

### STAFF SUMMARY

**TO:** Board of Directors  
**FROM:** Frederick A. Laskey, Executive Director *Frederick A. Laskey*  
**DATE:** February 16, 2022  
**SUBJECT:** Report on 2021 Water Use Trends and Reservoir Status

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**COMMITTEE:** Water Policy & Oversight

X  INFORMATION  
  VOTE

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

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

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### 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.

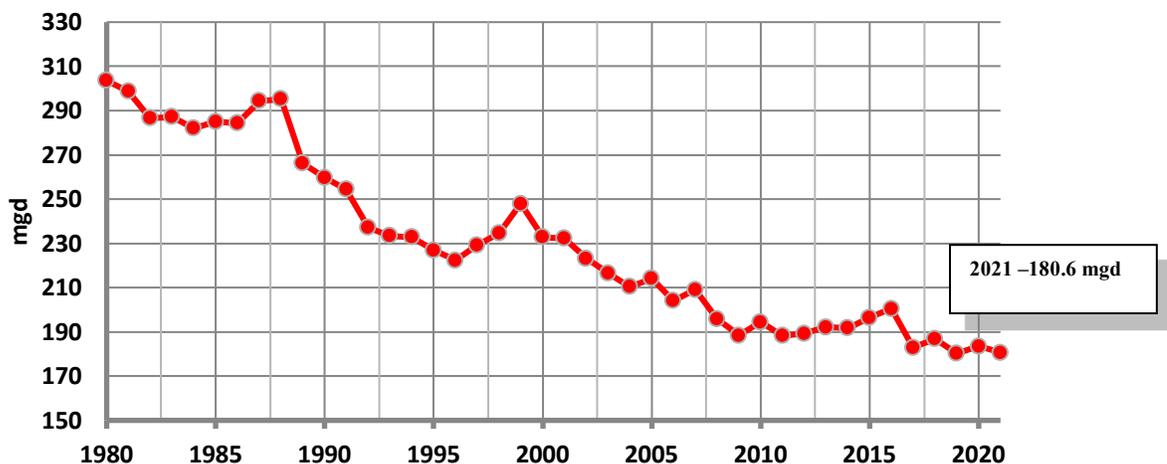
### DISCUSSION:

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 use continued the long-term trend downward.

### Water Consumption by MWRA Communities

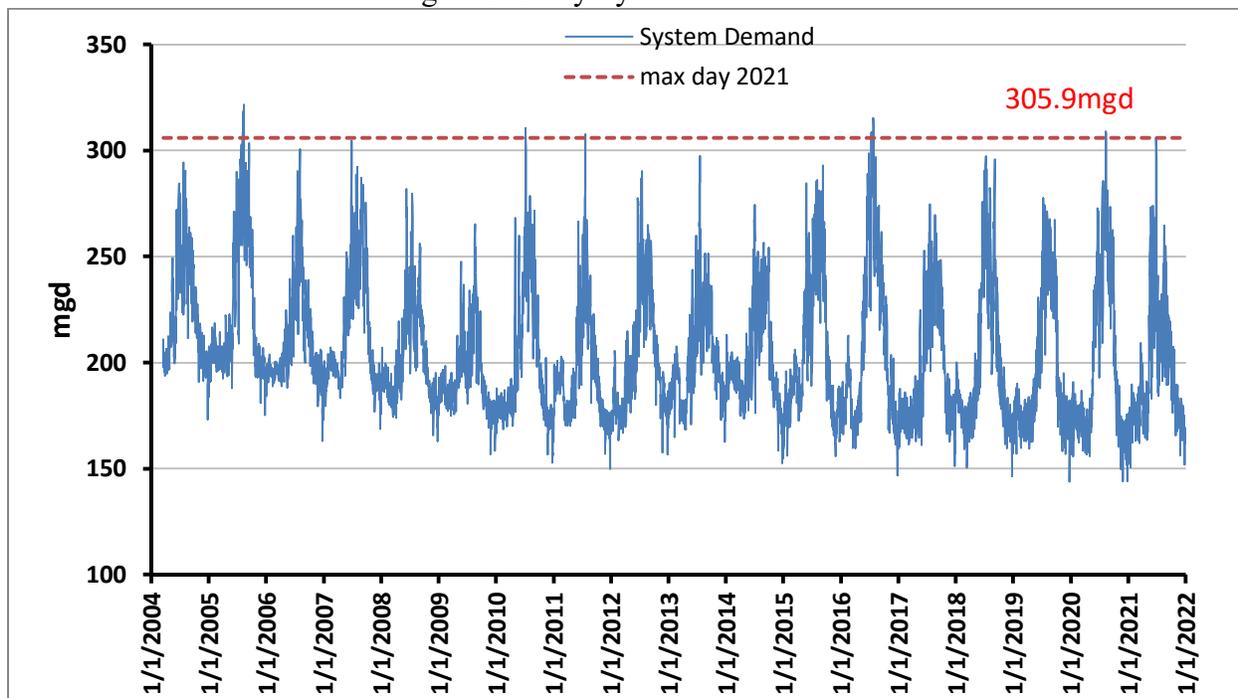
Calendar year 2021 water consumption by all MWRA communities of 180.6 million gallons per day (mgd) was 3.3 mgd (1.8 percent) lower than 2020, as shown on Figure 1.

Figure 1 – Total Consumption by MWRA Communities (1980 to 2021)



System wide, 2021 had a maximum day withdrawal of 305.9 mgd on June 28 (one percent lower than 2020). At the opposite extreme, the Friday after Thanksgiving Day, at 156.3 mgd, and the day after Christmas, at 151.9 mgd, were the lowest two days of the year, but both slightly higher than last year’s Christmas. Figure 2 below shows daily system withdrawals since 2004.

Figure 2: Daily System Withdrawals



Demand from MWRA’s largest customer, the Boston Water and Sewer Commission, was 58.8 mgd, which was just slightly higher than last year by 0.3 mgd (0.55 percent). Current Boston demand continues to be lower than demand before 1900 as shown on Figure 3 below.

Figure 3: Boston Water Use (1900-2021)

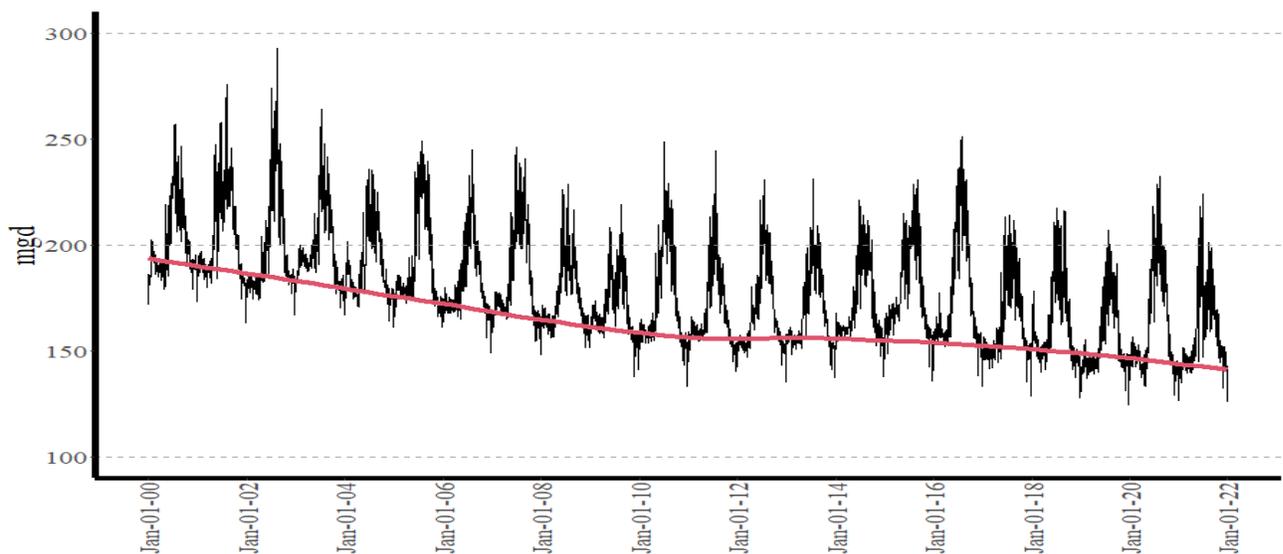


The pandemic caused substantial shifts in demand during 2020 from the center cities to suburbs with office closings and work from home. Calendar year 2021 saw a shift back toward more normal demand patterns with a rebalancing of the suburban and center city demand. Many communities saw decreases in demand, while Boston saw a slight increase, resulting in an increase in Boston’s share of total system demands of 1.8 percent. See Attachment A for community demands and system share data.

## 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 increases in water, sewer, and energy costs. Water use reductions also reflect the success of MWRA and community leak reduction programs with reduced pipeline leaks. Countervailing pressures include population and employment increases.

Figure 4: Fully Supplied Communities Demand (1999 to 2021)<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 5 and 6 on the next page show the variation in seasonal water use over time, and both the longer-term decline in both base and total use, and the relatively small impact that seasonal demand has on total water use. Seasonal use in 2021 of 17.3 mgd was about typical on a volume basis, but above average on a percentage use basis, at 10.9%. The early part of the outdoor use season was relatively dry, but the later portions saw well above average rainfall.

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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.

Figure 5: Fully Supplied Communities Annual Base and Seasonal Demand

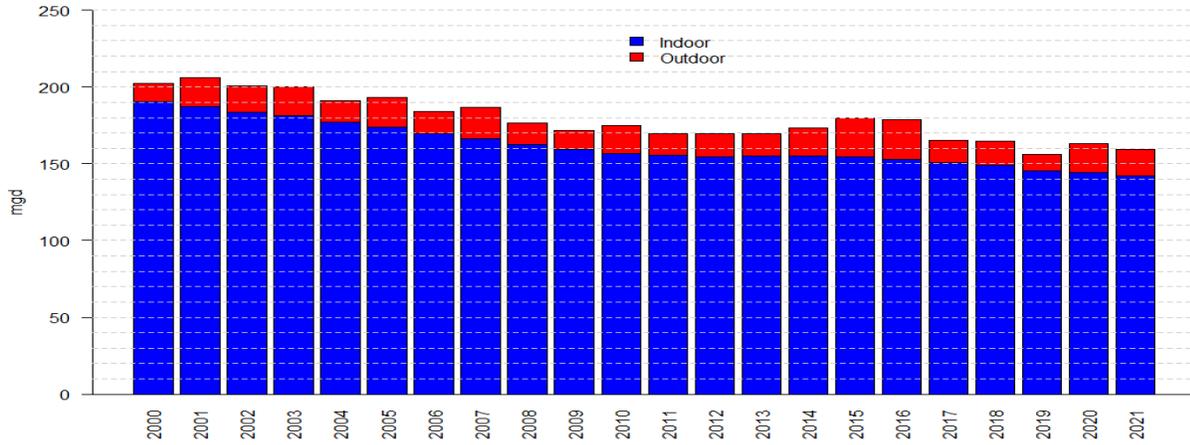
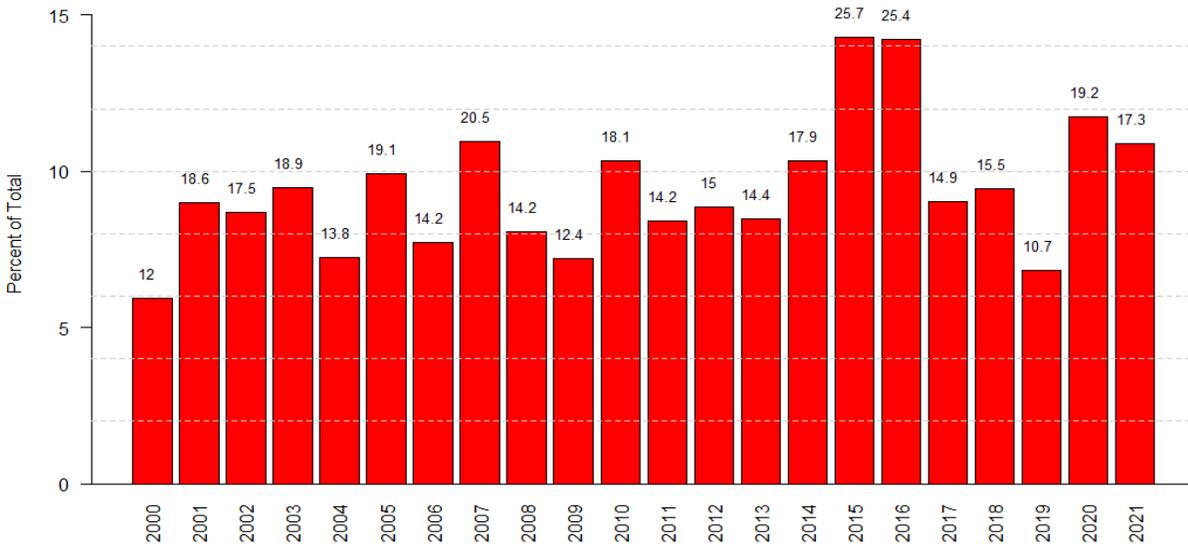


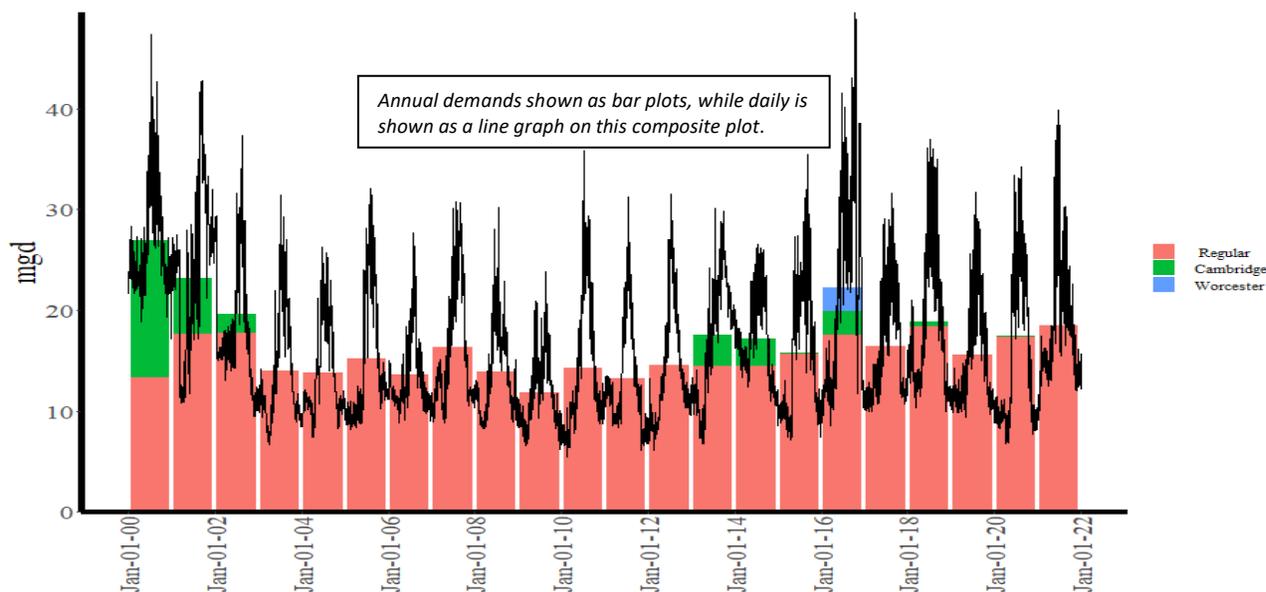
Figure 6: Fully Supplied Communities' Annual Seasonal Demand (Labels show demand in mgd)



## Partially Supplied Communities

Demand for the partially supplied communities, shown on Figure 7, was up by 1.1 mgd (6.0%) when compared to 2020.

Figure 7: Partially Supplied Communities – MWRA Supplied Demand (Daily and Annual)



Cambridge used 19.4 million gallons over three separate days in August and September. Burlington, the newest partially supplied community used 270.8 million gallons in 2021.

## Reservoir Withdrawals and Releases

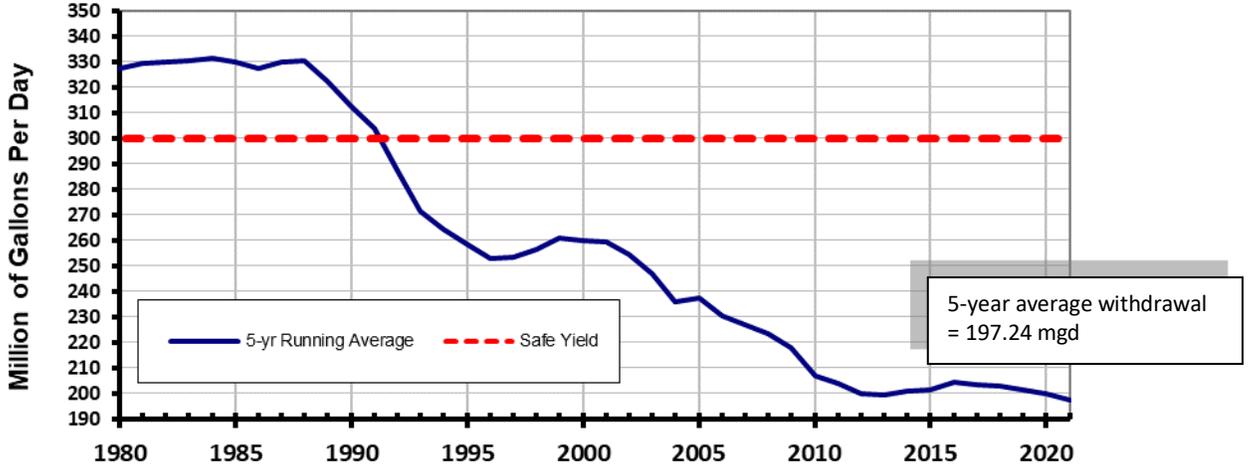
Reservoir withdrawals are the metric used to compare to the 300 mgd safe yield of the watershed/reservoir system<sup>2</sup>. Withdrawals include water sold to MWRA communities, as well as other non-revenue generating uses in the watershed and MWRA system. Total MWRA water withdrawals decreased by 2.44 percent in 2021, from 199.4 mgd in 2020 to 194.6 mgd.

The pipeline supplying the McLaughlin Fish Hatchery in Belchertown was in service for the entire year, with an average withdrawal of 6.2 mgd. Without that withdrawal, total reservoir withdrawals for community water supply in 2021 would have been 188.4 mgd. MWRA began serving the hatchery through the dedicated hydroelectric station and pipeline in December 2016.

Figure 8, 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 1.4 percent decrease from 2020, although the trend line is essentially flat for most of the past decade.

<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.

Figure 8: Total Reservoir Withdrawals – Five-Year Running Average 1980 to 2021

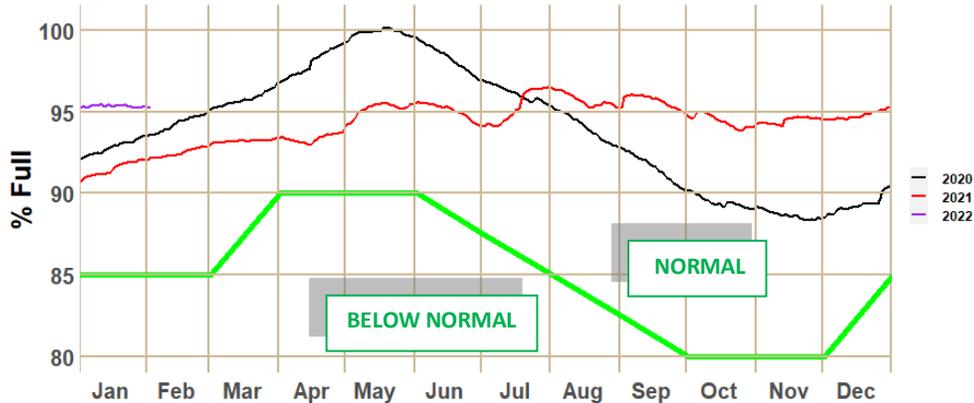


It is worth noting that since MWRA was created, MWRA has added demand from eight additional communities and the McLaughlin Fish Hatchery, as well as the added demand from the growth in population and employment within the original service area. Without the added communities and hatchery demands, the five-year average demand would have been almost nine mgd lower at 188.6 mgd. This further demonstrates the substantial improvements in water use efficiency within the MWRA service area, which have improved system reliability and allowed MWRA to provide service to additional communities in need of that reliable supply.

Reservoir Status

Quabbin Reservoir levels were well within the normal operating band and steadily rose through the year. Figure 9 below shows a comparison of Quabbin volume levels between 2020 and 2021. 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 9: Quabbin Reservoir Volumes for 2020 to 2021



Quabbin Reservoir spilled 20.26 million gallons to the Swift River in 2021, beginning on July 19 and spilling for just 18 days. In order to meet metro-Boston water demand and to maintain water quality, 48.8 billion gallons of the higher quality Quabbin water was transferred to Wachusett Reservoir during 2021. The transfer was equivalent to about 75 percent of Wachusett’s volume

and equivalent to about 80 percent of the water used by MWRA's customers in the metro Boston system. To maintain Wachusett Reservoir in its normal narrow operating band, MWRA released 38.4 billion gallons to the Nashua River through controlled releases.

**ATTACHMENT:**

Community Water Use Data

**Massachusetts Water Resources Authority**  
**MWRA Water Supplied**  
**Reporting Period: December 2021**

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

	Monthly (MG)			YTD (MG)			YTD System Share			Prior Year-End Totals 2020	
	Dec		Flow Change	YTD		Flow Change	Flow Share <sup>1</sup>		% Change in YTD Flow Share	Annual Flow (mg)	Flow Share <sup>1</sup>
	2021	2020		2021	2020		2021	2020			
<b>Metro-System (Fully Served)</b>											
Arlington	95.5	103.5	-7.7%	1,220.4	1,358.0	-10.1%	1.96%	2.14%	-8.8%	1,358.0	2.14%
Belmont	46.1	49.1	-6.0%	677.3	757.1	-10.5%	1.09%	1.20%	-9.2%	757.1	1.20%
Boston (BWSC)	1,716.2	1,619.1	6.0%	21,475.3	21,417.0	0.3%	34.41%	33.81%	1.8%	21,417.0	33.81%
Brookline	124.2	120.6	3.0%	1,732.6	1,826.0	-5.1%	2.78%	2.88%	-3.7%	1,826.0	2.88%
Chester	94.3	107.4	-12.3%	1,179.9	1,244.6	-5.2%	1.89%	1.96%	-3.8%	1,244.6	1.96%
Everett	109.2	113.6	-3.8%	1,387.8	1,429.7	-2.9%	2.22%	2.26%	-1.5%	1,429.7	2.26%
Frammingham	156.7	151.2	3.6%	2,059.4	2,117.0	-2.7%	3.30%	3.34%	-1.2%	2,117.0	3.34%
Lexington <sup>2</sup>	113.0	118.0	-4.2%	1,835.2	1,999.7	-8.2%	2.94%	3.16%	-6.8%	1,999.7	3.16%
Lynnfield W.D.	11.8	9.9	19.1%	187.0	196.5	-4.8%	0.30%	0.31%	-3.4%	196.5	0.31%
Malden	157.8	155.7	1.4%	1,892.4	1,909.6	-0.9%	3.03%	3.01%	0.6%	1,909.6	3.01%
Marblehead	40.1	40.3	-0.7%	635.5	705.0	-9.8%	1.02%	1.11%	-8.5%	705.0	1.11%
Medford	131.2	115.0	14.1%	1,656.5	1,677.6	-1.3%	2.65%	2.65%	0.2%	1,677.6	2.65%
Melrose	56.6	63.9	-11.5%	756.2	800.3	-5.5%	1.21%	1.26%	-4.1%	800.3	1.26%
Milton	62.2	62.6	-0.6%	869.2	885.5	-1.8%	1.39%	1.40%	-0.4%	885.5	1.40%
Nahant	8.5	7.2	18.9%	125.0	121.6	2.8%	0.20%	0.19%	4.4%	121.6	0.19%
Newton	215.4	208.9	3.1%	3,059.0	3,126.7	-2.2%	4.90%	4.94%	-0.7%	3,126.7	4.94%
Norwood	71.7	68.5	4.7%	972.9	1,005.0	-3.2%	1.56%	1.59%	-1.7%	1,005.0	1.59%
Quincy	240.5	237.0	1.5%	2,994.0	3,063.6	-2.3%	4.80%	4.84%	-0.8%	3,063.6	4.84%
Reading	41.2	41.9	-1.6%	606.7	645.3	-6.0%	0.97%	1.02%	-4.6%	645.3	1.02%
Revere	111.9	110.5	1.3%	1,371.8	1,312.0	4.6%	2.20%	2.07%	6.1%	1,312.0	2.07%
Saugus	84.5	76.0	11.1%	1,084.9	1,108.0	-2.1%	1.74%	1.75%	-0.6%	1,108.0	1.75%
Somerville	160.9	157.7	2.1%	2,046.6	2,045.3	0.1%	3.28%	3.23%	1.6%	2,045.3	3.23%
Southborough	20.4	21.7	-6.2%	322.1	390.8	-17.6%	0.52%	0.62%	-16.3%	390.8	0.62%
Stonham	48.9	49.5	-1.1%	710.7	811.8	-12.4%	1.14%	1.28%	-11.1%	811.8	1.28%
Swampscott	43.0	38.8	11.0%	551.6	588.4	-6.3%	0.88%	0.93%	-4.8%	588.4	0.93%
Waltham	178.5	170.5	4.7%	2,386.3	2,356.4	1.3%	3.82%	3.72%	2.8%	2,356.4	3.72%
Watertown	66.7	70.1	-4.8%	896.1	949.6	-5.6%	1.44%	1.50%	-4.2%	949.6	1.50%
Weston	29.7	27.8	7.0%	530.7	646.8	-17.9%	0.85%	1.02%	-16.7%	646.8	1.02%
Winthrop	32.5	33.4	-2.7%	414.5	472.8	-12.3%	0.66%	0.75%	-11.0%	472.8	0.75%
<b>Subtotal Metro-System (Fully Served)</b>	<b>4,269.2</b>	<b>4,148.9</b>	<b>2.9%</b>	<b>55,637.4</b>	<b>56,967.5</b>	<b>-2.3%</b>	<b>89.2%</b>	<b>89.9%</b>	<b>-0.9%</b>	<b>56,967.5</b>	<b>89.93%</b>
<b>Metro-System (Partially Served)</b>											
Ashtand (P)	-	-	0.0%	-	-	0.0%	0.00%	0.00%	0.0%	-	0.0%
Burlington (P)	32.9	-	100.0%	270.8	-	100.0%	0.43%	0.00%	100.0%	-	0.0%
Canton (P)	14.2	12.9	10.6%	436.9	343.6	27.2%	0.70%	0.54%	29.1%	343.58	0.5%
Dedham-Westwood W.D. (P)	13.4	0.0	39538%	55.3	141.3	-60.8%	0.09%	0.22%	-60.3%	141.3	0.2%
Leominster (P)	-	-	0.0%	-	-	0.0%	0.00%	0.00%	0.0%	-	0.0%
Lynn (LWSC) (P)	3.4	3.4	-0.7%	40.6	28.6	41.6%	0.07%	0.05%	43.7%	28.6	0.0%
Marlborough (P)	114.0	105.0	8.6%	1,454.8	1,502.1	-3.1%	2.33%	2.37%	-1.7%	1,502.1	2.4%
Needham (P)	-	2.7	-100%	316.4	380.7	-16.9%	0.51%	0.60%	-15.7%	380.7	0.6%
Northborough (P)	24.4	26.6	-8.3%	326.0	401.2	-18.7%	0.52%	0.63%	-17.5%	401.212	0.6%
Peabody (P)	54.7	62.7	-12.6%	817.1	523.7	56.0%	1.31%	0.83%	58.4%	523.7	0.8%
Stoughton (P)	1.5	3.2	-54.5%	25.7	38.2	-32.7%	0.04%	0.06%	-31.7%	38.17	0.1%
Wakefield (P)	48.0	32.5	47.7%	565.5	643.9	-12.2%	0.91%	1.02%	-10.9%	643.9	1.0%
Wellesley (P)	52.7	8.9	489.4%	718.5	524.6	37.0%	1.15%	0.83%	39.0%	524.6	0.8%
Wilmington (P)	2.5	8.5	-70.6%	154.8	250.4	-38.2%	0.25%	0.40%	-37.2%	250.4	0.4%
Winchester (P)	16.9	28.0	-39.4%	420.0	477.1	-12.0%	0.67%	0.75%	-10.6%	477.1	0.8%
Woburn (P)	49.5	51.7	-4.1%	1,163.7	1,125.1	3.4%	1.86%	1.78%	5.0%	1,125.1	1.8%
<b>Subtotal Metro-System (Partially Served)</b>	<b>428.2</b>	<b>346.1</b>	<b>23.7%</b>	<b>6,766.2</b>	<b>6,380.7</b>	<b>6.0%</b>	<b>10.8%</b>	<b>10.1%</b>	<b>7.6%</b>	<b>6,380.7</b>	<b>10.1%</b>
<b>Subtotal Metro-System (Full &amp; Partial)</b>	<b>4,697.4</b>	<b>4,495.0</b>	<b>4.5%</b>	<b>62,403.6</b>	<b>63,348.2</b>	<b>-1.5%</b>	<b>100%</b>	<b>100%</b>		<b>63,348.2</b>	<b>100%</b>
<b>Chicopee Valley Aqueduct</b>											
Chicopee	124.6	130.3	-4.4%	1,811.7	1,902.4	-4.8%	69.75%	68.33%	2.08%	1,902.4	68.3%
South Hadley FD #1	25.3	26.1	-3.3%	383.5	421.1	-8.9%	14.77%	15.13%	-2.37%	421.1	15.1%
Wilbraham	24.6	22.9	7.4%	402.1	460.5	-12.7%	15.48%	16.54%	-6.41%	460.5	16.5%
<b>Subtotal CVA System</b>	<b>174.4</b>	<b>179.3</b>	<b>-2.7%</b>	<b>2,597.3</b>	<b>2,784.0</b>	<b>-6.7%</b>	<b>100%</b>	<b>100%</b>		<b>2,784.0</b>	<b>100%</b>
<b>Other Revenue Supply</b>											
Cambridge (P)	-	-	0.0%	0.05	19.4	-99.8%				19.4	
Clinton <sup>3</sup>	32.0	37.5	-14.8%	449.5	495.0	-9.2%				495.0	
Worcester (P)	-	-	0.0%	-	-	0.0%				0.0	
<b>Other Revenue Customers<sup>4</sup></b>	<b>39.0</b>	<b>42.6</b>	<b>-8.6%</b>	<b>483.5</b>	<b>500.6</b>	<b>-3.4%</b>				<b>500.6</b>	
<b>Subtotal Other Revenue Supply<sup>5</sup></b>	<b>70.9</b>	<b>80.1</b>	<b>-11.5%</b>	<b>933.0</b>	<b>1,015.1</b>	<b>-8.1%</b>				<b>1,015.1</b>	
<b>Total Water Supplied</b>											
<b>Fully Supplied Metro Communities</b>	<b>4,269.2</b>	<b>4,148.9</b>	<b>2.9%</b>	<b>55,637.4</b>	<b>56,967.5</b>	<b>-2.3%</b>				<b>56,968</b>	
<b>CVA Communities</b>	<b>174.4</b>	<b>179.3</b>	<b>-2.7%</b>	<b>2,597.3</b>	<b>2,784.0</b>	<b>-6.7%</b>				<b>2,784</b>	
<b>Partially Supplied Communities</b>	<b>428.2</b>	<b>346.1</b>	<b>23.7%</b>	<b>6,766.2</b>	<b>6,380.7</b>	<b>6.0%</b>				<b>6,381</b>	
<b>Other Revenue Customers</b>	<b>70.9</b>	<b>80.1</b>	<b>-11.5%</b>	<b>933.0</b>	<b>1,015.1</b>	<b>-8.1%</b>				<b>1,015.1</b>	
<b>Total Water Supplied<sup>6</sup></b>	<b>4,942.7</b>	<b>4,754.4</b>	<b>4.0%</b>	<b>65,933.9</b>	<b>67,147.3</b>	<b>-1.8%</b>				<b>67,147.3</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 Aqueduct Valley (CVA) community is each CVA community's share of total MWRA water supplied to the CVA system. Water assessments for 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.

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