

# Update and Status of the USGS/MA Cooperative Hydrologic Monitoring Network



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October 13, 2022



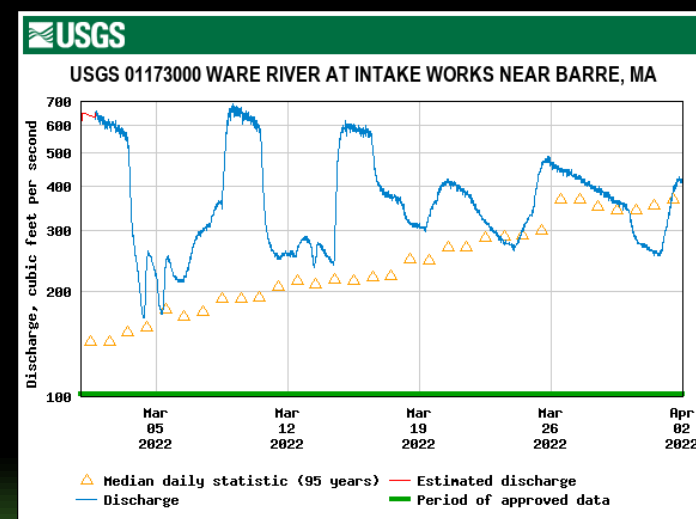
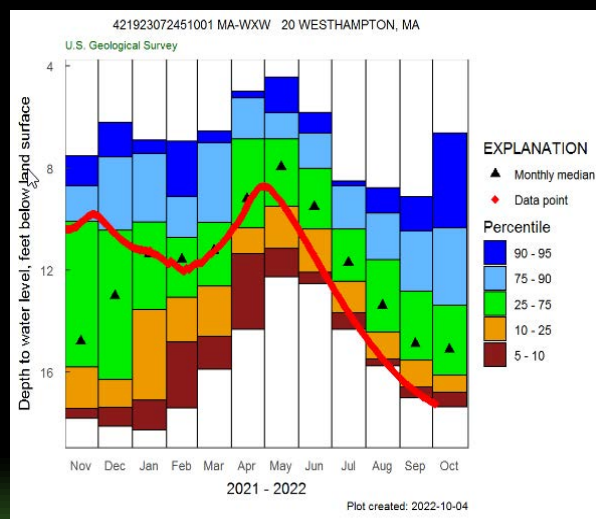
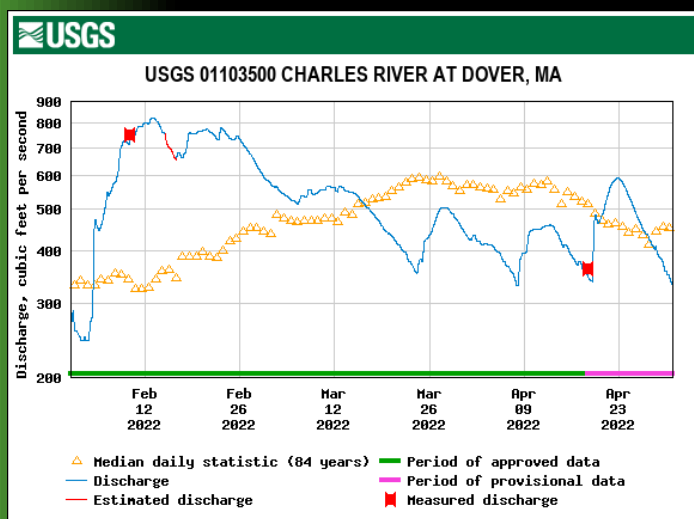


# Overview

- Data uses
- Mass. USGS streamgage Network and DCR Contributions
- What is a streamgage?
- Data collection background and discharge data
- Streamgage challenges
- Weather stations and tide gages
- Groundwater network
- Program Budgets

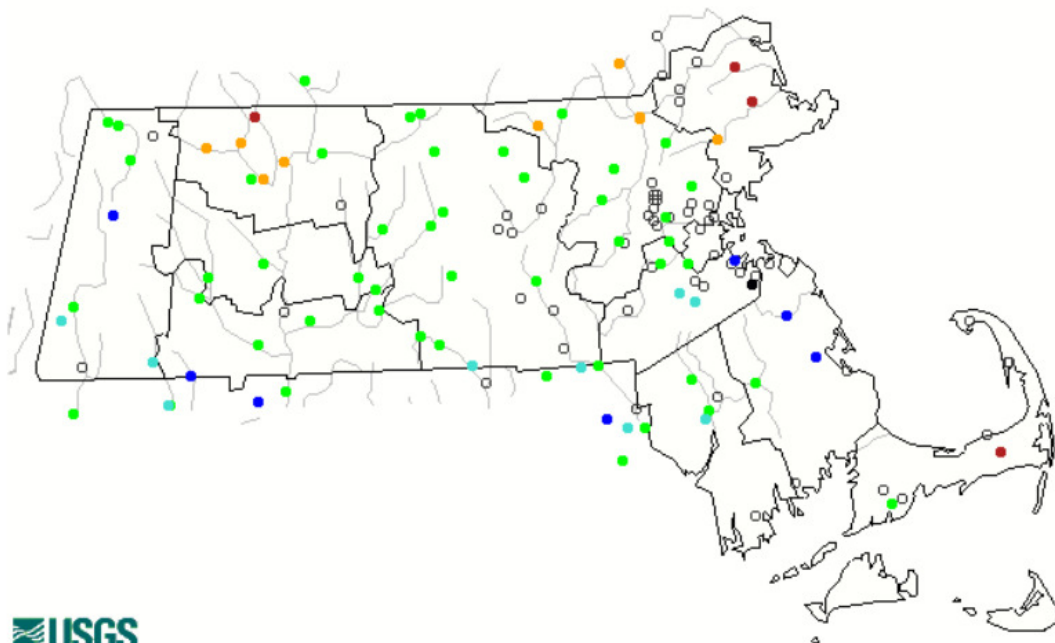
# Data Uses

- Emergency management/flood forecasting
- Bridge, culvert and other infrastructure design
- Flood zone mapping
- Septic system design
- Wastewater treatment plant design
- Drought monitoring



# USGS Streamgage Network









Wednesday, October 05, 2022 12:30ET



Search USGS streamgage

Choose a data retrieval option and select a location on the map

☐ List of all stations ☒ Single station ☐ Nearest stations ☐ Peak flow

| Explanation - Percentile classes                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |
| Low                                                                                 | <10<br>Much below normal                                                            | 10-24<br>Below normal                                                               | 25-75<br>Normal                                                                     | 76-90<br>Above normal                                                               | >90<br>Much above normal                                                            | High                                                                                | Not-ranked                                                                           |

142 USGS gages in MA

58 Real-time gages funded in  
by OWR

13 Real-time gages funded by  
BOE

10 Rea-time gages funded by  
WSP

Planned Changes for FY23

Total Annual O&M ~\$909,000

- USGS Matching ~ \$224,000

- NPS(Federal) ~ \$68,900

- MA DCR WRC ~ \$684,000

\$16,300 per streamgage



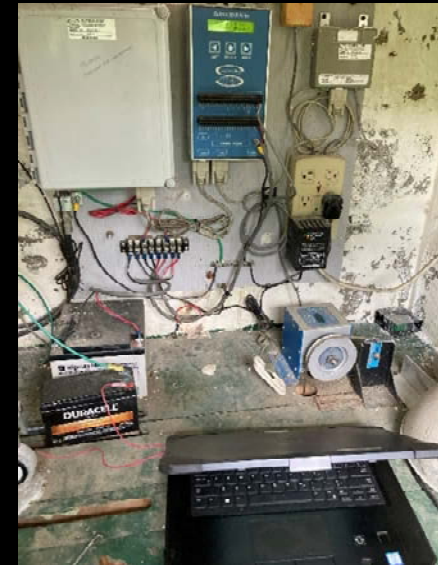
# Streamgages





# Types of Streamgauge Sensors

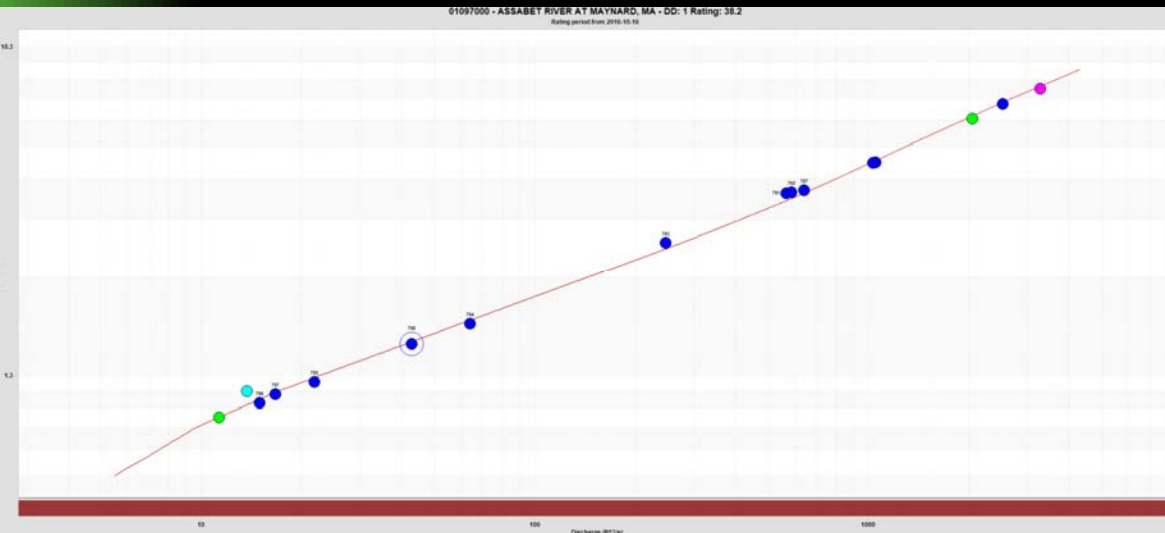
- Submersible pressure transducers
- Non-Submersible pressure transducers
- Stilling wells with digital encoder
- Radars
- Hydro-acoustic velocity meters
- Cameras?



# Data Collection and Discharge

- Stage (elevation) data collected with 0.01 ft accuracy
- Discharge measurements collected periodically at different stages.
- Regression (rating) developed based on this relationship
- Rating is maintained (shift curves developed) based on re-occurring discharge measurements in the field.

# Data Collection and Discharge



Expanded Rating Table: 38.2

| Gage height (ft) | Discharge (ft <sup>3</sup> /s) |       |       |       |       |       |       |       |       |       | Diff In Q Per<br>.1 Units |
|------------------|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------------------------|
|                  | .00                            | .01   | .02   | .03   | .04   | .05   | .06   | .07   | .08   | .09   |                           |
| 0.80             | 5.500*                         | 5.688 | 5.879 | 6.073 | 6.269 | 6.468 | 6.669 | 6.873 | 7.080 | 7.289 | 2.000                     |
| 0.90             | 7.500*                         | 7.704 | 7.910 | 8.118 | 8.327 | 8.540 | 8.754 | 8.970 | 9.188 | 9.408 | 2.130                     |
| 1.00             | 9.630*                         | 9.944 | 10.26 | 10.59 | 10.92 | 11.26 | 11.60 | 11.95 | 12.30 | 12.66 | 3.390                     |
| 1.10             | 13.02                          | 13.40 | 13.77 | 14.16 | 14.54 | 14.94 | 15.34 | 15.75 | 16.16 | 16.58 | 3.980                     |
| 1.20             | 17.00*                         | 17.51 | 18.03 | 18.56 | 19.10 | 19.65 | 20.21 | 20.78 | 21.35 | 21.94 | 5.540                     |
| 1.30             | 22.54                          | 23.15 | 23.77 | 24.40 | 25.04 | 25.69 | 26.35 | 27.02 | 27.70 | 28.39 | 6.550                     |
| 1.40             | 29.09                          | 29.81 | 30.53 | 31.27 | 32.01 | 32.77 | 33.54 | 34.32 | 35.11 | 35.91 | 7.640                     |
| 1.50             | 36.73                          | 37.55 | 38.39 | 39.24 | 40.10 | 40.97 | 41.85 | 42.75 | 43.66 | 44.58 | 8.780                     |
| 1.60             | 45.51                          | 46.45 | 47.41 | 48.37 | 49.35 | 50.35 | 51.35 | 52.37 | 53.40 | 54.44 | 9.990                     |
| 1.70             | 55.50                          | 56.56 | 57.64 | 58.74 | 59.84 | 60.96 | 62.10 | 63.24 | 64.40 | 65.57 | 11.260                    |
| 1.80             | 66.76                          | 67.96 | 69.17 | 70.39 | 71.63 | 72.88 | 74.15 | 75.43 | 76.72 | 78.03 | 12.590                    |
| 1.90             | 79.35                          | 80.69 | 82.03 | 83.40 | 84.77 | 86.17 | 87.57 | 88.99 | 90.42 | 91.87 | 13.990                    |
| 2.00             | 93.34                          | 94.81 | 96.31 | 97.81 | 99.33 | 100.9 | 102.4 | 104.0 | 105.6 | 107.2 | 15.460                    |
| 2.10             | 108.8                          | 110.4 | 112.0 | 113.7 | 115.4 | 117.1 | 118.8 | 120.5 | 122.2 | 124.0 | 16.900                    |
| 2.20             | 125.7                          | 127.5 | 129.3 | 131.1 | 132.9 | 134.8 | 136.6 | 138.5 | 140.4 | 142.3 | 18.500                    |
| 2.30             | 144.2                          | 146.2 | 148.1 | 150.1 | 152.1 | 154.1 | 156.1 | 158.1 | 160.2 | 162.3 | 20.200                    |
| 2.40             | 164.4                          | 166.5 | 168.6 | 170.7 | 172.9 | 175.0 | 177.2 | 179.4 | 181.7 | 183.9 | 21.800                    |
| 2.50             | 186.2                          | 188.4 | 190.7 | 193.0 | 195.4 | 197.7 | 200.1 | 202.4 | 204.8 | 207.3 | 23.500                    |
| 2.60             | 209.7                          | 212.1 | 214.6 | 217.1 | 219.6 | 222.1 | 224.7 | 227.2 | 229.8 | 232.4 | 25.300                    |
| 2.70             | 235.0*                         | 237.5 | 240.1 | 242.7 | 245.3 | 247.9 | 250.5 | 253.1 | 255.8 | 258.5 | 26.100                    |
| 2.80             | 261.1                          | 263.9 | 266.6 | 269.3 | 272.1 | 274.9 | 277.7 | 280.5 | 283.3 | 286.1 | 27.900                    |
| 2.90             | 289.0*                         | 291.7 | 294.5 | 297.2 | 300.0 | 302.8 | 305.6 | 308.4 | 311.2 | 314.1 | 27.900                    |



# Problems with Streamgages?





# Precipitation/Weather Stations

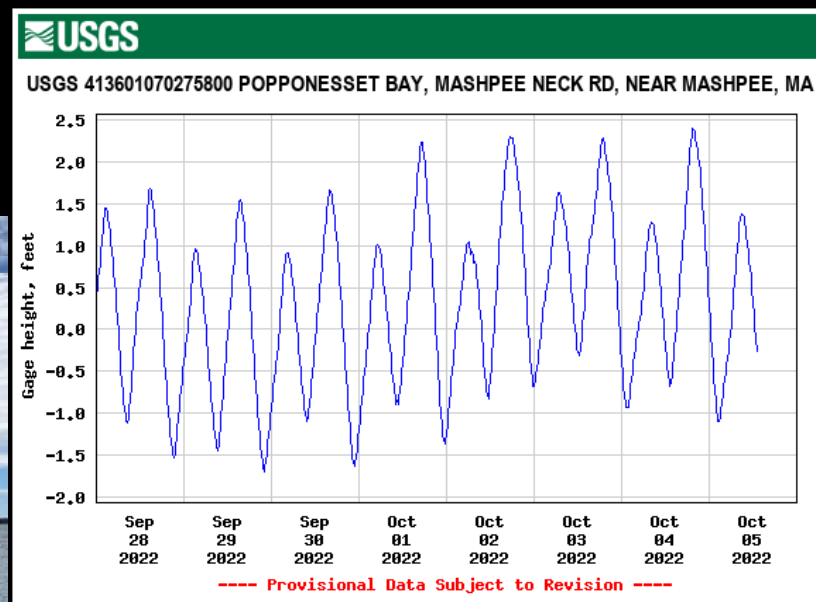
- Peabody
- Fall River
- Groton
- Florida
- Sheffield
- Per gage \$3,300/\$6,700





# Tide Gages

- Provincetown
- Dennis
- Merrimack
- Popponesset Bay
- Per gage 7,000\$



# Active Water Level Network

## 108 wells

- 61 realtime
- 47 monthly

## Planned Changes for FY23

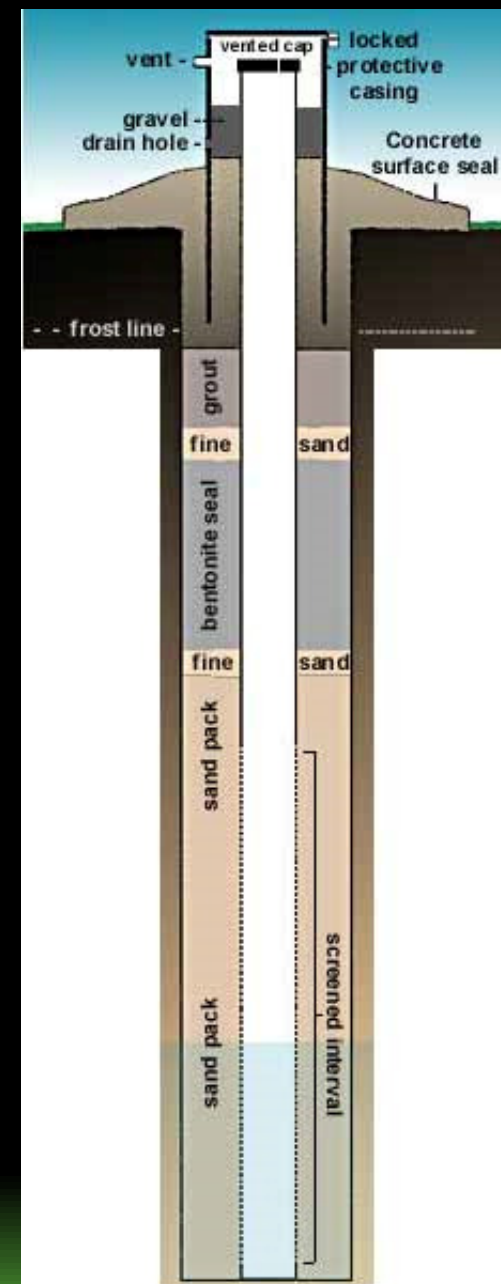
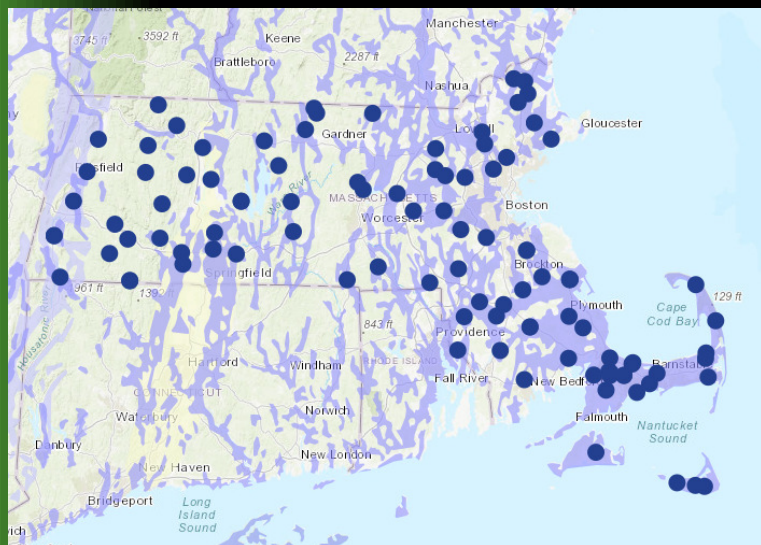
- Finish upgrading CRN

## Annual O&M ~ \$345,000

- USGS ~ 66,000
- MA DCR ~ 279,000

\$5,770 per realtime gage

\$980 per furnished (discrete)

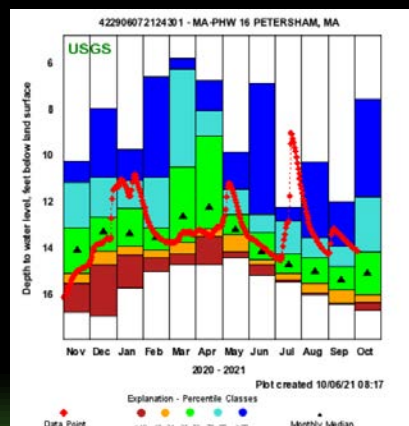
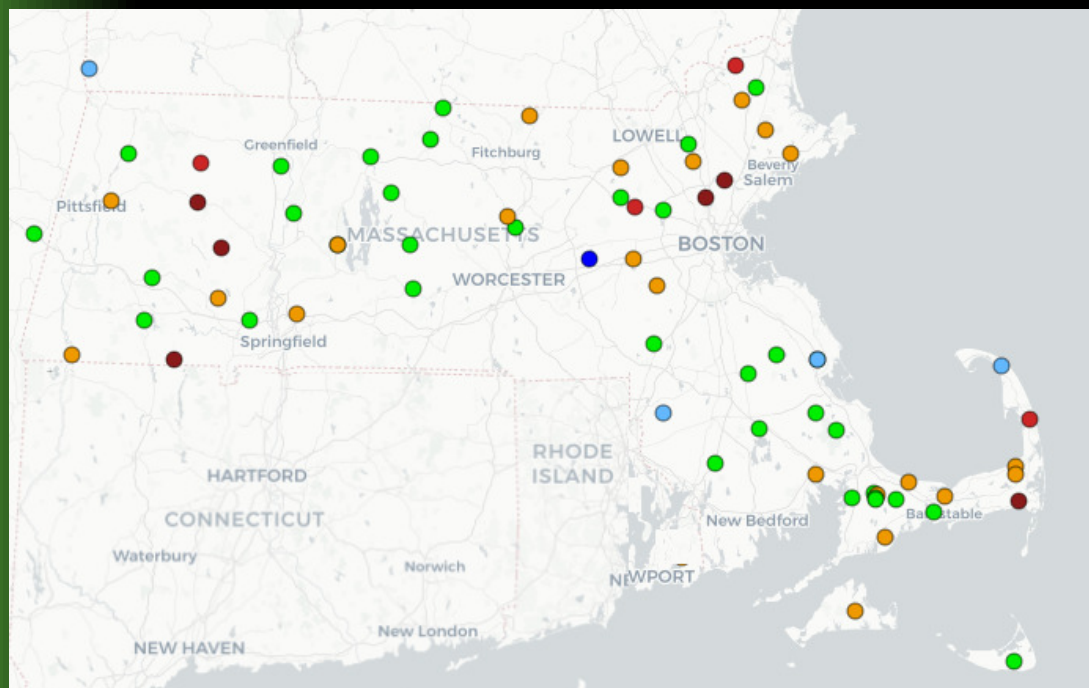




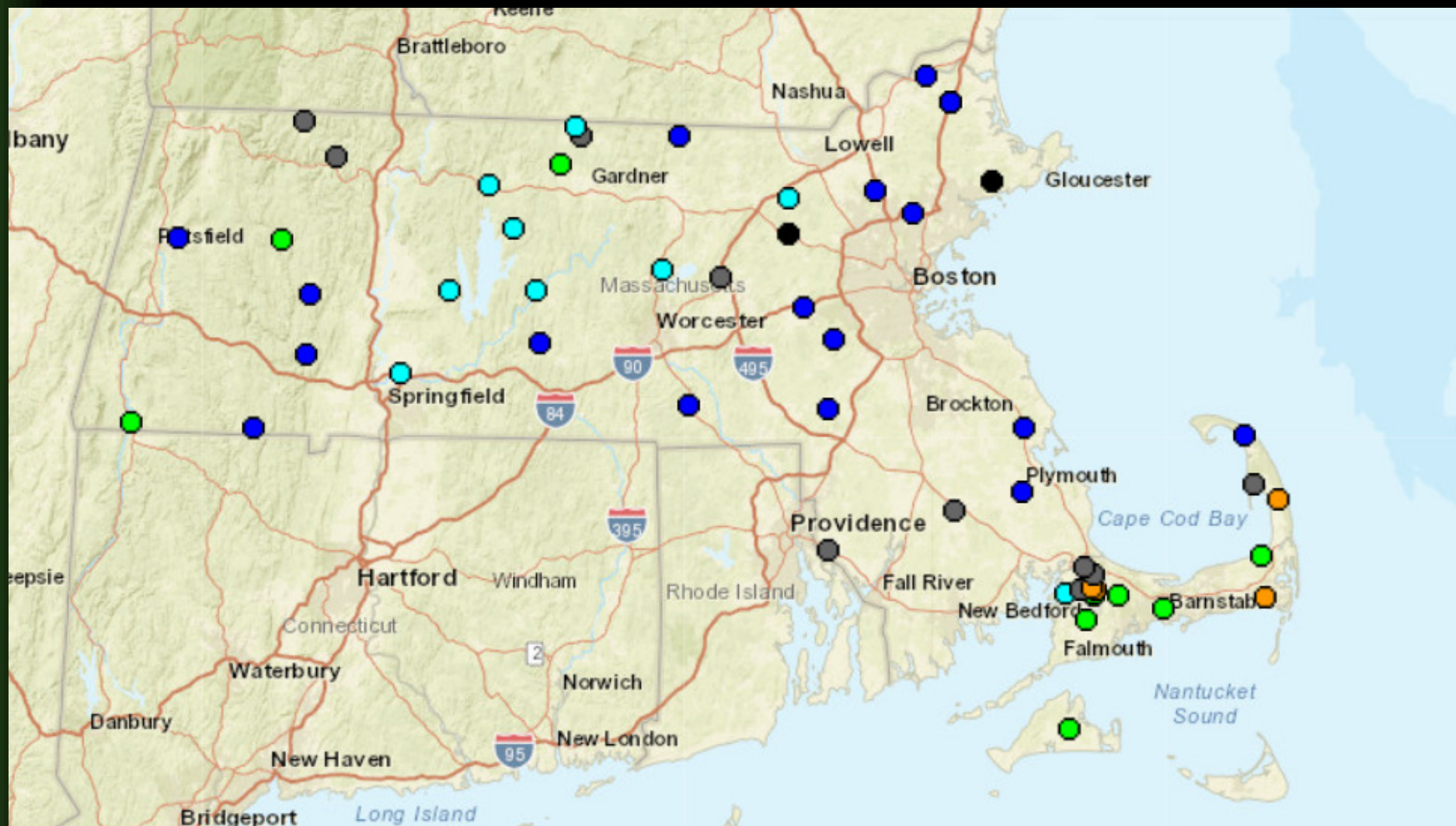
# Climate Response Network

69 Observation Wells

All will be realtime by  
end of FY23

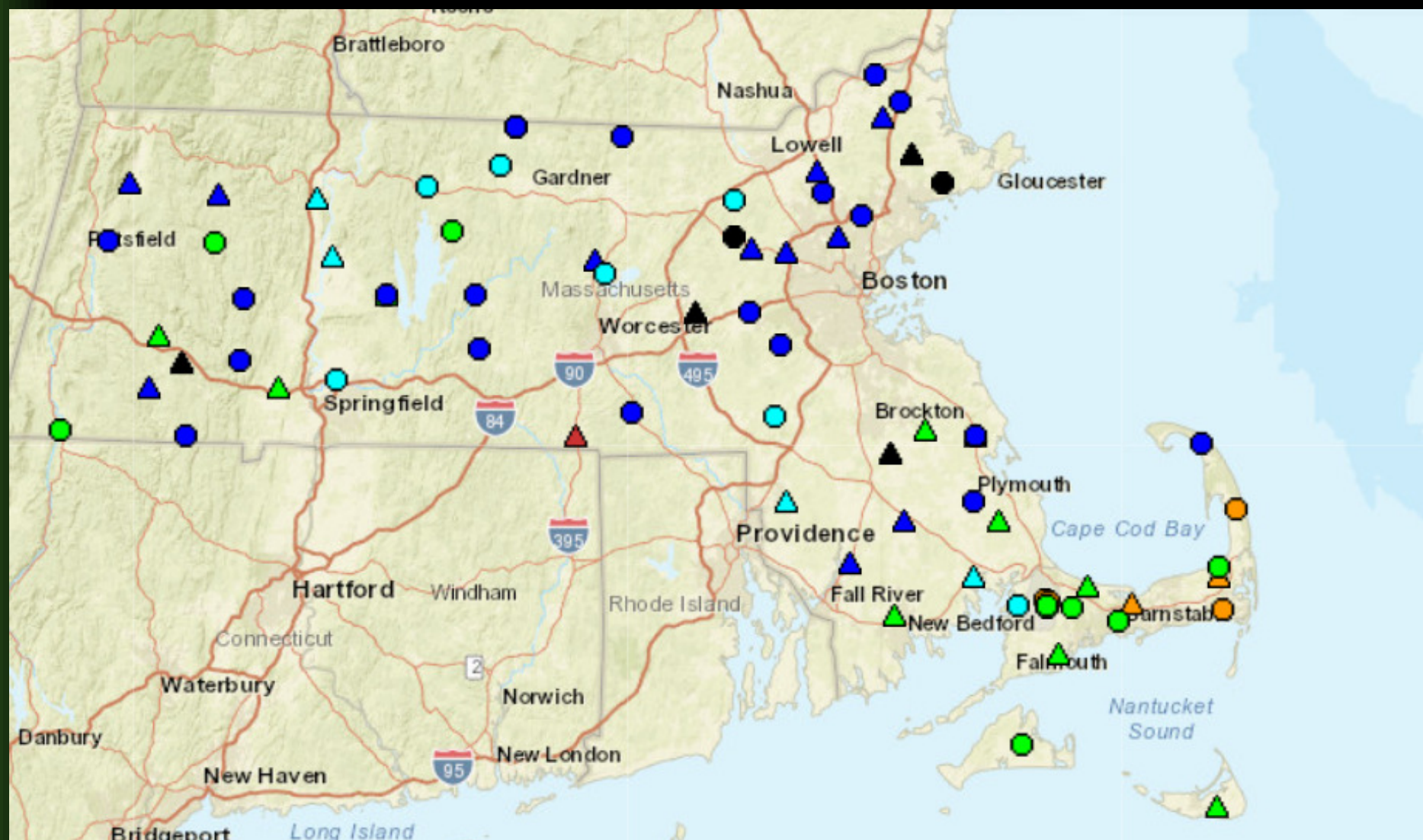


# Current Real-time GW Network





# Future Realtime Network



# FY23 Hydrologic Monitoring

## Program Budget - OWR

- State
  - \$968,136
- USGS
  - \$290,570
- NSIP
  - \$68,900
- Total Budget
  - \$1,258,706



# WRC Program Budget FY23

- Streamgages
  - \$849,396
- Ground Water
  - \$344,810
- Water Quality
  - \$5,150
- Precipitation/Weather
  - \$31,350
- Tide Gages
  - \$28,000

# Questions

