels ranged from below normal to above normal. The CTRV, Northeast, and Cape Cod Regions are at ISL 1 and the Islands Region is at ISL 2.
- Lake and impoundment levels varied across the state with many levels below the 30th percentile. The CTRV, Northeast, and Cape Cod Regions are at ISL 2.
- The Keetch-Byram Drought Index was only elevated in the Northeast Region at ISL 1.
- The Evaporative Demand Drought Index for November was elevated across the entire state.
- NOAA's December outlook shows equal chances for below-normal, normal, or above-normal temperatures and precipitation.
- NOAA's 3-month outlook shows chances leaning for above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.
- Appendix II provides information on the Massachusetts Drought Management Plan (DMP).

TEMPERATURE

Monthly average temperatures were mostly above normal across the state. According to the Northeast Regional Climate Center, the Boston climate site had its 7th warmest November on record, and the Worcester site had its 4th warmest.

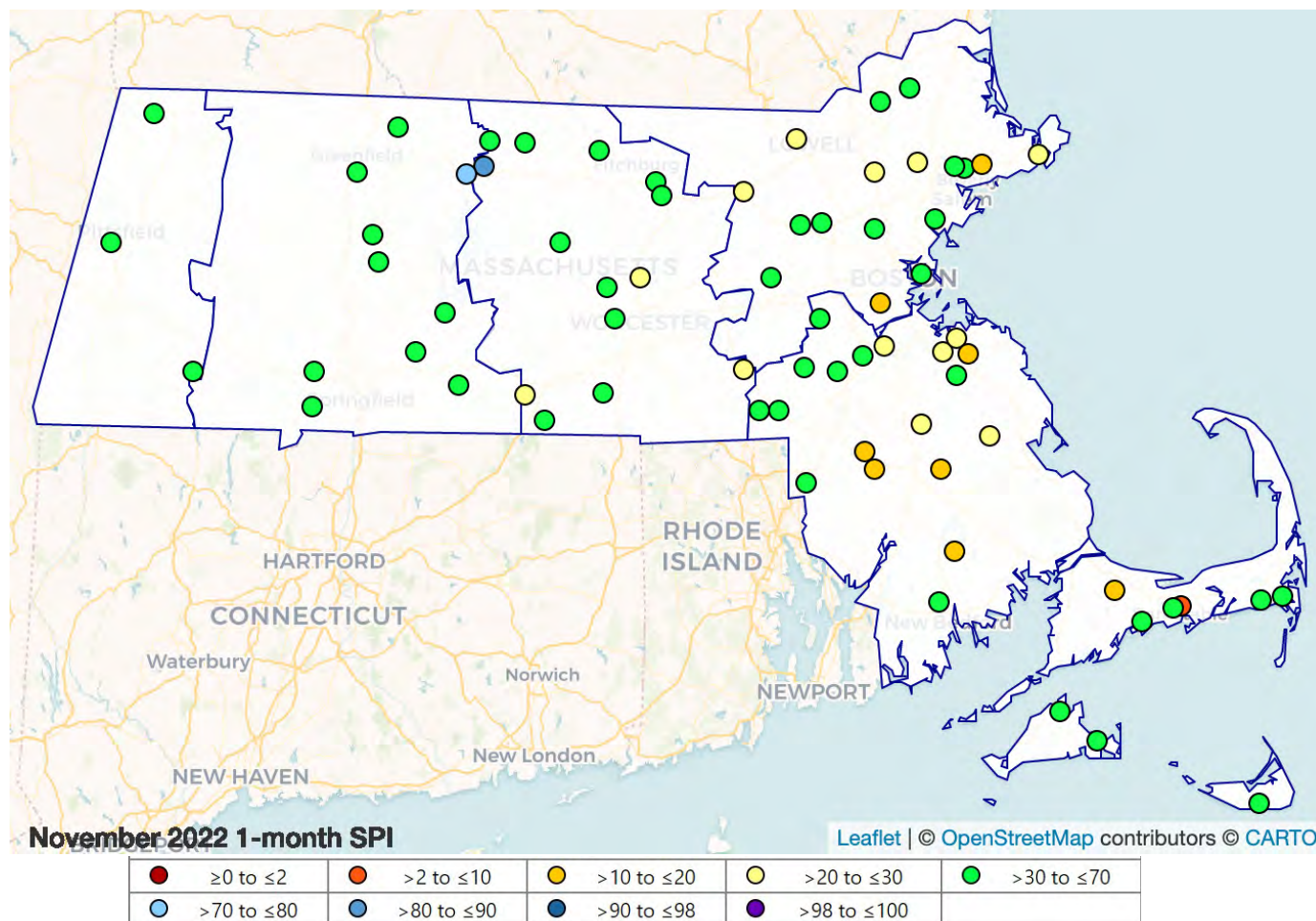
<http://www.nrcc.cornell.edu/regional/monthly/monthly.html>



PRECIPITATION

November precipitation was mostly normal in the western half of the state to below normal in the eastern half. Regionally the Southeast Region was the only one at an elevated Index Severity Level (ISL). However, longer look-back periods are still showing deficits in most Regions and ISLs remain elevated at look-back periods beyond the 3-month time period. In addition to the table below, Appendix I provides all look-back periods.

Standardized Precipitation Index (SPI) 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	3	3.52	-0.25	57	69	24
CTRV	10	3.44	-0.20	49	75	36
CENTRAL	14	3.45	-0.61	44	71	41
NORTHEAST	17	2.79	-1.24	32	40	11
SOUTHEAST	20	2.79	-1.50	30	66	43
CAPE COD	6	3.64	-0.59	57	71	46
ISLANDS	3	3.94	-0.25	52	72	49

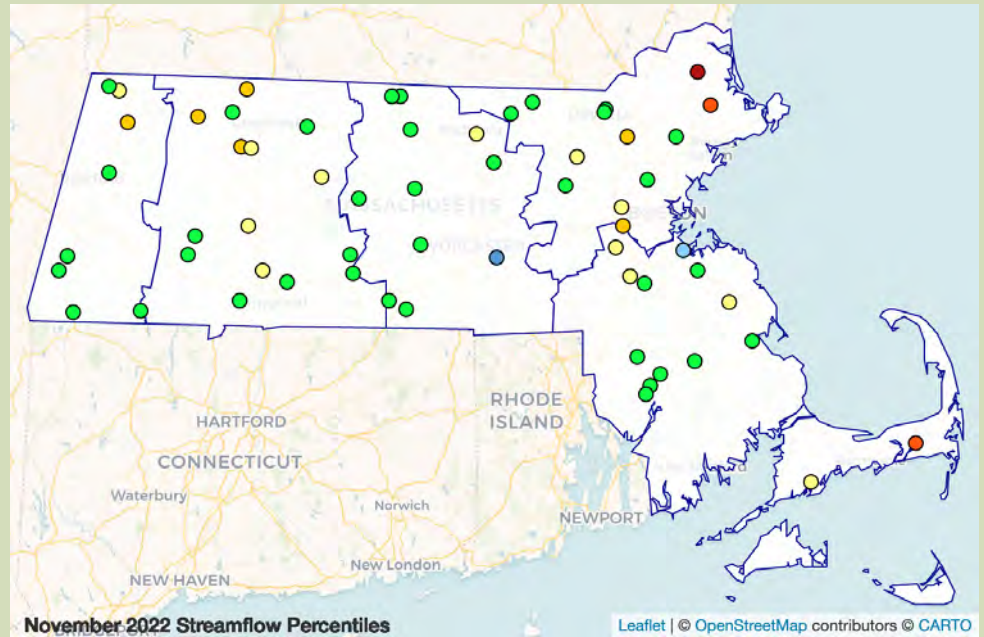
SPI is the Standardized Precipitation Index used in the Drought Management Plan (DMP) expressed here as a percentile and represents the variation, in standard deviations, from long-term precipitation averages.

DMP Index Severity Levels			
1	2	3	4

STREAMFLOW

During November, percentiles of individual streamflow gages varied across the state from significantly below normal to above normal. Monthly percentiles were in the below-normal range for some gages in all regions, and especially in the Northeast and CTRV Regions. The Cape Cod Region remains at Index Severity Level 1, the only elevated region.

Median Monthly Streamflow Percentiles Compared to Historical Values



●	≥0 to ≤2	●	>2 to ≤10	●	>10 to ≤20	●	>20 to ≤30	●	>30 to ≤70
●	>70 to ≤80	●	>80 to ≤90	●	>90 to ≤98	●	>98 to ≤100		

REGION	NUMBER OF GAGES REPORTING	≥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	1	1	0	41
CTRV	15	0	0	2	5	0	33
CENTRAL	11	0	0	0	1	0	49
NORTHEAST	13	1	1	2	2	0	31
SOUTHEAST	12	0	0	0	3	0	37
CAPE COD	2	0	0	1	1	0	21

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

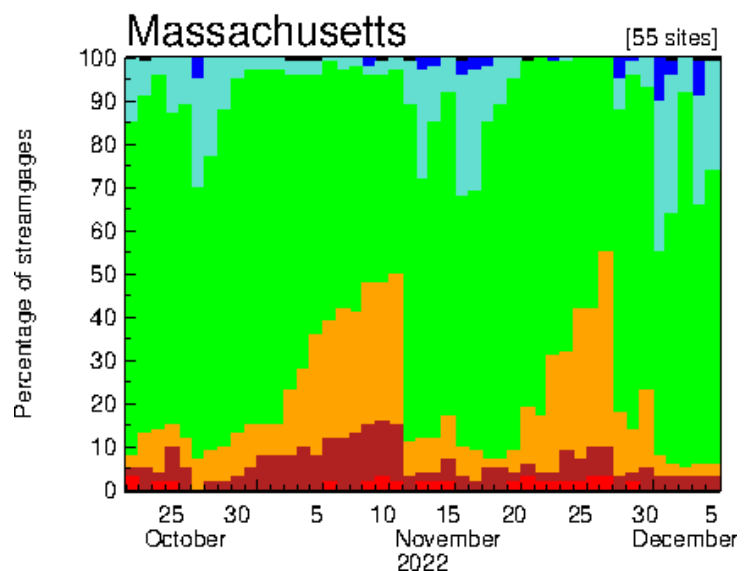
DMP Index Severity Levels			
1	2	3	4

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.

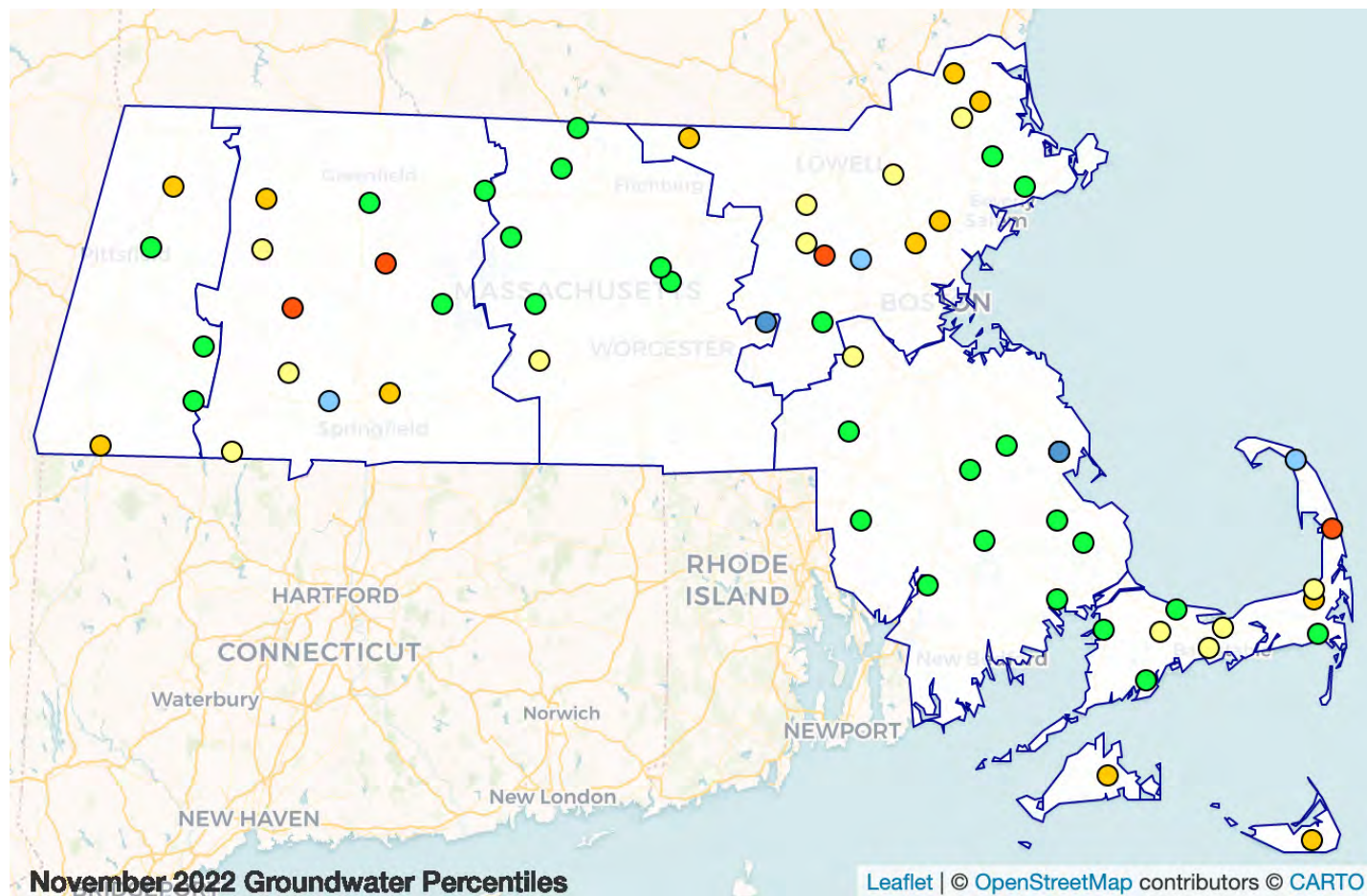
<https://waterdata.usgs.gov/nwis/sw>

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

November groundwater levels ranged across the state from below normal to above normal. Regional medians of individual well percentiles improved as compared to October in some regions and declined in others. The Cape Cod Region remains at Index Severity Level 1 and the Islands Region remains at Index Severity Level 2 while the CTRV and Northeast Regions are now at Level 1.



● ≥ 0 to ≤ 2	● > 2 to ≤ 10	● > 10 to ≤ 20	● > 20 to ≤ 30	● > 30 to ≤ 70
● > 70 to ≤ 80	● > 80 to ≤ 90	● > 90 to ≤ 98	● > 98 to ≤ 100	

REGION	NUMBER OF WELLS REPORTING	≥ 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	2	0	0	50
CTRV	11	0	2	2	3	0	24
CENTRAL	8	0	0	0	1	0	53
NORTHEAST	14	0	1	5	4	0	22
SOUTHEAST	12	0	0	0	1	0	46
CAPE COD	11	0	1	1	4	0	25
ISLANDS	2	0	0	2	0	0	14

DMP Index Severity Levels			
1	2	3	4

LAKE AND IMPOUNDMENTS

REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	35th
CTRV	2	17th
CENTRAL	3	45th
NORTHEAST	5	15th
SOUTHEAST	2	35th
CAPE COD	1	15th

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

At the end of November, many lake and impoundment levels were below their 30th percentile. The CTRV, Northeast, and Cape Cod Regions are at Index Severity Level 2.

DMP Index Severity Levels			
1	2	3	4

REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	2	0
CTRV	4	1
CENTRAL	5	9
NORTHEAST	3	258
SOUTHEAST	4	2
CAPE COD	4	10
ISLANDS	2	0

KEETCH-BYRAM DROUGHT INDEX (KBDI)

At the end of November, KBDI values were still elevated in the Northeast Region, which is at Index Severity Level 1.

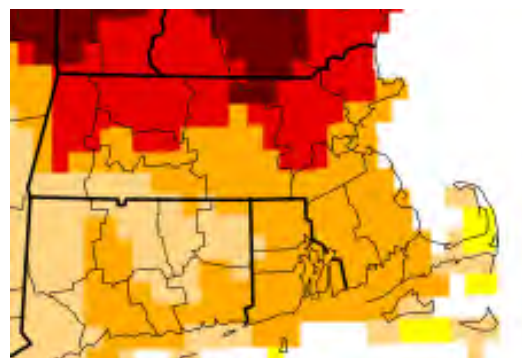
EVAPOTRANSPIRATION (ET) INDEX

Crop Moisture Index (CMI) - 2019 Drought Management Plan

At the end of November, CMI values were in the Slightly Dry/Favorably Moist range across the entire state. All Drought Regions are at Index Severity Level 0. https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

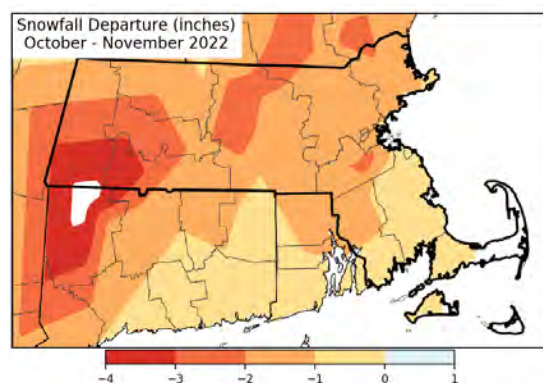
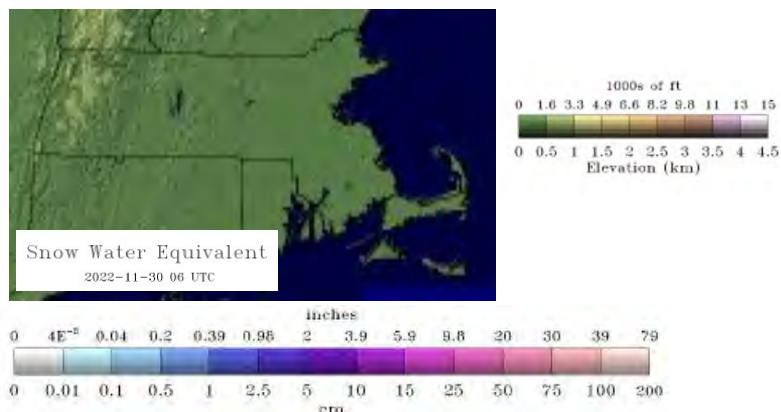
Evaporative Demand Drought Index (EDDI) - proposed 2022 Drought Management Plan

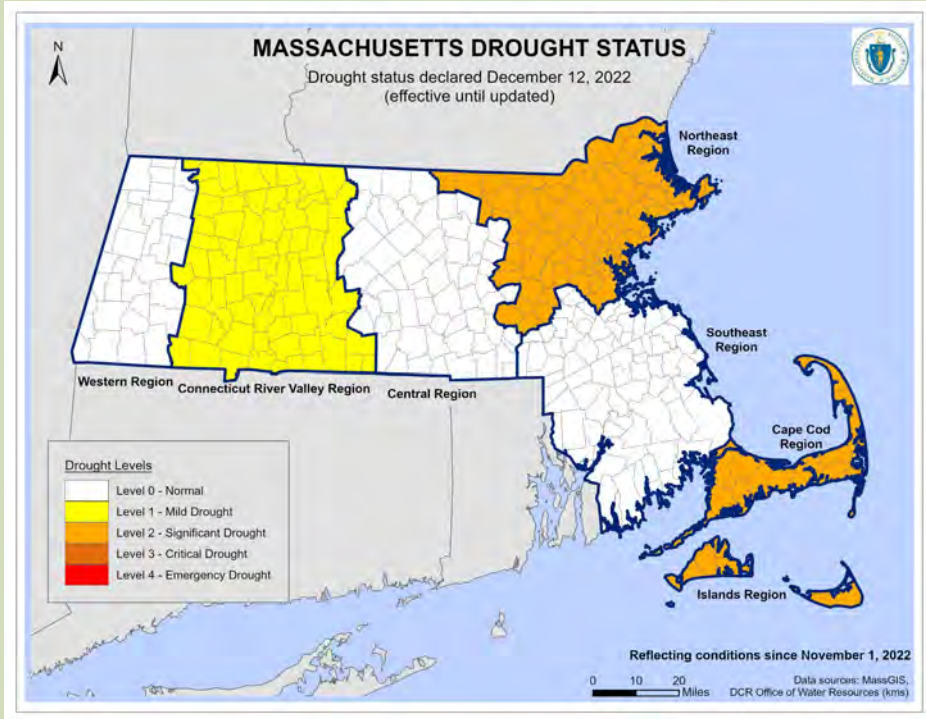
The 1-month EDDI shows areas of elevated ET across the state.



Map dated November 30th

SNOWFALL





DROUGHT

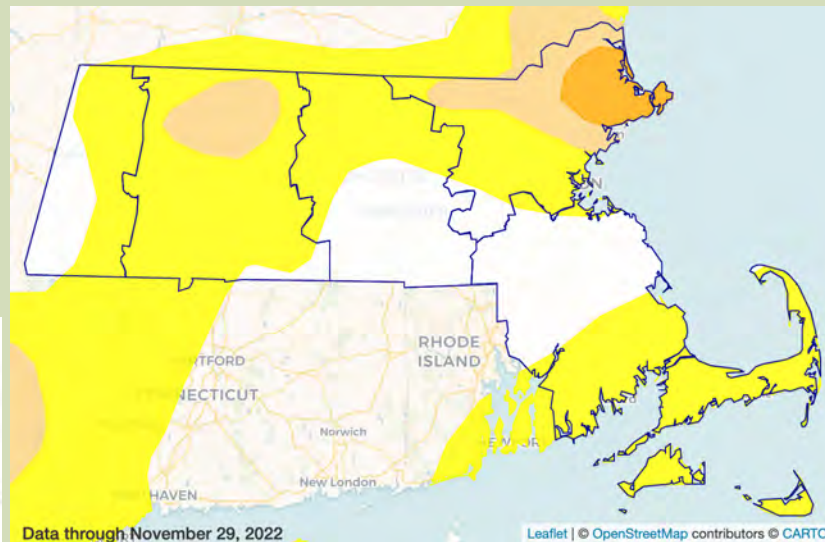
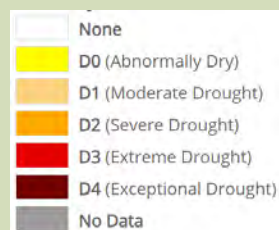
Massachusetts Drought Status

On December 12th Massachusetts Energy and Environmental Affairs (EEA) Secretary Bethany A. Card declared a Level 0 Normal Conditions for the Western, Central, and Southeast Regions; Level 1 Mild Drought for the CTRV; and Level 2 Significant Drought for the Northeast, Cape Cod, and Island Regions. This status remains in effect until further updated.

U.S. Drought Monitor (USDM)

At the end of November, the USDM showed areas of no drought and D0, D1, and D2 drought conditions in Massachusetts. These are equivalent to Massachusetts Drought Levels 0, 1, 2, and 3.

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 issued 11/30 shows equal chances for above-normal, normal, or below-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

December through February: The outlook issued 11/17 shows a 40-50% chance of above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation. <https://www.cpc.ncep.noaa.gov/>

Monthly and Seasonal Drought Outlook

The monthly outlook for December released on 11/30 shows drought remaining but improving in the northern part of Essex County, and drought removal likely in the southern part of Essex County and in the Connecticut River Valley along the state line. The seasonal outlook for December through February issued on 11/30 shows the same conditions stated above.

<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 12/07/2022. Additional information, previous reports, and the Massachusetts Drought Dashboard with weekly updates to the drought indices can be found at: <https://www.mass.gov/drought-monitoring>

APPENDIX I – ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index—November 2022 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	3	57	61	69	24	37	40	81	69
CTRV	10	49	52	75	36	36	35	76	63
CENTRAL	14	44	50	71	41	30	38	81	74
NORTHEAST	17	32	40	40	11	7	8	60	68
SOUTHEAST	20	30	56	66	43	18	19	70	60
CAPE COD	6	57	76	71	46	17	20	49	30
ISLANDS	3	52	75	72	49	30	23	38	24

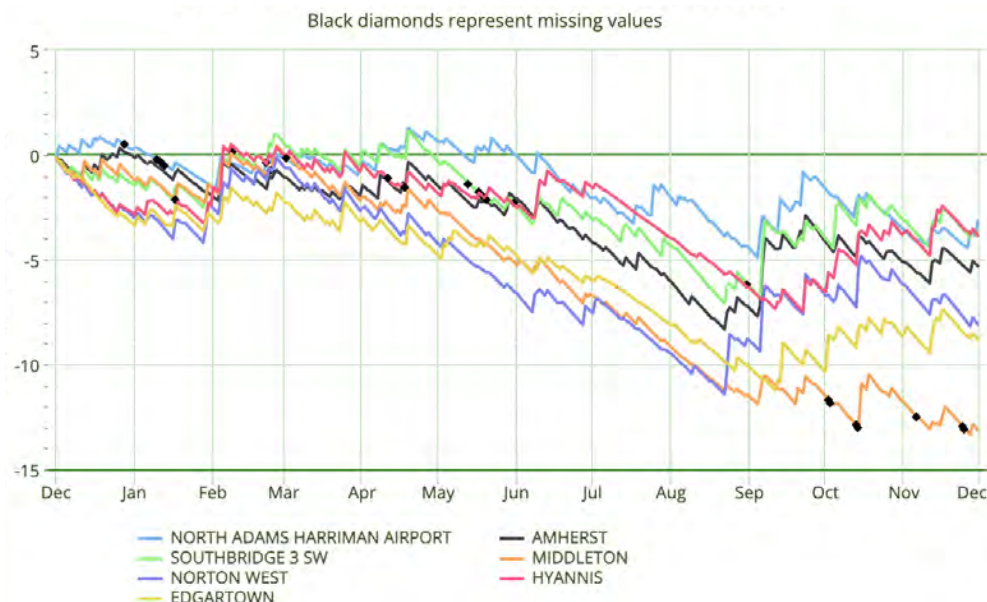
DMP Index Severity Levels			
1	2	3	4

Percent of Average Historical Precipitation—November 2022

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	NOVEMBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	3	3.77	3.52	-0.25	93%
CTRV	10	3.64	3.44	-0.20	95%
CENTRAL	14	4.06	3.45	-0.61	85%
NORTHEAST	17	4.03	2.79	-1.24	69%
SOUTHEAST	20	4.29	2.79	-1.50	65%
CAPE COD	6	4.23	3.64	-0.59	86%
ISLANDS	3	4.19	3.94	-0.25	94%

Accumulated Precipitation Departure from 30-Year Normals in Inches

Graph does not consider starting condition's wetness/dryness; does not show summer heat waves with high evapotranspiration; and shows only one station per Drought Region. <https://xmacis.rcc-acis.org/>



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 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

