STAFF SUMMARY

TO: Board of Directors
FROM: Frederick A. Laskey, Executive Director
DATE: February 19, 2020
SUBJECT: Report on 2019 Water Use Trends and Reservoir Status

---

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, P.E.
Chief Operating Officer

The year 2019 was a water surplus year. The Quabbin Reservoir was at normal operating level for the entire year and spilled 47.2 billion gallons during the first half of the year. More water was spilled than was transferred to Wachusett. In spite of a growing economy, total water withdrawals were 1.7% lower than the previous 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.

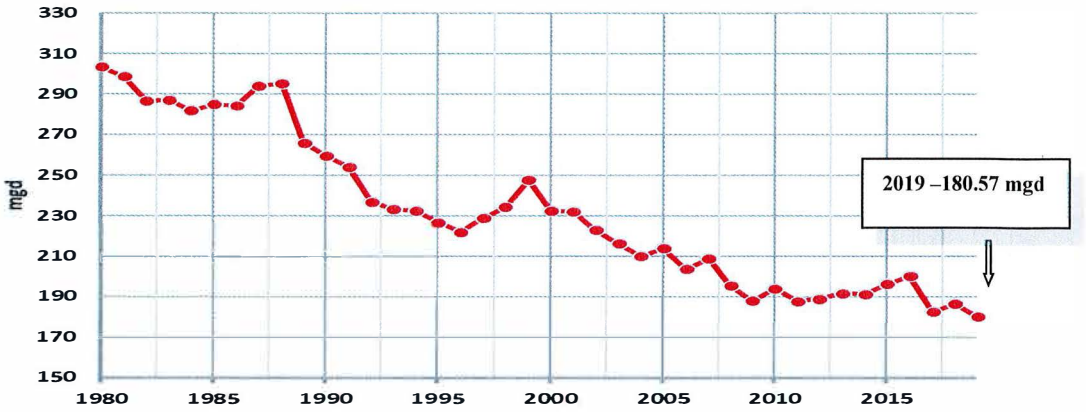
DISCUSSION:

Calendar Year 2019, like the year before it, was a water surplus year. Total releases and spills exceeded reservoir withdrawals by 13.5 billion gallons. Total reservoir withdrawals dropped slightly by 1.7% when compared to 2018.

Water Consumption by MWRA Communities

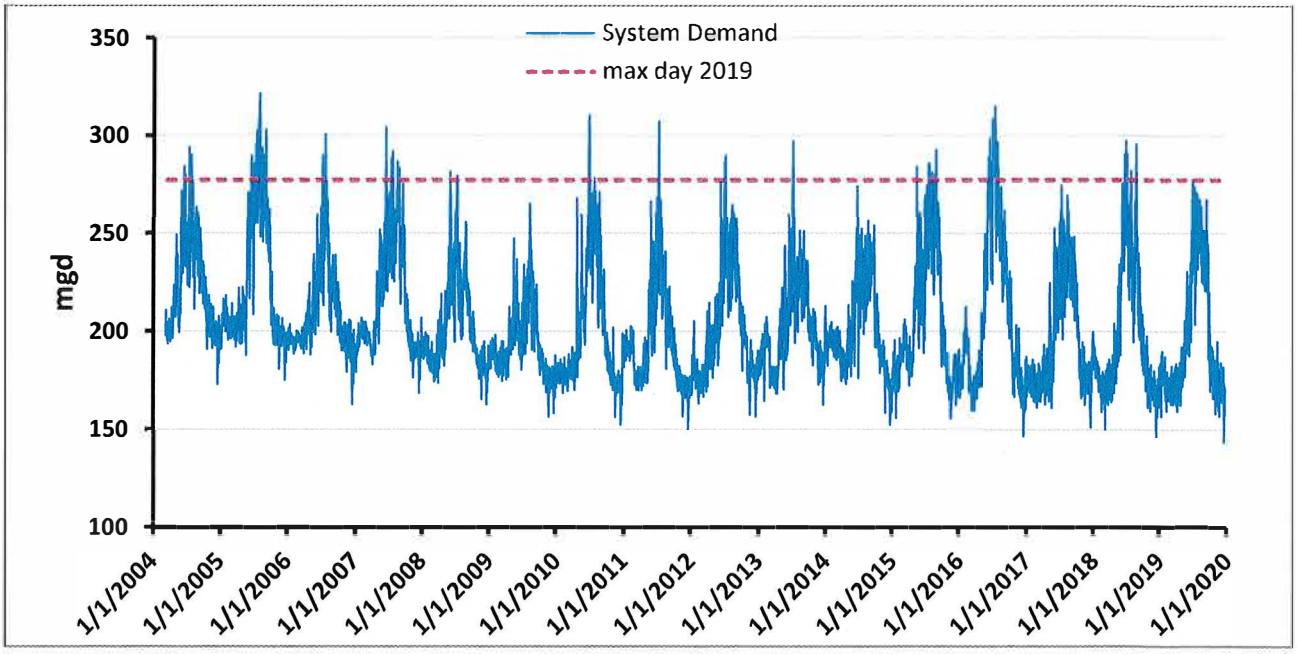
Calendar Year 2019 water consumption by all MWRA communities of 180.57 million gallons per day (mgd) was about 5.99 mgd (3.2%) lower than 2018, as shown on Figure 1 on the next page.

Figure 1 – Total Consumption by MWRA Communities (1980 to 2019)



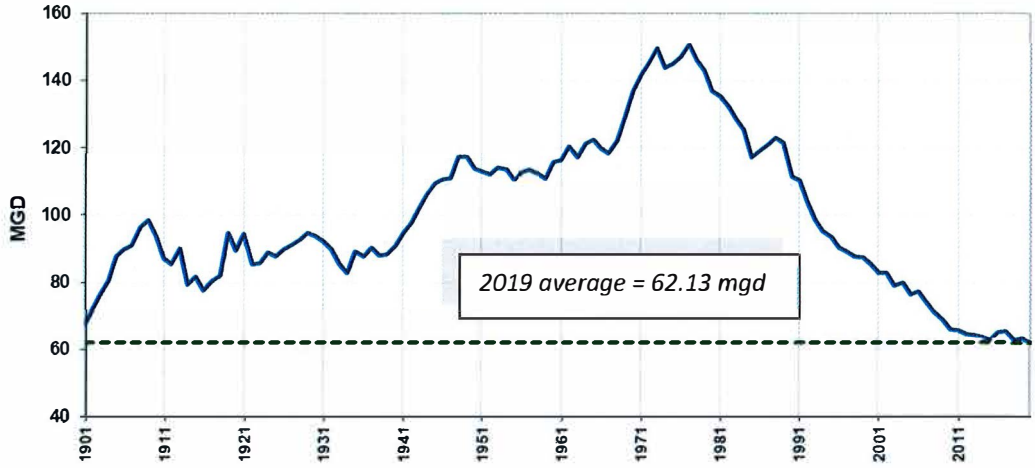
System wide, 2019 had a maximum day demand of 277.7 mgd (6.7% lower than 2018) on July 10th. At the opposite extreme, Christmas day had the lowest demand for the year at 143.7 mgd, which was the record for the lowest single day demand since the creation of the MWRA. Figure 2 below shows daily system demand.

Figure 2: Daily System Demand



Demand from MWRA's largest customer, the Boston Water and Sewer Commission, was 62.13 mgd, which was lower than last year by 1.49 mgd (2.33%). Current Boston demand continues to be lower than demand before 1900 as shown on Figure 3 on the next page.

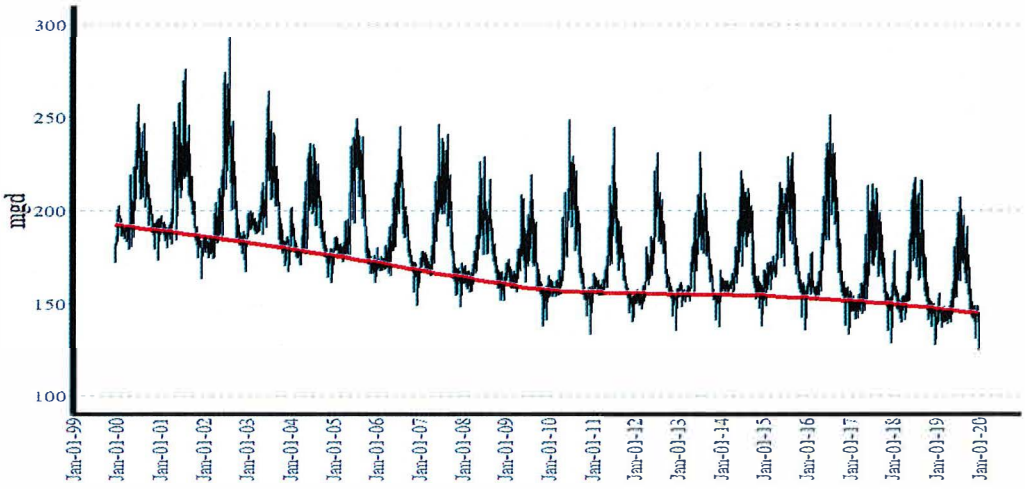
Figure 3: Boston Water Use (1900-2019)



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. Indoor water use, shown as the red line on Figure 4 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 as well as reduced pipeline leaks. Although decreases before the recession of 2008 ranged from around 1% to 2% per year, it appears that the rate of decrease has slowed after the recession. This is likely due to efficiency gains being counterbalanced by the improving regional economy and population growth. During the last three years, the rate of decrease has reduced to about 68% of pre-recession rates.

Figure 4: Fully-Supplied Communities Demand (1999 to 2019)[1]



[1] 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

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 will reduce outdoor use. Over time, the price of water also influences seasonal use.

Figures 5 and 6 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 5 shows a 29.2% drop in 2019 when compared to the previous year. Seasonal use in 2019 of 11.4 mgd was the lowest in the past 19 years on a volume basis. Given declining use overall, it was third lowest on a percentage basis, standing at 7.3% of total water use. Staff attribute the low seasonal use to the unusually wet spring and summer seasons last year.

Figure 5: Fully Supplied Communities' Annual Seasonal Demand
(Labels show demand in mgd)

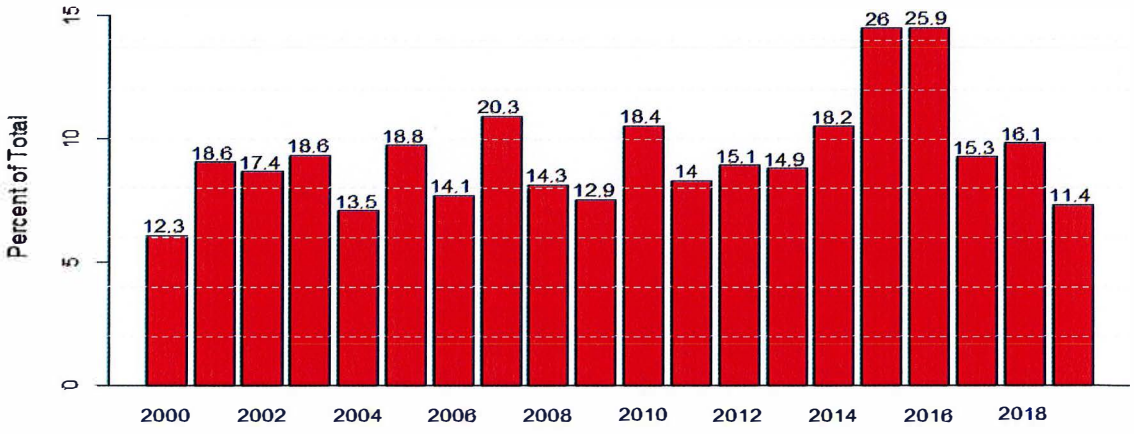
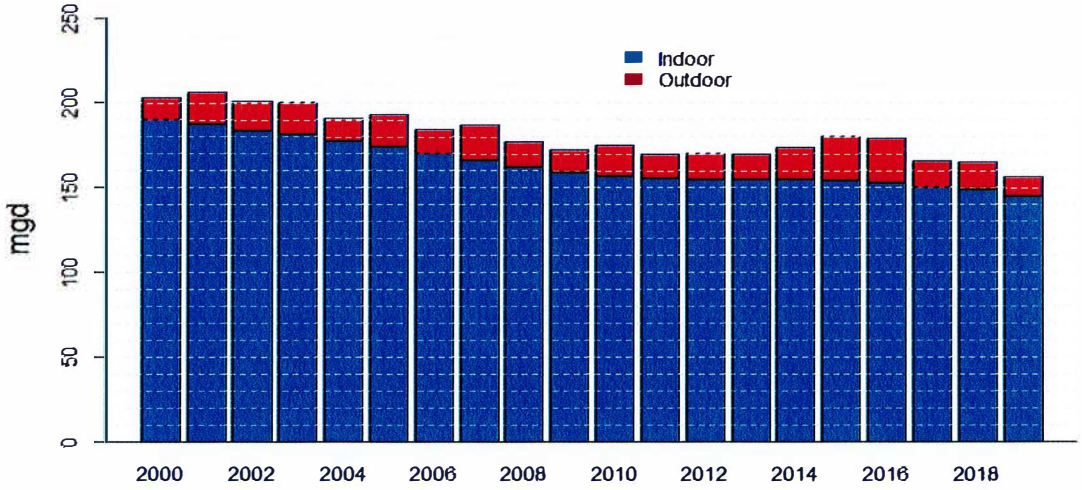


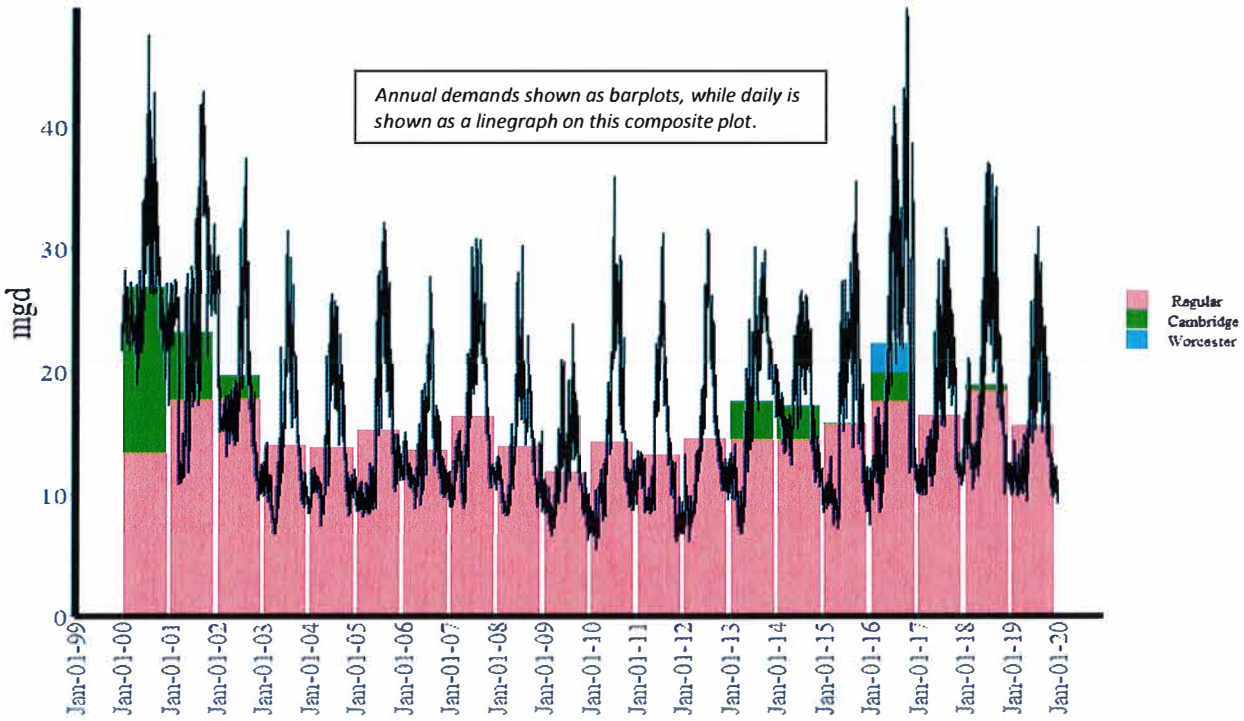
Figure 6: Fully-Supplied Communities Annual Base and Seasonal Demand



Partially Supplied Communities

Demand for the partially supplied communities, shown on Figure 7 below, was down by 3.3 mgd (17.4%) when compared to 2018.

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



Reservoir Withdrawals and Releases

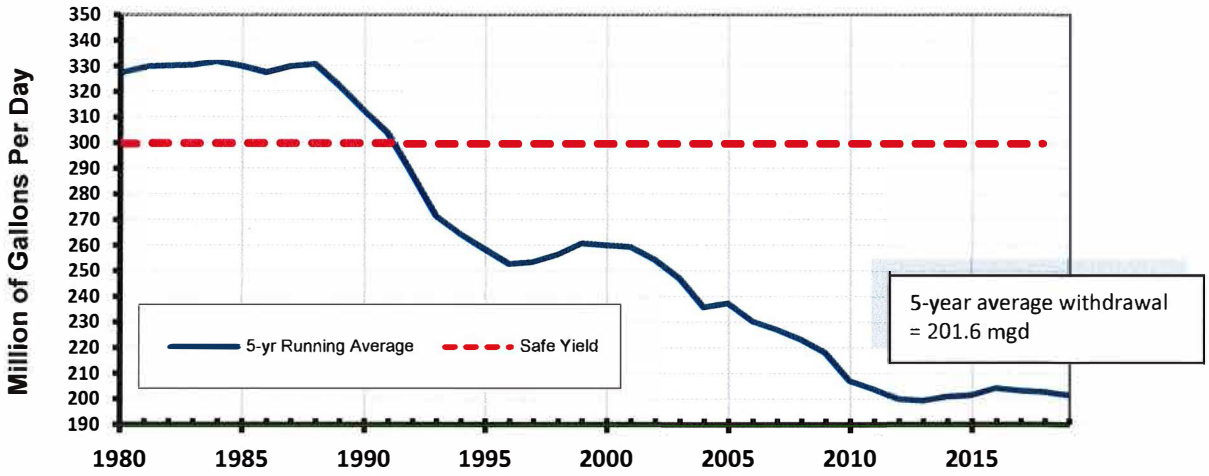
Reservoir withdrawals are the metric used to compare to the 300 mgd safe yield of the watershed/reservoir system.[2] Withdrawals include water sold to MWRA communities, as well as other non-revenue generating uses in the watershed and MWRA system. Total MWRA water withdrawals decreased by 1.7% in 2019, from 199.98 mgd in 2018 to 196.6 mgd.

The pipeline supplying the McLaughlin Fish Hatchery in Belchertown was in service for the entire year, with an average withdrawal of 6.18 mgd. Without that withdrawal, total reservoir withdrawals in 2019 would have been about 190.42 mgd.

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 slight decrease from 2018. Staff will monitor any changes in water use, to see if the longer-term downward trend resumes.

[2] 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.

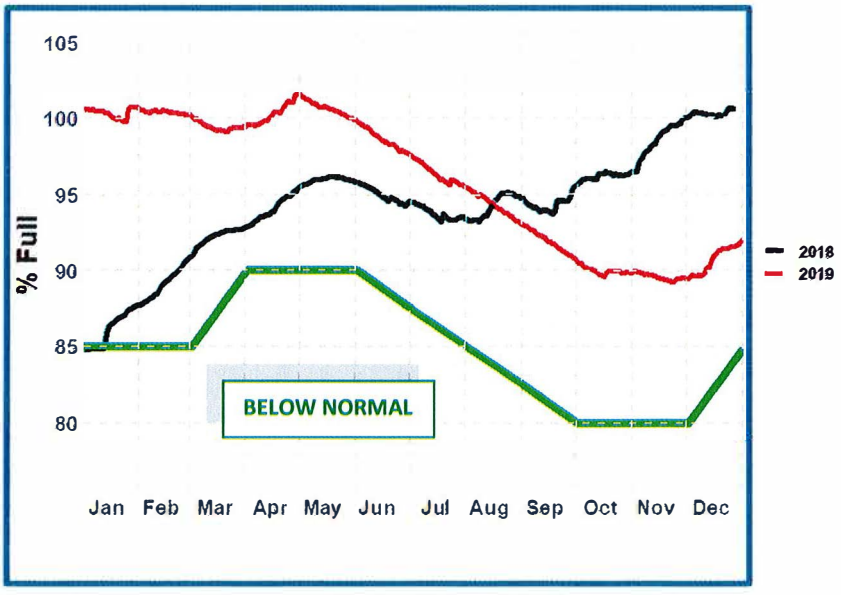
Figure 8: Total Reservoir Withdrawals – Five-Year Running Average 1980 to 2019



Reservoir Status

By the end of November 2019, all the state's drought-monitoring regions were in normal status. Quabbin Reservoir levels have been well within the normal operating band and followed typical seasonal variation patterns. Figure 9 below shows a comparison of Quabbin volume levels between 2018 and 2019. 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 2018 to 2019



The Quabbin Reservoir spilled for more than half the year for a total of 195 days and 47.2 billion gallons. In order to maintain water quality, 44.8 billion gallons of the higher quality Quabbin water was transferred to the Wachusett Reservoir during 2019. The transfer was equivalent to about 68% of Wachusett's capacity. To maintain the Wachusett Reservoir in its normal narrow operating band, MWRA transferred 23.5 billion gallons to the Nashua River through controlled releases and spills and 6 billion gallons to the Sudbury Reservoir.

ATTACHMENT:

Community Water Use Data

Massachusetts Water Resources Authority

MWRA Water Supplied (MGD)

Reporting Period: December 2019

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

	Monthly (MGD)			YTD (MGD)			YTD System Share			Prior Year-End Totals 2018	
	Dec			YTD			Flow Share [1]		% Change in YTD		
Metro-System (Fully Served)	2019	2018	Flow Change	2019	2018	Flow Change	2019	2018	Flow Share	Ave. Flow mgd	Flow Share [1]
Arlington	3.313	3.287	0.8%	3.568	3.698	-3.5%	2.1%	2.1%	-0.1%	3.698	2.1%
Belmont	1.570	1.687	-6.9%	1.928	2.045	-5.7%	1.1%	1.2%	-2.4%	2.045	1.2%
Boston (BWSC)	57.749	56.404	2.4%	62.130	63.644	-2.4%	36.4%	36.0%	1.0%	63.644	36.0%
Brookline	3.931	4.191	-6.2%	4.783	4.974	-3.8%	2.8%	2.8%	-0.5%	4.974	2.8%
Chelsea	3.154	3.033	4.0%	3.271	3.365	-2.8%	1.9%	1.9%	0.6%	3.365	1.9%
Everett	3.724	3.544	5.1%	3.778	3.777	0.0%	2.2%	2.1%	3.5%	3.777	2.1%
Framingham	4.960	5.016	-1.1%	5.602	5.756	-2.7%	3.3%	3.3%	0.7%	5.756	3.3%
Lexington [2]	4.403	3.771	16.8%	5.119	5.122	-0.0%	3.0%	2.9%	3.4%	5.122	2.9%
Lynnfield W.D.	0.346	0.347	-0.3%	0.485	0.546	-11.2%	0.28%	0.31%	-8.0%	0.546	0.3%
Malden	5.051	4.946	2.1%	5.060	5.146	-1.7%	3.0%	2.9%	1.8%	5.146	2.9%
Marblehead	1.293	1.230	5.1%	1.689	1.755	-3.8%	1.0%	1.0%	-0.4%	1.755	1.0%
Medford	4.184	4.061	3.0%	4.358	4.458	-2.2%	2.6%	2.5%	1.2%	4.458	2.5%
Melrose	1.753	1.924	-8.9%	1.969	2.028	-2.9%	1.2%	1.1%	0.5%	2.028	1.1%
Milton	1.898	1.855	2.3%	2.235	2.391	-6.5%	1.3%	1.4%	-3.3%	2.391	1.4%
Nahant	0.250	0.238	5.1%	0.326	0.312	4.7%	0.2%	0.2%	8.3%	0.312	0.2%
Newton	7.725	7.294	5.9%	8.581	8.668	-1.0%	5.0%	4.9%	2.5%	8.668	4.9%
Norwood	2.378	2.349	1.2%	2.692	2.701	-0.3%	1.6%	1.5%	3.2%	2.701	1.5%
Quincy	7.439	7.403	0.5%	7.864	7.981	-1.5%	4.6%	4.5%	2.0%	7.981	4.5%
Reading	1.266	1.335	-5.2%	1.522	1.615	-5.8%	0.9%	0.9%	-2.5%	1.615	0.9%
Revere	3.302	3.376	-2.2%	3.546	3.585	-1.1%	2.1%	2.0%	2.4%	3.585	2.0%
Saugus	2.646	2.487	6.4%	2.832	2.876	-1.5%	1.7%	1.6%	1.9%	2.876	1.6%
Somerville	6.085	5.291	15.0%	5.883	5.614	4.8%	3.4%	3.2%	8.5%	5.614	3.2%
Southborough	0.674	0.604	11.5%	0.936	0.923	1.4%	0.5%	0.5%	4.9%	0.923	0.5%
Stoneham	1.629	1.562	4.2%	1.820	2.057	-11.5%	1.1%	1.2%	-8.4%	2.057	1.2%
Swampscott	1.244	1.284	-3.1%	1.485	1.473	0.8%	0.9%	0.8%	4.4%	1.473	0.8%
Waltham	5.639	5.325	5.9%	6.371	6.556	-2.8%	3.7%	3.7%	0.6%	6.556	3.7%
Watertown	2.261	2.309	-2.1%	2.496	2.656	-6.0%	1.5%	1.5%	-2.8%	2.656	1.5%
Weston	0.805	0.874	-7.8%	1.519	1.645	-7.7%	0.9%	0.9%	-4.4%	1.645	0.9%
Winthrop	1.191	1.238	-3.8%	1.242	1.259	-1.4%	0.7%	0.7%	2.1%	1.259	0.7%
Subtotal Metro-System (Fully Served)	**141.862**	**138.266**	**2.6%**	**155.090**	**158.626**	**-2.2%**	**90.9%**	**89.8%**	**1.2%**	**158.626**	**89.8%**
Metro-System (Partially Served)											
Canton (P)	0.450	1.355	-66.8%	1.031	1.456	-29.1%	0.6%	0.8%	-26.7%	1.456	0.8%
Dedham-Westwood W.D. (P)	0.764	0.134	469.1%	0.658	0.124	430.9%	0.4%	0.1%	449.5%	0.124	0.1%
Leominster (P)	0.000	0.000	0.0%	0.000	0.000	0.0%	0.0%	0.0%	0.0%	0.000	0.0%
Lynn (LWSC) (P)	0.128	0.299	-57.1%	0.251	0.267	-6.1%	0.15%	0.15%	-2.8%	0.267	0.2%
Marlborough (P)	3.517	3.354	4.9%	3.928	4.003	-1.9%	2.3%	2.3%	1.6%	4.003	2.3%
Needham (P)	0.677	0.385	75.8%	0.712	0.962	-26.0%	0.42%	0.54%	-23.4%	0.962	0.5%
Northborough (P)	0.852	0.841	1.4%	0.902	0.894	0.8%	0.5%	0.5%	4.4%	0.894	0.5%
Peabody (P)	0.579	0.811	-28.6%	0.831	2.971	-72.0%	0.49%	1.68%	-71.1%	2.971	1.7%
Stoughton (P)	0.100	0.046	116.5%	0.089	0.100	-10.5%	0.05%	0.06%	-7.4%	0.100	0.06%
Wakefield (P)	1.548	1.334	16.0%	1.823	1.759	3.7%	1.07%	1.00%	7.3%	1.759	1.0%
Wellesley (P)	0.213	0.394	-45.8%	1.164	1.006	15.7%	0.7%	0.6%	19.7%	1.006	0.6%
Wilmington (P)	0.023	0.036	-36.0%	0.380	0.499	-23.8%	0.22%	0.28%	-21.1%	0.499	0.3%
Winchester (P)	0.472	0.904	-47.8%	1.164	1.180	-1.4%	0.7%	0.7%	2.1%	1.180	0.7%
Woburn (P)	1.535	1.051	46.2%	2.663	2.806	-5.1%	1.56%	1.59%	-1.8%	2.806	1.6%
Subtotal Metro-System (Partially Served)	**10.860**	**10.945**	**-0.8%**	**15.596**	**18.028**	**-13.5%**	**9.1%**	**10.2%**	**-10.5%**	**18.028**	**10.2%**
Subtotal Metro-System (Full & Partial)	**152.723**	**149.211**	**2.4%**	**170.687**	**176.654**	**-3.4%**	**100%**	**100%**		**176.654**	**100%**
Chicopee Valley Aqueduct											
Chicopee	4.199	4.158	1.0%	5.046	4.998	1.0%	70.2%	70.3%	-0.2%	4.998	70.3%
South Hadley FD #1	0.784	0.773	1.5%	1.043	1.003	4.0%	14.5%	14.1%	2.8%	1.003	14.1%
Wilbraham	0.761	0.769	-1.0%	1.098	1.106	-0.7%	15.3%	15.6%	-1.8%	1.106	15.6%
Subtotal CVA System	**5.744**	**5.699**	**0.8%**	**7.187**	**7.108**	**1.1%**	**100%**	**100%**		**7.108**	**100%**
Other Revenue Supply											
Cambridge (P)	0.000	0.000	0.0%	0.000	0.025	-100.0%				0.025	
Clinton [3]	1.144	1.178	-2.9%	1.334	1.374	-2.9%				1.374	
Worcester (P)	0.000	0.000	0.0%	0.000	0.000	0.0%				0.000	
Other Revenue Customers [4]	1.296	1.524	-15.0%	1.360	1.392	-2.3%				1.392	
Subtotal Other Revenue Supply [5]	**2.439**	**2.702**	**-9.7%**	**2.694**	**2.792**	**-3.5%**				**2.792**	
Total Water Supplied											
Fully Supplied Metro Communities	141.862	138.266	2.6%	155.090	158.626	-2.2%				158.626	
CVA Communities	5.744	5.699	0.8%	7.187	7.108	1.1%				7.108	
Partially Supplied Communities	10.860	10.945	-0.8%	15.596	18.028	-13.5%				18.054	
Other Revenue Customers	2.439	2.702	-9.7%	2.694	2.792	-3.5%				2.766	
Total Water Supplied [6]	**160.906**	**157.612**	**2.1%**	**180.568**	**186.553**	**-3.2%**				**186.553**	

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, Deer Island WWTP and Department of Youth Services.

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 exisitng user agreements. It does not include water utilized for system maintenance.

(P) Community is partially supplied by MWRA.

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

28-Jan-20