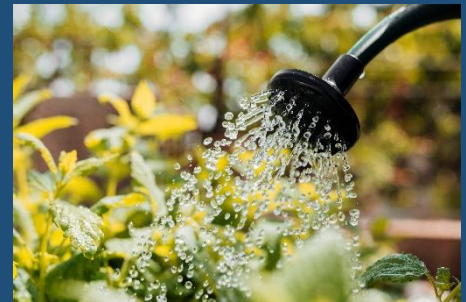


VANDANA RAO, PhD
Director of Water
Policy

Executive Office of
Energy and
Environmental
Affairs

WATER CONSERVATION IN THE AGE OF CLIMATE CHANGE



Granted, we don't have this.....

Location:
Mumbai (Bombay),
India



OR SO WE THOUGHT!

We ARE seeing more of this....



July 10, 2010 Storm – 4 inches in 1 hour

Source: John Bolduc, Environmental Planner, City of Cambridge



March 31, 2010 - West Warwick

Source: Northeast River Forecasting Center

and this.....



And this.....Worcester in October 2016

....while we were in the middle of our worst drought since the 1960s!

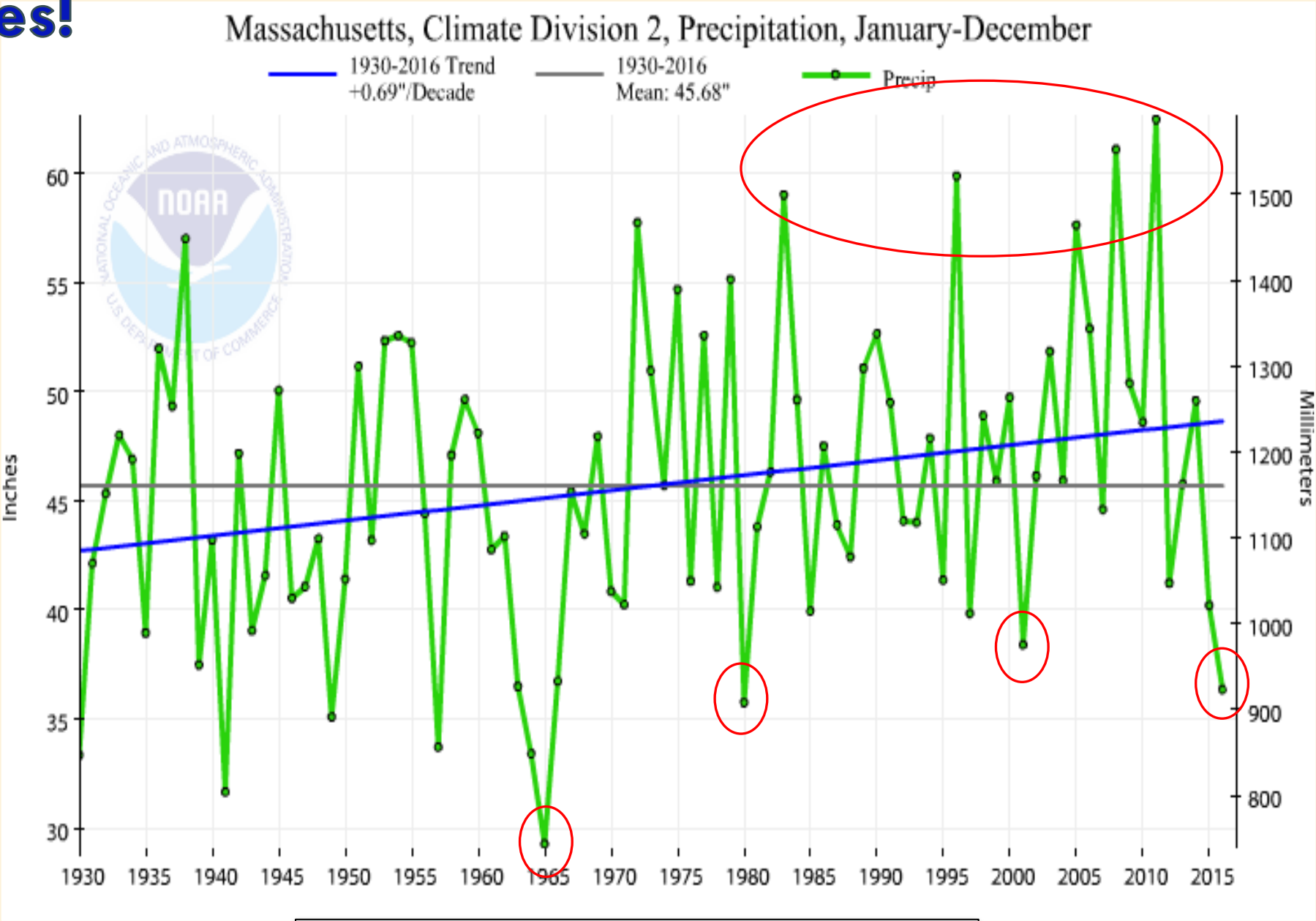


“Sandy was a whole other story!”

Jim Cooper, Superintendent of Milford (CT) Wastewater Division



Extremes!



CT Valley to Merrimack Valley

Source: <http://www.ncdc.noaa.gov/cag>

Period: 1895–2020

Temperatures are Rising!

Map showing temperature anomalies by state for September 4, 2020. The map uses a color scale from light yellow (cooler) to dark red (warmer). The following table lists the temperature anomalies for each state:

State	Temperature Anomaly
Alaska	124
Arizona	126
California	123
Colorado	120
Connecticut	126
Delaware	125
District of Columbia	126
Florida	121
Georgia	95
Hawaii	124
Idaho	115
Illinois	93
Indiana	92
Iowa	86
Kansas	98
Kentucky	88
Louisiana	87
Maine	124
Maryland	119
Massachusetts	126
Michigan	119
Minnesota	120
Mississippi	85
Missouri	83
Montana	117
Nebraska	112
Nevada	115
New Hampshire	124
New Jersey	124
New Mexico	124
New York	123
North Carolina	101
North Dakota	116
Ohio	116
Oklahoma	125
Oregon	120
Pennsylvania	124
Rhode Island	125
South Carolina	88
South Dakota	118
Tennessee	88
Texas	120
Utah	124
Vermont	124
Virginia	114
Washington	123
West Virginia	112
Wisconsin	115
Wyoming	116

National Centers for Environmental Information
Fri Sep 4 2020

**Record Coldest
(1)**

Much Below Average

Below Average

Near Average

 Above Average

Much Above Average

Record Warmest
(126)

Sea Level Rising and Increased Storm Surge!



High Intensity Rains resulting in Flooding!

Photo from J. Field



Source: Steve Mabee

Infrastructure and Property Damage!



Photo: J. Kopera



Photo: Steve Mabree

Natural Resource Impacts!



Source: J. Kopera

And over the last 20 years



Our most severe drought since the 1960s

**Mattapoissett River
September 2016**



**Quabbin Reservoir
September 2016**



**Cambridge Reservoir
Fall 2016**



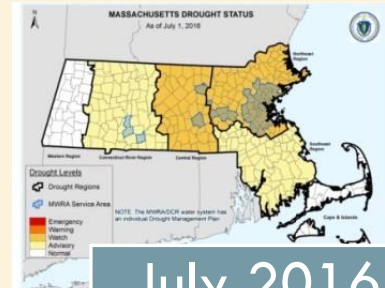
**Martins Brook
Fall 2016**



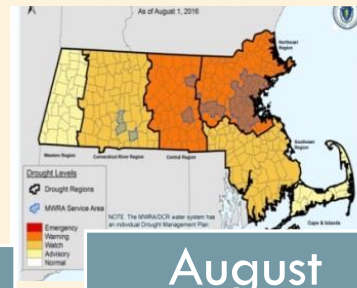
**Scituate Reservoir
2016**



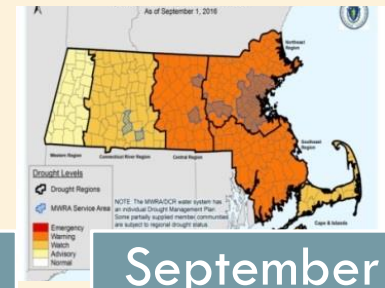
The Drought of 2016 - 2017



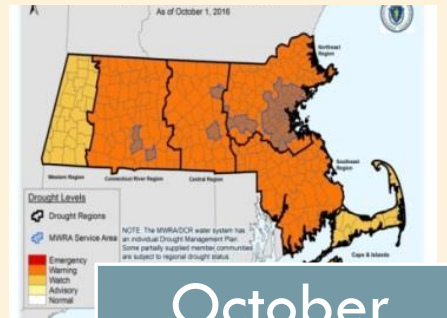
July 2016



August



September



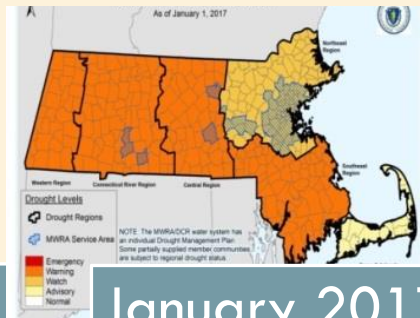
October



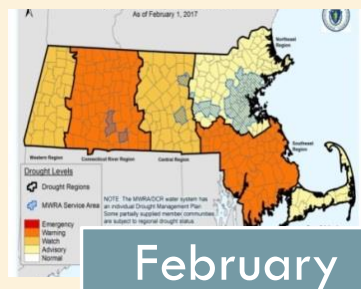
November



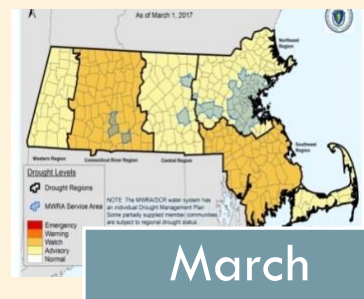
December



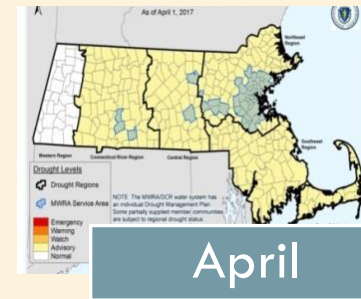
January 2017



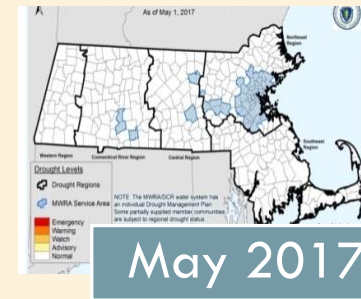
February



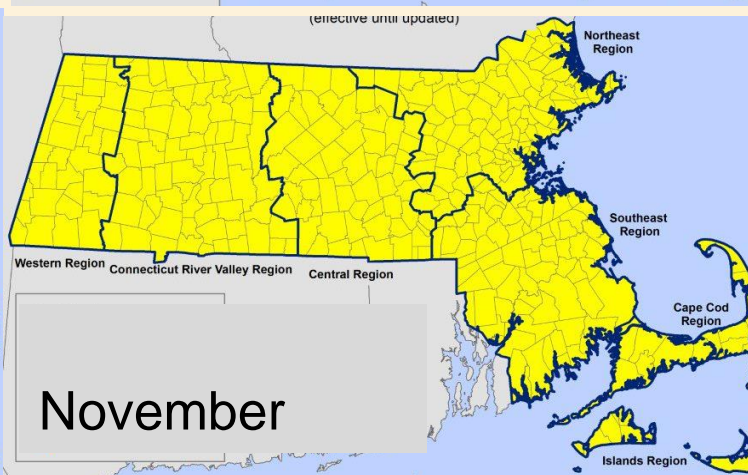
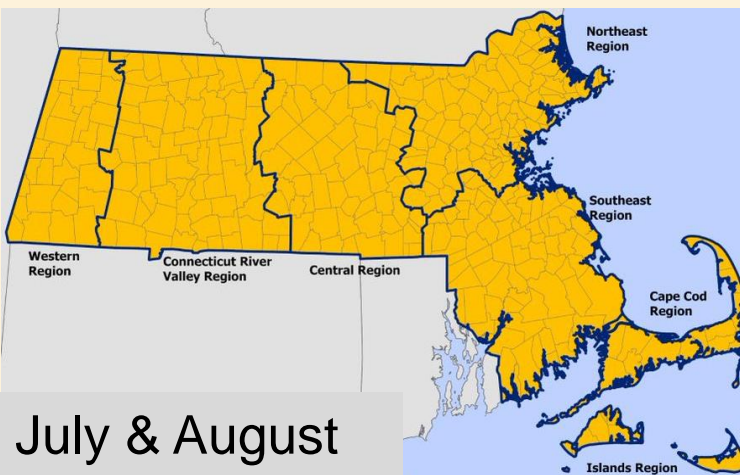
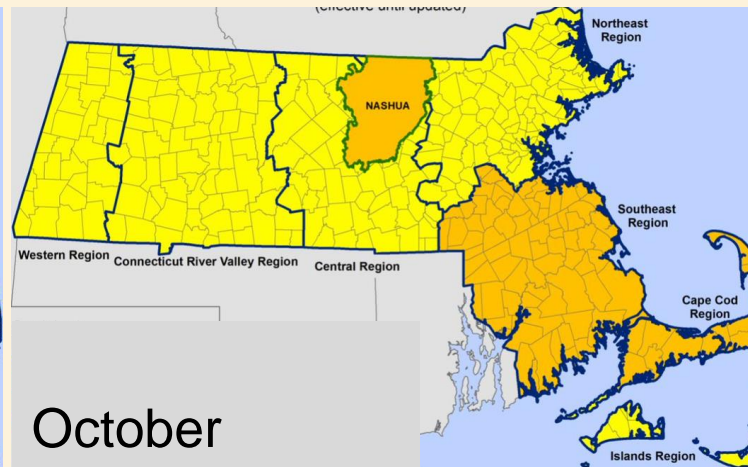
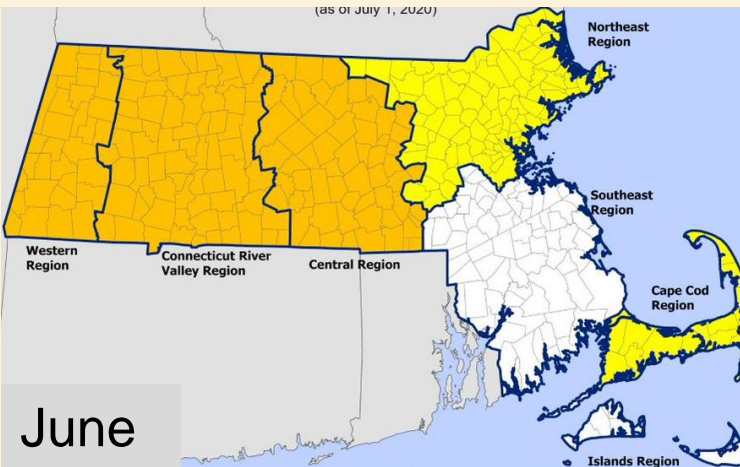
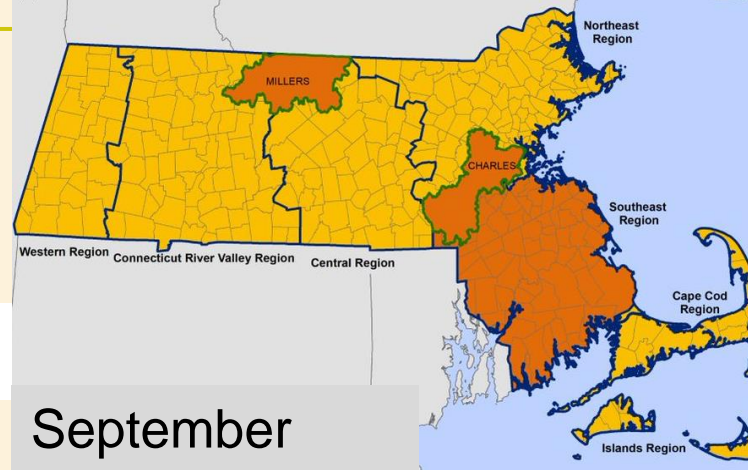
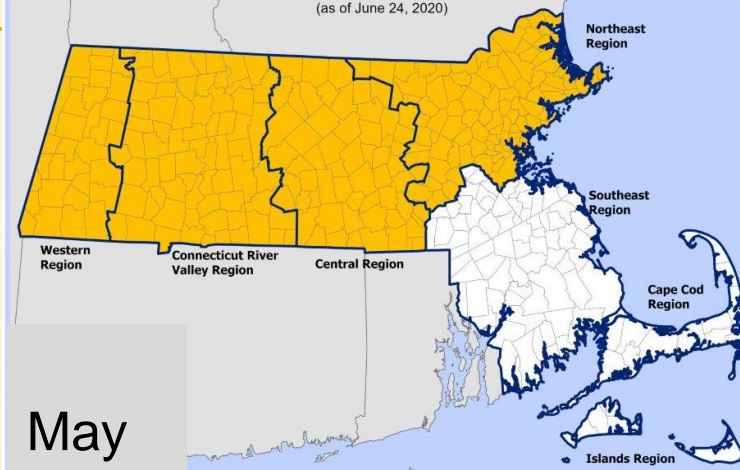
March



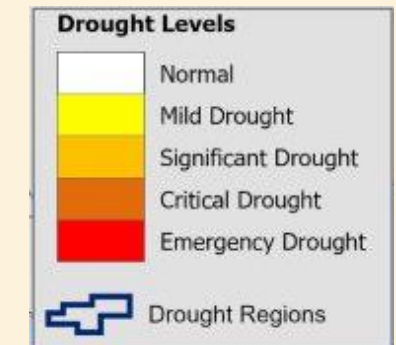
April



May 2017



The Drought of 2020



Streamflow Record Lows

2016-2017 Drought

Month	# Gages with Period Of Record Lows	# Gages with SF between 2-10 Percentile
September 2016	15	41
October	2	23
November	2	30
December	1	9
January 2017	0	0
February	0	0
March	1	10

2020 Drought

Month	# Gages with Period Of Record Lows	# Gages with SF between 2-10 Percentile
June 2020	0	24
July	0	1
August	3	14
September	1	22
October	0	4
November	0	0

Groundwater Record Lows

2016-2017 Drought

Month	# Wells with Period Of Record Lows
September 2016	14
October	13
November	8
December	6
January 2017	4
February	3
March	2

2020 Drought

Month	# Wells with Period Of Record Lows
June 2020	4
July	1
August	2
September	6
October	6
November	2

Annual Precipitation

2016 – 37 inches; **2017** – 47 inches

Average per year: 48 inches

Rainfall during the drought of record (1960s) – low 30s

So what is going on?

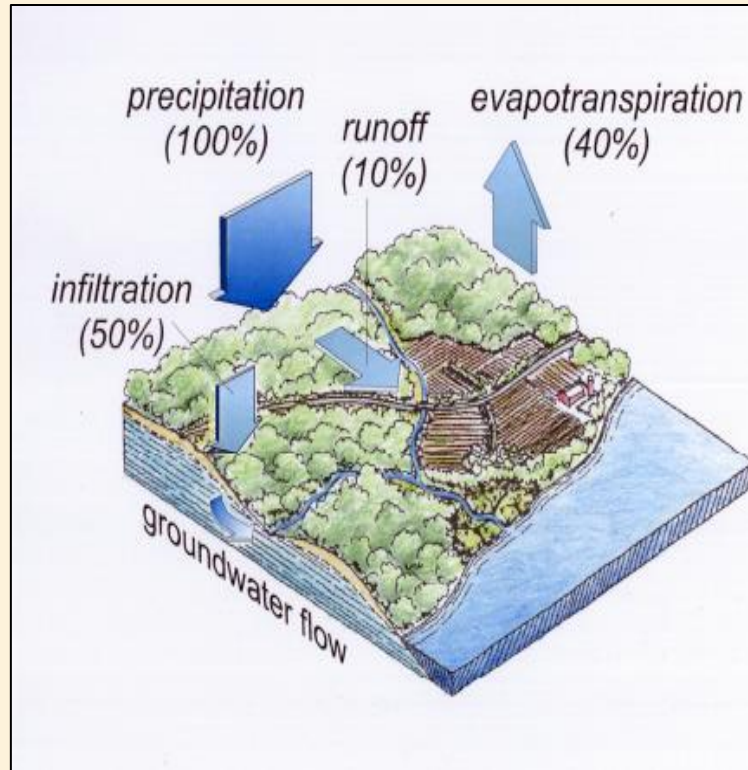
How should
Massachusetts address
its new hydrological
regime and impacts?

What should we do at the
state and **local** levels?

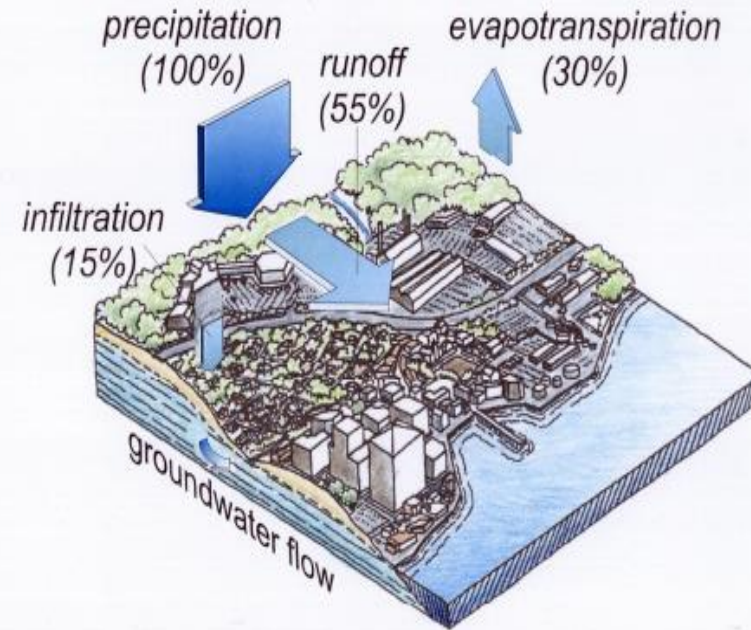


Understanding the Problem.....its really basic!

Pre-Development



Impacts from Typical Development



Its ALL about Managing for the Extremes!

**.....and the two are
connected!**

Take-Aways from 2016 & 2020 Droughts

- Climate is changing and MA is predicted to see more short- and long-term droughts
- Have started to experience a newer phenomenon of a “flash drought” with a fast onset and quick deterioration in conditions
- Consistently above normal temperatures – contribution to flash droughts, more evaporation, winter precipitation as rain, greater outdoor use
- Seen many record low streamflow and groundwater levels across the state (worse than during the drought of the 60s) in spite of rainfall amounts being higher
- Need to have a consistent approach to drought planning and mitigation (including water conservation), and communication

We need to be better PREPARED and take a hard look at water and land use!



What can be done at the State Level

WCS
implemented
through
regulatory
programs

Drought Management and Mitigation

- Actively promote water conservation
- Maintain Open Space and Protect Land in particular Upland areas; they are important, and perhaps more so from a drought perspective
- Maintain, modernize and make infrastructure more climate resilient
- Restore natural habitats

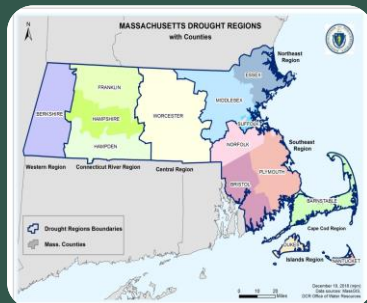
MA Drought
Plan

Grants
\$50M/year

Dept. Fish & Game
Grants & Tech
Assistance

SRF &
Municipal
Vulnerability
Preparednes
s (\$11M)





Updated MA DROUGHT PLAN

Developed after
2016/17 Drought



MASSACHUSETTS

DROUGHT MANAGEMENT PLAN

September 2019

Massachusetts Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

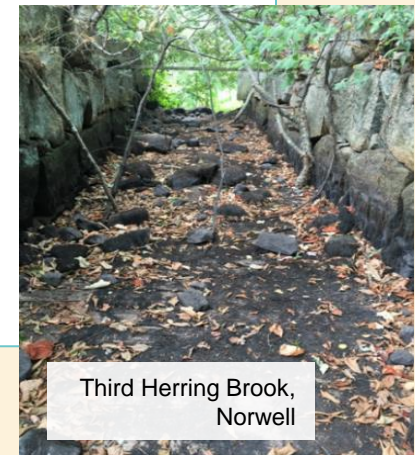


Massachusetts Emergency Management Agency
400 Worcester Rd, Box 1496
Framingham, MA 01701



Drought Preparedness and Response Actions: Guidance for Communities

- Identifies key actions that can be taken at the local level before a drought (to prepare) and during a drought (to respond), along with resources to implement key actions
- Audience: municipalities and/or public water systems, partners that can support and assist with implementation, including environmental groups, concerned citizens, and local boards such as the planning board, conservation commission, and town select board or city council
- **Action 1: Develop a Water Conservation Program**
- **Action 2: Develop a Local Drought Management Plan**



Third Herring Brook,
Norwell

What can be done at the Local Level

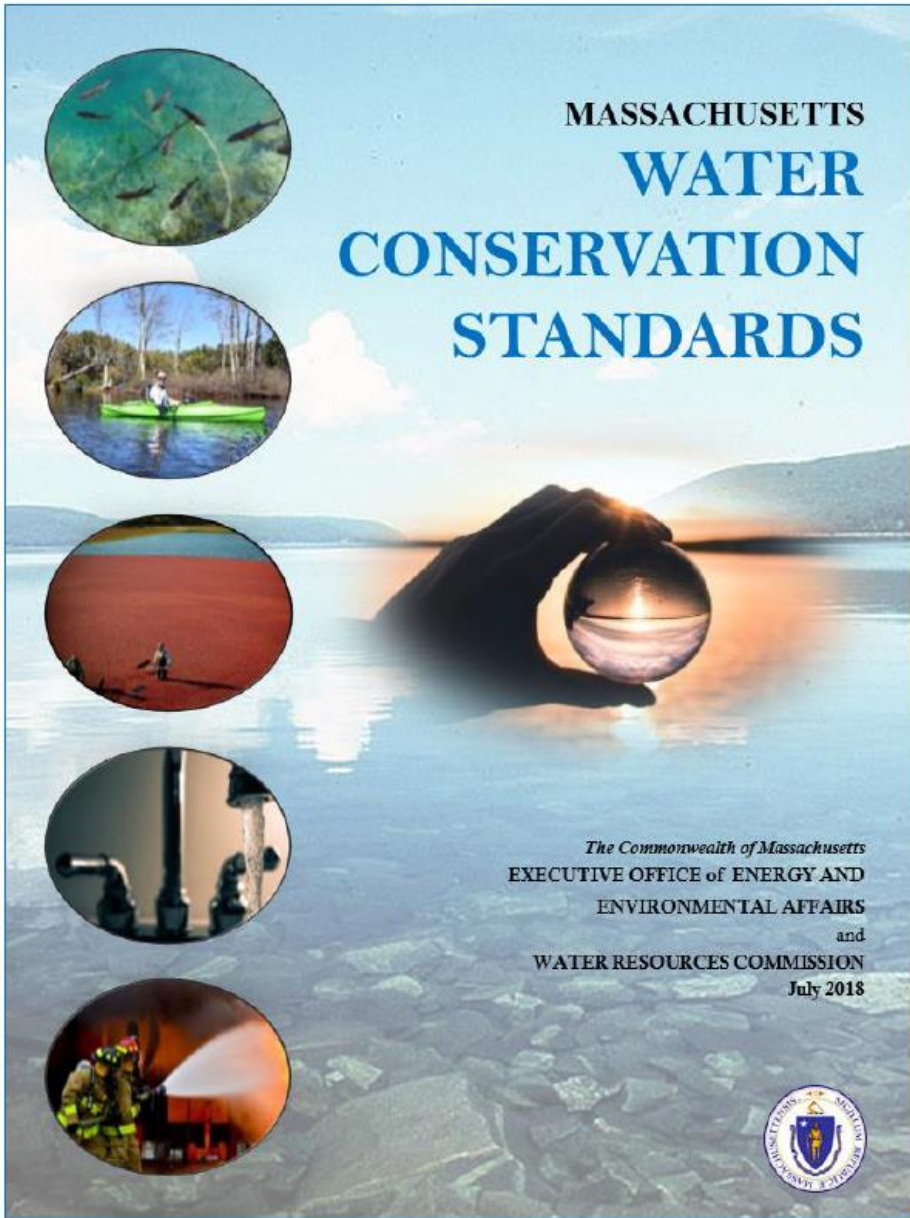
- Revise Open Space & Community Development Plans
- Protect Upland areas; they are important, and perhaps more so from a drought perspective
- Complete Habitat and Resource area vulnerability assessments
- Pass conservation zoning and general wetland protection bylaws/ordinances
- Support & initiate ecological restoration projects
- Pursue water conservation & stream flow restoration efforts
- Partner with DPW to build climate smart infrastructure



What can be done at the Industrial-Commercial-Institutional Level

- Pursue **Water Conservation** both Indoors & Outdoors
- Minimize/Eliminate your Impervious Footprint
- Partner with local government to build climate smart infrastructure
- Be a Local Role Model!





SECTORS



Residential



Public Sector



Industrial Commercial
Institutional



Agricultural



Public Education

In Addition.....



**Water Loss
Control**



Metering



Pricing

**Outdoor
Water**



**Comprehensive
Planning &
Drought
Management**



PUBLIC SECTOR & ICI Apply to...

INDUSTRIAL
Facilities

PRIVATE
SECTOR &
NONPROFIT
Entities

STATE
Facilities, Policy
& Regulatory
Entities

COMMERCIAL
Facilities

INSTITUTIONAL
Facilities

MUNICIPAL
Bodies,
Boards/Depts,
Facilities &
Public Works

Office Parks &
Buildings



ICI STANDARDS

6

GOLF & COMMERCIAL
Entities enhance Water
Efficiency

5

Practice WATER-SAVING
LAWN & LANDSCAPING
Techniques



• Do a **WATER AUDIT** & use findings to help:

- Reuse and recycle cooling waters,
- Reuse process waters
- Use non-potable water
- Replace water cooling with air cooling
- Install efficient sanitary water devices
- Water efficient landscaping

1

2

Install SEPARATE METERS
for Process Water

3

Implement a
WATER SAVINGS
STRATEGY

4

Use best available
WATER SAVINGS
TECHNOLOGY in
Buildings

4

REUSE Treated
WASTEWATER



PUBLIC SECTOR STANDARDS

2

METER or Estimate
Contractor use of
water from hydrants



1

For Buildings, Facilities & Grounds:

- Conduct Indoor & Outdoor WATER AUDITs based on full metering & use
- Analyze water data for trends, patterns, unusual increases/leaks
- In new buildings, install water-reducing equipment
- In existing buildings, replace/retrofit equipment
- Practice efficient lawn and landscape water use

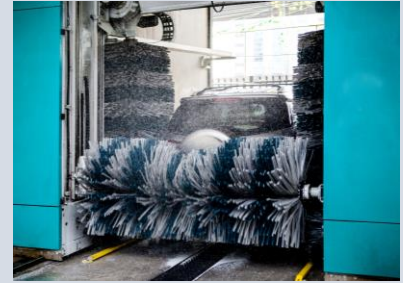


3

Strictly Apply
Plumbing Codes

RECOMMENDATIONS

- Create demonstration sites
- Office of Technical Assistance inform and assist companies and large users
- Install and retrofit water-saving sanitary devices
- Work with code officials, state programs, manufacturers, legislators to promote water conservation
- Increase amount of pervious areas on property



NEW!

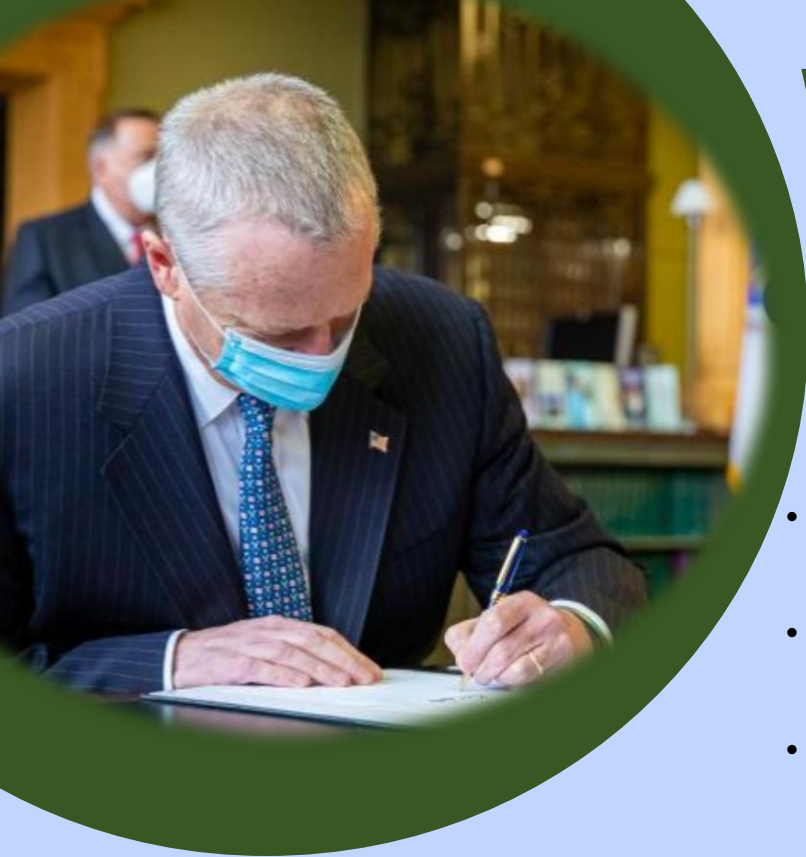
“CLIMATE BILL – S9”

An Act creating a next-generation roadmap for Massachusetts climate policy



- On March 26, 2021, Governor Baker signed Climate Legislation to Reduce Greenhouse Gas Emissions, Protect Environmental Justice Communities
- Changes Efficiency Standards for Plumbing fixtures
- NEW energy-efficiency requirements for commercial kitchen equipment, plumbing, and consumer appliances including faucets, residential ventilating fans, portable electric spas, showerheads, toilets, and water coolers.

“No new, commercial dishwasher,..... commercial steam cooker, faucet,..... showerhead, spray sprinkler body, urinal, water closet or water cooler shall be sold or offered for sale, lease or rent in the commonwealth unless the efficiency of the new product meets or exceeds the efficiency standards set forth in the regulations adopted pursuant to this section..”



Water Conservation Implementation



“CLIMATE BILL – S9”

- The flow rate of lavatory faucets and replacement aerators shall not be greater than 1.5 gallons per minute (gpm) at 60 pounds per square inch (psi).
- For sprayheads with independently controlled orifices and manual controls, the maximum flow rate of each orifice that manually turns on or off shall not exceed the maximum flow rate for a lavatory faucet.
- The flow rate of residential kitchen faucets and replacement aerators shall not be greater than 1.8 gpm with optional temporary flow of 2.2 gpm at 60 psi.
- The flow rate of public lavatory faucets and replacement aerators shall not be greater than 0.5 gpm at 60 psi.
- The flow rate of showerheads shall not be greater than 2.0 gpm at 80 psi.
- Urinals shall have a maximum flush volume of 0.5 gallons per flush (gpf).
- Water closets, except for dual-flush tank-type water closets, shall have a maximum flush volume of 1.28 gpf.
- Dual-flush tank-type water closets shall have a maximum effective flush volume of 1.28 gpf.
- Commercial dishwashers included in the scope of the ENERGY STAR Product Specification for Commercial Dishwashers, Version 2.0, shall meet the qualification criteria of that specification.

RESOURCES



- State Water Conservation Website: www.mass.gov/conservemawater
- WaterSense Water Efficiency Standards: www.epa.gov/watersense
- Institutional facilities managers should consult “WaterSense at Work” which describes BMPs on water & energy efficiency
- For facilities with automatic irrigation systems, WaterSense labels professional certification programs for irrigation auditors, irrigation designers, and irrigation installation and maintenance professionals.
- New state law (MGL c. 21 s. 67) requires system interruption devices be installed “for newly installed or renovated irrigation systems”
- Water Resources Commission staff in DCR’s Office of Water Resources available to provide guidance

Thank you!

VANDANA RAO

Email: vandana.rao@mass.gov

**Website: www.mass.gov/eea
www.mass.gov/conservemawater
www.mass.gov/drought-management**

