


## STAFF SUMMARY

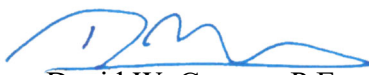
**TO:** Board of Directors  
**FROM:** Frederick A. Laskey, Executive Director   
**DATE:** February 17, 2021  
**SUBJECT:** Report on 2020 Water Use Trends and Reservoir Status

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**COMMITTEE:** Water Policy & Oversight

INFORMATION  
 VOTE

Carolyn Fiore, Deputy Chief Operating Officer  
Daniel Nvule, Senior Program Manager  
Stephen Estes-Smargiassi, Director, Planning  
Preparer/Title

  
David W. Coppes, P.E.  
Chief Operating Officer

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*The year 2020 was an unusual water year. The pandemic caused shifts in the patterns of use across the service area, with decreasing use in Boston and increases elsewhere, resulting in a substantial shift in the shares of use. The drought increased seasonal use, use by partial users and slightly increased total use. However, watershed yields exceeded total reservoir withdrawals, keeping the Quabbin Reservoir in its normal operating range for the entire year.*

### RECOMMENDATION:

For information only. At the beginning of each year, staff provide the Board with a review of the previous year's water use data and discuss trends.

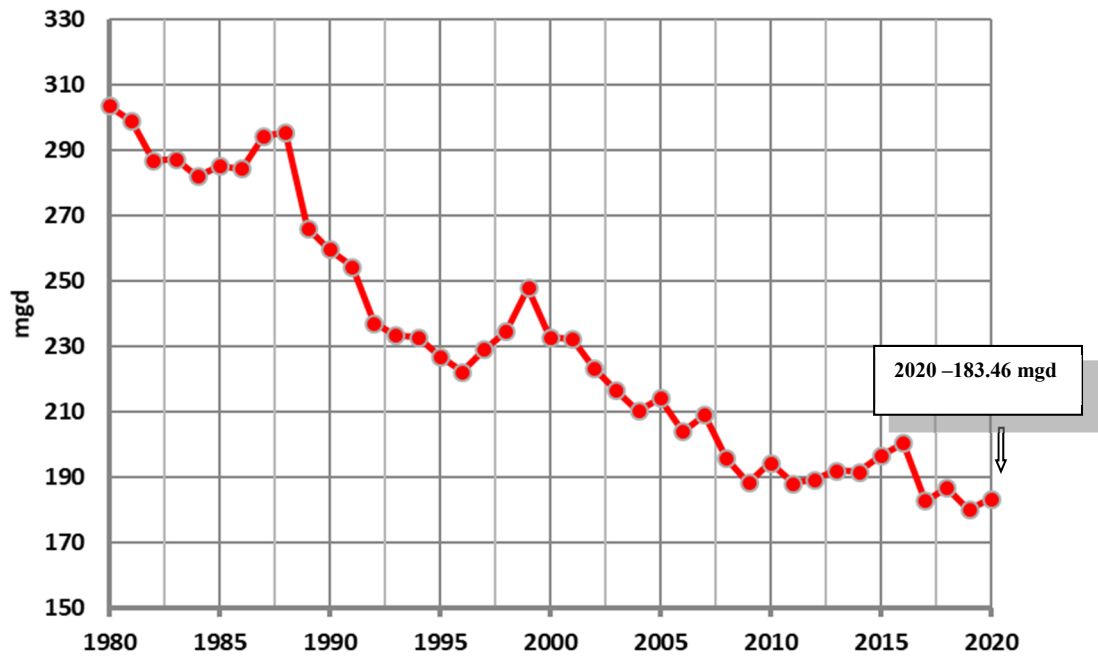
### DISCUSSION:

This staff summary provides an overview of water consumption by communities, base and seasonal water use trends; use by MWRA's partial and emergency customers, and reservoir withdrawals and reservoir status.

#### Water Consumption by MWRA Communities

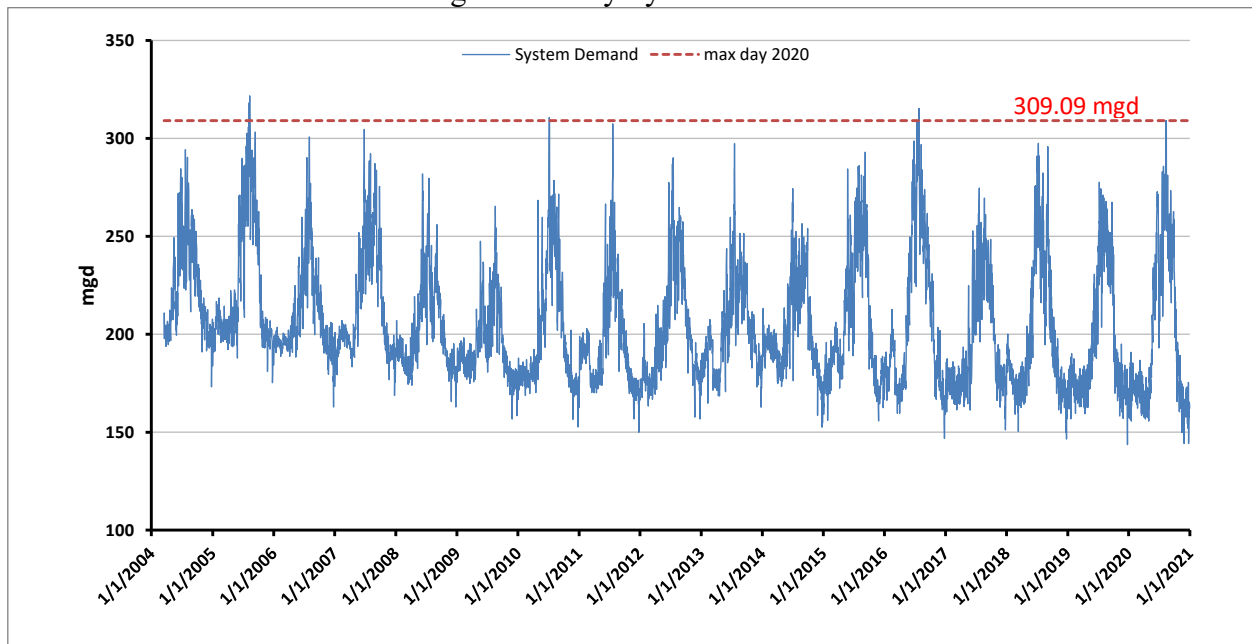
Calendar Year 2020 water consumption by all MWRA communities of 183.46 million gallons per day (mgd) was about 3.24 mgd (1.8 percent) higher than 2019, as shown on Figure 1 on the next page.

Figure 1 – Total Consumption by MWRA Communities (1980 to 2020)



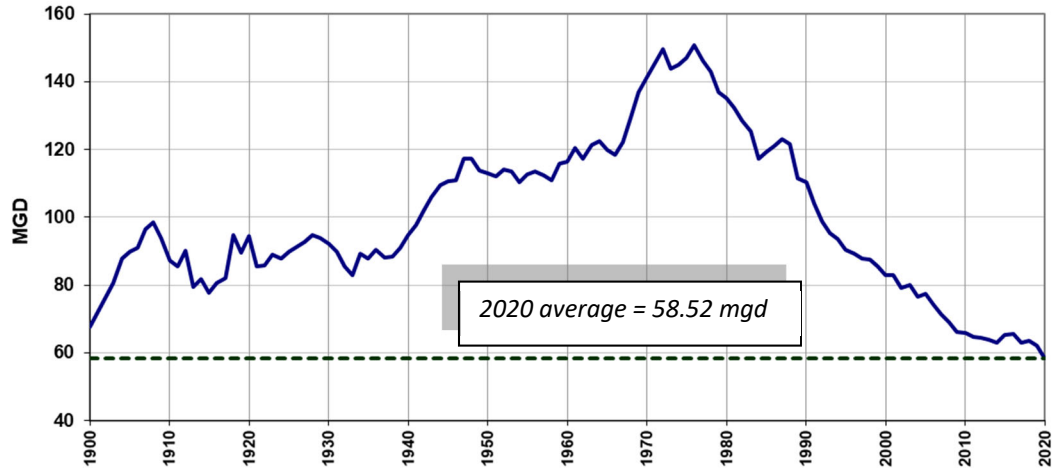
System wide, 2020 had a maximum day demand of 309.09 mgd on August 12th (11.3 percent higher than 2019, but slightly lower than the peak during the 2016 drought). At the opposite extreme, Thanksgiving Day at 144.18 mgd and Christmas at 144.19 mgd were among the lowest seen since MWRA’s creation, but slightly higher than last year’s Christmas. Figure 2 below shows daily system demand since 2004.

Figure 2: Daily System Demand



Demand from MWRA’s largest customer, the Boston Water and Sewer Commission, was 58.52 mgd, which was lower than last year by 3.61 mgd (5.82 percent). Staff attribute this reduction to the impact of the pandemic as remote work arrangements kept workers away from their workplaces. Current Boston demand continues to be lower than demand before 1900 as shown on Figure 3 below.

Figure 3: Boston Water Use (1900-2020)



### Pandemic Impact

While the pandemic did not have a substantial impact on overall system demand, it did create demand share shifts within communities. In the first few weeks of the lockdown in March, total demand was down slightly from the prior year, with Boston’s demand down substantially. As shown in Figure 4 below, over the course of the second quarter, Boston’s demand was down from 2019 by 7.8 percent, while the rest of the metro area demand increased by 9.2 percent. Total demand increased more with the dry summer and fall conditions, while Boston’s use was below the prior year in every quarter. Over the course of the year, Boston’s share of total demand continued to be lower than in previous years.

Figure 4 – MetroBoston Quarterly Water Use Comparison (mgd)

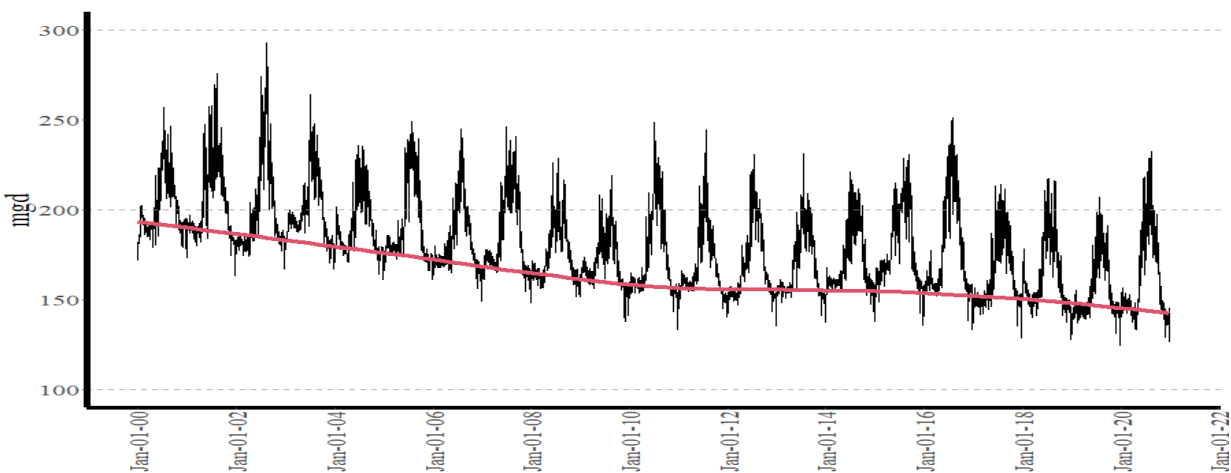
Quarter	Metro Boston Total			Boston			Non-Boston		
	2020	2019	% change	2020	2019	% change	2020	2019	% change
Q-1	147.8	148.7	-0.6	57.6	58.6	-1.7	90.2	90.1	0.1
Q-2	163.0	158.7	2.7	56.2	61.0	-7.8	106.8	97.7	9.2
Q-3	194.4	188.6	3.1	65.7	69.0	-4.8	128.7	119.6	7.6
Q-4	147.7	151.7	-2.6	54.5	59.9	-9.0	93.2	91.8	1.5

The community’s previous year’s share of the overall demand determines the percentage of the total water assessment that will be allocated to that particular community. The Community Water Use Table, on the last page, shows the community share shifts. Boston’s share of metro Boston water use was down 7.3 percent, which results in the remaining communities share increasing by 4.2 percent.

## Base or Indoor Demand

Over time, there have been substantial water use reductions in both base (or indoor) use, defined as water use from November to March, and outdoor use (or seasonal use), defined as the increase over the base demand during the irrigation season from May to September. Base or indoor water use, shown as the red line on Figure 5 below, has dropped substantially over the past several decades due to the improvements in the efficiency of water use in homes and businesses as water-saving technologies continue to increase market share, and consumers react to price increases. Water use reductions also reflects the success of the leak reduction program with reduced pipeline leaks. Countervailing pressures include population increases and the strong economy since the end of the recession.

Figure 5: Fully-Supplied Communities Demand (1999 to 2020)<sup>1</sup>



## Seasonal or Outdoor Demand

Seasonal water use is more variable than indoor demand and driven in large part by weather during the irrigation season. Factors influencing seasonal use include the total irrigation season precipitation, the number of dry days between rainfall events, temperature, and the total amount of sunshine. During drought conditions, mandatory restrictions or general media exposure will reduce outdoor use over what it would have been, but dry years still tend to have higher demand. Over time, the price of water also influences seasonal use.

Figures 6 and 7 below show the variation in seasonal water use over time, and both the relatively small impact that seasonal demand has on total water use and the longer-term decline in both base and total use. Figure 6 shows that 2020 seasonal use was greater than the past several years on both a percentage and gallons basis, but lower than the previous drought years of 2015 and 2016. Seasonal use in 2020 of 20.2 mgd was the fourth highest in the past 21 years on a volume basis. On a percentage use basis, it was the third highest at 12.4%. While the dry conditions are likely a

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<sup>1</sup> Certain analyses can only be done on fully-supplied communities where MWRA has information on their daily use available from MWRA's revenue meters. MWRA receives data on monthly total use for partially-supplied communities, but not until they provide that data to DEP in their Annual Statistical Reports in March. Fully-supplied communities represent almost 90% of the total annual demand.

major part of the explanation, anecdotally, increases in gardening and landscaping by families stuck at home during the pandemic may have also contributed to this increase.

Figure 6: Fully-Supplied Communities Annual Base and Seasonal Demand

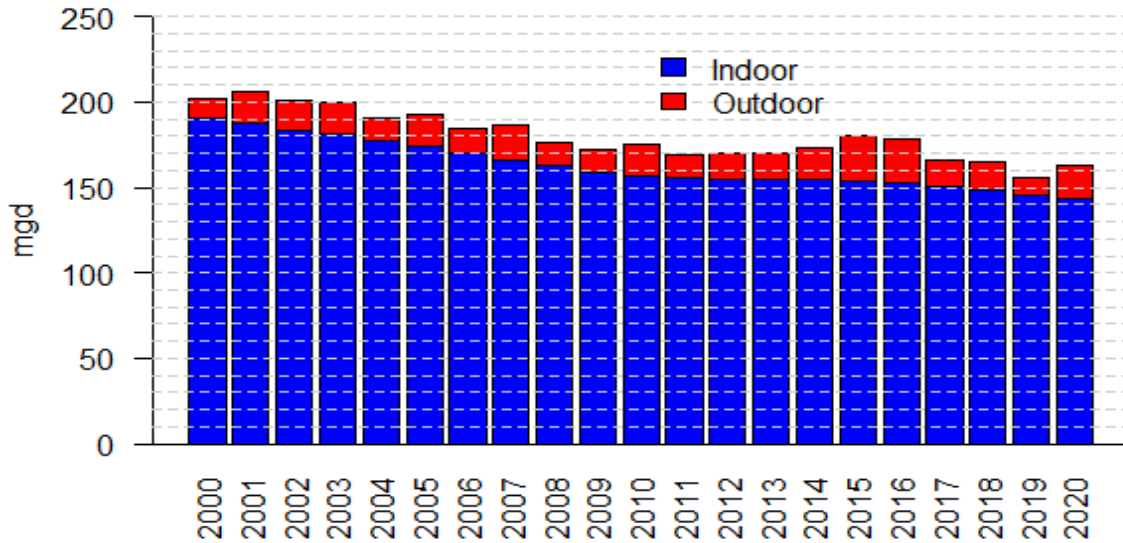
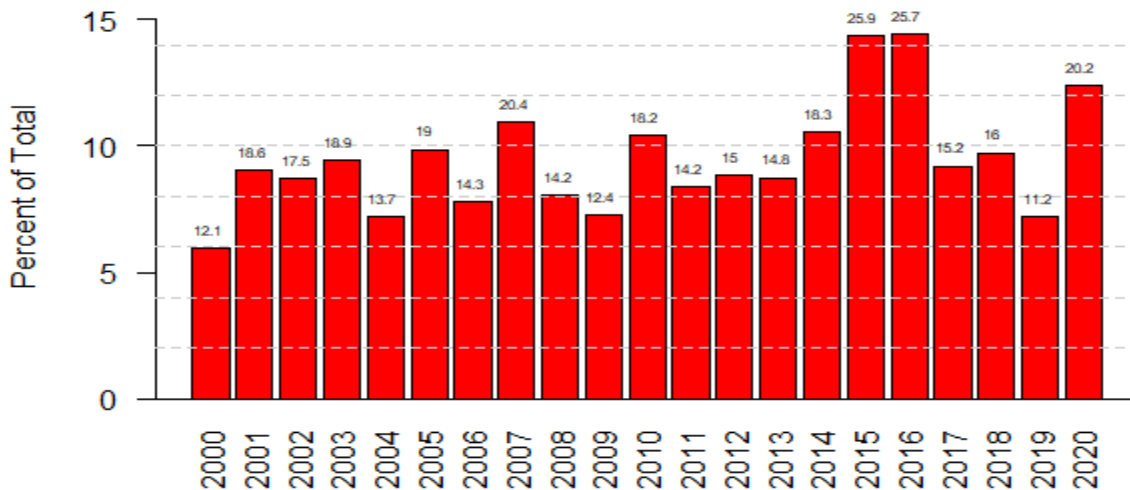


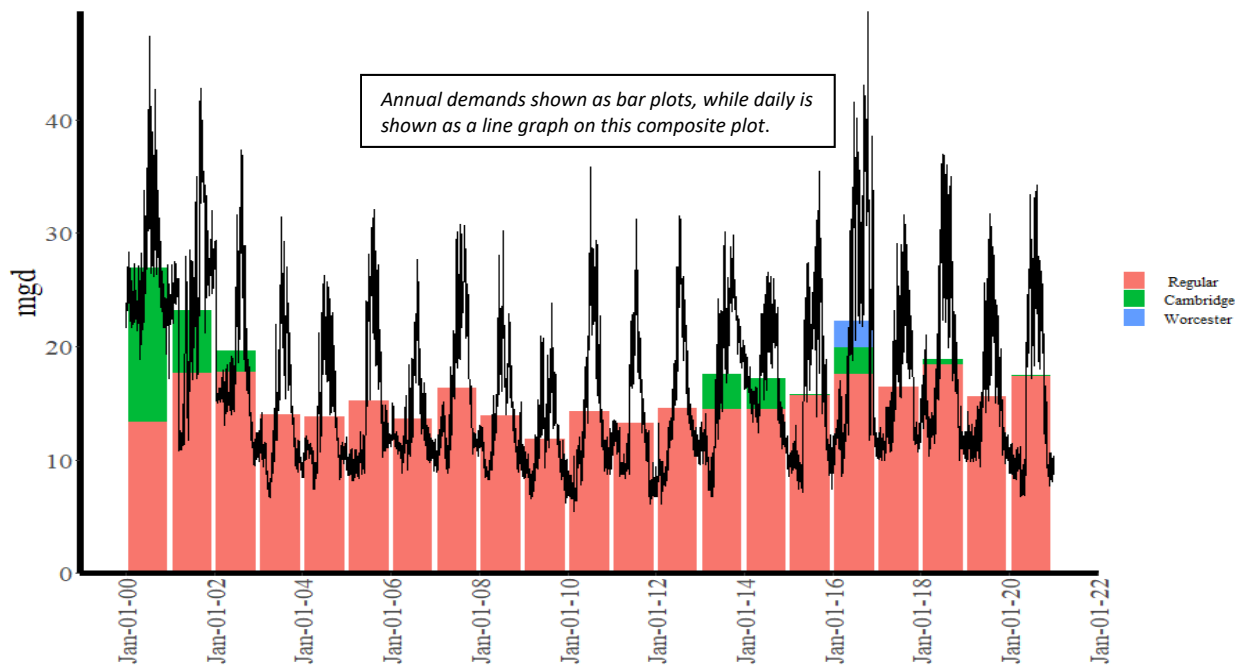
Figure 7: Fully Supplied Communities' Annual Seasonal Demand (Labels show demand in mgd)



Partially Supplied Communities

Demand for the partially supplied communities, shown on Figure 8 on the next page, was up by 1.84 mgd (11.8%) when compared to 2019.

Figure 8: Partially Supplied Communities – MWRA Supplied Demand (Daily and Annual)



Cambridge used 19.39 million gallons over three separate days in August and September. Burlington used 5.53 million gallons between July and December 9th, 2020 under their 8<sup>th</sup> emergency use agreement with MWRA. The water was provided via an emergency connection with Lexington. Burlington is now officially a partially supplied member community.

### Reservoir Withdrawals and Releases

Reservoir withdrawals are the metric used to compare to the 300 mgd safe yield of the watershed/reservoir system<sup>2</sup>. Withdrawals include water sold to MWRA communities, as well as other non-revenue generating uses in the watershed and MWRA system. Total MWRA water withdrawals increased by 1.42 percent in 2020, from 196.6 mgd in 2019 to 199.43 mgd.

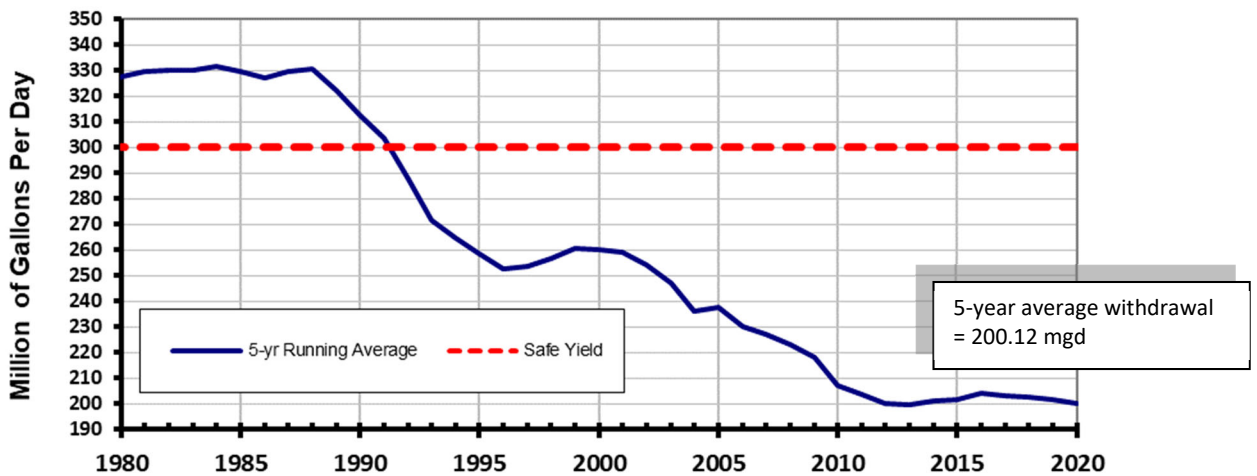
The pipeline supplying the McLaughlin Fish Hatchery in Belchertown was in service for the entire year, with an average withdrawal of 6.17 mgd. Without that withdrawal, total reservoir withdrawals in 2019 would have been 193.21 mgd. MWRA began serving the hatchery through the dedicated hydroelectric station and pipeline in December 2016.

Figure 9, on the next page, shows five-year averages of withdrawals from 1980 to present. The five-year averaging reduces the effects of year-to-year variability due to weather, and provides a good indication of longer-term trends. The average shows a slight decrease from 2019, although the trend line is essentially flat for most of the past decade. It is worth noting that since MWRA was created, MWRA has added demand from six additional communities and the hatchery, as well

<sup>2</sup> The 300-mgd safe yield is based on the drought of the 1960s. Use of a less conservative 20-year recurrence drought, as allowed by DEP, would result in a safe yield as high as 350 mgd. MWRA’s Water Management Act registration is for 312 mgd.

as the added demand from the growth in population and employment within the original service area.

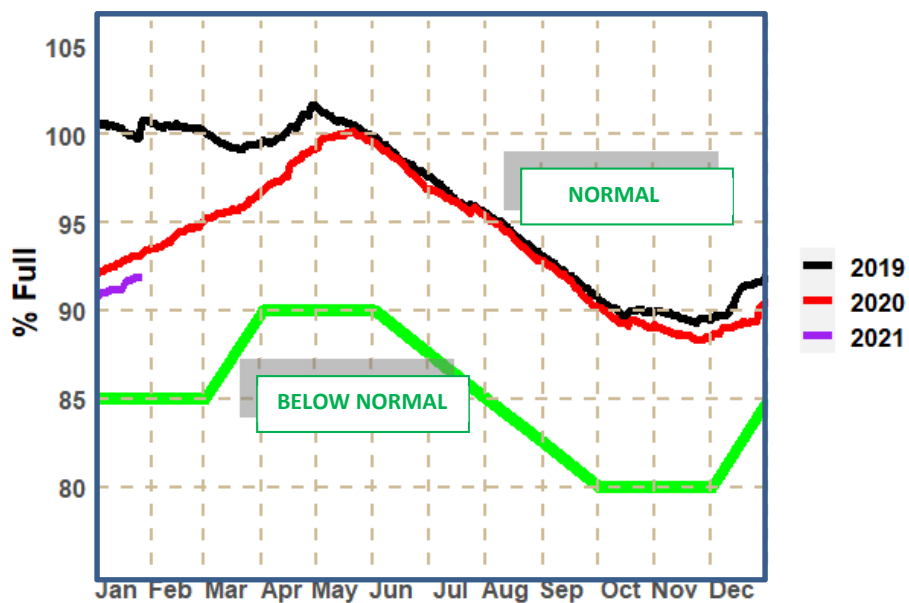
Figure 9: Total Reservoir Withdrawals – Five-Year Running Average 1980 to 2020



### Reservoir Status

There were drought concerns during 2020 across the state with drought conditions persisting from June 2020 thru January 2021. Given Quabbin Reservoir’s large storage coupled with demands that were below safe yield, Quabbin Reservoir levels were well within the normal operating band and followed typical seasonal variation patterns. Figure 10 below shows a comparison of Quabbin volume levels between 2019 and 2020. The green line on the Figure shows the seasonal monthly benchmarks for the operating band. Levels above the line are considered ‘normal’ and below the line are considered ‘below normal’. Further operating bands for varying degrees of drought status are significantly lower still.

Figure 10: Quabbin Reservoir Volumes for 2018 to 2020



Quabbin Reservoir spilled to the Swift River for 73 days for a total of 4.49 billion gallons. In order to maintain water quality, 38.84 billion gallons of the higher quality Quabbin water was transferred to Wachusett Reservoir during 2020. The transfer was equivalent to about 59 percent of Wachusett's capacity. To maintain Wachusett Reservoir in its normal narrow operating band, MWRA released 11.4 billion gallons to the Nashua River through controlled releases.

**ATTACHMENT:**

Community Water Use Data



# MWRA Water Supplied (Million Gallons)

**Reporting Period: December 2020**

ALL DATA SUBJECT TO CHANGE OR ADJUSTMENT PENDING ADDITIONAL MWRA AND COMMUNITY REVIEW

**Prior Year-End Totals**

	Monthly (MG)				YTD (MG)			YTD System Share			2019 Totals	
	Dec		Flow Change	YTD		Flow Change	Flow Share <sup>1</sup>		% Change in YTD	Annual Flow (mg)	Flow Share <sup>1</sup>	
	2020	2019		2020	2019		2020	2019				
<b>Metro-System (Fully Served)</b>												
Arlington	103.5	102.7	0.8%	1,358.0	1,302.4	4.3%	2.14%	2.09%	2.3%	1,302.4	2.09%	
Belmont	49.1	48.7	0.8%	757.1	703.7	7.6%	12.0%	11.3%	5.6%	703.7	11.3%	
Boston (BWSC)	1619.1	1790.2	-9.6%	2147.0	22,677.6	-5.6%	33.81%	36.48%	-7.3%	22,677.6	36.48%	
Brookline	120.6	121.9	-1.1%	1,826.0	1,745.9	4.6%	2.88%	2.81%	2.6%	1,745.9	2.81%	
Chelsea	107.4	97.8	9.9%	1,244.6	1,194.0	4.2%	1.96%	1.92%	2.3%	1,194.0	1.92%	
Everett	113.6	115.5	-1.6%	1,429.7	1,379.0	3.7%	2.26%	2.22%	1.7%	1,379.0	2.22%	
Framingham	151.2	153.8	-1.7%	2,117.0	2,044.7	3.5%	3.34%	3.29%	1.6%	2,044.7	3.29%	
Lexington <sup>2</sup>	118.0	116.5	-1.3%	1,999.7	1,868.5	7.0%	3.16%	3.01%	5.0%	1,868.5	3.01%	
Lynnfield W.D.	9.9	10.7	-7.5%	196.5	177.0	11.0%	0.31%	0.28%	8.9%	177.0	0.28%	
Malden	155.7	156.6	-0.6%	1,909.6	1,847.0	3.4%	3.01%	2.97%	1.5%	1,847.0	2.97%	
Marblehead	40.3	40.1	0.6%	705.0	616.6	14.3%	1.1%	0.99%	12.2%	616.6	0.99%	
Medford	115.0	129.7	-11.4%	1,677.6	1,590.6	5.5%	2.65%	2.56%	3.5%	1,590.6	2.56%	
Melrose	63.9	54.3	17.6%	800.3	718.7	11.4%	1.26%	1.16%	9.3%	718.7	1.16%	
Milton	66.4	58.9	12.8%	889.3	815.7	9.0%	1.40%	1.31%	7.0%	815.7	1.31%	
Nahant	7.2	7.7	-7.4%	121.6	119.1	2.1%	0.19%	0.19%	0.2%	119.1	0.19%	
Newton	208.9	239.5	-12.8%	3,126.7	3,132.0	-0.2%	4.94%	5.04%	-2.0%	3,132.0	5.04%	
Norwood	68.5	73.7	-7.1%	1,005.0	982.7	2.3%	1.59%	1.58%	0.4%	982.7	1.58%	
Quincy	237.0	230.6	2.8%	3,063.6	2,870.3	6.7%	4.84%	4.62%	4.7%	2,870.3	4.62%	
Reading	41.9	39.2	6.8%	645.3	555.4	16.2%	1.02%	0.89%	14.0%	555.4	0.89%	
Revere	110.5	102.3	7.9%	1,312.0	1,294.2	1.4%	2.07%	2.08%	-0.5%	1,294.2	2.08%	
Saugus	76.0	82.0	-7.3%	1,108.0	1,033.6	7.2%	1.75%	1.66%	5.2%	1,033.6	1.66%	
Somerville	157.7	162.8	-3.2%	2,045.3	2,016.2	1.4%	3.23%	3.24%	-0.4%	2,016.2	3.24%	
Southborough	21.7	20.9	3.9%	390.8	341.6	14.4%	0.62%	0.55%	12.3%	341.6	0.55%	
Stoneham	49.5	50.5	-2.0%	811.8	664.4	22.2%	1.28%	1.07%	19.9%	664.4	1.07%	
Swampscott	38.8	38.6	0.5%	588.4	542.2	8.5%	0.93%	0.87%	6.5%	542.2	0.87%	
Waltham	170.5	174.8	-2.5%	2,356.4	2,325.3	1.3%	3.72%	3.74%	-0.6%	2,325.3	3.74%	
Watertown	70.1	70.1	0.0%	949.6	910.9	4.2%	1.50%	1.47%	2.3%	910.9	1.47%	
Weston	27.8	25.0	11.2%	646.8	554.3	16.7%	1.02%	0.89%	14.5%	554.3	0.89%	
Winthrop	33.4	36.9	-9.6%	472.8	453.3	4.3%	0.75%	0.73%	2.4%	453.3	0.73%	
<b>Subtotal Metro-System (Fully Served)</b>	<b>4,152.7</b>	<b>4,371.9</b>	<b>-5.0%</b>	<b>56,971.3</b>	<b>56,476.8</b>	<b>0.9%</b>	<b>89.9%</b>	<b>90.8%</b>	<b>-1.0%</b>	<b>56,476.8</b>	<b>90.84%</b>	
<b>Metro-System (Partially Served)</b>												
Canton (P)	12.9	14.0	-7.7%	343.6	376.5	-8.7%	0.54%	0.61%	-10.4%	376.5	0.6%	
Dedham-Westwood W.D. (P)	0.0	23.7	-99.9%	14.1	240.2	-41.2%	0.22%	0.39%	-42.3%	240.2	0.4%	
Leominster (P)	-	-	0.0%	-	-	0.0%	0.00%	0.00%	0.0%	-	0.0%	
Lynn (LWSC) (P)	3.4	4.0	-14.4%	28.6	91.7	-68.8%	0.05%	0.15%	-69.3%	91.7	0.1%	
Marlborough (P)	105.0	109.0	-3.7%	1,502.1	1,433.8	4.8%	2.37%	2.31%	2.8%	1,433.8	2.3%	
Needham (P)	2.7	2.10	87.0%	380.7	259.9	46.5%	0.60%	0.42%	43.8%	259.9	0.4%	
Northborough (P)	26.6	26.4	0.8%	401.2	329.2	21.9%	0.63%	0.53%	19.6%	329.9	0.5%	
Peabody (P)	62.7	18.0	248.8%	523.7	303.2	72.7%	0.83%	0.49%	69.5%	303.2	0.5%	
Stoughton (P)	3.2	3.1	2.7%	38.2	32.6	17.0%	0.06%	0.05%	14.8%	32.6	0.1%	
Wakefield (P)	32.5	48.0	-32.3%	643.9	665.3	-3.2%	1.02%	1.07%	-5.0%	665.3	1.1%	
Wellesley (P)	8.9	6.6	35.0%	524.6	424.8	23.5%	0.83%	0.68%	21.2%	424.8	0.7%	
Wilmington (P)	8.5	0.7	1084.2%	250.4	138.7	80.5%	0.40%	0.22%	77.1%	138.7	0.2%	
Winchester (P)	28.0	14.6	91.0%	477.1	424.8	12.3%	0.75%	0.68%	10.2%	424.8	0.7%	
Woburn (P)	51.7	47.6	8.5%	1,125.1	972.0	15.8%	1.78%	1.56%	13.6%	972.0	1.6%	
<b>Subtotal Metro-System (Partially Served)</b>	<b>346.1</b>	<b>336.7</b>	<b>2.8%</b>	<b>6,380.7</b>	<b>5,692.7</b>	<b>12.1%</b>	<b>10.1%</b>	<b>9.2%</b>	<b>10.0%</b>	<b>5,692.7</b>	<b>9.2%</b>	
<b>Subtotal Metro-System (Full &amp; Partially Served)</b>	<b>4,498.7</b>	<b>4,708.6</b>	<b>-4.5%</b>	<b>63,352.0</b>	<b>62,169.5</b>	<b>1.9%</b>	<b>100%</b>	<b>100%</b>		<b>62,169.5</b>	<b>100%</b>	
<b>Chicopee Valley Aqueduct</b>												
Chicopee	130.3	130.2	0.1%	1,902.4	1,841.7	3.3%	68.33%	70.20%	-2.66%	1,841.7	70.2%	
South Hadley FD #1	26.1	24.3	7.5%	421.1	380.8	10.6%	15.13%	14.52%	4.19%	380.8	14.5%	
Wilbraham	22.9	23.6	-3.1%	460.5	400.9	14.9%	15.54%	15.28%	8.24%	400.9	15.3%	
<b>Subtotal CVA System</b>	<b>179.3</b>	<b>178.1</b>	<b>0.7%</b>	<b>2,784.0</b>	<b>2,623.4</b>	<b>6.1%</b>	<b>100%</b>	<b>100%</b>		<b>2,623.4</b>	<b>100%</b>	
<b>Other Revenue Supply</b>												
Cambridge (P)	-	-	0.0%	19.4	-	#DIV/0!					0.0	
Clinton <sup>3</sup>	37.5	35.4	5.8%	495.0	486.9	1.7%					486.9	
Worcester (P)	-	-	0.0%	-	-	0.0%					0.0	
Other Revenue Customers <sup>4</sup>	38.8	44.3	-12.4%	496.9	500.5	-0.7%					500.5	
<b>Subtotal Other Revenue Supply</b>	<b>76.3</b>	<b>79.8</b>	<b>-4.3%</b>	<b>1,011.3</b>	<b>987.4</b>	<b>2.4%</b>					<b>987.4</b>	
<b>Total Water Supplied</b>												
Fully Served Metro	4,152.7	4,371.9	-5.0%	56,971.3	56,476.8	0.9%					56,476.8	
CVA Communities	179.3	178.1	0.7%	2,784.0	2,623.4	6.1%					2,623.4	
Partially Served Communities	346.1	336.7	2.8%	6,380.7	5,692.7	12.1%					5,693	
Other Revenue Customers	76.3	79.8	-4.3%	1,011.3	987.4	2.4%					987.4	
<b>Total Water Supplied <sup>6</sup></b>	<b>4,754.4</b>	<b>4,966.4</b>	<b>-4.3%</b>	<b>67,147.3</b>	<b>65,780.3</b>	<b>2.1%</b>					<b>65,780.3</b>	

1) System share for each rate revenue community is the community's share of total MWRA water use for all rate revenue communities. System share for each Chicopee Valley Aqueduct (CVA) community is each CVA community's share of total MWRA water supplied to the CVA system. Water assessments for rate revenue communities are calculated by allocating the total annual water rate revenue requirement based on each community's share of flow. Water assessments for CVA communities are calculated by allocating the annual CVA rate revenue requirement based on each CVA community's share of CVA flow.

2) Lexington supplies Bedford with partial MWRA water service.

3) The Town of Clinton receives up to 800 million gallons of water per year free of charge and is charged a flat wholesale rate per million gallons for water in excess of 800 million gallons per year.

4) Other Revenue Customers: D.C.R. (Parks & Pools), DCR Blue Hills Ski Area, Stone Zoo, and the Deer Island WWTP.

5) Other Revenue Customers are charged a flat wholesale rate per million gallons of water supplied.

6) This report includes only water supplied for which revenue is collected in accordance with existing user agreements. It does not include water utilized for system maintenance.

(P) Community is partially supplied by MWRA. Marlborough & Northborough are temporarily being fully supplied.

Questions regarding water supplied can be directed to Michael Greeley @ (857) 305-5814 or Leo Norton @ (617) 788-2256.

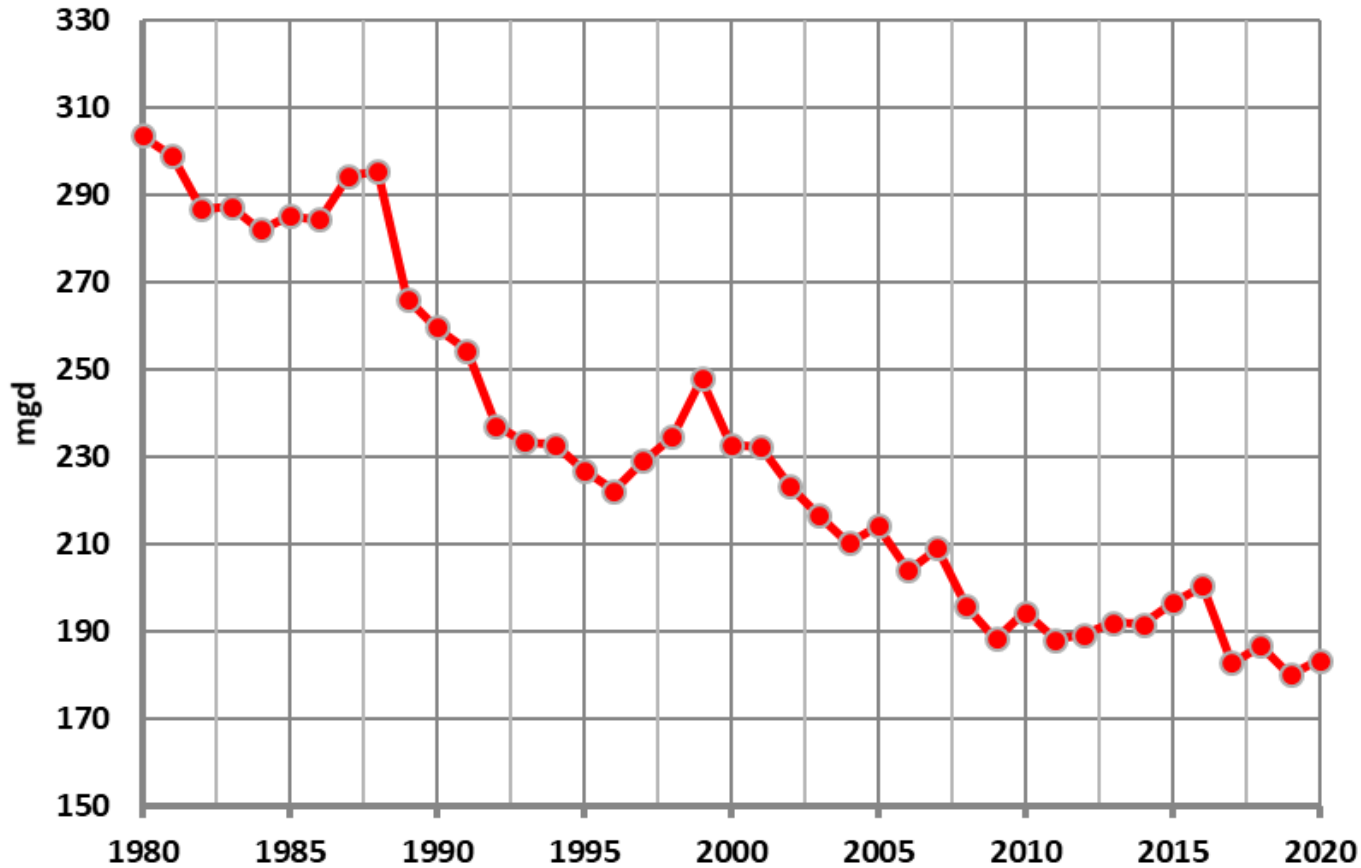


*Report on 2020 Water Use Trends and Reservoir  
Status*

February 17, 2021



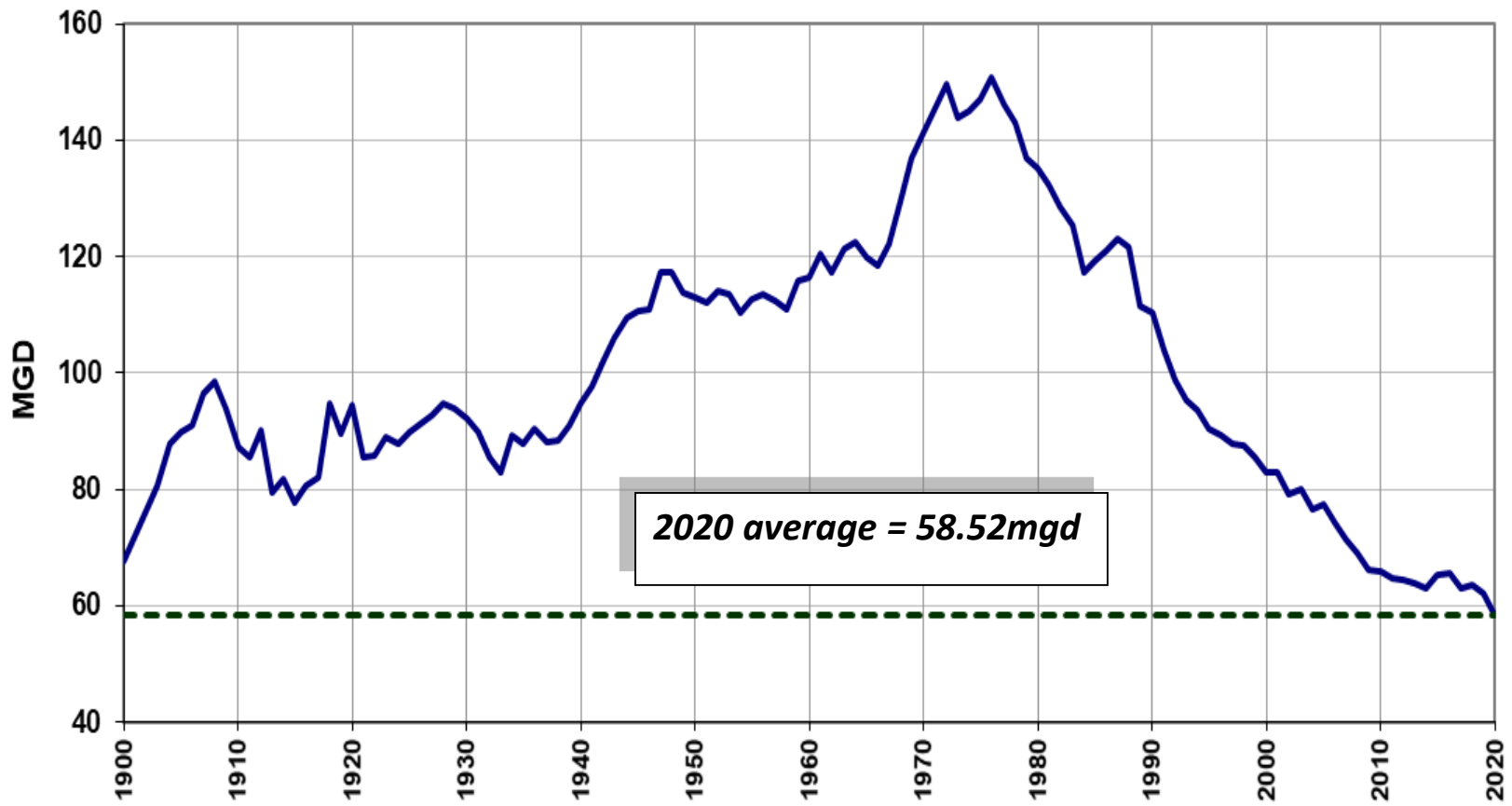
# Total Consumption by MWRA Communities (1980 to 2020)



2020 --  
183.46 mgd

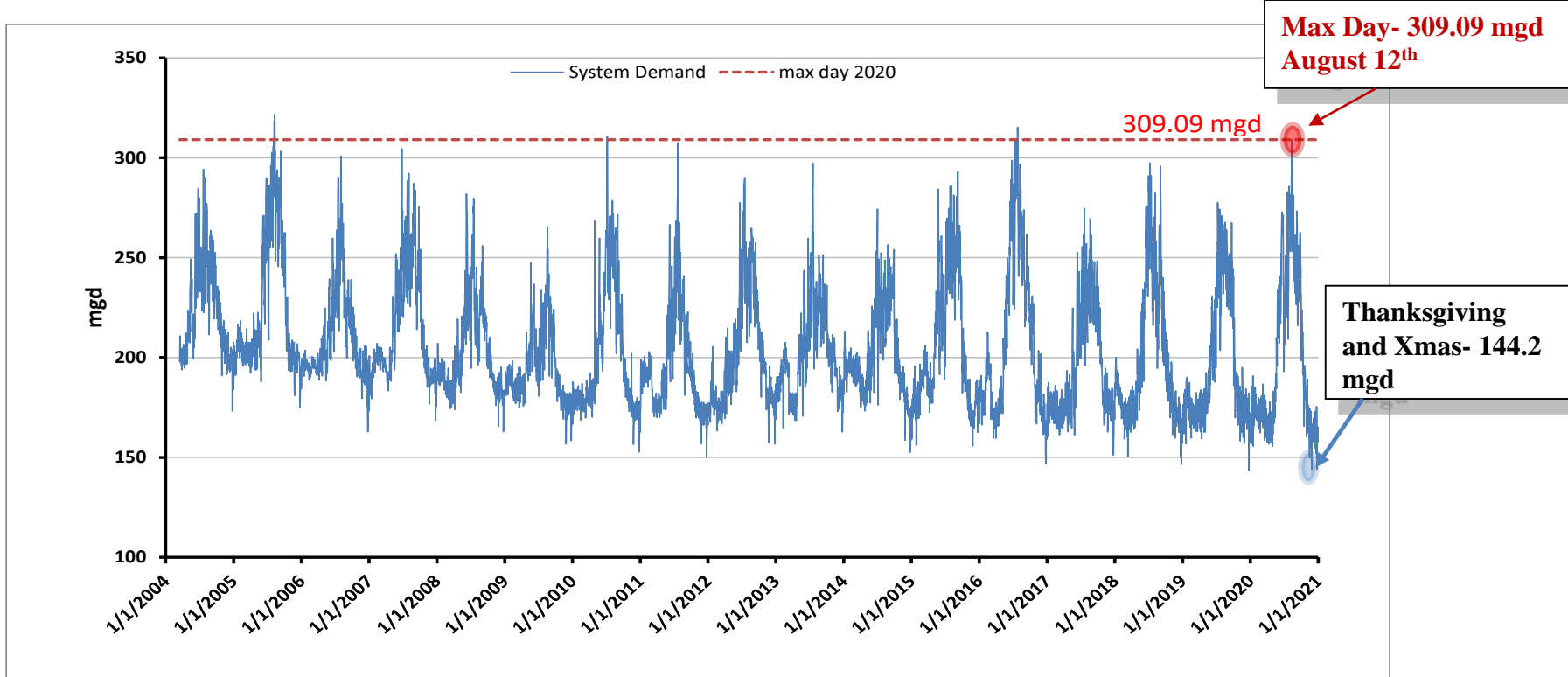


# Boston Water Use (1900 to 2020)



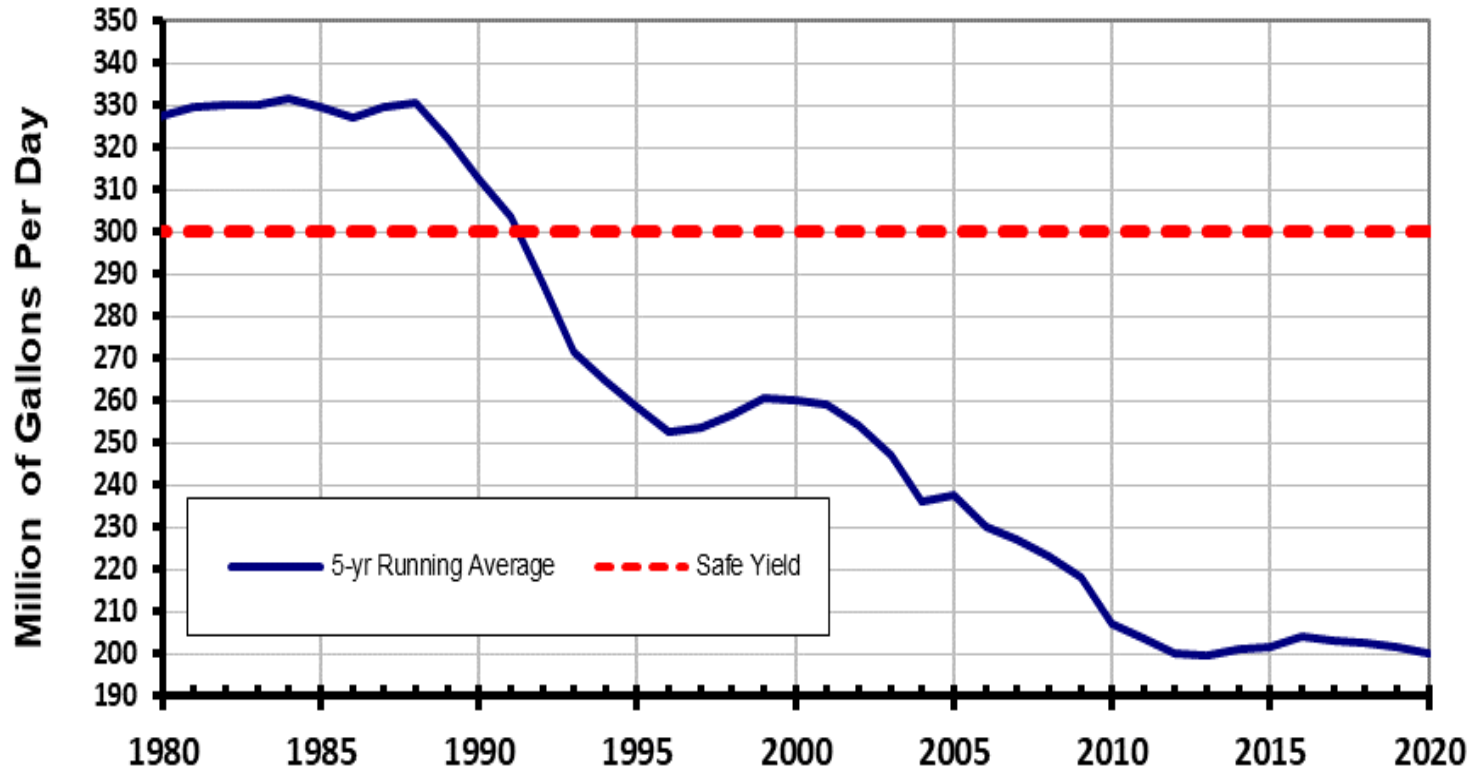


# Daily System Demand





# Reservoir Withdrawals – 5 Year Running Average



5-year average  
withdrawal = 200.12 mgd



# MetroBoston Quarterly Water Use Comparison (mgd)

Quarter	Metro Boston Total			Boston			Non-Boston		
	2020	2019	% change	2020	2019	% change	2020	2019	% change
Q-1	147.8	148.7	-0.6	57.6	58.6	-1.7	90.2	90.1	0.1
Q-2	163.0	158.7	2.7	56.2	61.0	-7.8	106.8	97.7	9.2
Q-3	194.4	188.6	3.1	65.7	69.0	-4.8	128.7	119.6	7.6
Q-4	147.7	151.7	-2.6	54.5	59.9	-9.0	93.2	91.8	1.5