

Hydrologic Conditions in Massachusetts

Drought Management Task Force

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DCR Office of Water Resources

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Meeting Co-Chairs: EOEEA, MEMA

MA Drought Management Plan

Drought Indices

Index Severity Level	Standardized Precipitation Index	Streamflow	Lakes and Impoundments	Groundwater	Keetch- Byram Drought Index	Crop Moisture Index
0	>30 th 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

MA Drought Management Plan

Drought Levels

Level 0 – NORMAL

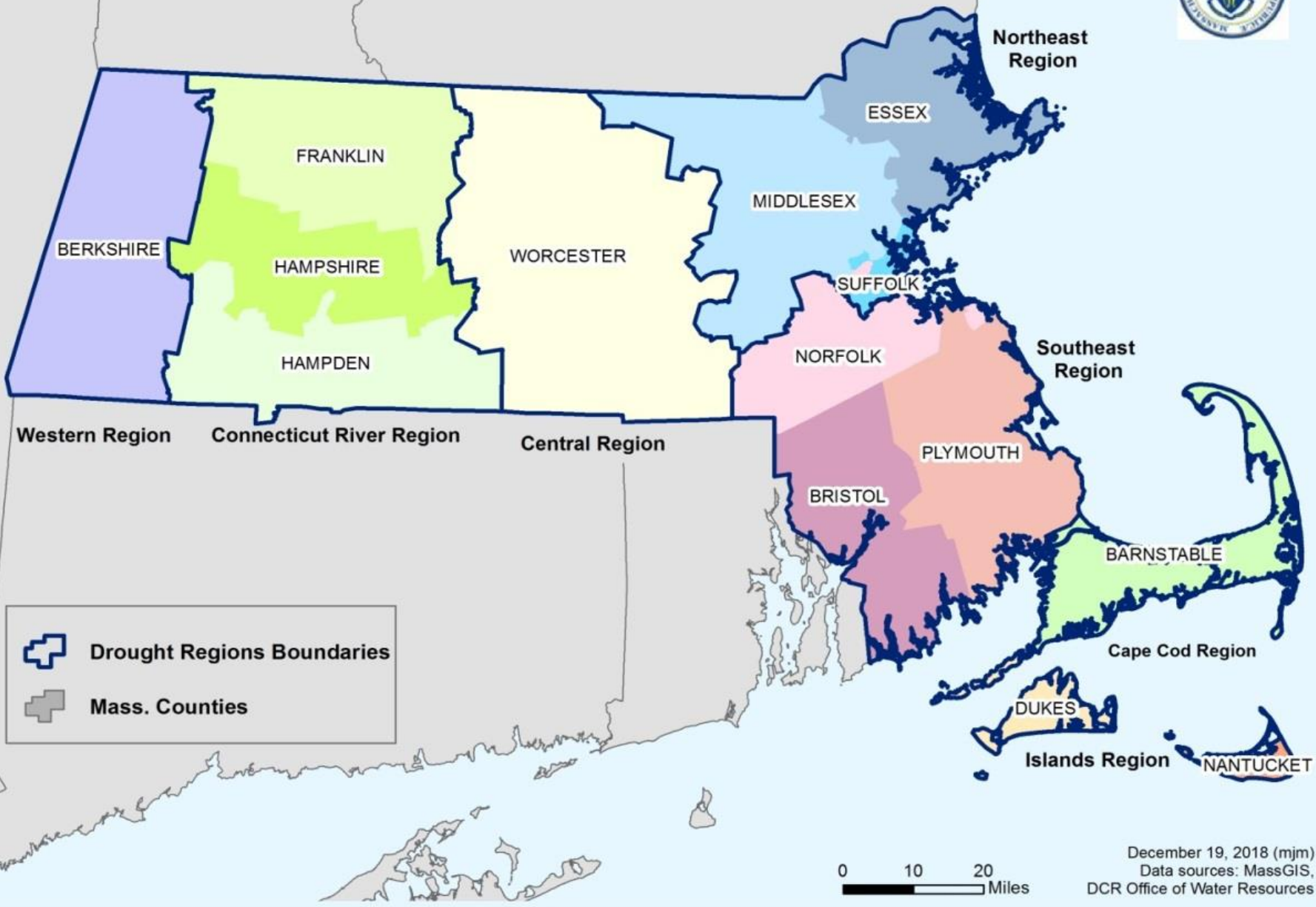
Level 1 - MILD Drought (formerly Advisory)

Level 2 - SIGNIFICANT Drought (formerly Watch)

Level 3 - CRITICAL Drought (formerly Warning)

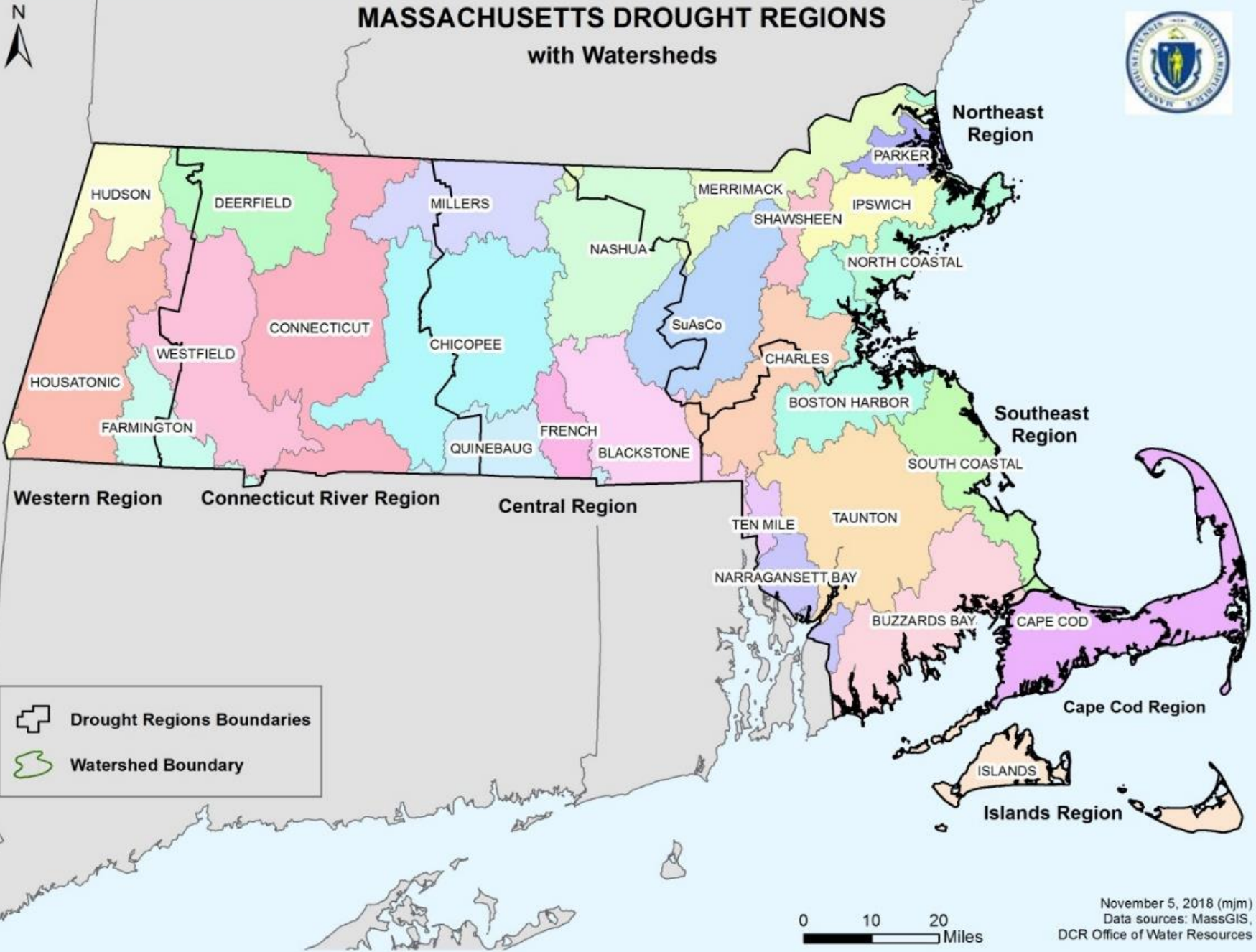
Level 4 – EMERGENCY Drought

MASSACHUSETTS DROUGHT REGIONS with Counties



December 19, 2018 (mjm)
Data sources: MassGIS,
DCR Office of Water Resources

MASSACHUSETTS DROUGHT REGIONS with Watersheds



 Drought Regions Boundaries

 Watershed Boundary

0 10 20
Miles

November 5, 2018 (mjm)
Data sources: MassGIS,
DCR Office of Water Resources

Overview of Recent Conditions

- Since May, scattered storms have created a patchwork of drying conditions. July was the hottest month on record for Boston and the summer was the 10th warmest summer. This led to above normal evapotranspiration.
- In September, these conditions were exacerbated by extremely low precipitation and continued above normal temperatures resulting in significantly low streamflow and groundwater values in some regions.
- The second half of October brought two significant rain events providing relief in precipitation deficits and most streamflow and groundwater values.

Precipitation Index - SPI

Index Severity Level	Percentile Ranges	SPI Values
0	>30	> -0.52
1	≤30 and >20	≤ -0.52 and > -0.84
2	≤20 and >10	≤ -0.84 and > -1.28
3	≤10 and >2	≤ -1.28 and > -2.05
4	≤2	≤ -2.05

Precipitation Index - SPI

Drought Region	Number of Sites	SPI1	SPI2	SPI3	SPI6	SPI9	SPI12	SPI24	SPI36
Western	5	1.11	0.05	-0.14	-0.19	-0.13	0.90	0.96	0.84
Connecticut River	11	0.80	0.01	-0.19	-0.28	-0.05	0.75	1.20	1.12
Central	12	1.17	0.30	0.41	0.35	0.68	1.45	1.50	1.58
Northeast	13	1.00	0.09	0.18	0.46	0.65	1.03	1.09	1.02
Southeast	15	0.73	0.06	-0.26	0.39	0.64	1.14	1.42	1.07
Cape Cod	4	1.06	0.93	0.38	0.62	0.75	1.22	1.34	1.16
Islands	3	1.24	1.00	0.42	0.90	0.97	1.46	0.89	1.05

Index Severity Levels



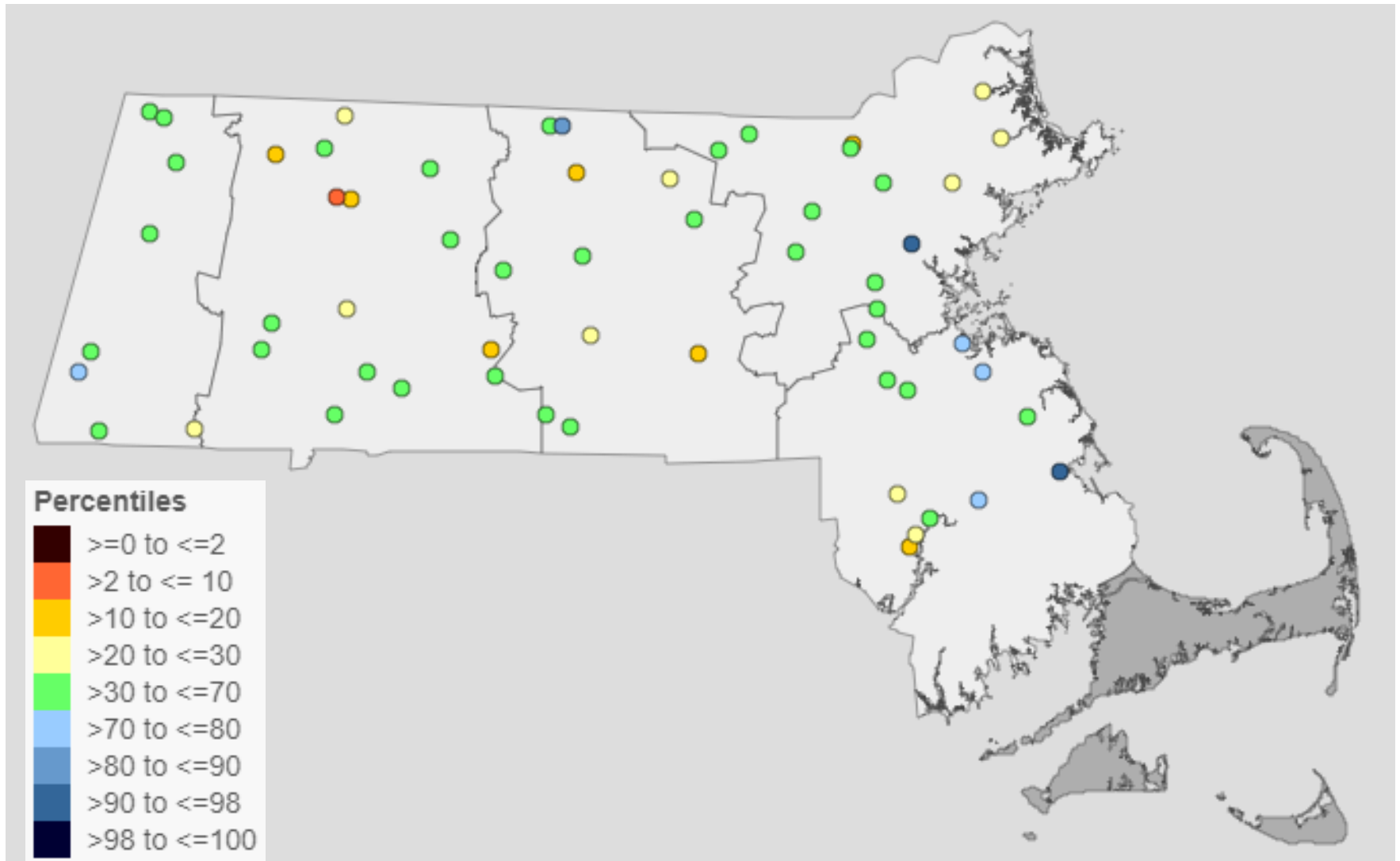
Precipitation Index - SPI

Index Severity Levels

Level 0 Level 1 Level 2 Level 3 Level 4

Major Basin	Number of Sites	SPI1	SPI2	SPI3	SPI6	SPI9	SPI12	SPI24	SPI36
BLACKSTONE	3	0.77	0.23	0.47	0.59	0.80	1.40	1.42	1.11
BOSTON HARBOR	7	0.63	-0.04	-0.26	0.39	0.64	1.14	1.09	1.03
BUZZARDS BAY	1	1.54	0.95	0.73	1.44	1.16	1.77	1.77	1.26
CAPE COD	4	1.06	0.93	0.38	0.62	0.75	1.22	1.34	1.16
CHARLES	3	0.98	0.16	0.44	1.04	1.18	1.54	1.53	1.37
CHICOPEE	4	1.22	0.30	0.79	0.48	0.88	1.38	1.63	1.71
CONNECTICUT	3	0.53	-0.49	-0.30	-0.56	-0.17	0.75	1.23	0.97
DEERFIELD	1	0.42	-0.70	-0.84	-1.45	-1.42	-0.12	0.27	0.17
FARMINGTON	1	1.55	1.22	1.45	1.30	1.74	2.06	3.34	3.48
FRENCH	1	0.94	-0.03	0.50	0.82	1.16	1.72	1.97	1.64
HOUSATONIC	2	1.01	0.50	-0.21	-0.16	-0.12	0.68	0.69	0.69
HUDSON	2	0.97	-0.13	-0.45	-0.34	-0.47	0.32	0.39	0.27
IPSWICH	2	0.87	0.09	0.40	0.46	0.31	0.57	0.40	0.21
ISLANDS	3	1.24	1.00	0.42	0.90	0.97	1.46	0.89	1.05
MERRIMACK	3	1.04	0.06	-0.21	0.46	0.58	1.00	1.09	0.95
MILLERS	2	0.82	-0.27	-0.25	-0.05	-0.31	0.24	0.74	0.80
NASHUA	4	1.19	0.21	-0.02	0.25	0.43	1.08	1.50	1.37
NORTH COASTAL	2	1.06	0.26	0.29	0.58	0.75	1.14	1.00	1.03
QUINEBAUG	2	1.24	0.40	0.75	0.61	0.91	1.55	1.52	1.38
SHAWSHEEN	1	1.00	0.03	0.00	-0.07	0.37	0.70	0.21	0.00
SOUTH COASTAL	2	0.80	0.18	-0.34	0.49	0.63	1.17	1.11	0.83
SuAsCo	2	1.19	0.31	0.32	0.57	0.88	1.58	1.49	1.49
TAUNTON	5	0.58	-0.36	-0.60	-0.03	0.06	0.99	1.13	0.85
WESTFIELD	3	0.80	0.10	0.23	-0.28	-0.05	0.74	1.20	1.12

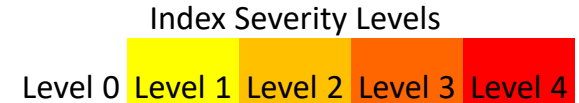
Streamflow- Percentiles of Monthly Median - October



Streamflow Index

By Region

- August – all regions at level 0
- September
 - CT River Valley – Index Severity 1
 - All other regions – Index Severity 0
- **October – all regions at Level 0**

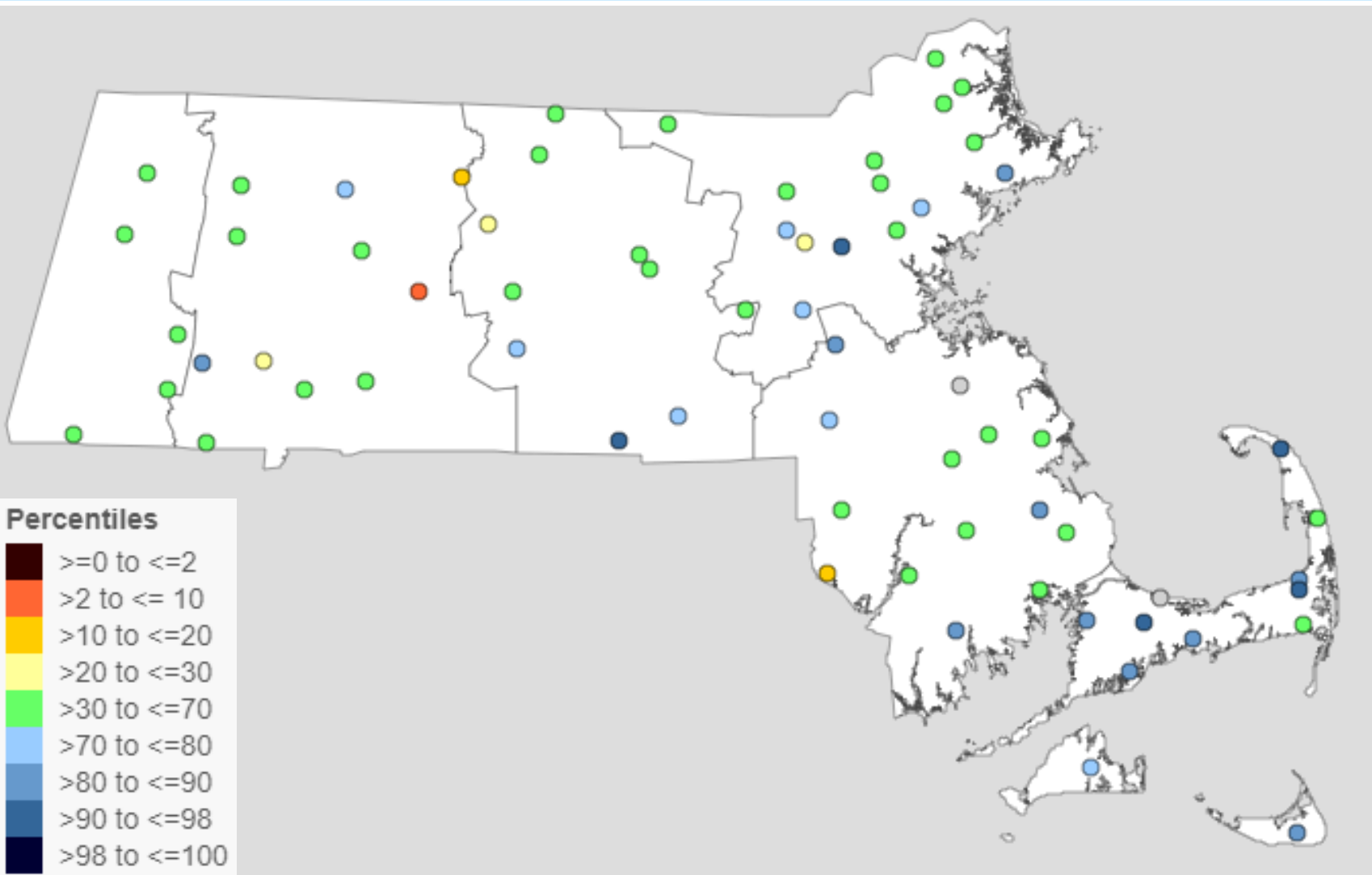


By Major Basin → Much more impact is seen at the basin scale because summer showers and rainfall tend to come as scattered storms with highly variable rainfall spatially even from town to town.

<u>SEPTEMBER</u>	Number of Gages	Median of Individual Gage Percentiles	Index Severity Level
Basin			
DEERFIELD	5	16	2
HOUSATONIC	4	22	1
BOSTON HARBOR	5	28	1
NASHUA	4	9	3

<u>OCTOBER</u>	Number of Gages	Median of Individual Gage Percentiles	Index Severity Level
Basin			
DEERFIELD	5	16	2
MERRIMACK	1	19	2
BLACKSTONE	1	19	2
FARMINGTON	1	24	1
IPSWICH	2	27	1
PARKER	1	25	1

Groundwater – Percentiles of End of Month OCTOBER



Groundwater Index

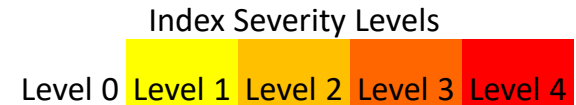
By Drought Region

August and September

- CT River Valley region - Index Severity Level 1
- All other regions - Index Severity Level 0

October

- All regions at level 0



By Basin

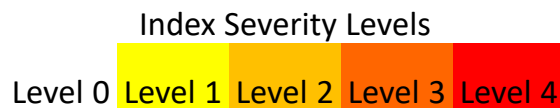
Similar to streamflow, more impacts are seen at the smaller watershed scale which allows smaller areas of more intense dryness and drought to show.

- August and September – 3 watersheds ranged from Level 1 to Level 3
- October – all watersheds at level 0

Lakes and Impoundments

Region	Total Reporting for Oct.	Median of Lakes and Impoundments Percentiles	MA Drought Management Plan Lakes and Impoundments Index
Western	2	51	0
CT River Valley	2	32*	0
Central	2	55	0
Northeast	7	65	0
Southeast	2	55	0
Cape Cod	1	87	0
Islands	N/A	N/A	N/A

*CT River Valley: Springfield's reservoir was at the 15th percentile or index severity level 2. The reservoir is ~70% full which is the threshold just before their first drought level; therefore, supplies relative to demand are not in a local drought level but relatively to the past 21 years, their reservoir level is at 15th percentile. The other reservoir in the region is the Quabbin at 50th percentile.



KBDI

Fire Danger Index: dryness of top 8" of soil

- Data from DCR Fire Chief
- August – all but Cape & Islands at Level 1 or 2
- September – all but Islands at Level 1 or 2
- October – all regions at level 0

Crop Moisture Index

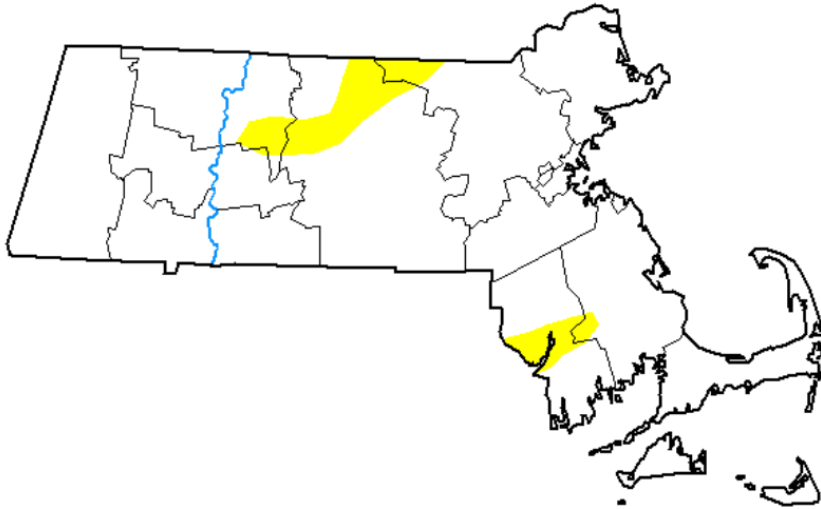
The CMI map for the week ending November 2, 2019 shows Excessive Wet conditions for the Wester Region and Wet conditions for the rest of the state, resulting in **Drought Index Severity Level of 0** for all regions.

The CMI shows the *short-term need versus available water* in a shallow soil profile and responds quickly to changing conditions. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level. This indicator is *relevant during growing season*.

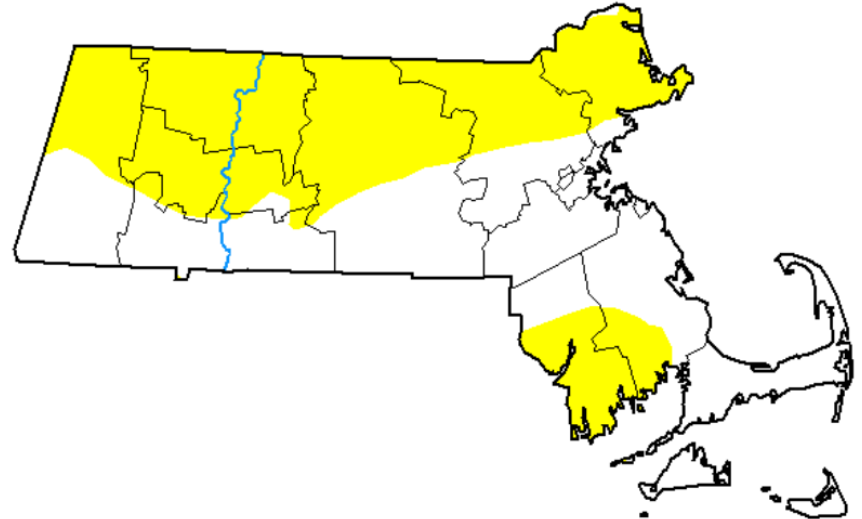
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif

US Drought Monitor


September 19, 2019




September 26 through October 29, 2019



Intensity:

 D0 (Abnormally Dry)

 D2 (Severe Drought)

 D4 (Exceptional Drought)

 D1 (Moderate Drought)

 D3 (Extreme Drought)

[starting November 9, 2019 – USDM does not show any dry or drought conditions]

Summary of Drought Indices by Drought Region

Drought Indicator	West	CT River Valley	Central	Northeast	Southeast	Cape	Islands
Precipitation	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0
Streamflow	Level 0	Level 0	Level 0	Level 0	Level 0	N/A	N/A
Groundwater	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0
Lakes/Impoundments	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0	N/A
Crop Moisture Index	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0
KBDI - Fire danger	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0
<i>Recommended October¹</i>	Normal	Normal	Normal	Normal	Normal	Normal	Normal

1) This summary is provided for informational purposes. No changes in drought status are official until the Drought Management Task Force convenes and makes a recommendation accepted by Secretary of the Executive Office of Energy and Environmental Affairs. Data are preliminary and not final until all data are reported.

Summary of Drought Indices by Basin

Index Severity	Deerfield
Precipitation	Level 3
Streamflow	Level 2
Groundwater	Level 0
Lakes/ Impoundments	N/A
Crop Moisture Index	Level 0
KBDI - Fire danger	Level 0
<i>Recommended October</i> ¹	Mild

1) This summary is provided for informational purposes. No changes in drought status are official until the Drought Management Task Force convenes and makes a recommendation accepted by Secretary of the Executive Office of Energy and Environmental Affairs. Data are preliminary and not final until all data are reported.

Number of Measurements	Deerfield
Precipitation	1
Streamflow	5
Groundwater	1

Major Basin	Number of Sites	SPI1	SPI2	SPI3	SPI6	SPI9	SPI12	SPI24	SPI36
DEERFIELD	1	0.42	-0.70	-0.84	-1.45	-1.42	-0.12	0.27	0.17

DMTF Deliberation