

MASSACHUSETTS WATER RESOURCES COMMISSION



HYDROLOGIC CONDITIONS IN MASSACHUSETTS

JUNE
2023

The Commonwealth of Massachusetts

Maura T. Healey, Governor

*Rebecca L. Tepper, Secretary
Executive Office of Energy and Environmental Affairs*



JUNE 2023 HYDROLOGIC CONDITIONS

SUMMARY OF CONDITIONS



- Monthly average temperatures were mostly below normal to normal.
- Precipitation was variable by site but overall normal to above normal in the Regions



- Crop Moisture Index showed normal conditions at the end of the month. The 1-mos Evaporative Demand Drought Index showed mostly wet conditions.



- The Keetch-Byram Drought Index showed normal soil moisture conditions at the end of the month except for the Connecticut River Valley which is at ISL 1.



- Streamflow varied from below normal to above normal. The Western and Cape Cod Regions are at ISL 1.



- Groundwater was below normal to above normal. Regional medians of individual well percentiles were in the normal range except for the Islands, which is at ISL 1.



- Lake and impoundment levels were mostly above their 30th percentile and/or were at or near 100% full.



- NOAA's July outlook shows chances leaning for above-normal temperatures and above-normal precipitation.



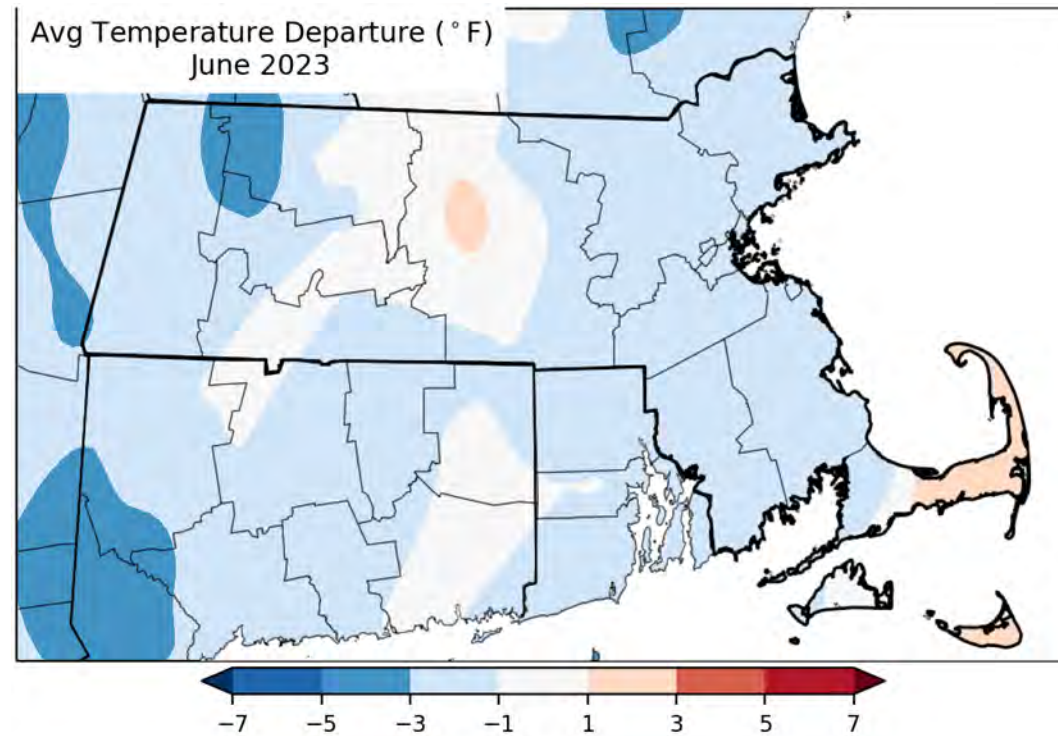
- NOAA's 3-month outlook shows chances likely for above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.
- Appendix II provides information on the Massachusetts Drought Management Plan (DMP) including ISL thresholds used in this report.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 07/07/2023. 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>

Monthly average temperatures were mostly below normal to normal except for some areas in the central part of the state, Cape Cod, and Nantucket.

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

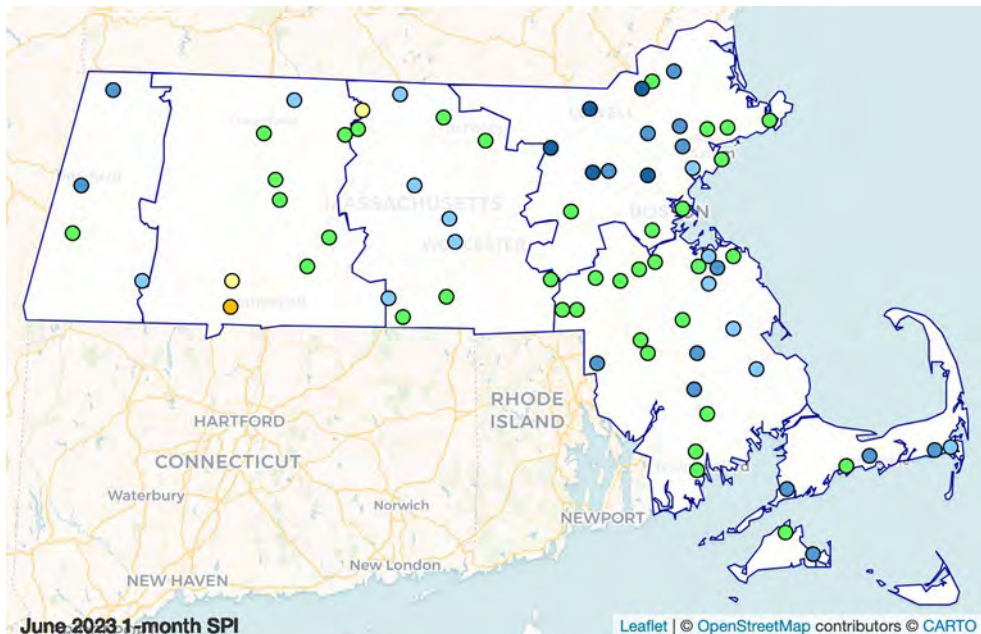
AVERAGE TEMPERATURE DEPARTURE





STANDARDIZED PRECIPITATION INDEX (SPI) AS A PERCENTILE

June precipitation was mostly normal to above normal with a few stations below normal. Regional medians of individual gages were normal to above normal. In addition to the table below, Appendix I provides all look-back periods.



● ≥ 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 SITES REPORTING	JUNE MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	4	5.66	1.29	79	60	63
CTRV	9	3.63	-0.42	47	42	67
CENTRAL	12	4.34	0.38	66	56	69
NORTHEAST	19	5.64	2.05	84	66	74
SOUTHEAST	22	4.43	0.67	68	45	59
CAPE COD	5	4.97	1.72	81	55	79
ISLANDS	2	4.43	1.20	75	37	65

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

DMP Index Severity Levels			
1	2	3	4

CROP MOISTURE INDEX (CMI) - 2019 DROUGHT MANAGEMENT PLAN

Weekly values for the period ending June 24, 2023 from NOAA’s National Weather Service Climate Prediction Center were: -0.01 in the western part, 0.05 in the central part, and 0.17 in the coast part of the state, all of which are in the slightly dry/favorably moist/normal range.

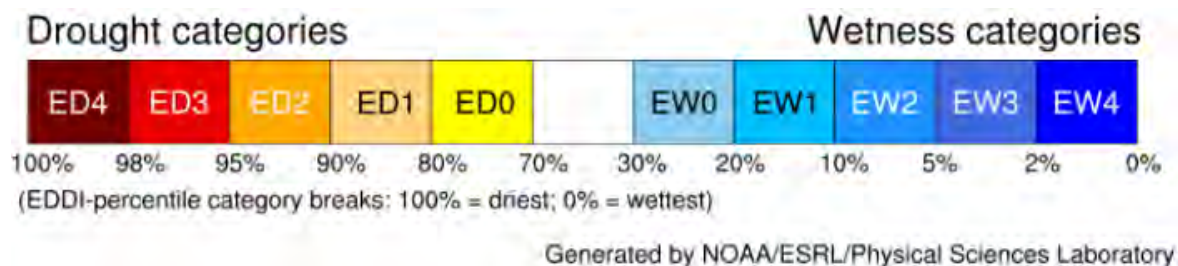
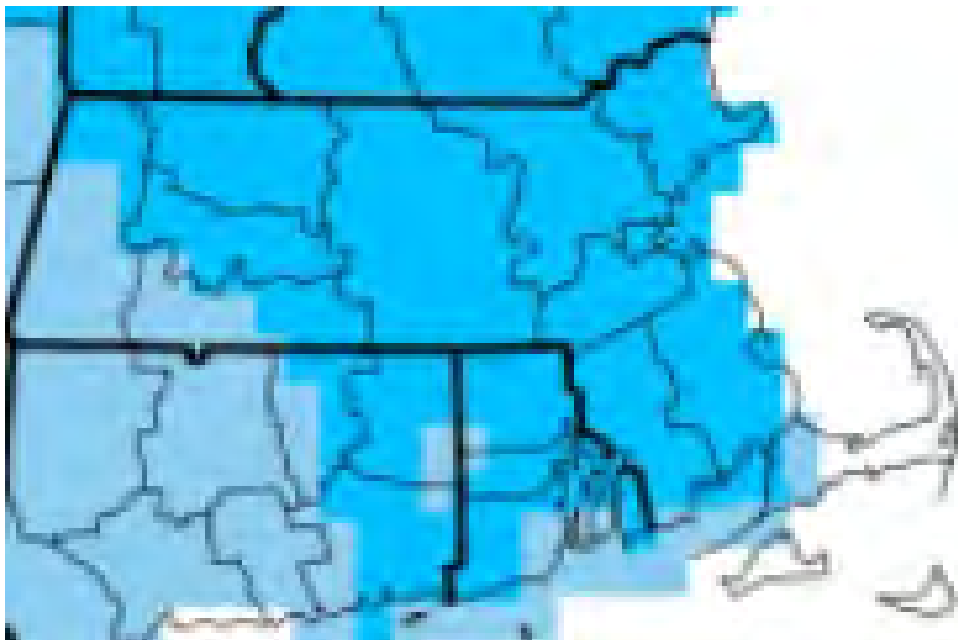
https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

CLIMATE DIVISION	CROP MOISTURE INDEX
WESTERN	-0.01
CENTRAL	0.05
COASTAL	0.17



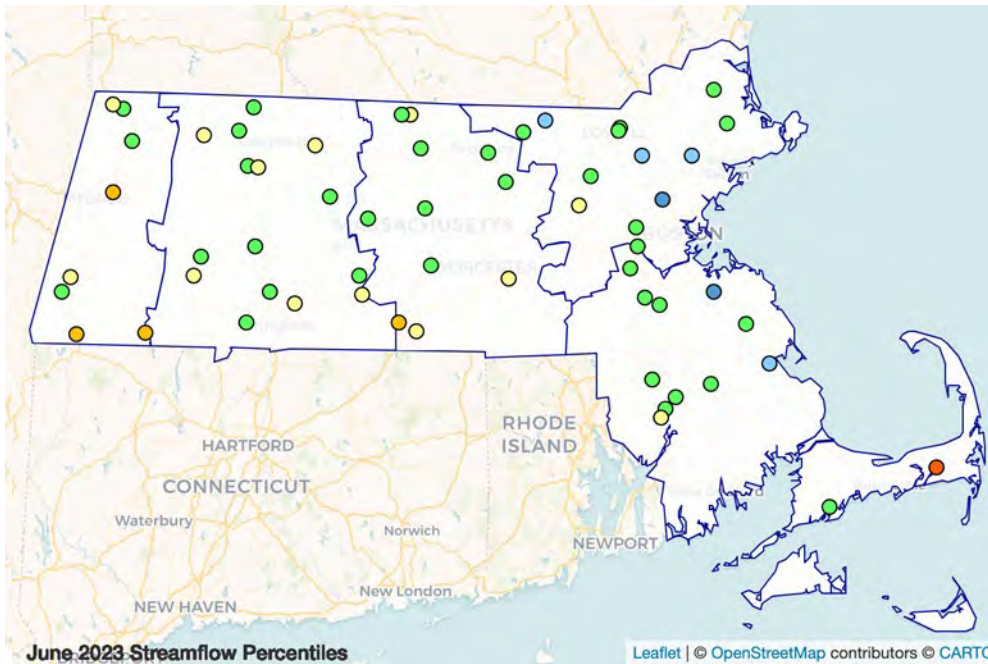
EVAPORATIVE DEMAND DROUGHT INDEX (EDDI) - PROPOSED FOR THE DROUGHT MANAGEMENT PLAN

The 1-mos EDDI categories for June 30, 2023 were wet except for Cape Cod and Islands, which were normal.



During June, percentiles of individual streamflow gages varied across the state from below normal to above normal. The Western and Cape Cod Regions are at ISL 1.

MEDIAN MONTHLY STREAMFLOW PERCENTILES COMPARED TO HISTORICAL VALUES



● ≥ 0 to ≤ 2	● > 2 to ≤ 10	● > 10 to ≤ 20	● > 20 to ≤ 30	● > 30 to ≤ 40
● > 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	3	2	0	23
CTRV	15	0	0	0	6	0	34
CENTRAL	11	0	0	1	3	0	51
NORTHEAST	13	0	0	0	1	0	57
SOUTHEAST	11	0	0	0	1	0	49
CAPE COD	2	0	1	0	0	0	21

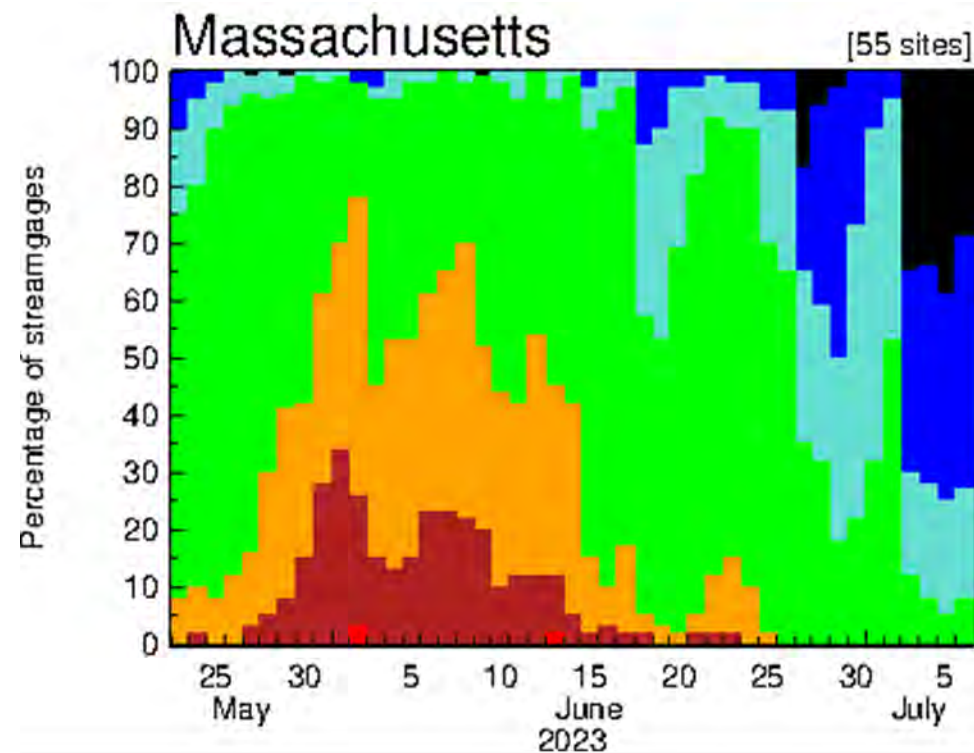
Note: Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to the Islands.

DMP Index Severity Levels			
1	2	3	4

USGS TIME SERIES OF THE PERCENT OF GAGES AT THEIR RESPECTIVE PERCENTILE FLOWS FOR AVERAGE DAILY STREAMFLOWS COMPARED TO HISTORICAL VALUES

<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		



According to the June NWS E-5 Monthly Report of Hydrologic Conditions for the Boston/Norton service area, no flooding was reported in the Boston/Norton service area within Massachusetts. According to the Iowa Environmental Mesonet database, no flood warnings were issued in Berkshire County for the month of June.

<https://mesonet.agron.iastate.edu/vtec/search.php#eventsbypoint/-93.6530/41.5300>

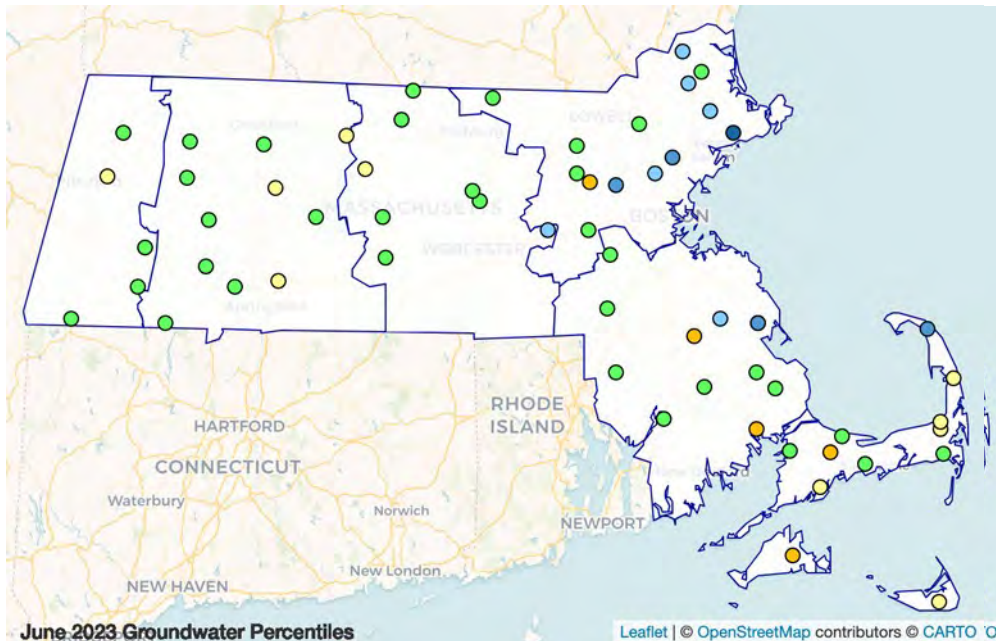


Image: Courtesy of NASA/JPL-Caltech



June groundwater levels ranged from below normal to above normal. Regional medians of individual well percentiles were in the normal range except for the Islands, which is at ISL 1.

END OF MONTH GROUNDWATER COMPARED TO HISTORICAL IN THE CLIMATE RESPONSE NETWORK WELLS



● ≥ 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	1	0	39
CTRV	11	0	0	0	3	0	49
CENTRAL	8	0	0	0	1	0	48
NORTHEAST	14	0	0	1	0	1	70
SOUTHEAST	12	0	0	2	0	0	46
CAPE COD	10	0	0	1	4	0	31
ISLANDS	2	0	0	1	1	0	23

DMP Index Severity Levels			
1	2	3	4

At the end of June, most lake and impoundment levels were above their 30th percentile and/or were at or near 100% full.

REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	99%
CTRV	1	94%
CENTRAL	3	84th
NORTHEAST	4	87th
SOUTHEAST	2	80th
CAPE COD	1	35th

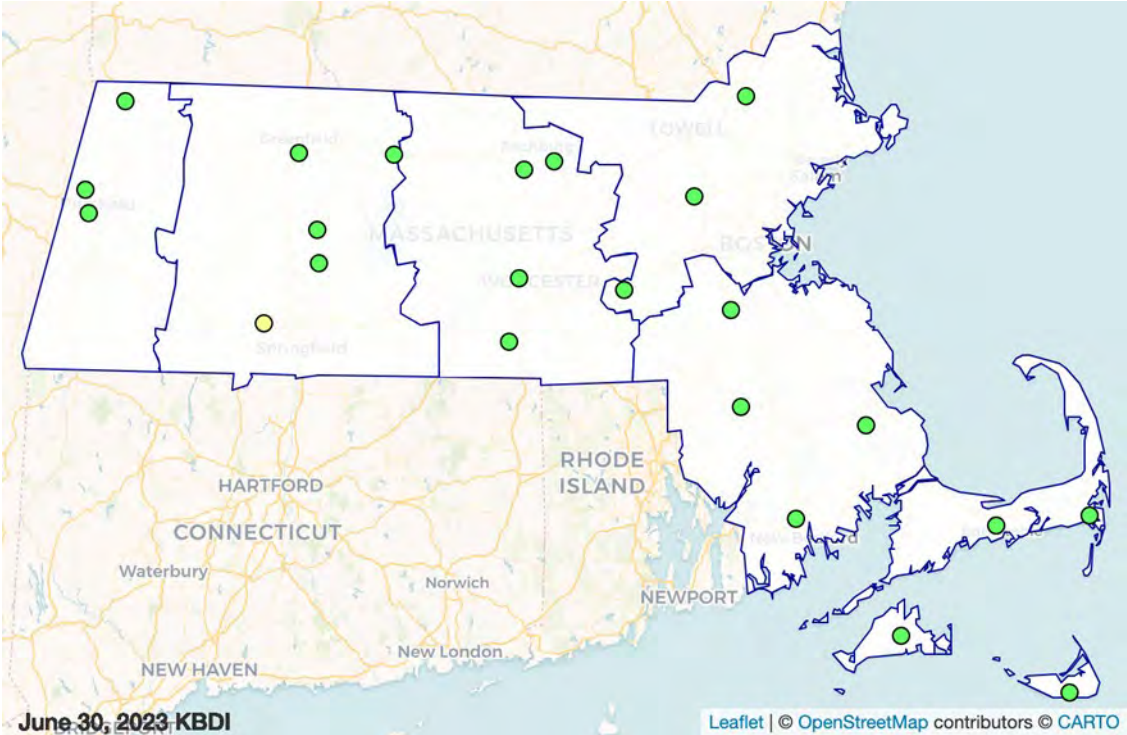
DMP Index Severity Levels do not necessarily reflect water supply status.

DMP Index Severity Levels			
1	2	3	4





At the end of June, Keetch Byram Drought Index (KBDI) values were in the normal range except for the southern part of the CTRV Region, which is at ISL 1.

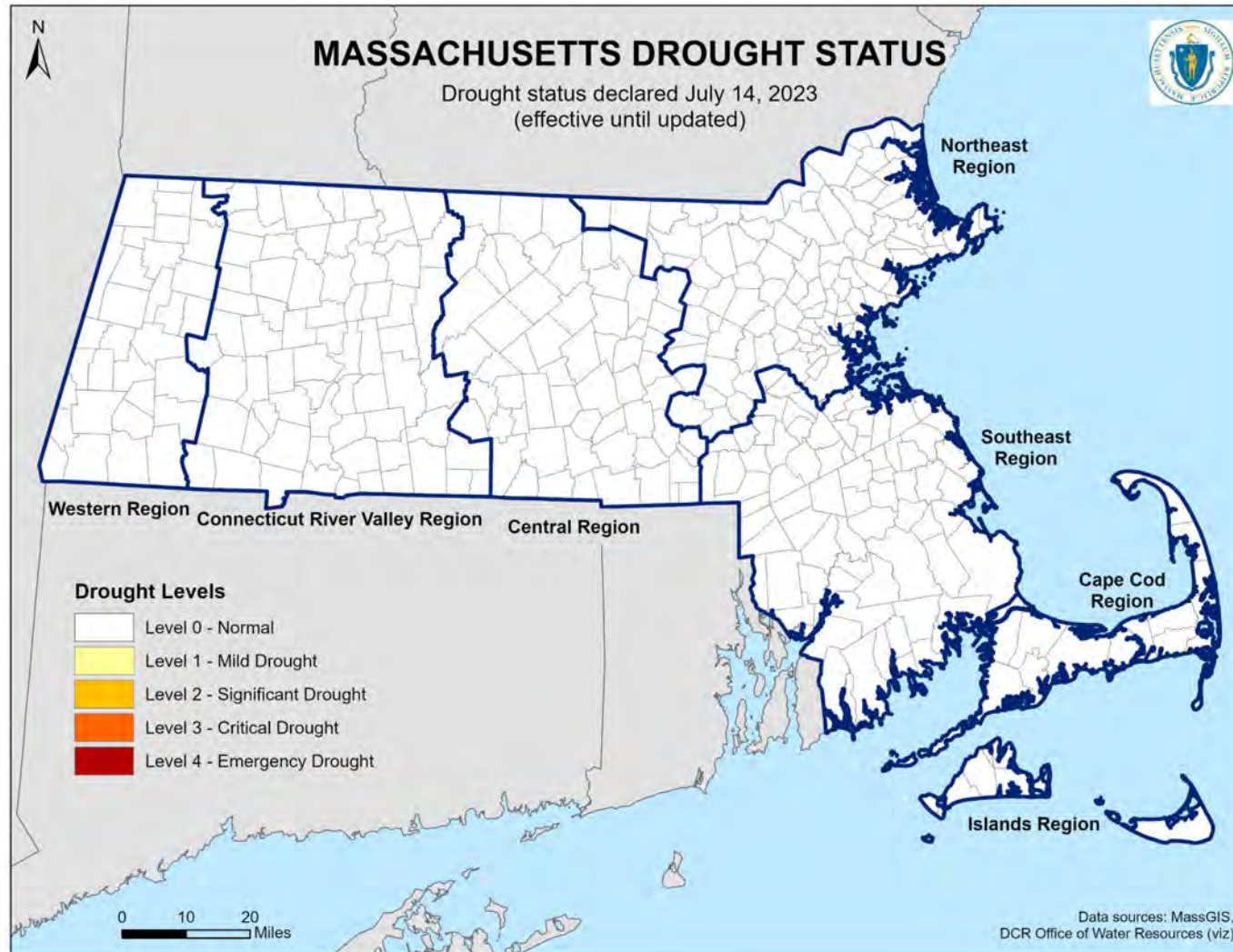


REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	3	35
CTRV	5	256
CENTRAL	4	121
NORTHEAST	3	160
SOUTHEAST	4	145
CAPE COD	2	33
ISLANDS	2	49

DMP Index Severity Levels			
1	2	3	4

Point Values - KBDI Range				
● ≥700 to ≤800	● ≥600 to <700	● ≥400 to <600	● ≥200 to <400	● ≥0 to <200

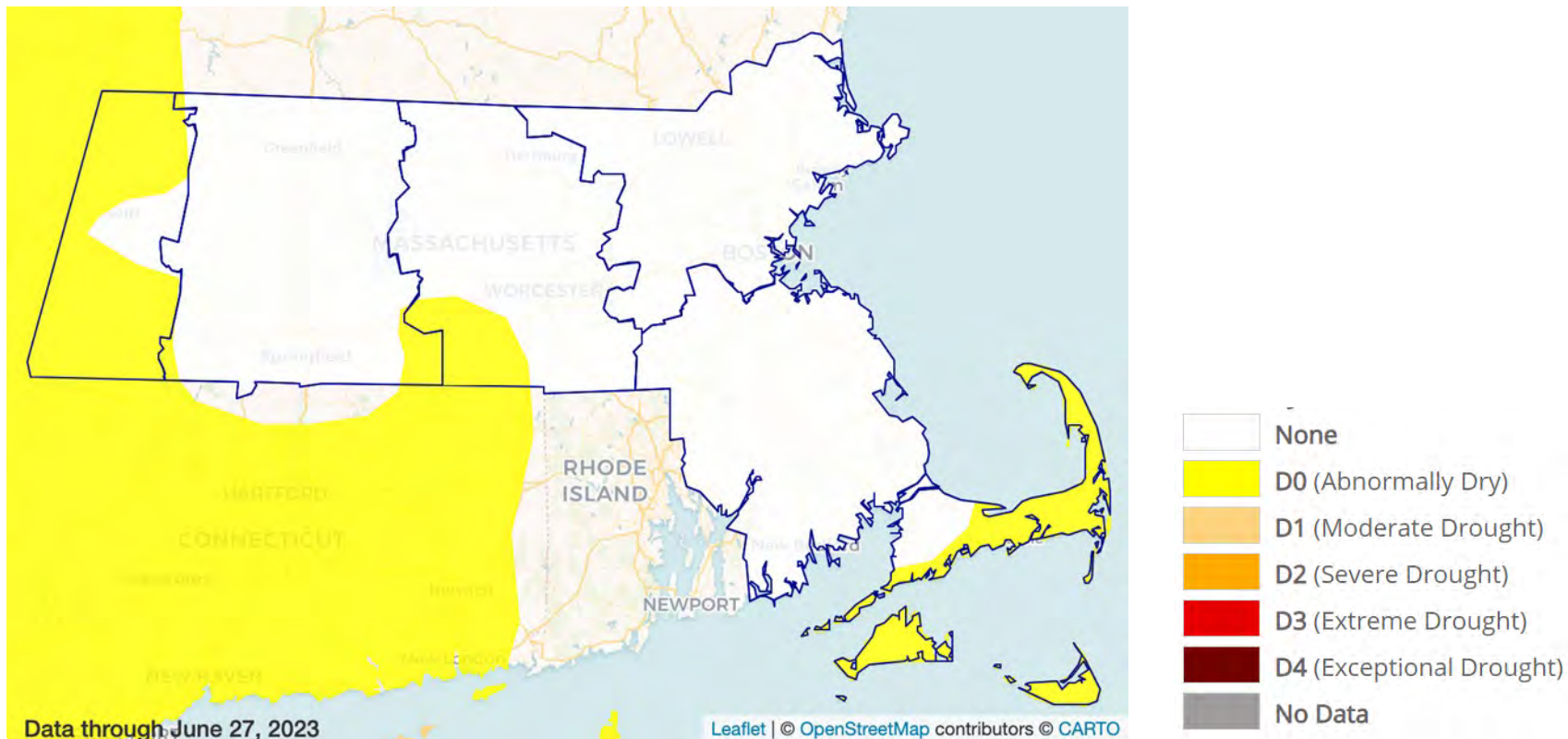
MASSACHUSETTS DROUGHT STATUS



U.S. DROUGHT MONITOR (USDM)

At the end of June, the USDM showed areas of D0 (Abnormally Dry) in parts of western and southern central MA as well as Cape Cod and Islands.

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

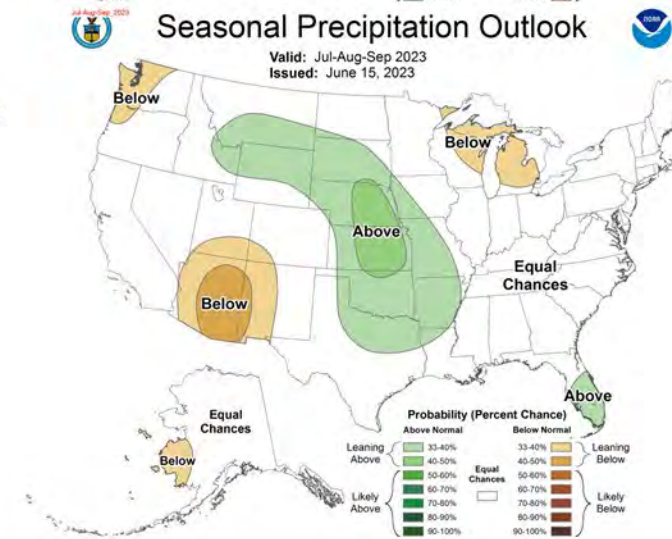
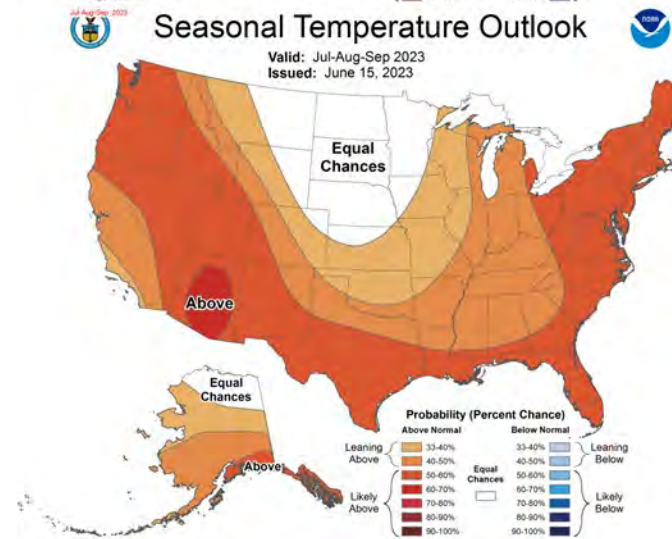
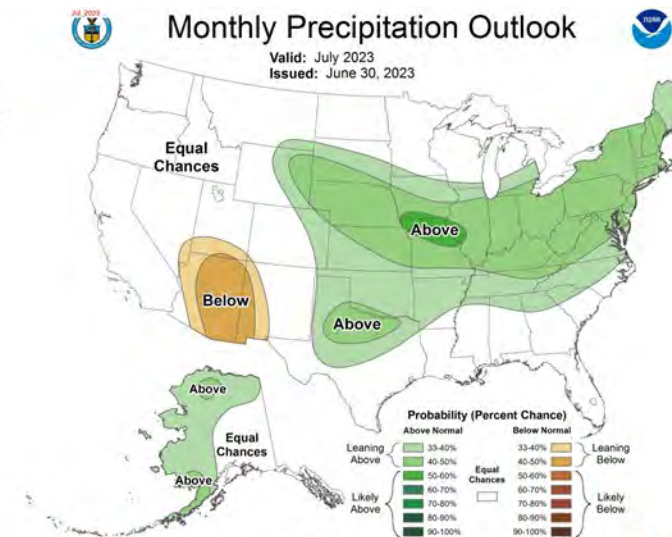
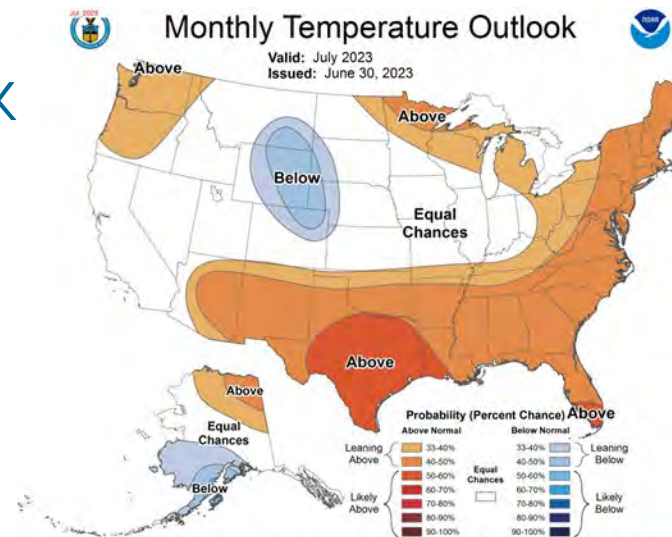


TEMPERATURE AND PRECIPITATION OUTLOOK

July: The outlook issued 6/30 shows a 40-50% chance of above-normal temperatures, and a 40-50% chance for above-normal precipitation.

July through September: The seasonal outlook issued 6/15 shows a 50-60% chance of above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

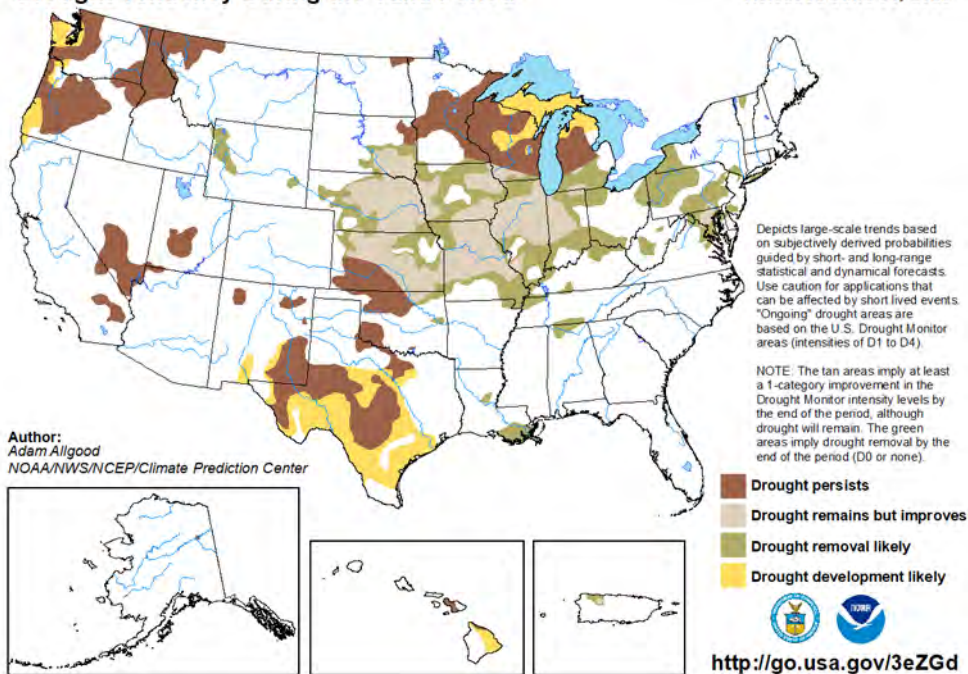
<https://www.cpc.ncep.noaa.gov/>



U.S. Monthly Drought Outlook

Drought Tendency During the Valid Period

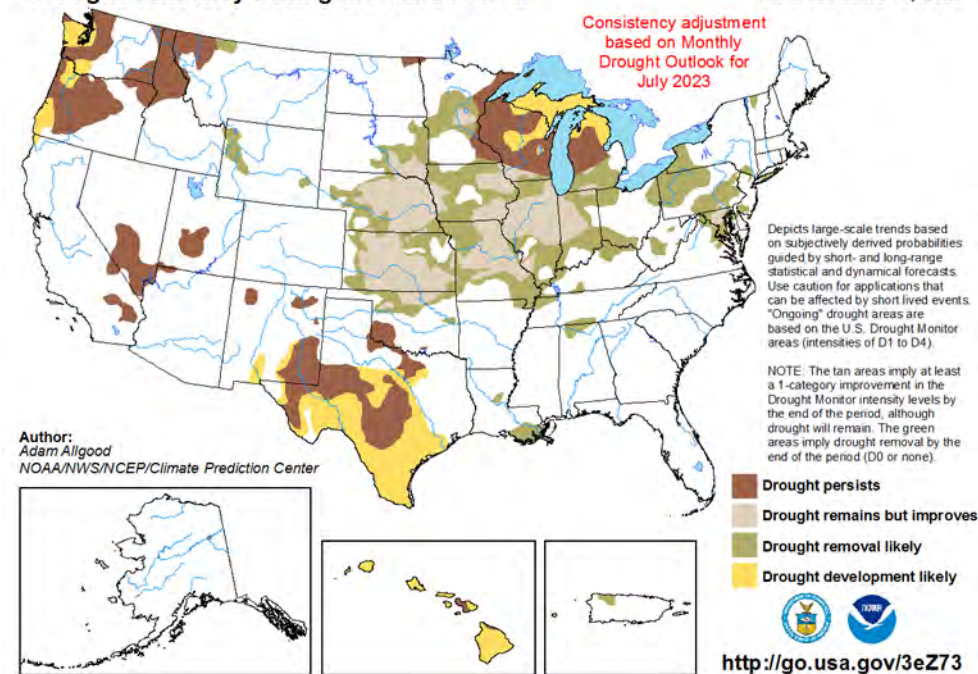
Valid for July 2023
Released June 30, 2023



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for July 1 - September 30, 2023
Released June 30, 2023



MONTHLY AND SEASONAL DROUGHT OUTLOOK

The monthly outlook for July released on 6/30 shows no drought development in Massachusetts.

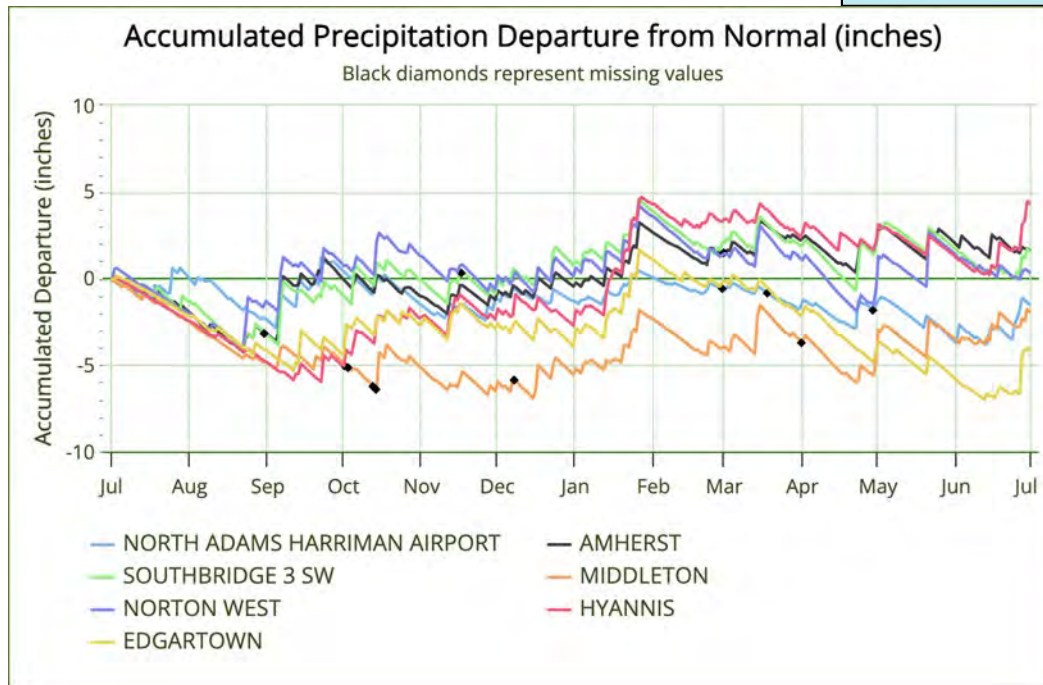
The seasonal outlook for July through September issued on 6/30 shows no drought development in Massachusetts.

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

ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index— June 2023 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	4	79	59	60	63	72	57	88	75
CTRV	9	47	45	42	67	69	65	83	72
CENTRAL	12	66	53	56	69	76	67	91	82
NORTHEAST	19	84	75	66	74	67	44	72	71
SOUTHEAST	22	68	51	45	59	64	59	71	60
CAPE COD	5	81	59	55	79	88	69	81	62
ISLANDS	2	75	59	37	65	70	45	34	15



DMP Index Severity Levels			
1	2	3	4

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/>

ADDITIONAL PRECIPITATION DATA (CONT.)

Percent of Average Historical Precipitation—June 2023

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	JUNE AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	4	4.37	5.66	1.29	130%
CTRV	9	4.05	3.63	-0.42	90%
CENTRAL	12	3.96	4.34	0.38	110%
NORTHEAST	19	3.59	5.64	2.05	157%
SOUTHEAST	22	3.76	4.43	0.67	118%
CAPE COD	5	3.25	4.97	1.72	153%
ISLANDS	2	3.23	4.43	1.20	137%

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.

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

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



Massachusetts Water Resources Commission

Executive Office of Energy and Environmental Affairs

www.mass.gov/conservemawater

www.mass.gov/drought-management