

# MASSACHUSETTS WATER RESOURCES COMMISSION

## SEPTEMBER 2021 HYDROLOGIC CONDITIONS IN MASSACHUSETTS



The Commonwealth of Massachusetts  
Charles D. Baker, Governor

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

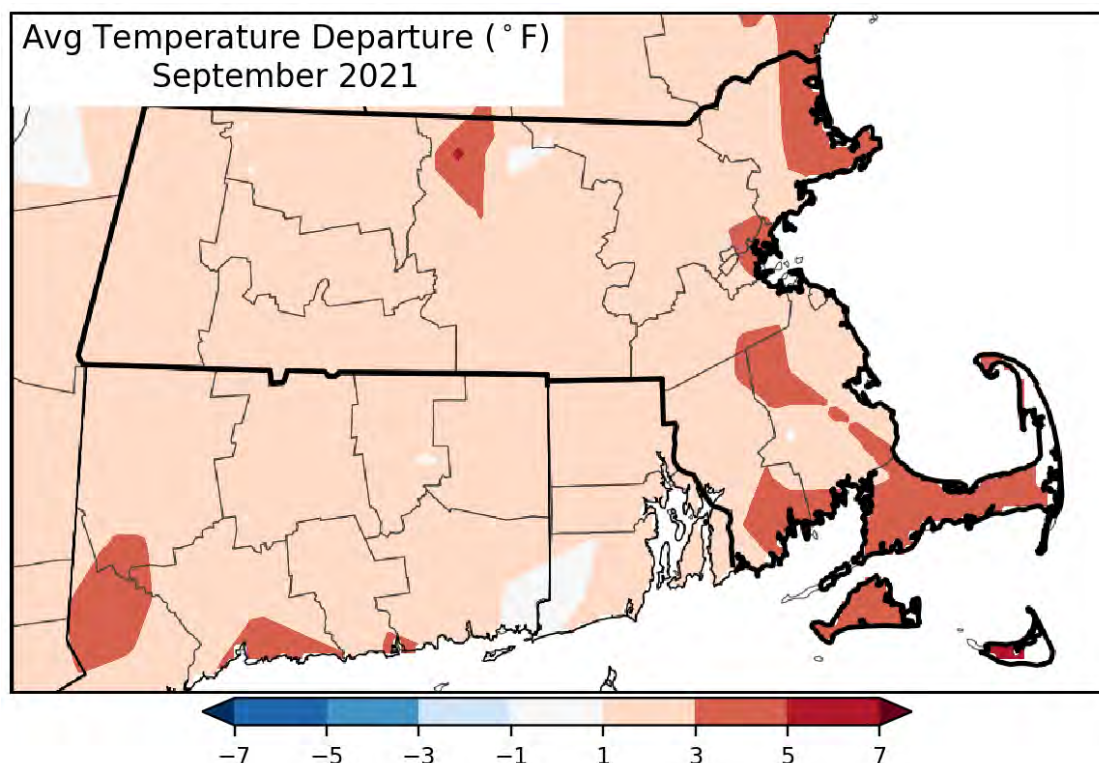
## SEPTEMBER 2021 HYDROLOGIC CONDITIONS SUMMARY OF CONDITIONS

- Monthly average temperatures were above normal.
- Monthly precipitation was above normal. The remnants of Hurricane Ida brought significant rainfall in the early part of the month. The 1-month SPI Index Severity is at Level 0 for all regions.
- Streamflow was above normal across the state except for the Cape Cod region, which was normal. All regions are at Index Severity Level 0.
- Groundwater levels were high except for Nantucket and a few wells that continue to recover on Cape Cod. All regions are at Index Severity Level 0.
- Lakes & Impoundments were much above normal except for the pond on Cape Cod, which recovered into the normal range this month.
- NOAA's October outlook shows chances leaning to above normal temperatures and below normal precipitation.
- NOAA's 3-month outlook shows chances for above-normal temperatures and equal chances for 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 above normal. According to the Northeast Regional Climate Center (NRCC), the monthly average temperature at the Boston climate site was 4.1 degrees F above normal, making it the 2<sup>nd</sup> warmest September on record.

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

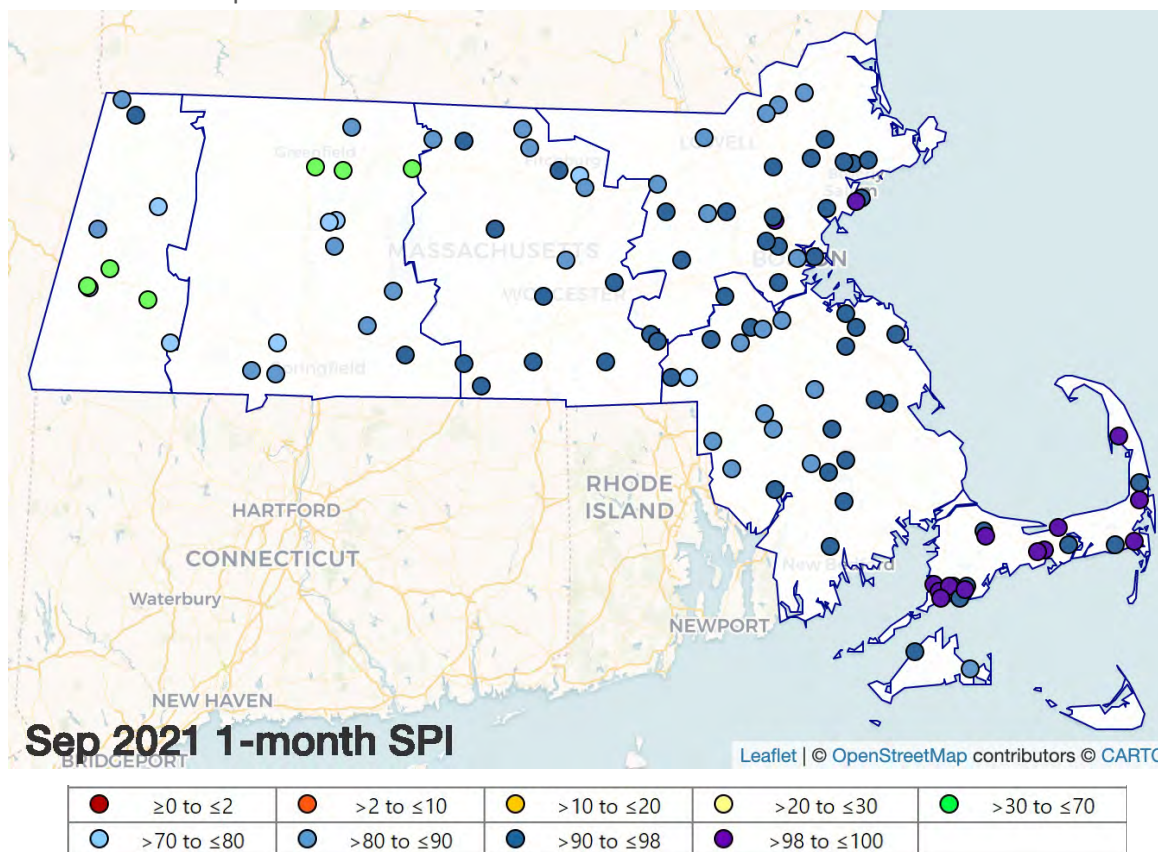




# PRECIPITATION

September precipitation was much above normal throughout most of the state. According to the NRCC, September 2021 ranked as the 7th wettest for the Boston climate site, and 10th wettest for the Worcester climate site. Cape Cod received normal to above-normal precipitation for all look-back periods. At the beginning of September the remnants of Hurricane Ida brought significant rainfall from approximately 2" to over 6" across most of the state, with the larger totals in the Southeast, Northeast, and Central regions. The Upper Cape especially benefitted from Ida plus from additional rain events throughout the month. The September 1-month SPI Index Severity is at Level 0 for all regions. Appendix I provides additional details for precipitation data, including longer look-back periods.

Standardized Precipitation Index as a Percentile



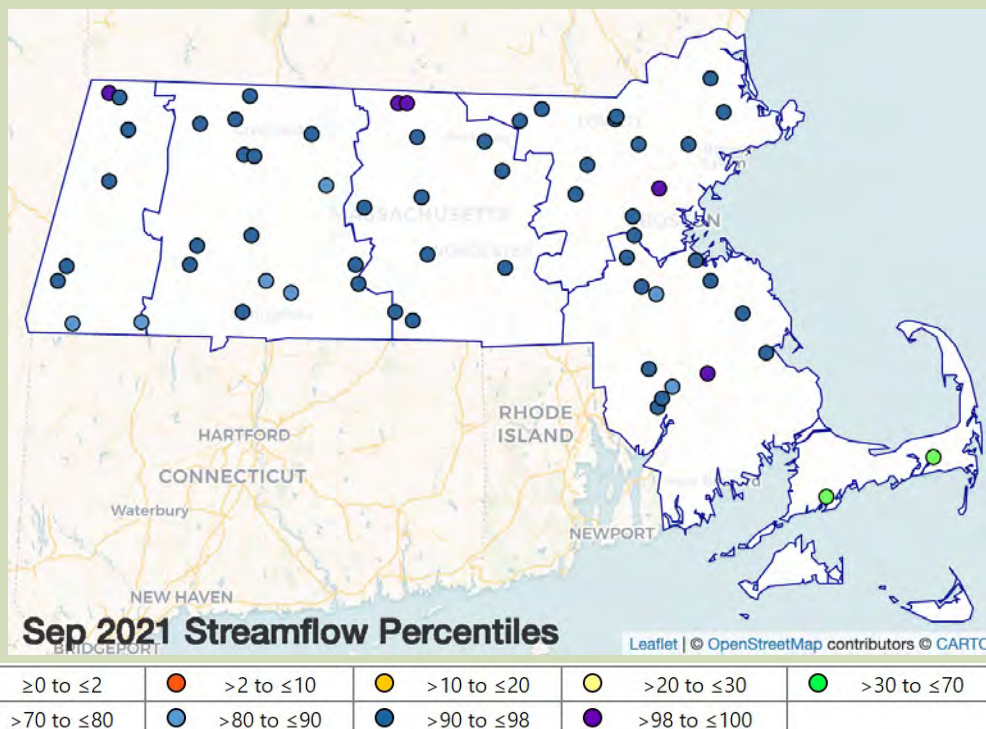
REGION	NUMBER OF SITES REPORTING	SEPTEMBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI* PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	9	6.34	2.03	80	98	98
CTRV	13	5.68	1.69	81	98	96
CENTRAL	17	7.44	3.52	92	99	97
NORTHEAST	25	7.23	3.69	94	99	99
SOUTHEAST	26	7.71	3.85	91	99	97
CAPE COD	19	10.96	7.17	99	92	80
ISLANDS	2	7.96	4.29	92	89	79

DMP Index Severity Levels			
1	2	3	4

## STREAMFLOW

Streamflow was above normal during September for most of the state. All regional monthly streamflow medians were above the 90th percentile except for the Cape Cod region, which was in the normal range. All regions are at Index Severity Level 0. The remnants of Hurricane Ida brought significant rainfall and flooding in some areas of Central, Northeast, and Southeast regions in early September. Events later in month brought some heavy rain including reports of road flooding in the Cape Cod Region on September 9th.

Median Monthly Streamflow Percentiles Compared to Historical Values



REGION	TOTAL GAGES REPORTING FOR SEP	$\geq 0$ TO $\leq 2$ PERCENTILE	$> 2$ TO $\leq 10$ PERCENTILE	$> 10$ TO $\leq 20$ PERCENTILE	$> 20$ TO $\leq 30$ PERCENTILE	$> 90$ PERCENTILE	MEDIAN OF INDIVIDUAL GAGE PERCENTILES
WESTERN	8	0	0	0	0	6	96
CTRV	15	0	0	0	0	12	95
CENTRAL	11	0	0	0	0	11	95
NORTHEAST	13	0	0	0	0	13	97
SOUTHEAST	12	0	0	0	0	10	96
CAPE COD	2	0	0	0	0	0	49

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

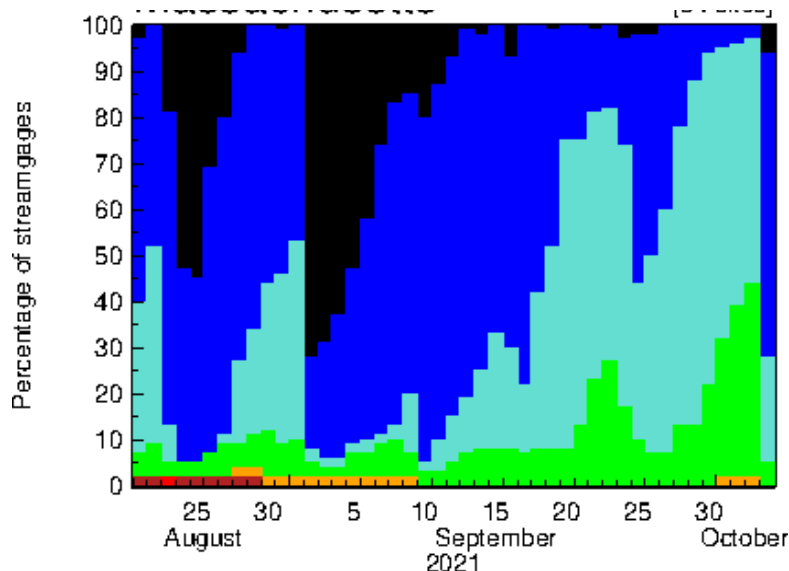
DMP Index Severity Levels			
1	2	3	4

### 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>

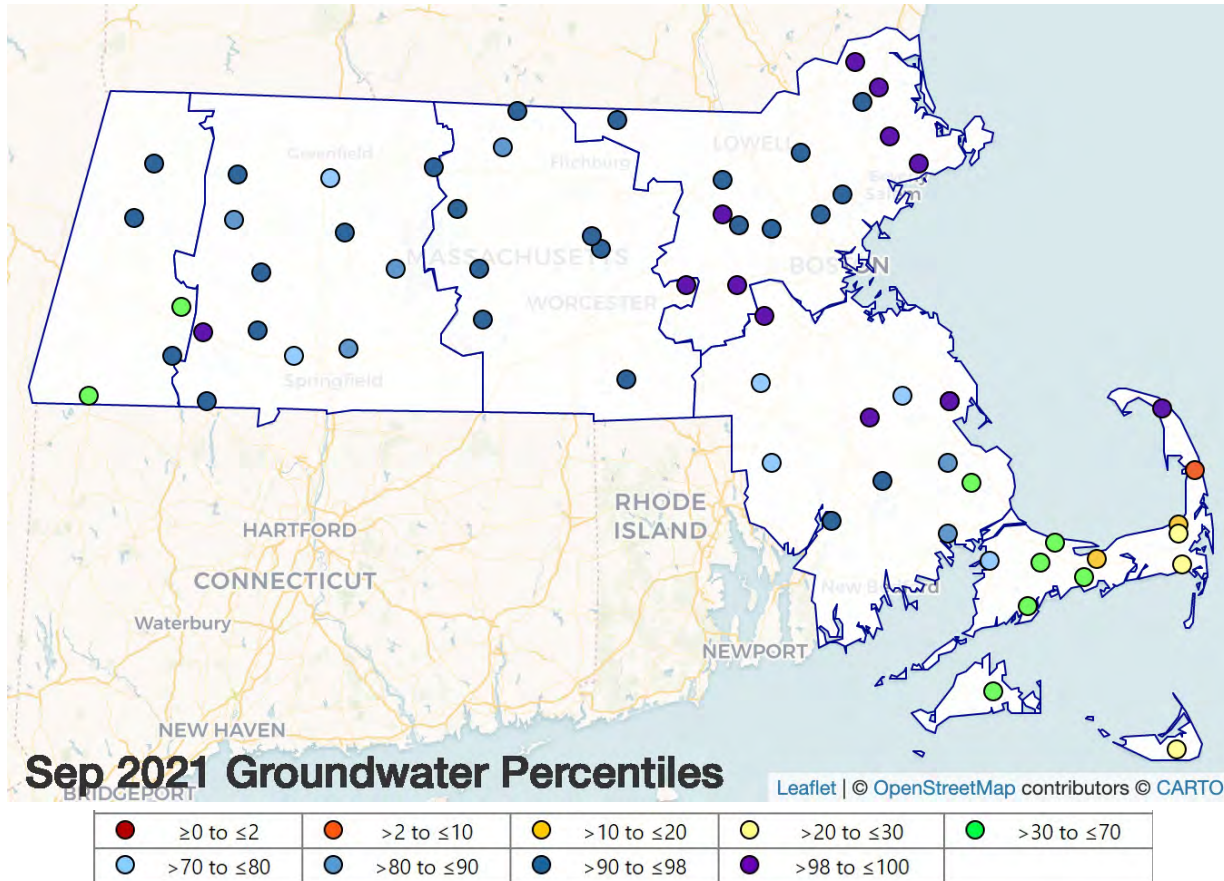
Explanation - Percentile classes							
Low	$< 10$	10-24	25-75	76-90	$> 90$	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



# GROUNDWATER

Percentiles of individual groundwater wells continued to be high throughout much of the state. The medians of individual well percentiles were much above normal for all regions except the Islands and Cape Cod, which were just in the normal range. While there are still some wells on Cape Cod that are below normal, they have started to recover. All regions are at Index Severity Level 0.

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



REGION	TOTAL WELLS REPORTING FOR SEP	$\geq 0$ TO $\leq 2$ PERCENTILE	$> 2$ TO $\leq 10$ PERCENTILE	$> 10$ TO $\leq 20$ PERCENTILE	$> 20$ TO $\leq 30$ PERCENTILE	$> 90$ PERCENTILE	MEDIAN OF INDIVIDUAL WELL PERCENTILES
WESTERN	5	0	0	0	0	3	93
CTRV	12	0	0	0	0	7	91
CENTRAL	9	0	0	0	0	8	96
NORTHEAST	14	0	0	0	0	14	98
SOUTHEAST	12	0	0	0	0	6	90
CAPE COD	11	0	1	2	2	1	37
ISLANDS	2	0	0	0	1	0	34

DMP Index Severity Levels			
1	2	3	4



## LAKES AND IMPOUNDMENTS

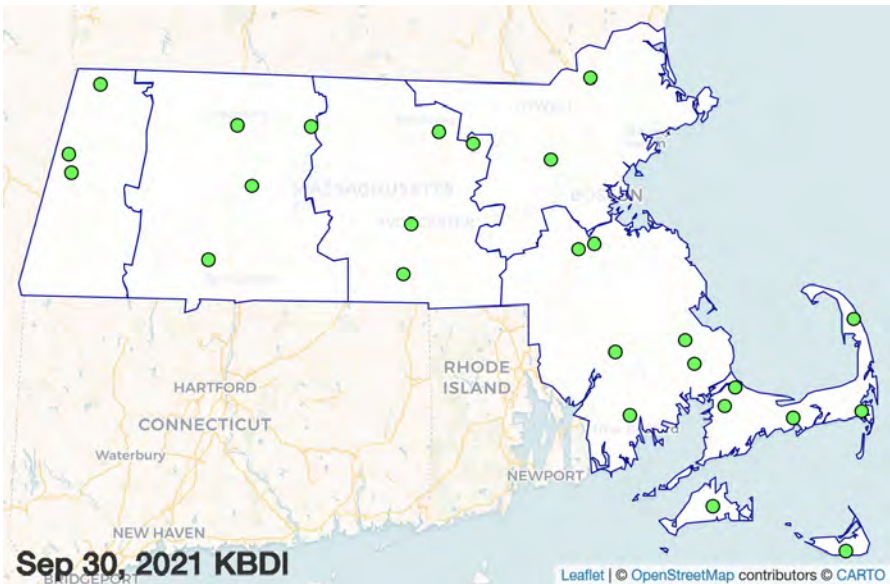
At the end of September, most lake and impoundment levels were much greater than their 30th percentile values. The monitored pond on Cape Cod has recovered and is just above the 30th percentile. All regions are at Index Severity Level 0.

REGION	TOTAL REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	100
CTRV	2	83
CENTRAL	4	92
NORTHEAST	5	100
SOUTHEAST	2	94
CAPE COD	1	32

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 September, KBDI values were below 200. All regions are at Index Severity Level 0.



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

REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	3	32
CTRV	4	180
CENTRAL	4	128
NORTHEAST	2	105
SOUTHEAST	6	150
CAPE COD	5	26
ISLANDS	2	131

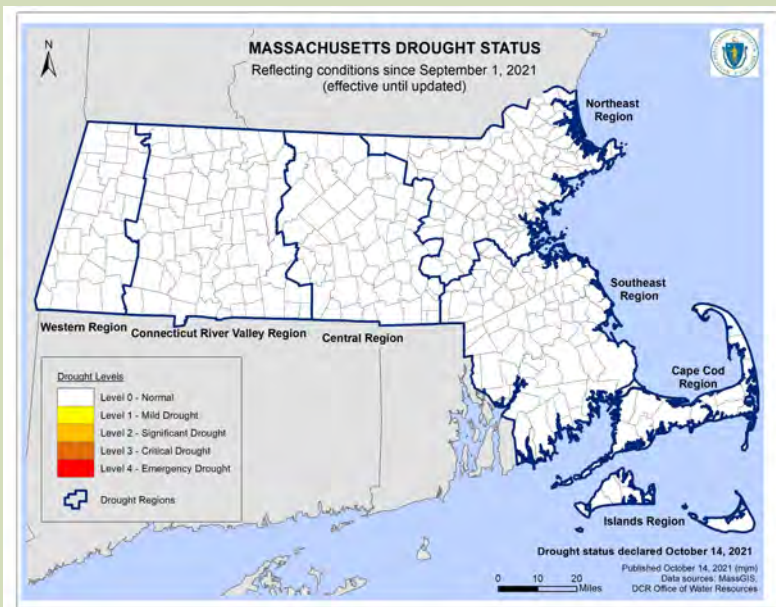
DMP Index Severity Levels			
1	2	3	4

## CROP MOISTURE INDEX (CMI)

CMI weekly values for the week ending October 2nd ranged from 0.55 & 0.94 (Slightly Dry/Favorably Moist) in the central and western areas respectively to 1.45 (Abnormally Moist) in the coastal area. All MA drought regions are at Index Severity Level 0.  
 Climate Prediction Center - Monitoring & Data: Drought Monitoring ([noaa.gov](https://www.noaa.gov))

## SNOWFALL

Snowfall is provided seasonally.



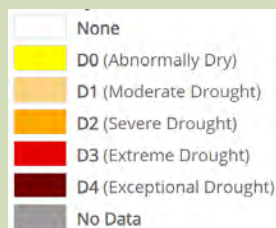
## Massachusetts Drought Status

Reflecting conditions since September 1<sup>st</sup>, on October 14, 2021 Massachusetts Energy and Environmental Affairs (EEA) Secretary Kathleen Theoharides declared a Level 0-Normal Conditions in the Cape Cod Region as well as the Western, Connecticut River Valley, Central, Northeast, Southeast, and Islands Regions.

## U.S. Drought Monitor (USDM)

At the end of September, the USDM showed a very small area of D0 on the Lower Cape.

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



Data through September 28, 2021; map released September 30, 2021



## NOAA Climate Prediction Center

### Temperature and Precipitation Outlook

**October:** The outlook released 9/30 shows a 40-50% probability of above-normal temperatures and a 50-60% probability of below-normal precipitation.

**October through December:** The outlook released 9/16 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/>

### Monthly and Seasonal Drought Outlook

The monthly outlook for October released on 9/30 shows no drought development in the state. The seasonal outlook released on 9/30 and valid through December 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. 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 September 2021 as percentiles

REGION	NUMBER OF SITES	1-mo*	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo*
WESTERN	9	80	74	98	98	93	89	83	78
CTRV	13	81	74	98	96	90	92	76	82
CENTRAL	17	92	89	99	97	92	93	84	92
NORTHEAST	25	94	95	99	99	96	97	83	89
SOUTHEAST	26	91	94	99	97	88	93	81	88
CAPE COD	19	99	95	92	80	60	60	28	76
ISLANDS	2	92	86	89	79	60	73	61	91

DMP Index Severity Levels			
1	2	3	4

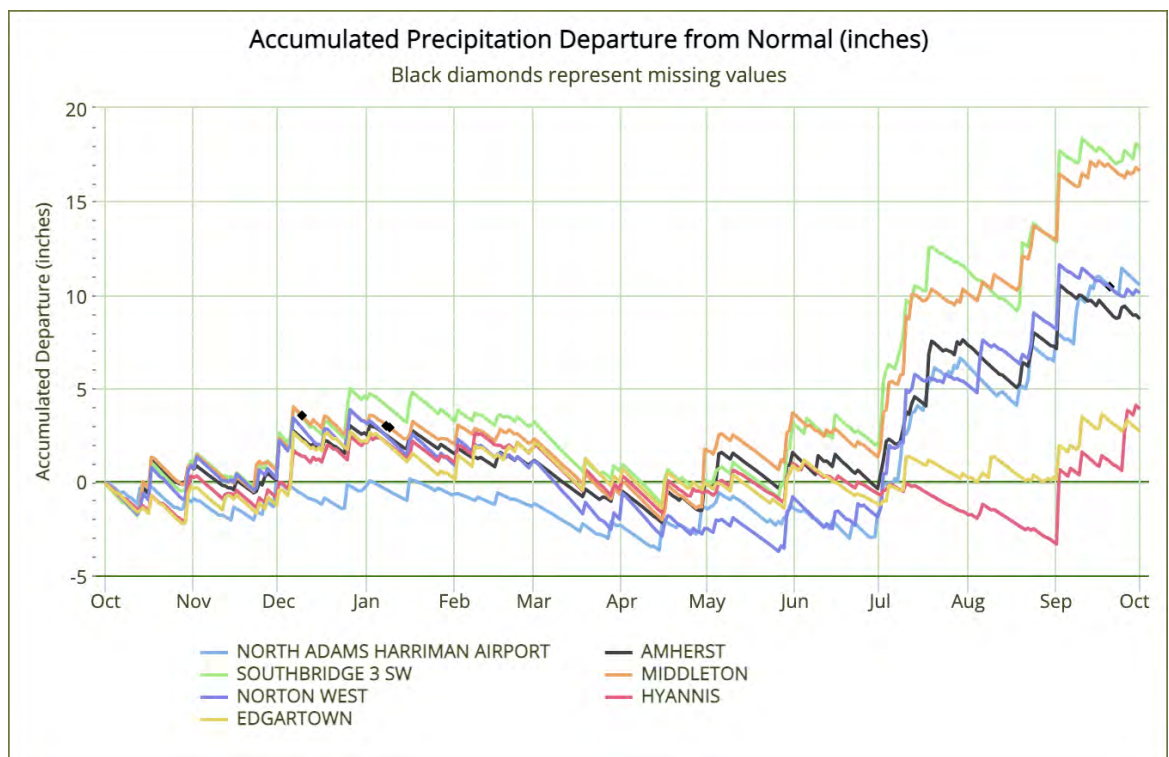
Percent of Average Historical Precipitation September 2021

REGION	NUMBER OF SITES	HISTORICAL AVERAGE	SEPTEMBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	9	4.31	6.34	2.03	147%
CTRV	13	3.99	5.68	1.69	142%
CENTRAL	17	3.92	7.44	3.52	190%
NORTHEAST	25	3.54	7.23	3.69	204%
SOUTHEAST	26	3.86	7.71	3.85	200%
CAPE COD	19	3.79	10.96	7.17	289%
ISLANDS	2	3.67	7.96	4.29	217%

**Accumulated Precipitation Departure** shows the previous 12 months (October 2020 — September 2021).

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 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	$\leq 30$ and $> 20$				200-400	$\leq -1.0$ and $> -2.0$
2	$\leq 20$ and $> 10$				400-600	$\leq -2.0$ and $> -3.0$
3	$\leq 10$ and $> 2$				600-700	$\leq -3.0$ and $> -4.0$
4	$\leq 2$				700-800	$\leq -4.0$

