MASSACHUSETTS WATER RESOURCES COMMISSION

DECEMBER

HYDROLOGIC CONDITIONS IN MASSACHUSETTS

The Commonwealth of Massachusetts
Maura T. Healey, Governor
Rebecca L. Tepper, Secretary, Executive Office of Energy and Environmental Affairs

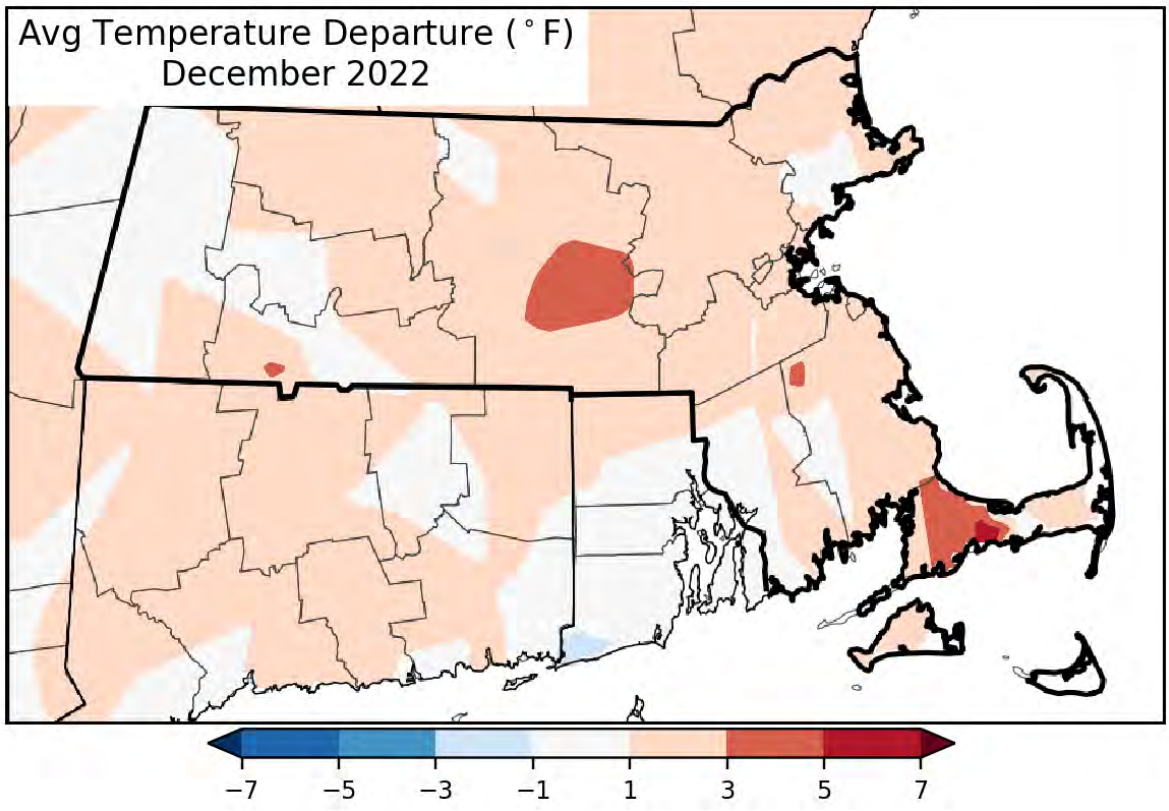
DECEMBER 2022 HYDROLOGIC CONDITIONS
SUMMARY OF CONDITIONS

- Monthly average temperatures were normal to above normal.
- Precipitation was normal to above normal in December. Index Severity Levels (ISLs) remain elevated at 6-months and longer look-back periods for multiple Regions.
- Streamflow was mostly normal to above normal. On a regional basis, only the Cape Cod Region is elevated at ISL 1.
- Groundwater levels ranged from below normal to above normal. The 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 some levels below the 30th percentile. The Central and Northeast Regions are at ISL1 and Cape Cod Region at ISL 2.
- Keetch Byram Drought Index and Evapotranspiration Index are outside of their reporting seasons.
- Snowfall is below normal across the state. At the end of December snow cover only remained in Berkshire county.
- NOAA's January outlook shows chances likely for above-normal temperatures and equal chances for below-normal, normal, or above-normal 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 normal to above normal across the state.

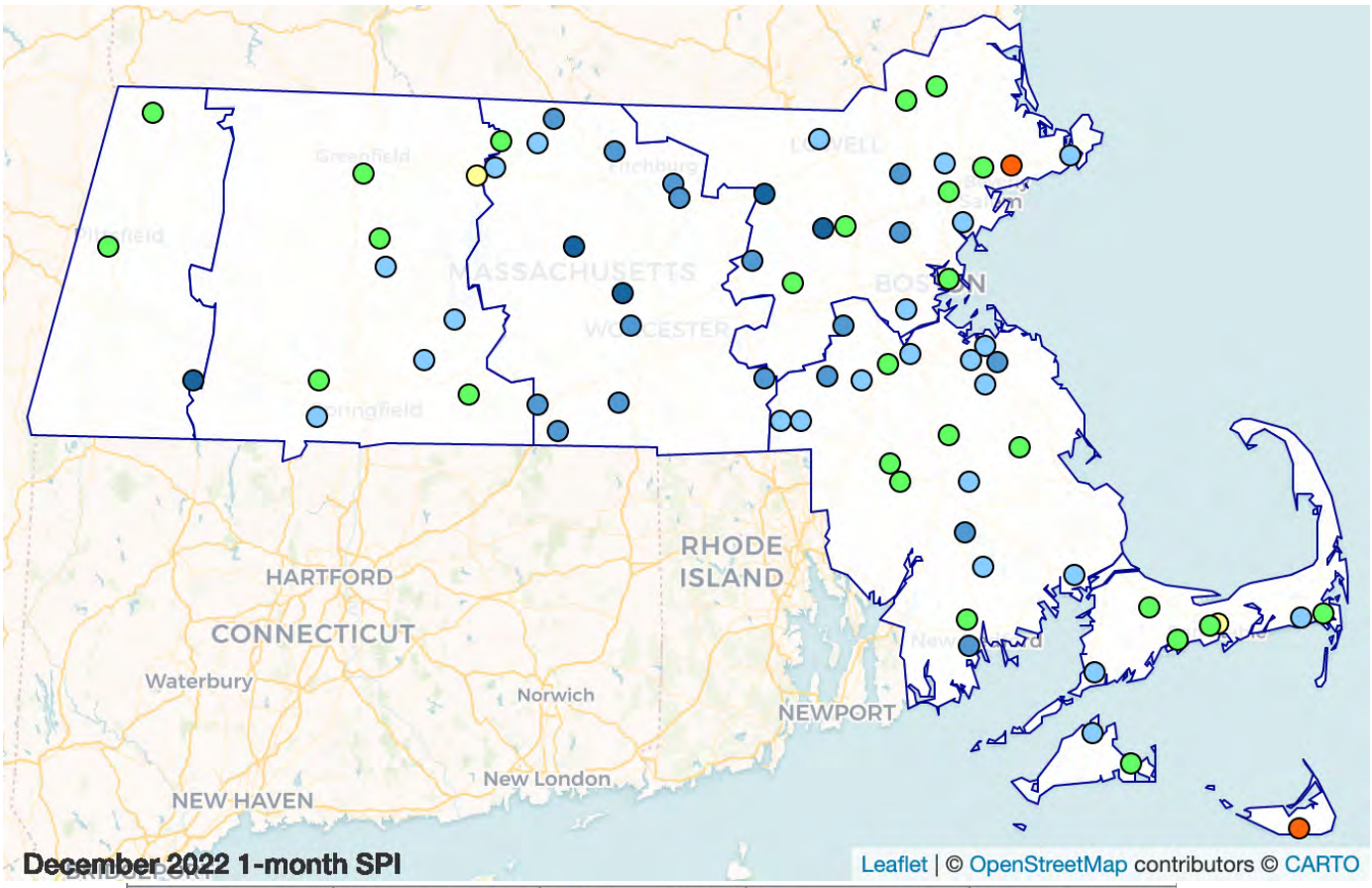
http://www.nrcc.cornell.edu/regional/monthly/monthly.html



PRECIPITATION

December precipitation was mostly normal to above normal and no Regions are elevated at the 1-month look-back period. However, longer look-back periods are still showing deficits in most Regions and ISLs remain elevated at the 6-month and longer look-back periods. In addition to the table below, Appendix I provides all look-back periods.

Standardized Precipitation Index (SPI) as a Percentile



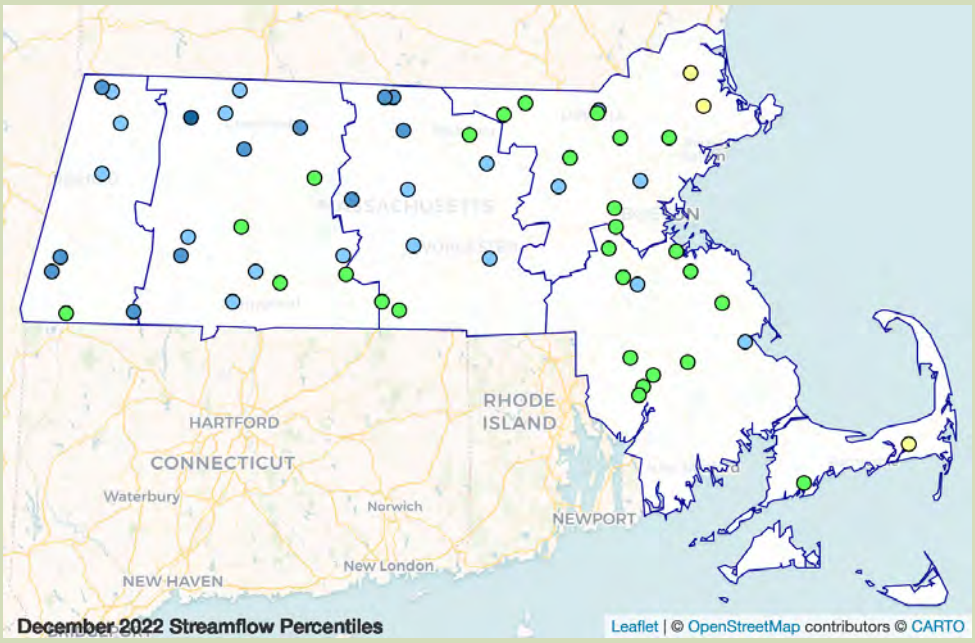
REGION	NUMBER OF SITES REPORTING	DECEMBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	3	4.55	1.10	65	68	39
CTRV	9	4.37	0.64	70	59	53
CENTRAL	14	5.94	1.97	84	72	66
NORTHEAST	18	5.11	1.15	74	51	25
SOUTHEAST	21	5.64	1.21	76	68	53
CAPE COD	7	4.60	0.20	60	76	36
ISLANDS	3	3.49	-0.75	44	71	35

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.

STREAMFLOW

During December, percentiles of individual streamflow gages were normal to above normal except for two gages in the Northeast Region and one gage in the Cape Cod Region. These gages are in areas where drought conditions have been persistent. 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	0	0	0	80
CTRV	14	0	0	0	0	1	76
CENTRAL	11	0	0	0	0	0	75
NORTHEAST	13	0	0	0	2	0	48
SOUTHEAST	12	0	0	0	0	0	65
CAPE COD	2	0	0	0	1	0	29

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

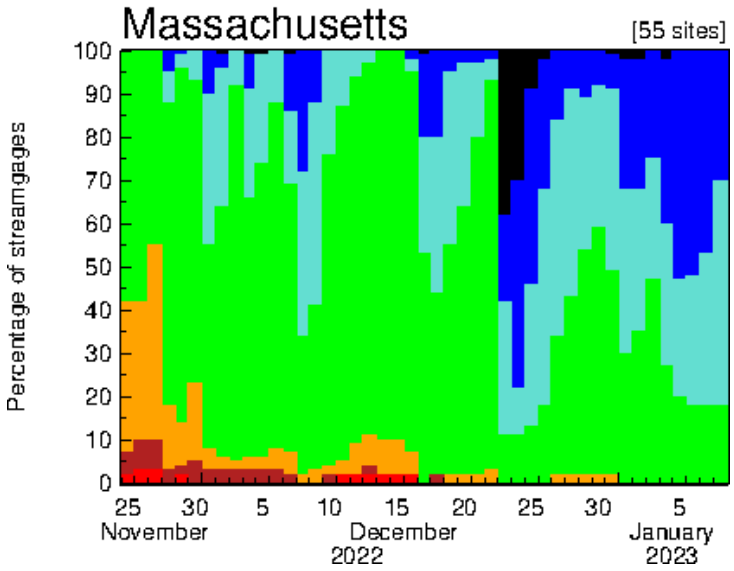
DMP Index Severity Levels			
1	2	3	4

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.

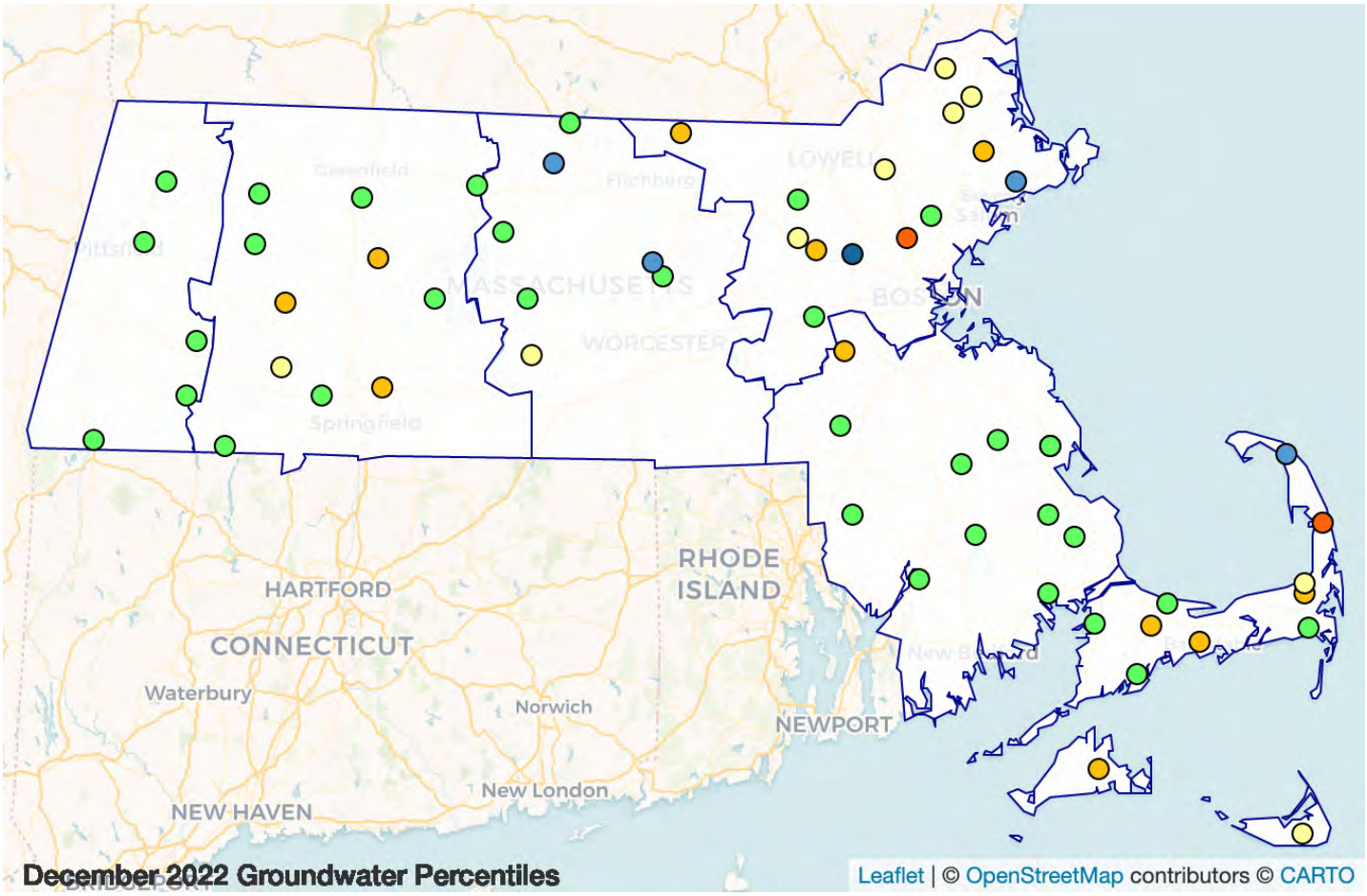
https://waterdata.usgs.gov/nwis/sw

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

December groundwater levels ranged across the state from below to above normal. Regional medians of individual well percentiles improved as compared to November in all Regions except the Western. The Cape Cod and Northeast Regions remain at Index Severity Level 1, and the Islands Region remains at Index Severity Level 2 while the CTRV is now at Level 0.



≥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	0	0	0	46
CTRV	11	0	0	3	1	0	42
CENTRAL	7	0	0	0	1	0	68
NORTHEAST	14	0	1	3	5	1	27
SOUTHEAST	12	0	0	1	0	1	52
CAPE COD	10	0	1	3	1	0	28
ISLANDS	2	0	0	1	1	0	16

LAKES AND IMPOUNDMENTS

REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	72nd
CTRV	2	34th
CENTRAL	3	30th
NORTHEAST	4	24th
SOUTHEAST	2	79th
CAPE COD	1	17th

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

At the end of December, some lake and impoundment levels were below their 30th percentile. The Central and Northeast Regions are at Index Severity Level 1, and the Cape Cod Region is at Index Severity Level 2.

DMP Index Severity Levels			
1	2	3	4

KEETCH-BYRAM DROUGHT INDEX(KBDI)

KBDI is reported seasonally.

EVAPOTRANSPIRATION (ET) INDEX

Crop Moisture Index (CMI) - 2019 Drought Management Plan

CMI is reported seasonally. https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

Evaporative Demand Drought Index (EDDI) - proposed 2023 Drought Management Plan

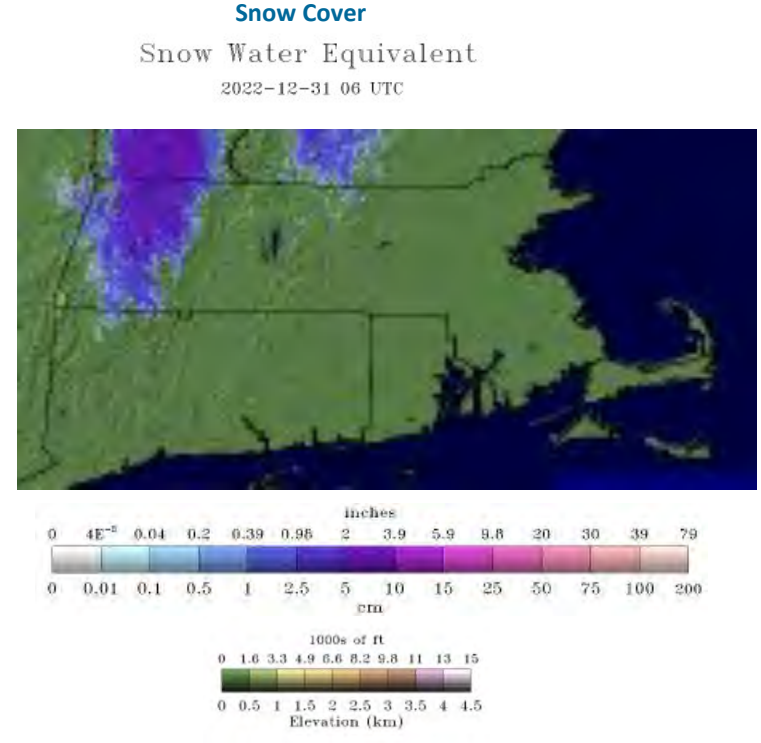
EDDI is reported seasonally. https://psl.noaa.gov/eddi

FLOODING

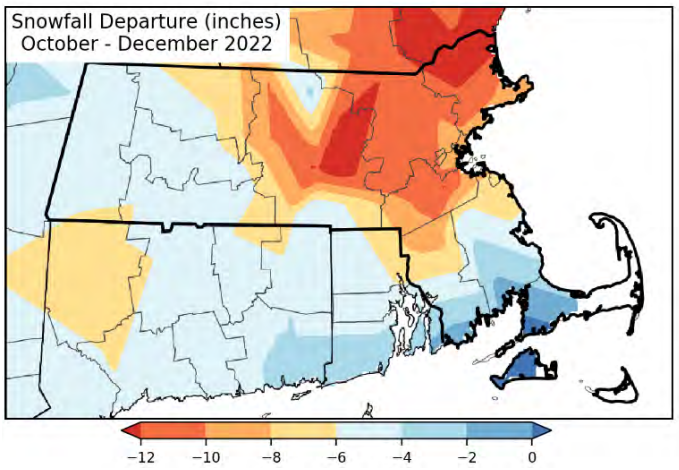
According to the NWS E-5 Monthly Report of Hydrologic Conditions for the Boston/Norton service area on December 23rd, strong winds and heavy rainfall caused coastal flooding, urban/poor drainage flooding and minor river flooding. In western MA, 1.5 to 2 inches of widespread rainfall combined with snowmelt to produce minor river flooding on the Green River at Colrain and on the Mill River at Northampton. No major impacts were reported from this flooding. In Fitchburg, heavy rainfall resulted in some minor street flooding.

SNOWFALL

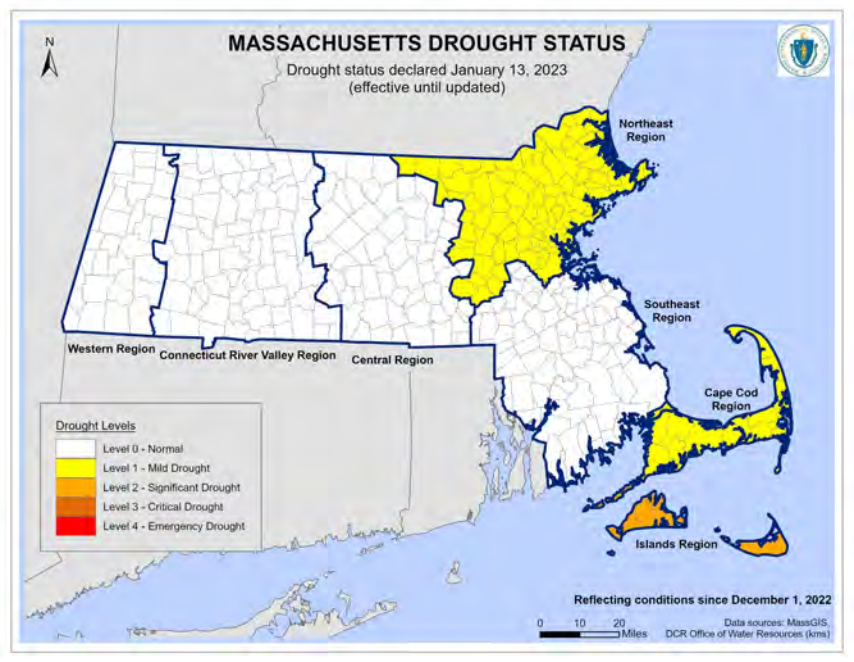
Snow Cover



Season-To-Date Snowfall Departure



DROUGHT CONDITIONS AND FORECASTS



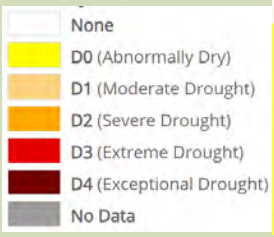
Massachusetts Drought Status

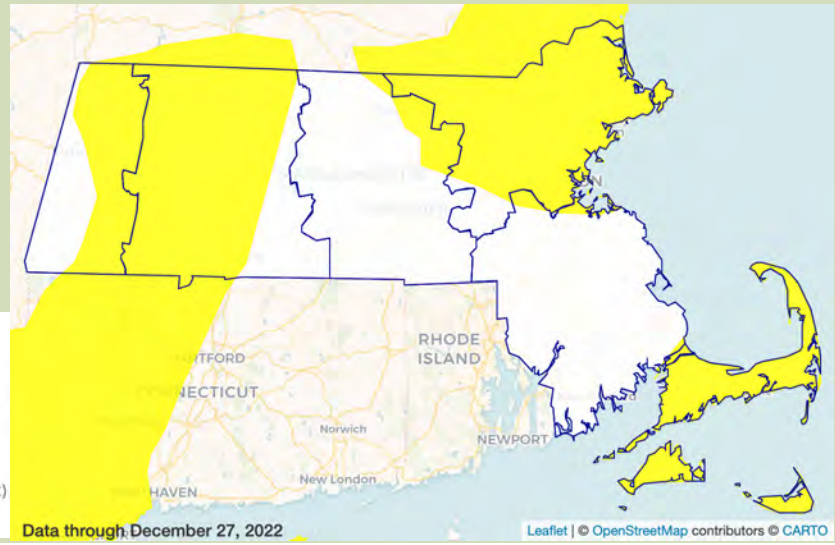
On January 13, 2023 Massachusetts Energy and Environmental Affairs (EEA) Secretary Rebecca L. Tepper declared Level 0 Normal Conditions for the Western, CTRV, Central, and Southeast Regions; Level 1 Drought Conditions for the Northeast and Cape Cod Regions; and Level 2 Drought Conditions for the Islands Region. This status remains in effect until further updated.

U.S. Drought Monitor (USDM)

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

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

January: The outlook issued 12/31 shows a 50-60% chance for above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

January through March: The outlook issued 12/15 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 January and the seasonal outlook for January through March both released on 12/31 show no drought development. 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 01/09/2023. 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—December 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	65	61	68	39	34	39	83	66
CTRV	9	70	57	59	53	34	35	72	57
CENTRAL	14	84	74	72	66	50	54	83	72
NORTHEAST	18	74	54	51	25	14	15	61	66
SOUTHEAST	21	76	53	68	53	31	32	61	52
CAPE COD	7	60	50	76	36	22	32	40	19
ISLANDS	3	44	42	71	35	25	28	21	12

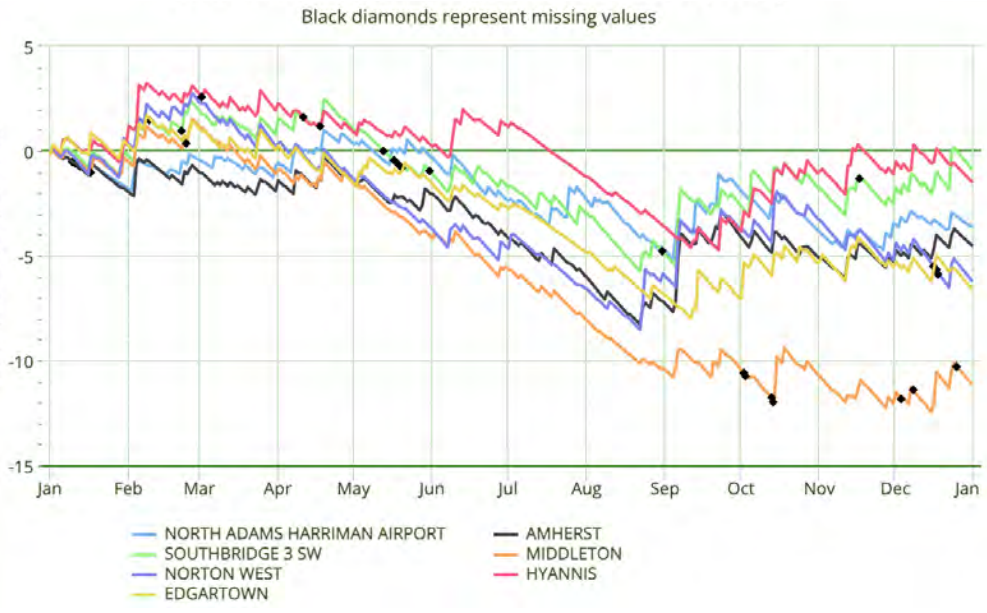
DMP Index Severity Levels			
1	2	3	4

Percent of Average Historical Precipitation—December 2022

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	DECEMBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	3	3.45	4.55	1.10	132%
CTRV	9	3.73	4.37	0.64	117%
CENTRAL	14	3.97	5.94	1.97	150%
NORTHEAST	18	3.96	5.11	1.15	129%
SOUTHEAST	21	4.43	5.64	1.21	127%
CAPE COD	7	4.40	4.60	0.20	105%
ISLANDS	3	4.24	3.49	-0.75	82%

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