

Hydrologic Conditions in Massachusetts

Drought Management Task Force

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DCR Office of Water Resources

October 10, 2019

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

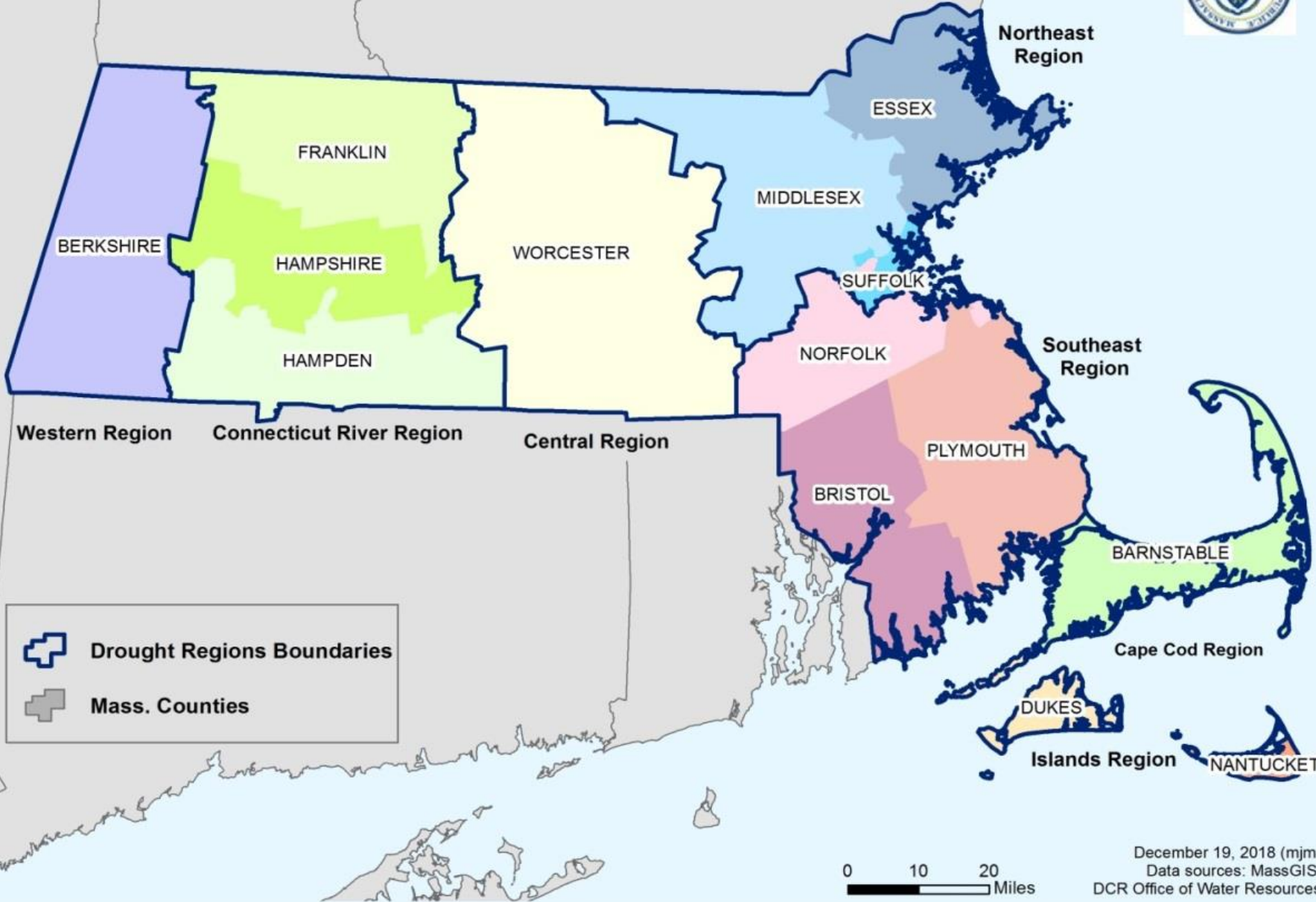
Level 1 - MILD Drought (formerly Advisory)

Level 2 - SIGNIFICANT Drought (formerly Watch)

Level 3 - CRITICAL Drought (formerly Warning)

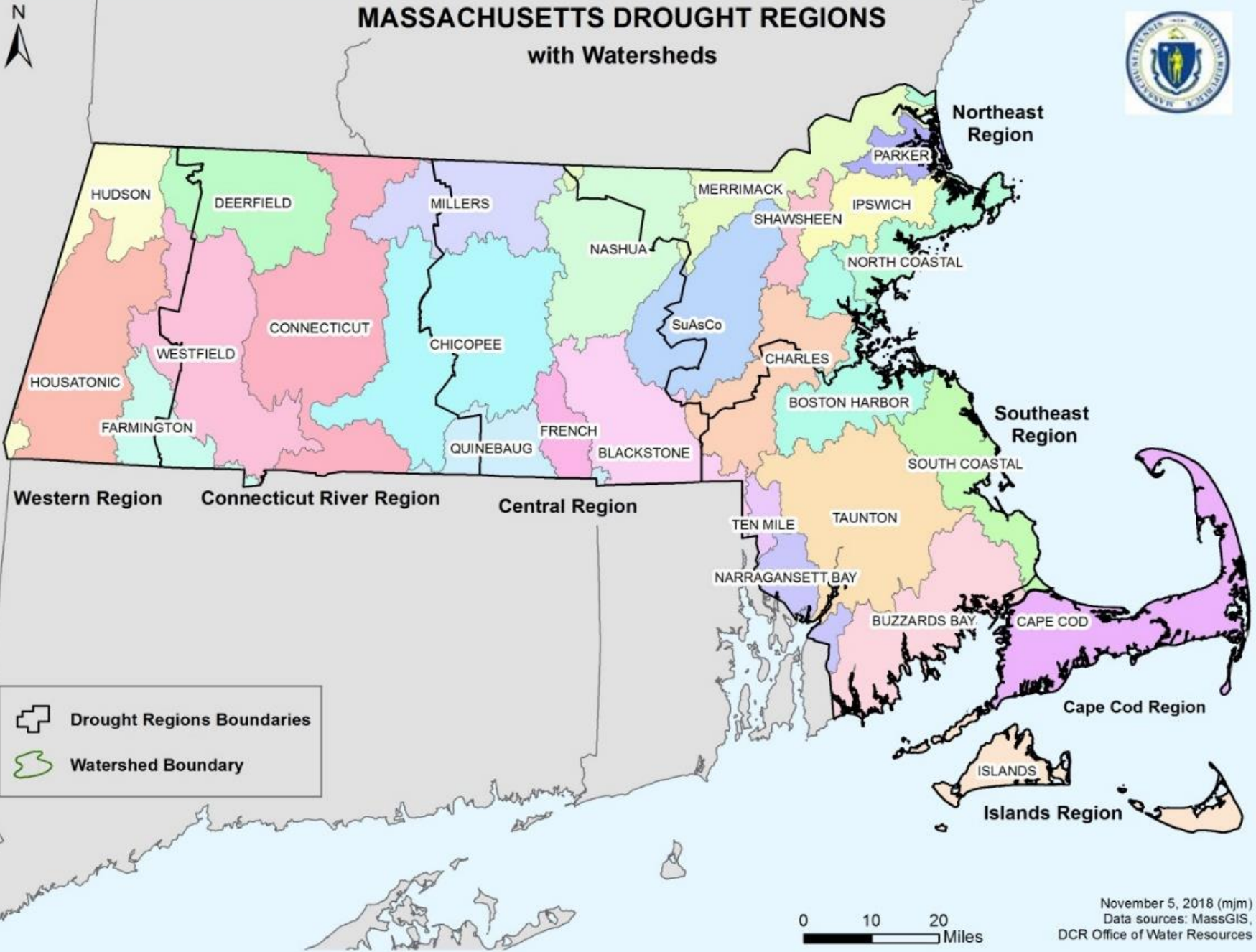
Level 4 – EMERGENCY Drought

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

- 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.

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

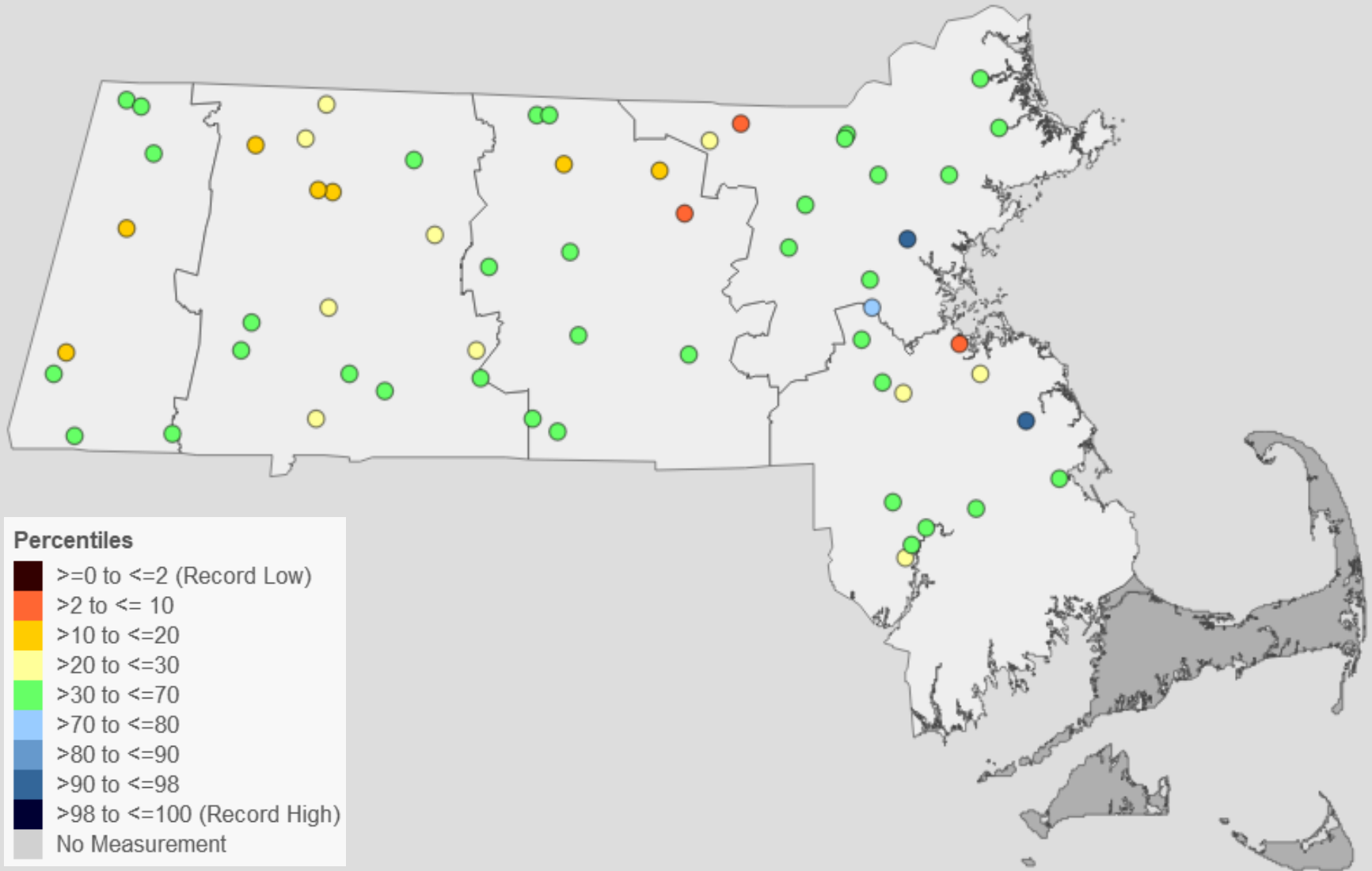
REGION	n	1-month	2-month	3-month	6-month	9-month	12-month	24-month	36-month
Cape Cod	5	0.22	-0.18	-0.12	0.68	0.56	1.08	0.95	1.07
Central	13	-1.15	-0.49	-0.1	0.5	0.31	0.87	1.47	1.21
Connecticut River	10	-1.05	-0.55	-0.54	0.04	-0.01	0.62	1.31	0.76
Islands	4	-0.2	-0.42	-0.62	0.41	0.6	1.31	0.89	1.23
Northeast	13	-1.75	-0.56	-0.1	0.36	0.19	0.67	0.62	0.52
Southeast	19	-1.22	-0.88	-0.05	0.61	0.63	1.32	1.46	1.18
Western	6	-0.74	-0.87	-1.17	-0.49	-0.6	-0.15	0.38	0.28

Level 1 Level 2 Level 3 Level 4

Precipitation Index - SPI

Major Basin	n	1-month	2-month	3-month	6-month	9-month	12-month	24-month	36-month
BLACKSTONE	3	-0.6	0.21	0.53	0.93	0.83	1.31	1.44	1.13
BOSTON HARBOR	6	-1.28	-0.89	-0.15	0.6	0.6	1.1	1.23	1.1
BUZZARDS BAY	2	-1.49	-0.77	0.59	1.06	0.94	1.52	1.58	1.31
CAPE COD	5	0.2	-0.28	-0.04	0.65	0.18	0.92	1	0.74
CHARLES	4	-0.98	0.04	0.64	1.29	1.15	1.71	1.88	1.76
CHICOPEE	5	-1.11	-0.05	0.07	0.94	0.87	0.9	1.55	1.44
CONNECTICUT	3	-1.29	-0.85	-0.92	-0.28	-0.32	0.52	1.27	0.8
DEERFIELD	1	-1	-1.01	-1.14	-1.23	-1.16	-0.3	0.45	-0.08
FARMINGTON	1	0.21	0.82	0.41	1.38	1.32	1.94	3.55	3.35
FRENCH	1	-1.04	0.06	0.67	1.13	1.17	1.53	2.11	1.69
HOUSATONIC	3	-0.47	-0.99	-1.26	-0.7	-0.58	-0.11	0.38	0.11
HUDSON	2	-1.03	-0.88	-0.97	-0.47	-0.49	-0.16	0.11	-0.06
IPSWICH	2	-1.42	-0.16	0.22	0.4	0.12	0.39	0.25	0.13
ISLANDS	4	-0.19	-0.22	-0.26	0.56	0.8	1.51	0.98	1.47
MERRIMACK	4	-3.19	-0.86	-0.39	0.21	0.14	0.72	0.71	0.66
MILLERS	2	-1.12	-0.75	-0.25	0	-0.34	-0.14	0.95	0.66
NASHUA	4	-1.7	-1.04	-0.6	0.16	-0.13	0.65	1.34	1.01
NORTH COASTAL	2	-1.61	-0.6	-0.14	0.22	0.03	0.57	0.29	0.43
QUINEBAUG	2	-1	0.06	0.2	0.91	0.7	1.38	1.64	1.27
SHAWSHEEN	1	-1.13	-0.74	-0.34	0.06	-0.01	0.51	0.18	0.03
SOUTH COASTAL	2	-0.73	-1.22	-0.14	0.68	0.57	1.33	1.02	0.83
SuAsCo	1	-0.32	0.16	0.61	0.87	0.7	1.03	1.06	0.67
TAUNTON	7	-1.7	-1.28	-0.39	-0.04	0.32	1.07	1.46	0.95
TEN MILE	1	-0.28	-0.21	0.01	0.79	0.97	1.8	1.95	1.66
WESTFIELD	2	-0.99	-0.77	-0.83	-0.54	-0.64	0.22	0.86	0.22

Streamflow- Percentiles of Monthly Median SEPTEMBER

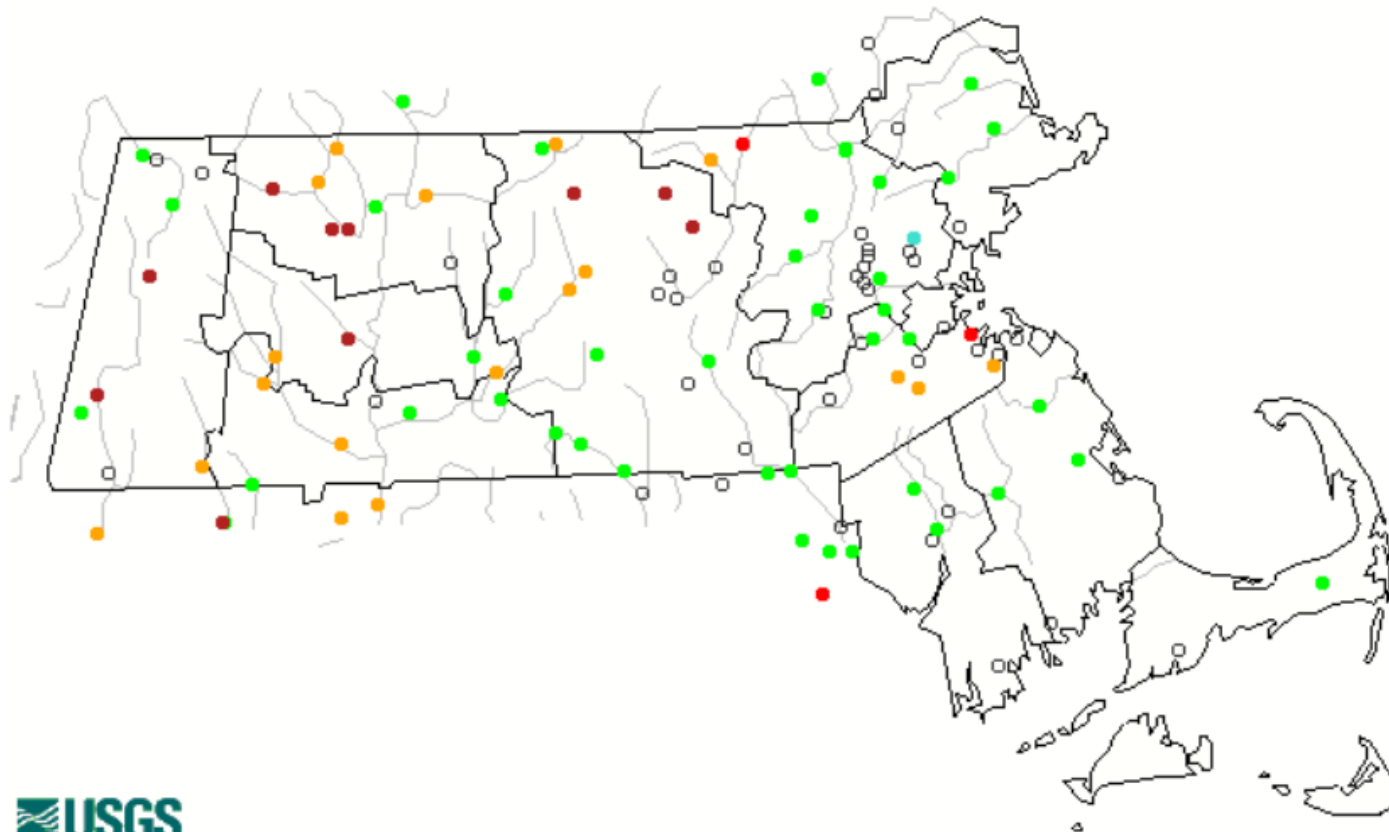


Streamflow- Percentiles of 28-day Average

Map of 28-day average streamflow compared to historical streamflow for the day of the year (Massachusetts)

Massachusetts ▼ or Water-Resources Regions ▼

Wednesday, October 02, 2019

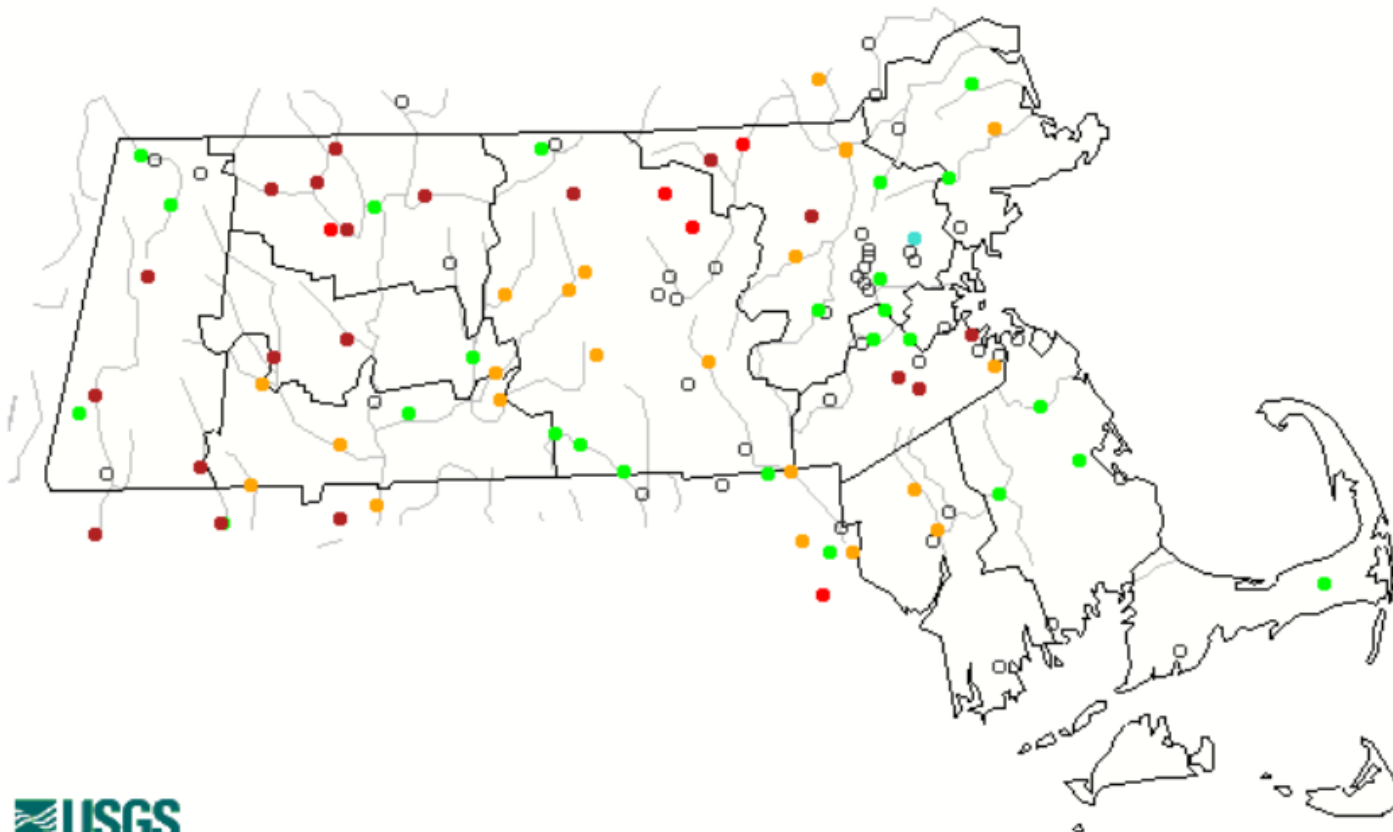


Streamflow- Percentiles of 14-day Average

Map of 14-day average streamflow compared to historical streamflow for the day of the year (Massachusetts)

Massachusetts ▼ or Water-Resources Regions ▼

Wednesday, October 02, 2019

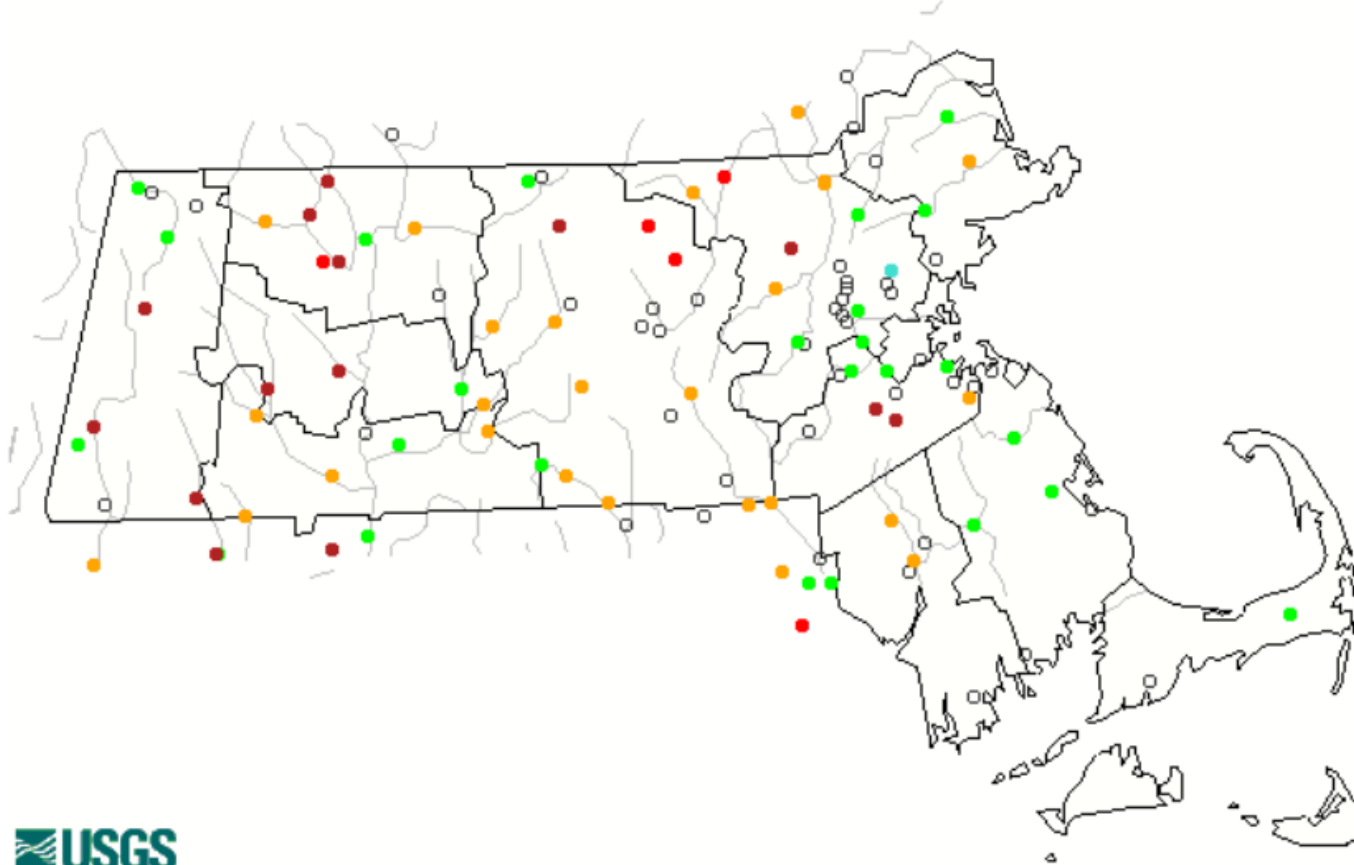


Streamflow- Percentiles of 7-day Average

Map of 7-day average streamflow compared to historical streamflow for the day of the year (Massachusetts)

Massachusetts ▼ or Water-Resources Regions ▼ All Days

Wednesday, October 02, 2019



Streamflow Index

By Region

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

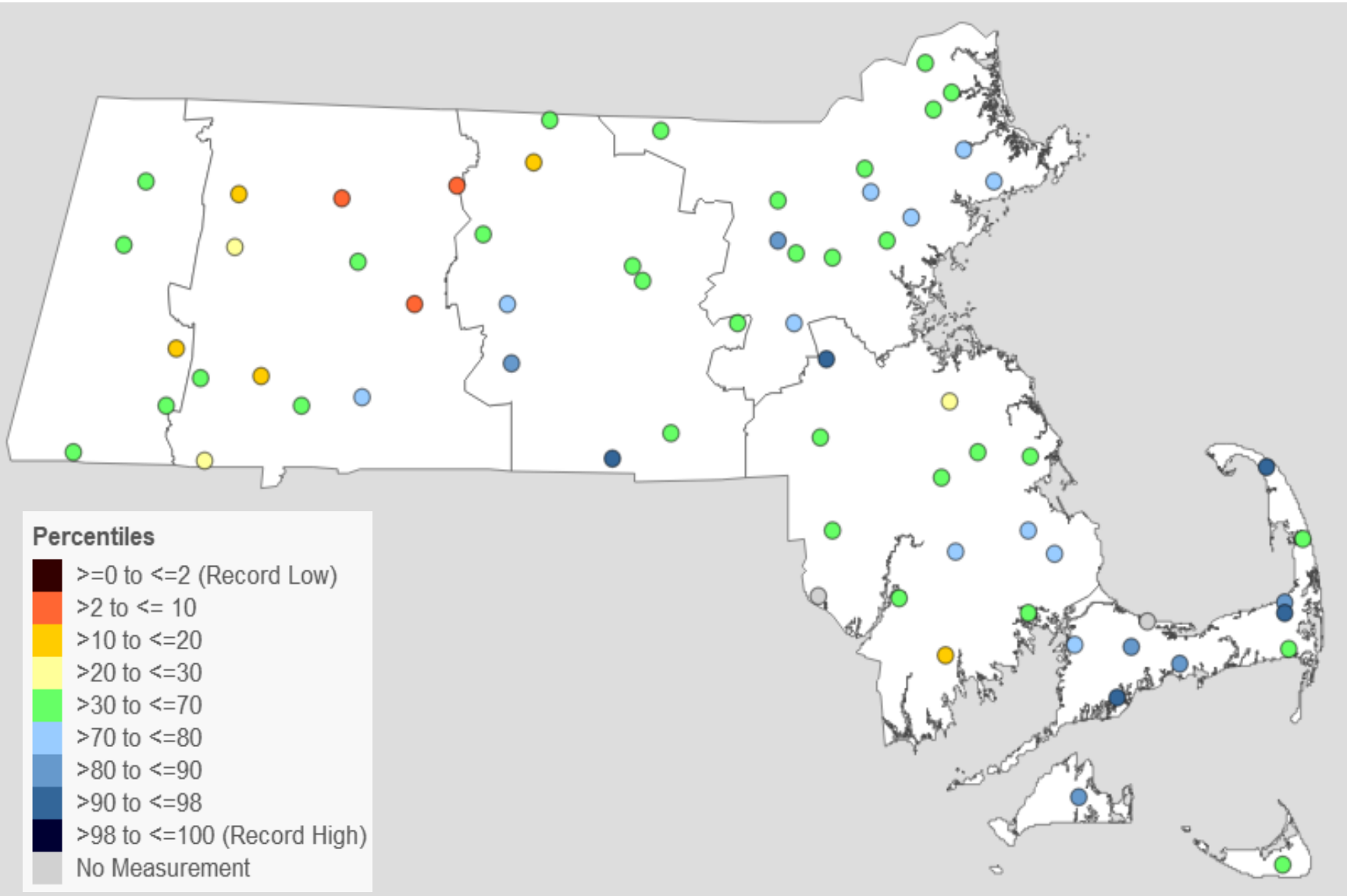
By Major Basin → Much more impact is seen at the basin scale because summer showers and rainfall tend to come as scattered storms with highly variable rainfall spatially even from town to town.

Level 1 Level 2 Level 3 Level 4

<u>AUGUST</u> Basin	Number of Gages	Median Percentile of Gages	Index Severity Level
HOUSATONIC	4	21	1
DEERFIELD	5	28	1

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

Groundwater – Percentiles at End of Month SEPTEMBER



Groundwater Index

By Drought Region

August and September

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

Level 1 Level 2 Level 3 Level 4

<u>AUGUST</u>	Number of Wells	Median Percentile of Wells	Index Severity Level
Basin			
WESTFIELD	6	28	1
FARMINGTON	1	13	2
DEERFIELD	1	28	1

<u>SEPTEMBER</u>	Number of Wells	Median Percentile of Wells	Index Severity Level
Basin			
WESTFIELD	6	22	1
MILLERS	3	12	2
DEERFIELD	1	9	3

Lakes and Impoundments

Region	Total Reporting for September	MA Drought Management Plan Lakes and Impoundments Index
Western	2	0
CT River Valley	2	0
Central	3	0
Northeast	8	0
Southeast	2	0
Cape Cod	1	0
Islands	N/A	N/A

KBDI

Fire Danger Index: dryness of top 8” of soil

- Data from DCR Fire Chief
- While brief showers are keeping fuel moist and fire danger seasonally average, KBDI as a Drought Index is showing impacts at all regions except the Islands in September.

Level 1 Level 2 Level 3 Level 4

<u>AUGUST</u>	Values	Index Level
Region		
Western	376	1
CT River Valley	409, 398, 372	2
Central	372, 230	1
Northeast	334, 330, 215	1
Southeast	219, 196	1
Cape Cod & Islands	95, 82, 17	0

<u>SEPTEMBER</u>	Values	Index Level
Region		
Western	443	2
CT River Valley	463, 459, 323	2
Central	332, 485	2
Northeast	465, 463, 497	2
Southeast	301, 303, 328	1
Cape Cod	203, 150	1
Islands	136, 27	0

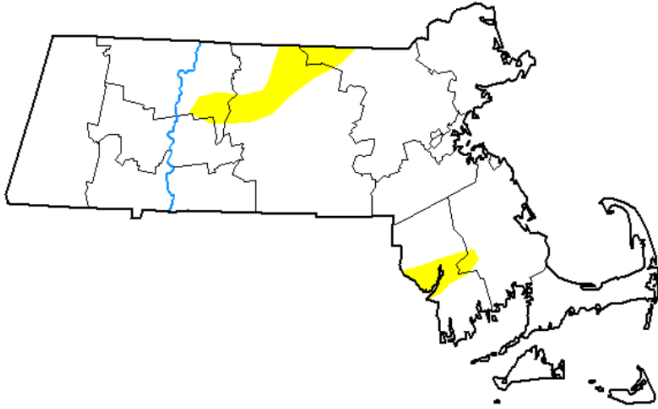
Crop Moisture Index

Weekly value ending September 28, 2019

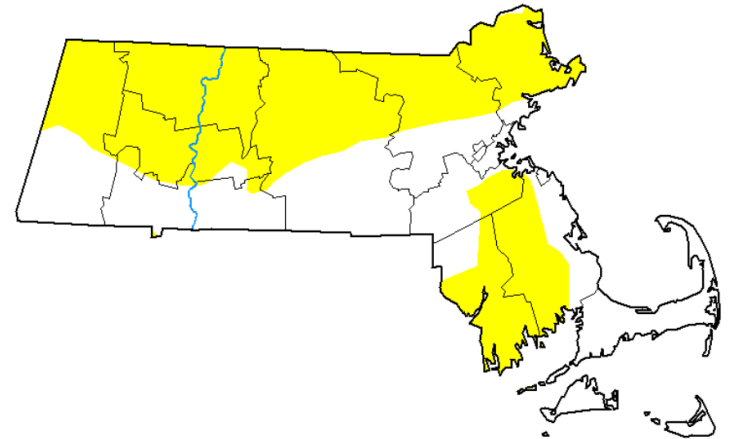


US Drought Monitor

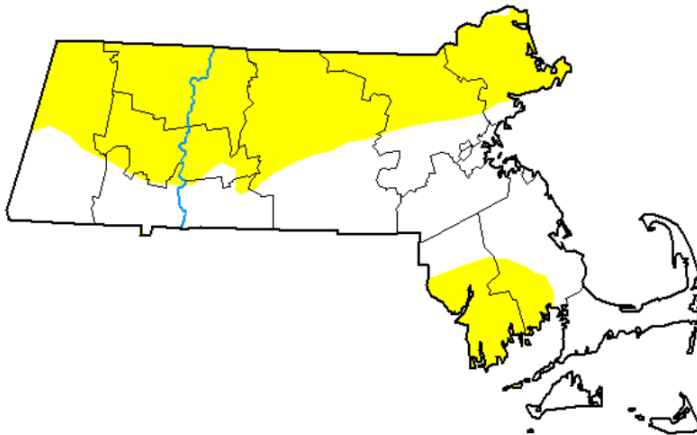
September 19, 2019



October 3, 2019




September 26, 2019



Intensity:

 D0 (Abnormally Dry)

 D2 (Severe Drought)

 D4 (Exceptional Drought)

 D1 (Moderate Drought)

 D3 (Extreme Drought)

Summary of Drought Indices

Drought Indicator	West	CT River Valley	Central	Northeast	Southeast	Cape	Islands
Precipitation	Level 2	Level 1	Level 0	Level 1	Level 2	Level 0	Level 0
Streamflow	Level 0	Level 1	Level 0	Level 0	Level 0	N/A	N/A
Groundwater	Level 0	Level 1	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 2	Level 2	Level 2	Level 2	Level 1	Level 1	Level 0
<i>Recommended September¹</i>	Normal	Mild Drought	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.

Connecticut River Valley Region

SPI	1-Month	2-Month	3-Month	6-Month	9-Month	12-Month	24-Month	36-Month
	-1.05	-0.55	-0.54	0.04	-0.01	0.62	1.31	0.76

Month	Number of STREAMFLOW gages				
	Total Reporting	<30 th to 20 th percentile	<20 th to 10 th percentile	<10 th to 2 nd percentile	<2 nd percentile
August	15	3	1	0	0
September	15	6	3	0	0

Notes: Gage counts are non-cumulative except for “total reporting”. Not all gages report in all months due to ice, beaver dams or other conditions.

Month	Number of GROUNDWATER wells				
	Total Reporting	<30 th to 20 th percentile	<20 th to 10 th percentile	<10 th to 2 nd percentile	<2 nd percentile
August	11	4	2	1	0
September	11	2	2	3	0

Notes: Well counts are non-cumulative except for “total reporting”. Not all data are available in time for reporting.

Index	Severity
Standardized Precipitation Index	Level 2
Streamflow	Level 1
Groundwater	Level 1
Reservoir*	Level 0
Crop Moisture Index	Level 0
KBDI - Fire danger	Level 2

*Springfield Reservoir is below 30th percentile according to MA Drought Plan and available data.

CT River Valley Region Reservoirs

Springfield	27.7
Quabbin	36.8
median	32.3

Level 1 Level 2 Level 3 Level 4

Summary of Drought Indices by Basin

	Housatonic	Deerfield	Westfield	Millers	Nashua	Boston Harbor
Index Severity						
Precipitation	Level 2	Level 2	Level 1	Level 1	Level 2	Level 2
Streamflow	Level 1	Level 2	Level 0	Level 0	Level 3	Level 1
Groundwater	Level 0	Level 3	Level 1	Level 2	Level 0	Level 0
Lakes/ Impoundments	Level 0	N/A	Level 1	N/A	N/A*	N/A*
Crop Moisture Index	Level 0	Level 0	Level 0	Level 0	Level 0	Level 0
KBDI - Fire danger	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2

***Reservoir Notes:**

Boston Harbor: The only monitored reservoir in the Boston Harbor Basin is part of a system with reservoirs in another basin.

Nashua: Rutland reading not available, Worcester reservoirs in Nashua are part of system with reservoirs in Blackstone

Westfield: Springfield Reservoir (Cobble Hill) is below 30th percentile (27.7th) according to MA Drought Plan and available data, but still just above "normal" range per Springfield Drought Plan, although below 10-year reservoir level average.

Number of Measurements	Housatonic	Deerfield	Westfield	Millers	Nashua	Boston Harbor
Precipitation	3	1	2	2	4	6
Streamflow	4	5	3	4	4	5
Groundwater	2	1	6	3	3	2

DMTF Deliberation