STAFF SUMMARY

TO: Board of Directors
FROM: Frederick A. Laskey, Executive Director
DATE: April 17, 2024
SUBJECT: Report on 2023 Water Use Trends and Reservoir Status

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COMMITTEE: Water Policy & Oversight

X INFORMATION
VOTE

Rebecca Weidman, Deputy Chief Operating Officer
Daniel Nvule, Senior Program Manager
Stephen Estes-Smargiassi, Director, Planning and Sustainability
Preparer/Title

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

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.

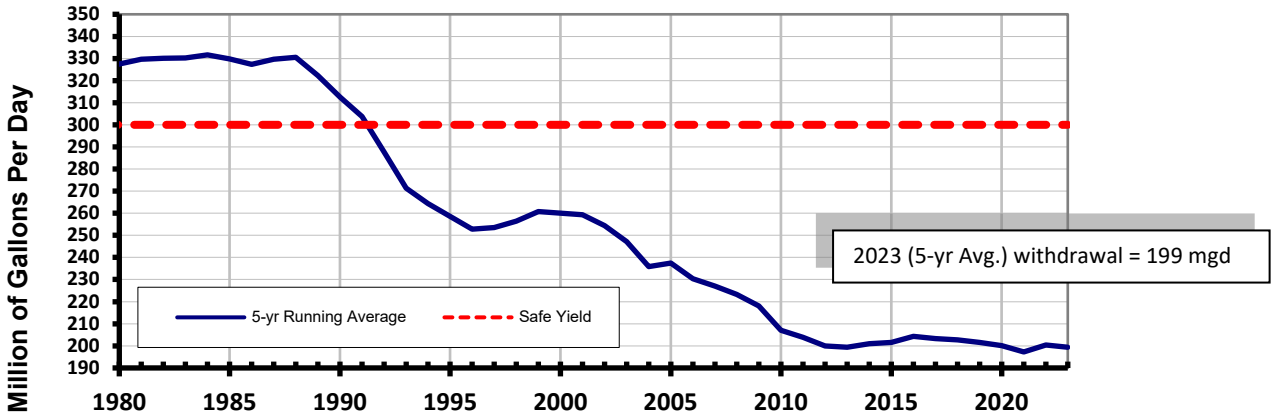
DISCUSSION:

This staff summary provides an overview of water consumption by communities, base and seasonal water use trends, and reservoir withdrawals and reservoir status.

Reservoir Withdrawals and Releases

Reservoir withdrawals are the metric used to compare to the 300 million gallons per day (mgd) safe yield of the watershed/reservoir system[1]. Figure 1 on the next page shows five-year averages of withdrawals from 1980 to the 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.

Figure 1. Total Reservoir Withdrawals – Five-Year Running Average 1980 to 2023



[1] 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.

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 8.2 percent in 2023, from 211.6 mgd in 2022 to 194.3 mgd. The last time annual demand was that low was around 1950. The five-year average had a very slight decrease between 2022 and 2023.

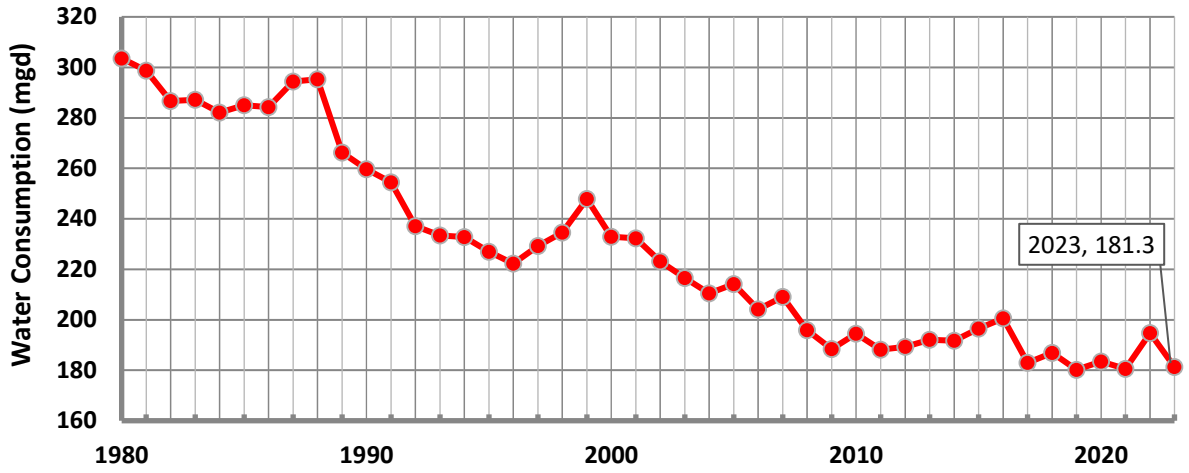
The pipeline supplying the McLaughlin Fish Hatchery in Belchertown had an average use of 6.13 mgd. MWRA activated the dedicated hydroelectric station and pipeline in December 2016. Without that withdrawal, total reservoir withdrawals in 2023 would have been 188.17 mgd.

Total reservoir withdrawals have decreased by over 130 mgd since the 1980's, even as the service area has expanded.

Water Consumption by MWRA Communities

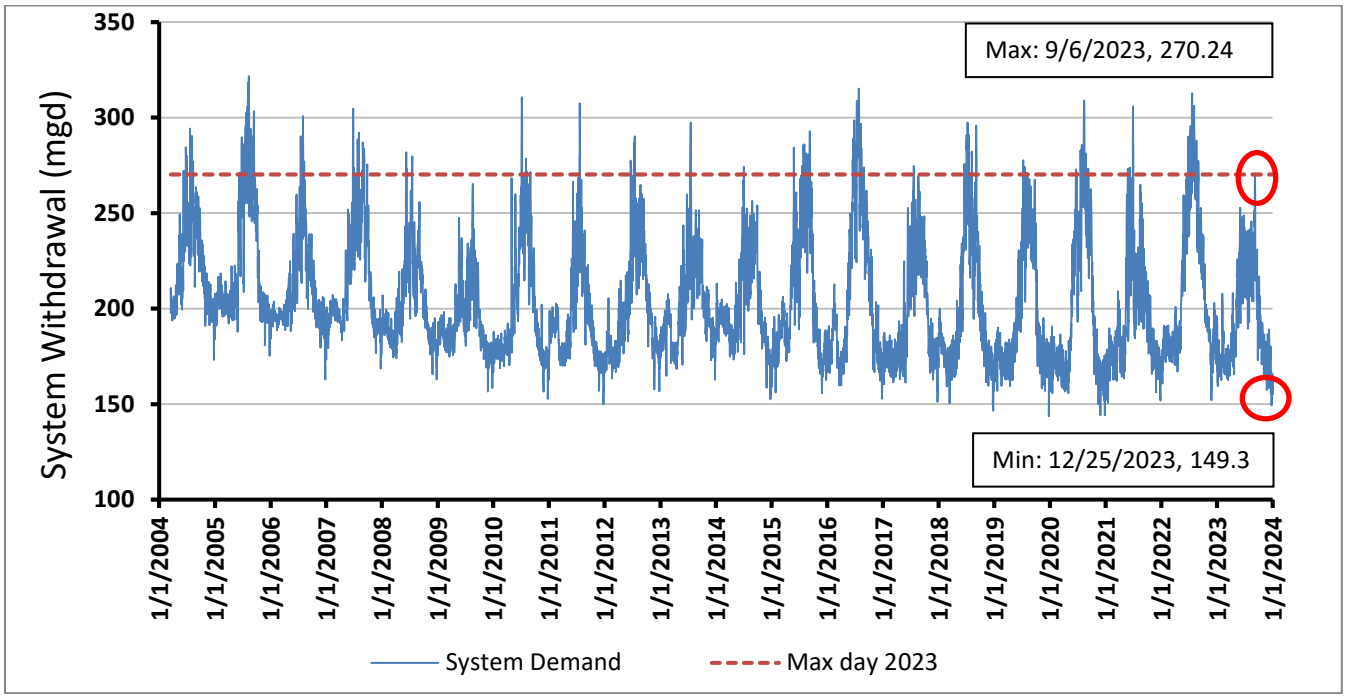
Water consumption by all MWRA communities of 181.3 mgd decreased by 6.8 percent (13.23 mgd) from 2022, as shown on Figure 2. In addition, Figure 2 illustrates a long term downward trend with a relative plateau in the last six years, even with new users.

Figure 2. Total Consumption by MWRA Communities (1980 to 2023)



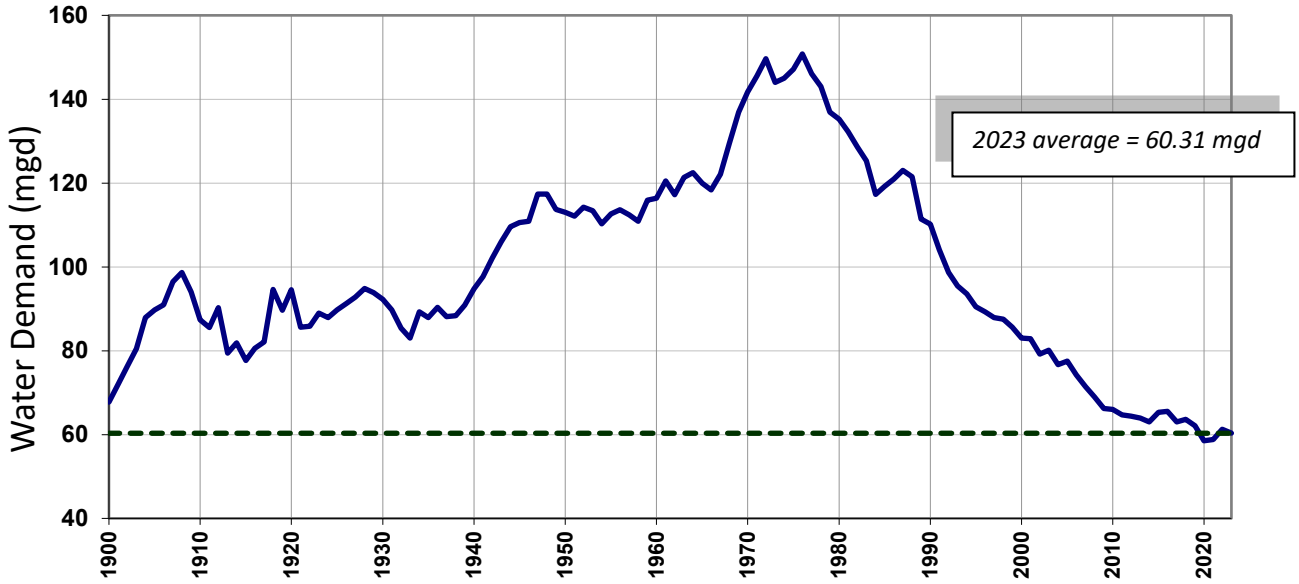
System-wide, 2023 had a maximum day reservoir withdrawal of 270.24 mgd on September 6 (13.6 percent lower than the 2022 maximum). This was the second lowest maximum day in 15 years. At the opposite extreme, Christmas Day at 149.3 mgd was the lowest day of the year. Figure 3 shows daily system withdrawals from 2004-2023 with the 2023 highlights of maximum and minimum withdrawals.

Figure 3. Daily System Withdrawals (2004 to 2023)



Demand from MWRA's largest customer, the Boston Water and Sewer Commission, was 60.31 mgd, which was slightly lower than last year by 0.86 mgd (1.4 percent). Current Boston demand continues to be lower than demand before 1900, as shown on Figure 4 below. As Attachment A indicates, many other communities experienced a decrease in demand.

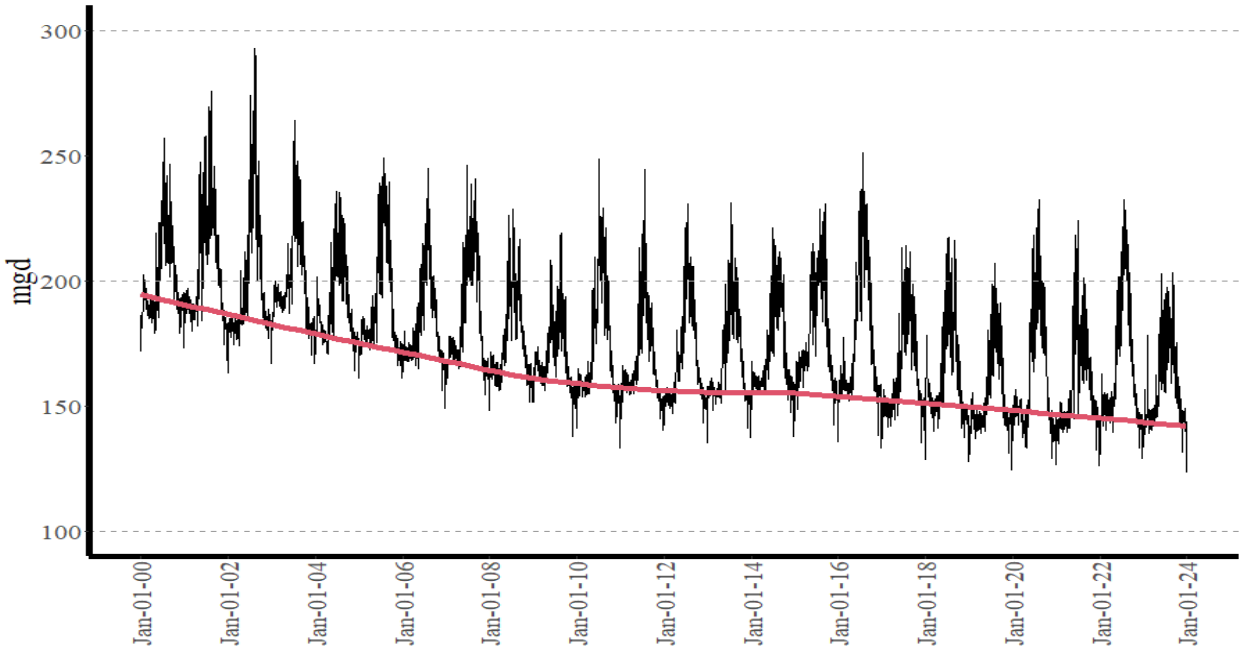
Figure 4. Boston Water Demand (1900-2023)



Demand – Base Water Use and Seasonal Water Use

Over time, there have been substantial water use reductions in both base (indoor) use, defined as water use, from November to March, and outdoor (seasonal) use, defined as the increase over the base demand during the irrigation season from May to September. Average base water use, shown as the red fitted curve line on Figure 5 below, has dropped substantially over the past several decades and continues to decrease 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 fewer pipeline leaks. Countervailing pressures include population and employment increases.

Figure 5: Fully Supplied Communities Demand (1999 to 2023)[2]



The impact of the downward trend in base water use partially explains the decreasing demand within the overall system, despite adding new communities as well as an increase in population and employment to the MWRA system. Table 1 lists these community additions and the system withdrawal (five-year average) from that associated year of admission.

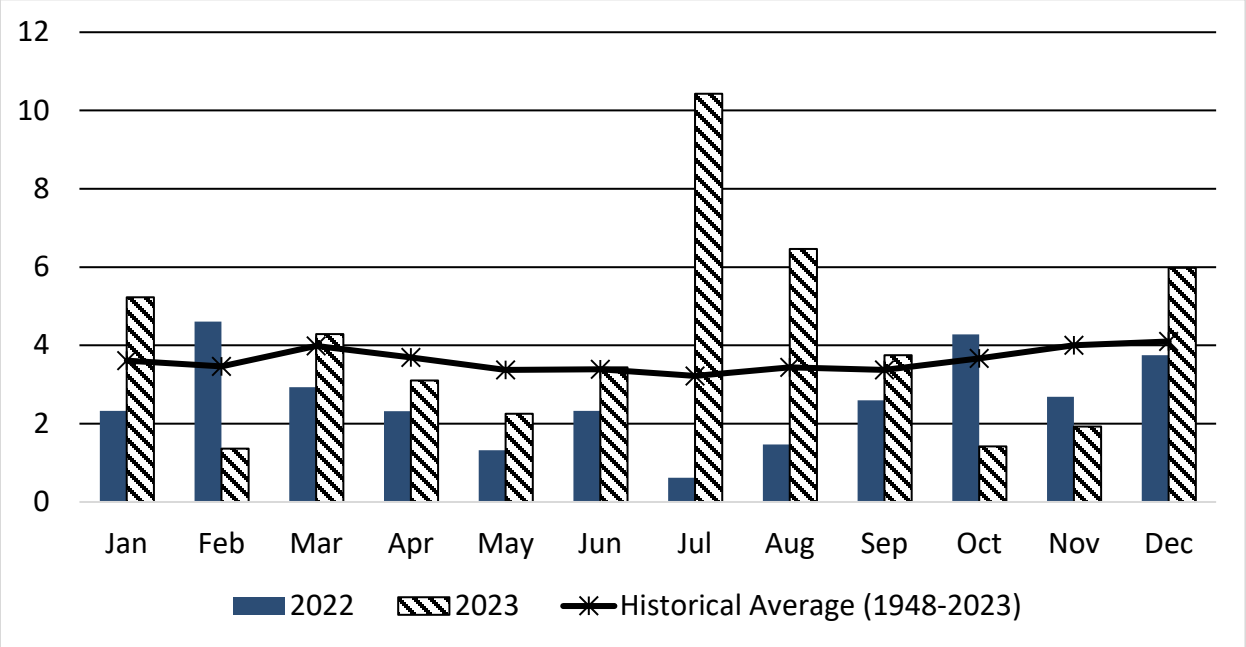
[2] Certain analyses can be done only on fully supplied communities where MWRA has information on their daily use available from MWRA's revenue meters. MWRA receives data on monthly total use for partially supplied communities, but not until they provide that data to DEP in their Annual Statistical Reports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

Table 1: Communities Admitted to the MWRA Water System		
Year	Community	MWRA Withdrawal (5-yr Avg.) at date of admission to MWRA
1993	Bedford	271.4
2002	Stoughton	254.3
2005	Reading	237.4
2005	Dedham-Westwood Water District	237.4
2009	Wilmington	218.1
2016	McLaughlin Hatchery	204.3
2018	Ashland	202.8
2020	Burlington	200.4

Demand – Seasonal Water Use

Seasonal, or outdoor, 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. Seasonal use can be compared using the 2022 drought and the late summer rainfall of 2023. Figure 6 shows two years of contrasting rainfall patterns. Later in this summary, the corresponding impact on seasonal use for these years can be seen. The Boston Globe reported that the summer of 2023 was the second rainiest since 1872.

Figure 6. Boston Monthly Average Rainfall (inches)



Figures 7 and 8 show the variation in seasonal water use in fully supplied communities over time, and the long term decline in both base and total water use. Figure 7 illustrates the relatively small impact that seasonal demand has on total water use.

Figure 7. Fully Supplied Communities Annual Base and Seasonal Demand

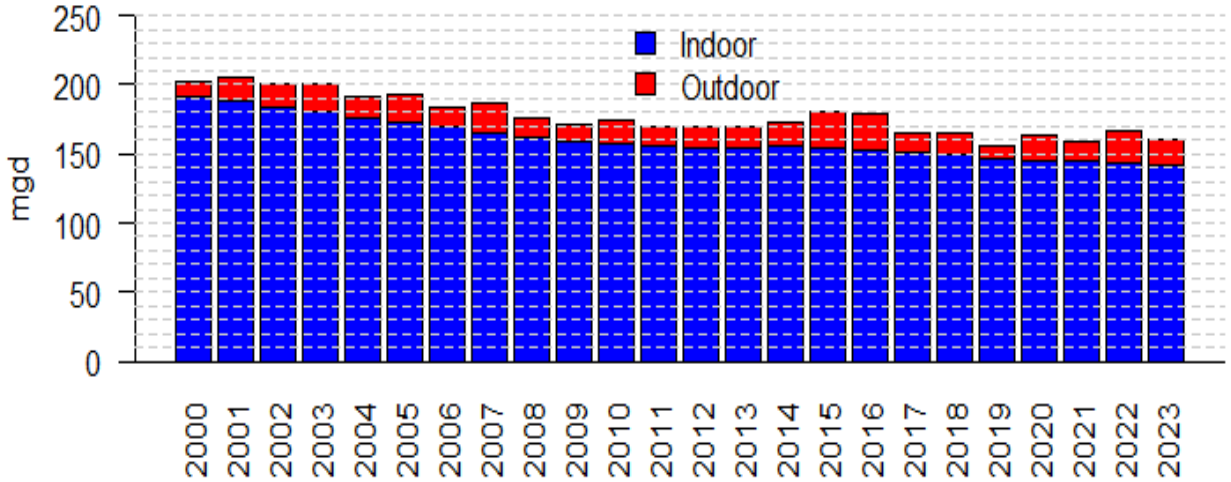
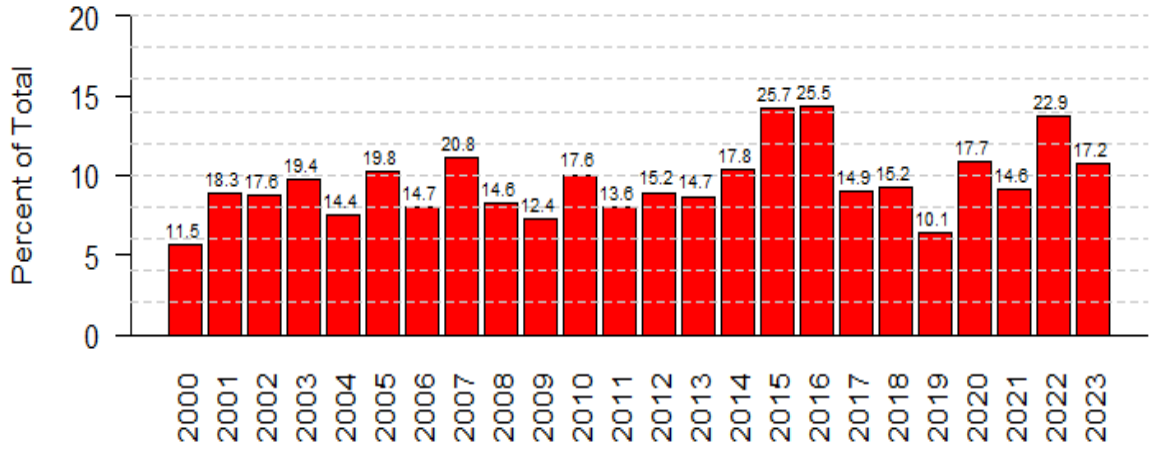


Figure 8 provides a closer look at the seasonal use from 2000-2023. The seasonal water use for 2023 of 17.2 mgd (10.8% of the total water use) was almost equal to the 23-year average of 17 mgd. The decline in seasonal water use from 2022 to 2023 is attributable to the wetter summer for 2023.

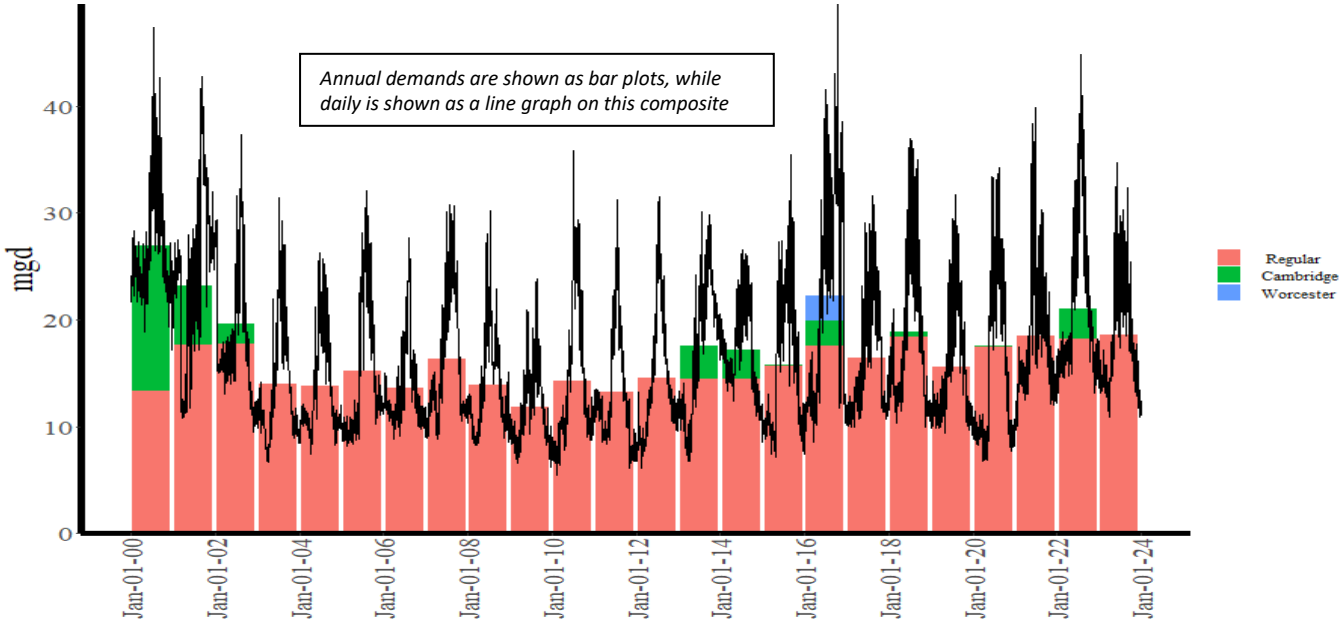
Figure 8. Fully Supplied Communities' Annual Seasonal Demand
(Labels show demand in mgd)



Demand - Partially Supplied Communities

Demand for the partially supplied communities decreased by 3.43 mgd (15.6 percent) from 2022 to 2023, as shown in Figure 9. This decrease was related to the 2022 Cambridge use of MWRA water while upgrading its treatment plant to improve PFAS removal. In 2023, Burlington increased MWRA water use as pipeline capacity was increased.

Figure 9. Partially Supplied Communities – MWRA Supplied Demand (Daily and Annual)



Reservoir Status

Quabbin Reservoir was in normal operating range for the entire year. In addition to routinely exceeding its minimum required releases, Quabbin spilled for 25 days in the spring, for a total of 135 million gallons. In a relatively rare event, Quabbin also spilled in January and February 2024. MWRA transferred 52 billion gallons from Quabbin Reservoir to Wachusett Reservoir between May and December to meet supply and water quality objectives. Releases from Wachusett to the Nashua River were 45.2 billion gallons, which was 123.8 mgd on average.

Despite adding new customers to the system, water demand in 2023 was the lowest since 1950. The system stayed in the normal operating range during the entire year, while both the Swift and Nashua Rivers received substantial releases from the reservoirs, well above their minimum requirements. MWRA's large multi-year reservoirs provide the storage needed to manage inflows during wet years, capturing excess yield for use during extended dry periods. MWRA's resilient supply system is well situated to provide a reliable supply of safe water to our customers, economic vitality to the region, and to be an option for communities struggling with water quality or source reliability issues.

ATTACHMENT:

Attachment A: Community Water Use Data

Massachusetts Water Resources Authority

MWRA Water Supplied

Reporting Period: December 2023

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

	Monthly (MG)			YTD (MG)			YTD System Share			Prior Year-End Totals 2022	
	Dec		Flow	YTD		Flow	Flow Share [1]		% Change in YTD	Annual	Flow
Metro-System (Fully Served)	2023	2022	Change	2023	2022	Change	2023	2022	Flow Share	Flow (mg)	Share [1]
Arlington	91.7	85.7	7.0%	1,142.1	1,261.8	-9.5%	1.83%	1.91%	-4.0%	1,261.8	1.91%
Belmont	48.2	46.8	3.1%	653.1	723.5	-9.7%	1.05%	1.09%	-4.2%	723.5	1.09%
Boston (BWSC)	1,721.3	1,711.7	0.6%	22,012.9	22,328.6	-1.4%	35.28%	33.74%	4.6%	22,328.6	33.74%
Brookline	112.4	122.7	-8.4%	1,677.7	1,881.9	-10.8%	2.69%	2.84%	-5.4%	1,881.9	2.84%
Chelsea	91.5	93.3	-1.9%	1,172.5	1,205.0	-2.7%	1.88%	1.82%	3.2%	1,205.0	1.82%
Everett	108.0	105.6	2.2%	1,373.7	1,362.2	0.8%	2.20%	2.06%	7.0%	1,362.2	2.06%
Framingham	149.1	148.5	0.4%	1,942.1	2,100.3	-7.5%	3.11%	3.17%	-1.9%	2,100.3	3.17%
Lexington [2]	100.7	113.0	-10.9%	1,689.5	1,947.2	-13.2%	2.71%	2.94%	-8.0%	1,947.2	2.94%
Lynnfield W.D.	9.5	9.6	-1.1%	184.3	208.5	-11.6%	0.30%	0.32%	-6.3%	208.5	0.32%
Malden	145.1	149.0	-2.6%	1,798.1	1,888.3	-4.8%	2.88%	2.85%	1.0%	1,888.3	2.85%
Marblehead	36.5	37.6	-2.8%	609.9	690.0	-11.6%	0.98%	1.04%	-6.3%	690.0	1.04%
Medford	125.7	136.0	-7.6%	1,611.2	1,724.7	-6.6%	2.58%	2.61%	-0.9%	1,724.7	2.61%
Melrose	58.9	54.0	9.0%	774.4	776.2	-0.2%	1.24%	1.17%	5.8%	776.2	1.17%
Milton	54.6	54.5	0.2%	810.7	920.7	-12.0%	1.30%	1.39%	-6.6%	920.7	1.39%
Nahant	6.4	7.3	-12.7%	113.6	130.6	-13.0%	0.18%	0.20%	-7.7%	130.6	0.20%
Newton	200.8	211.1	-4.9%	3,056.3	3,181.3	-3.9%	4.90%	4.81%	1.9%	3,181.3	4.81%
Norwood	68.7	71.0	-3.3%	948.8	1,024.4	-7.4%	1.52%	1.55%	-1.8%	1,024.4	1.55%
Quincy	240.6	229.8	4.7%	2,939.0	3,095.5	-5.1%	4.71%	4.68%	0.7%	3,095.5	4.68%
Reading	41.4	40.2	2.8%	572.0	623.1	-8.2%	0.92%	0.94%	-2.6%	623.1	0.94%
Revere	109.2	110.1	-0.8%	1,313.4	1,413.5	-7.1%	2.11%	2.14%	-1.5%	1,413.5	2.14%
Saugus	89.2	79.9	11.7%	1,074.7	1,200.8	-10.5%	1.72%	1.81%	-5.1%	1,200.8	1.81%
Somerville	174.8	171.9	1.7%	2,142.7	2,094.4	2.3%	3.43%	3.17%	8.5%	2,094.4	3.17%
Southborough	20.8	22.5	-7.6%	327.2	374.5	-12.6%	0.52%	0.57%	-7.3%	374.5	0.57%
Stoneham	53.7	53.3	0.7%	735.7	797.5	-7.8%	1.18%	1.21%	-2.2%	797.5	1.21%
Swampscott	34.5	34.7	-0.6%	500.2	575.4	-13.1%	0.80%	0.87%	-7.8%	575.4	0.87%
Waltham	193.5	189.2	2.3%	2,602.1	2,644.6	-1.6%	4.17%	4.00%	4.4%	2,644.6	4.00%
Watertown	69.5	69.8	-0.6%	918.3	926.5	-0.9%	1.47%	1.40%	5.1%	926.5	1.40%
Weston	23.9	22.4	6.4%	493.4	632.2	-22.0%	0.79%	0.96%	-17.2%	632.2	0.96%
Winthrop	43.8	32.2	36.2%	426.2	411.2	3.6%	0.68%	0.62%	9.9%	411.2	0.62%
Subtotal Metro-System (Fully Served)	**4,223.9**	**4,213.6**	**0.2%**	**55,615.6**	**58,144.5**	**-4.3%**	**89.1%**	**87.9%**	**1.4%**	**58,144.5**	**87.87%**
Metro-System (Partially Served)											
Ashland (P)	-	-	0.0%	-	-	0.0%	0.00%	0.00%	0.0%	-	0.0%
Burlington (P)	11.3	34.2	-66.8%	528.4	367.7	43.7%	0.85%	0.56%	52.4%	367.7	0.6%
Canton (P)	38.7	53.5	-27.6%	550.1	549.0	0.2%	0.88%	0.83%	6.3%	549.0	0.8%
Dedham-Westwood W.D. (P)	18.5	0.1	27892.5%	182.3	147.9	23.3%	0.29%	0.22%	30.7%	147.9	0.2%
Leominster (P)	-	-	0.0%	-	-	0.0%	0.00%	0.00%	0.0%	-	0.0%
Lynn (LWSC) (P)	6.1	1.5	309.9%	32.8	29.5	11.2%	0.05%	0.04%	17.9%	29.5	0.0%
Marlborough (P)	115.5	115.4	0.1%	1,478.6	1,573.6	-6.0%	2.37%	2.38%	-0.3%	1,573.6	2.4%
Needham (P)	1.93	8.6	100%	243.03	416.0	-41.6%	0.39%	0.63%	-38.0%	416.0	0.6%
Northborough (P)	25.1	25.6	-1.9%	310.6	325.5	-4.6%	0.50%	0.49%	1.2%	325.5	0.5%
Peabody (P)	14.3	71.1	-79.8%	465.6	871.4	-46.6%	0.75%	1.32%	-43.3%	871.4	1.3%
Stoughton (P)	1.5	1.4	9.4%	19.6	22.8	-14.0%	0.03%	0.03%	-8.8%	22.8	0.0%
Wakefield (P)	53.3	51.2	4.1%	662.1	735.8	-10.0%	1.06%	1.11%	-4.6%	735.8	1.1%
Wellesley (P)	34.5	38.2	-9.6%	653.6	928.4	-29.6%	1.05%	1.40%	-25.3%	928.4	1.4%
Wilmington (P)	8.2	5.2	57.9%	97.1	252.5	-61.6%	0.16%	0.38%	-59.2%	252.5	0.4%
Winchester (P)	20.8	28.4	-26.7%	407.6	519.6	-21.6%	0.65%	0.79%	-16.8%	519.6	0.8%
Woburn (P)	46.2	59.3	-22.0%	1,145.1	1,289.9	-11.2%	1.95%	1.95%	0.0%	1,289.9	1.9%
Subtotal Metro-System (Partially Served)	**396.1**	**493.4**	**-19.7%**	**6,776.3**	**8,029.7**	**-15.6%**	**10.9%**	**12.1%**	**-10.5%**	**8,029.7**	**12.1%**
Subtotal Metro-System (Full & Partial)	**4,620.1**	**4,707.0**	**-1.8%**	**62,391.9**	**66,174.1**	**-5.7%**	**100%**	**100%**		**66,174.1**	**100%**
Chicopee Valley Aqueduct											
Chicopee	136.4	133.3	2.4%	1,940.4	1,970.8	-1.5%	71.64%	70.31%	1.90%	1,970.8	70.3%
South Hadley FD #1	25.0	24.5	1.9%	360.1	391.3	-8.0%	13.30%	13.96%	-4.75%	391.3	14.0%
Wilbraham	25.0	25.0	0.1%	407.8	440.9	-7.5%	15.06%	15.73%	-4.26%	440.9	15.7%
Subtotal CVA System	**186.4**	**182.7**	**2.0%**	**2,708.3**	**2,803.0**	**-3.4%**	**100%**	**100%**		**2,802.95**	**100%**
Other Revenue Supply											
Cambridge (P)	-	-	0.0%	0.0273	1,017.60	-100%				1017.600	
Clinton [3]	50.3	47.2	6.4%	577.5	487.1	18.6%				487.1	
Worcester (P)	-	-	0.0%	-	-	0.0%				0.0	
Other Revenue Customers [4]	43.6	44.6	-2.4%	496.5	524.3	-5.3%				524.3	
Subtotal Other Revenue Supply [5]	**93.8**	**91.9**	**2.1%**	**1,074.0**	**2,029.0**	**-47.1%**				**2,029.0**	
Total Water Supplied											
Fully Supplied Metro Communities	**4,223.9**	**4,213.6**	**0.2%**	**55,615.6**	**58,144.5**	**-4.3%**				**58,144**	
CVA Communities	**186.4**	**182.7**	**2.0%**	**2,708.3**	**2,803.0**	**-3.4%**				**2,803**	
Partially Supplied Communities	**396.1**	**493.4**	**-19.7%**	**6,776.3**	**8,029.7**	**-15.6%**				**8,030**	
Other Revenue Customers	**93.8**	**91.9**	**2.1%**	**1,074.0**	**2,029.0**	**-47.1%**				**2,029.0**	
Total Water Supplied [6]	**4,900.3**	**4,981.6**	**-1.6%**	**66,174.2**	**71,006.1**	**-6.8%**				**71,006.1**	

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 exisitng user agreements. It does not include water utilized for system maintenance, or water provided to the McLaughlin Fish Hatchery.

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

Question's regarding water supplied can be directed to Tim Beaulieu @ (617) 660-7680 or Leo Norton @ (617) 788-2256.

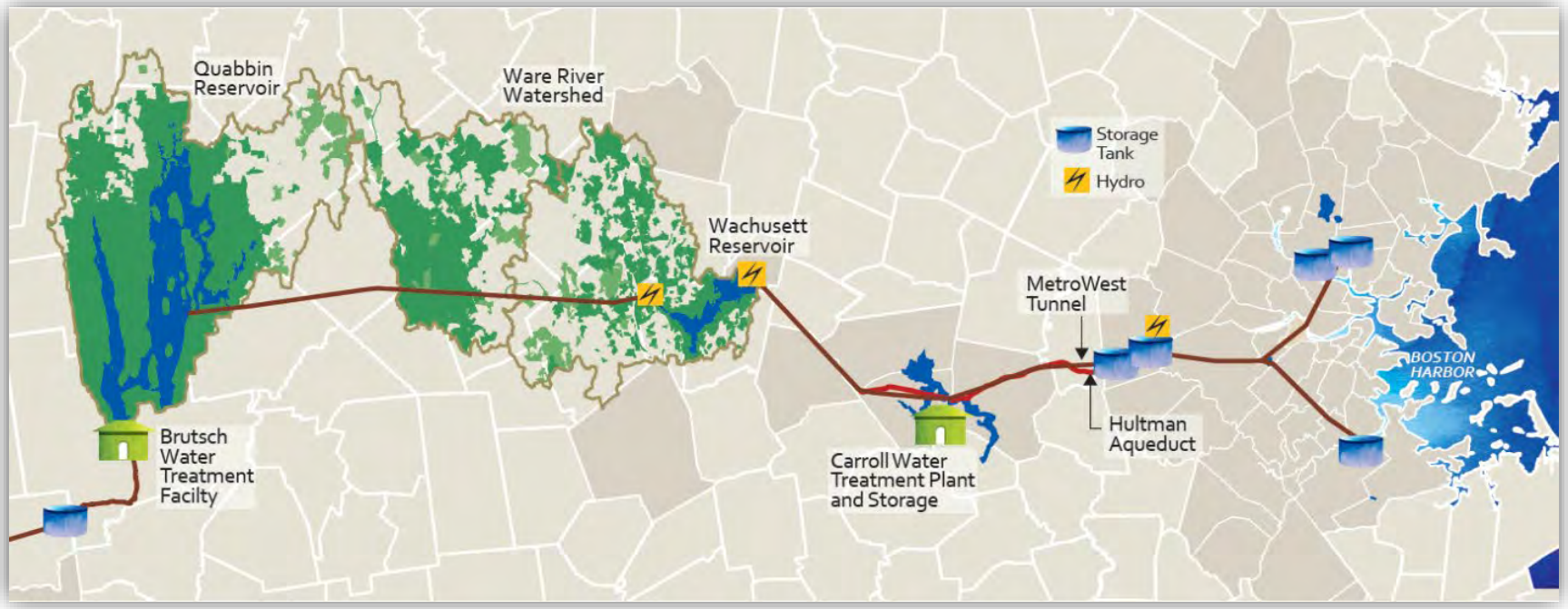
Presentation to

MWRA Board of Directors

Report on 2023 Water Use Trends and Reservoir Status

April 17, 2024

MWRA Source – Quabbin + Ware + Wachusett



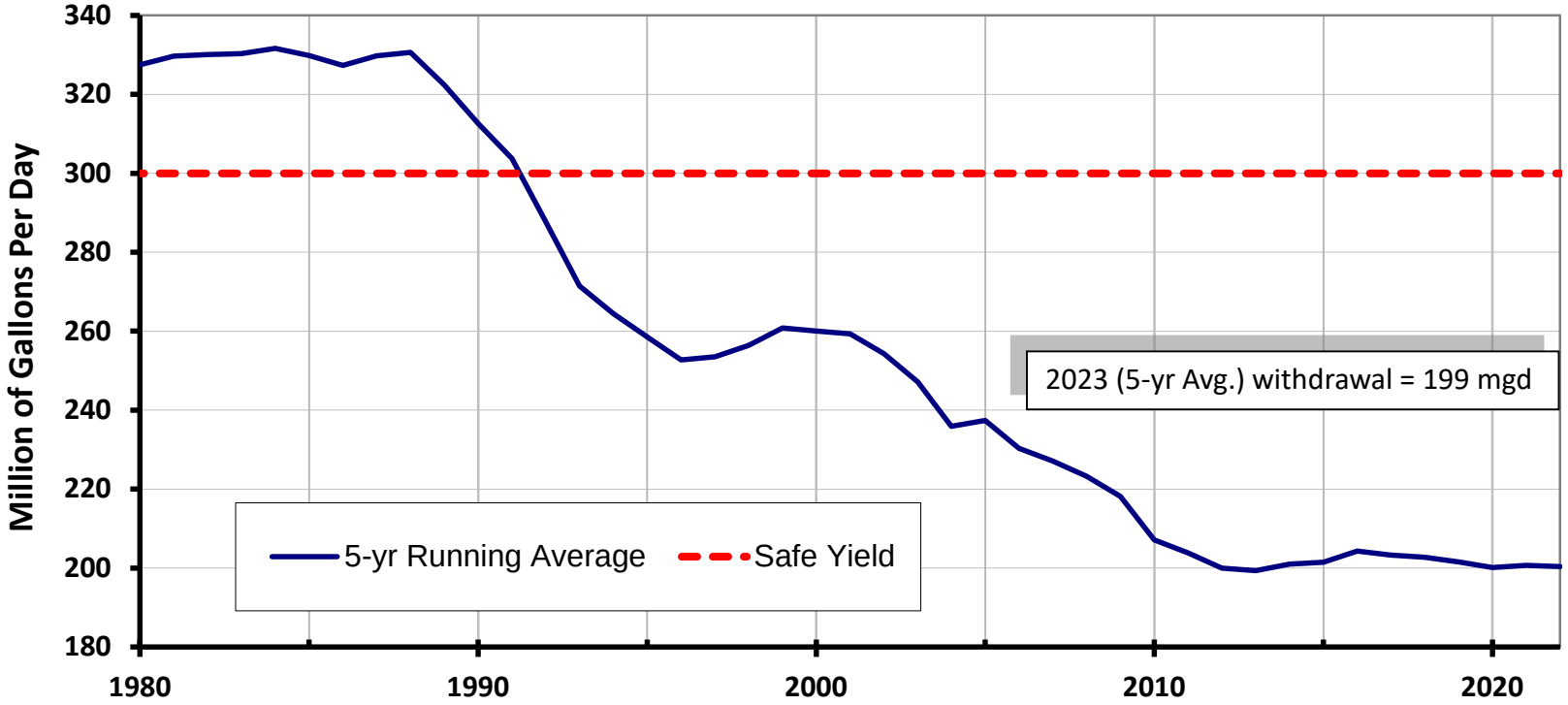
MWRA System Reliability Concepts

- Safe Yield – Quantity of water that can be reliably supplied over a period through periods of critical drought

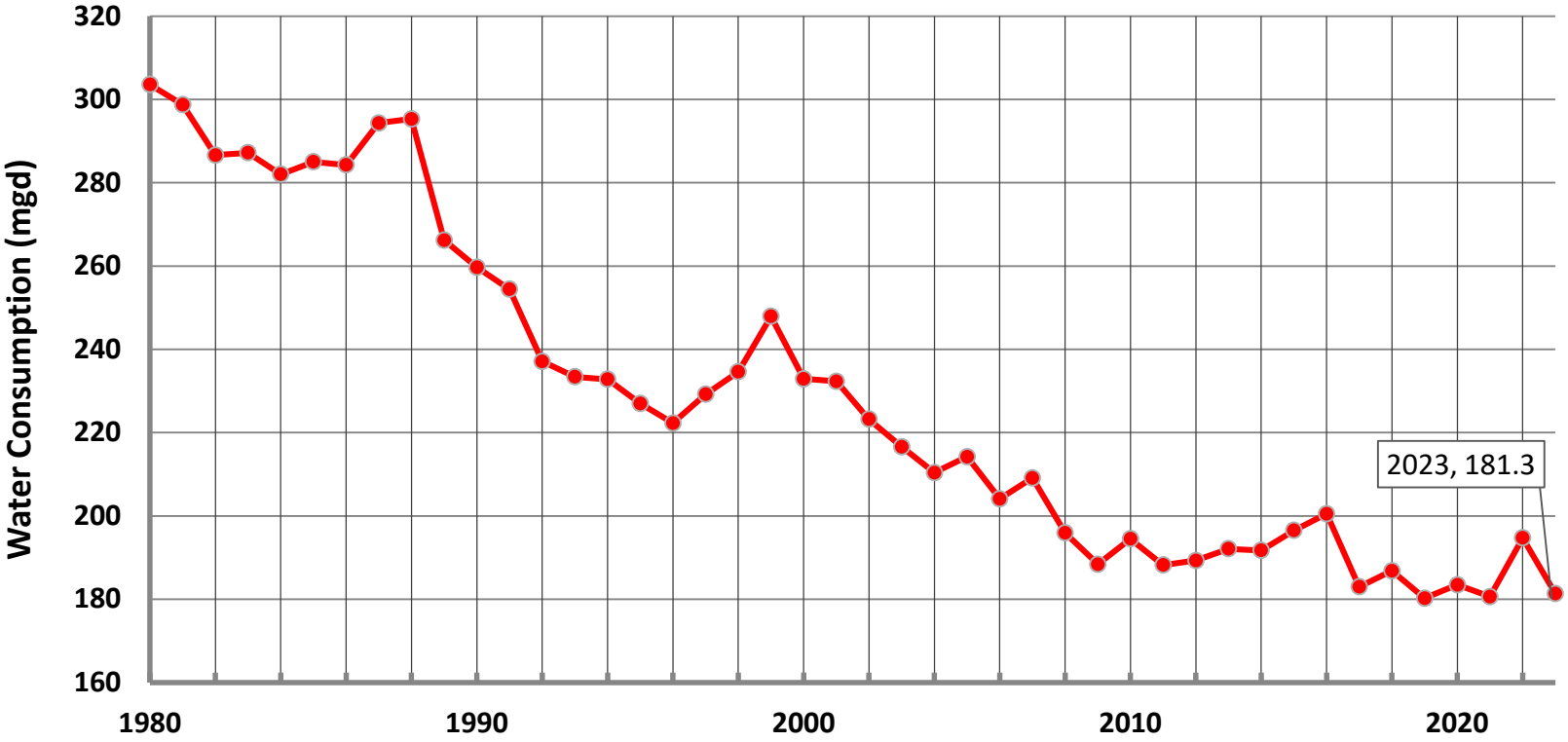
- Critical planning focus -- the multi-year drought of the 1960's

- 300 million gallons per day (mgd) -- Combined safe yield of all three sources
    - Quabbin
    - Ware
    - Wachusett

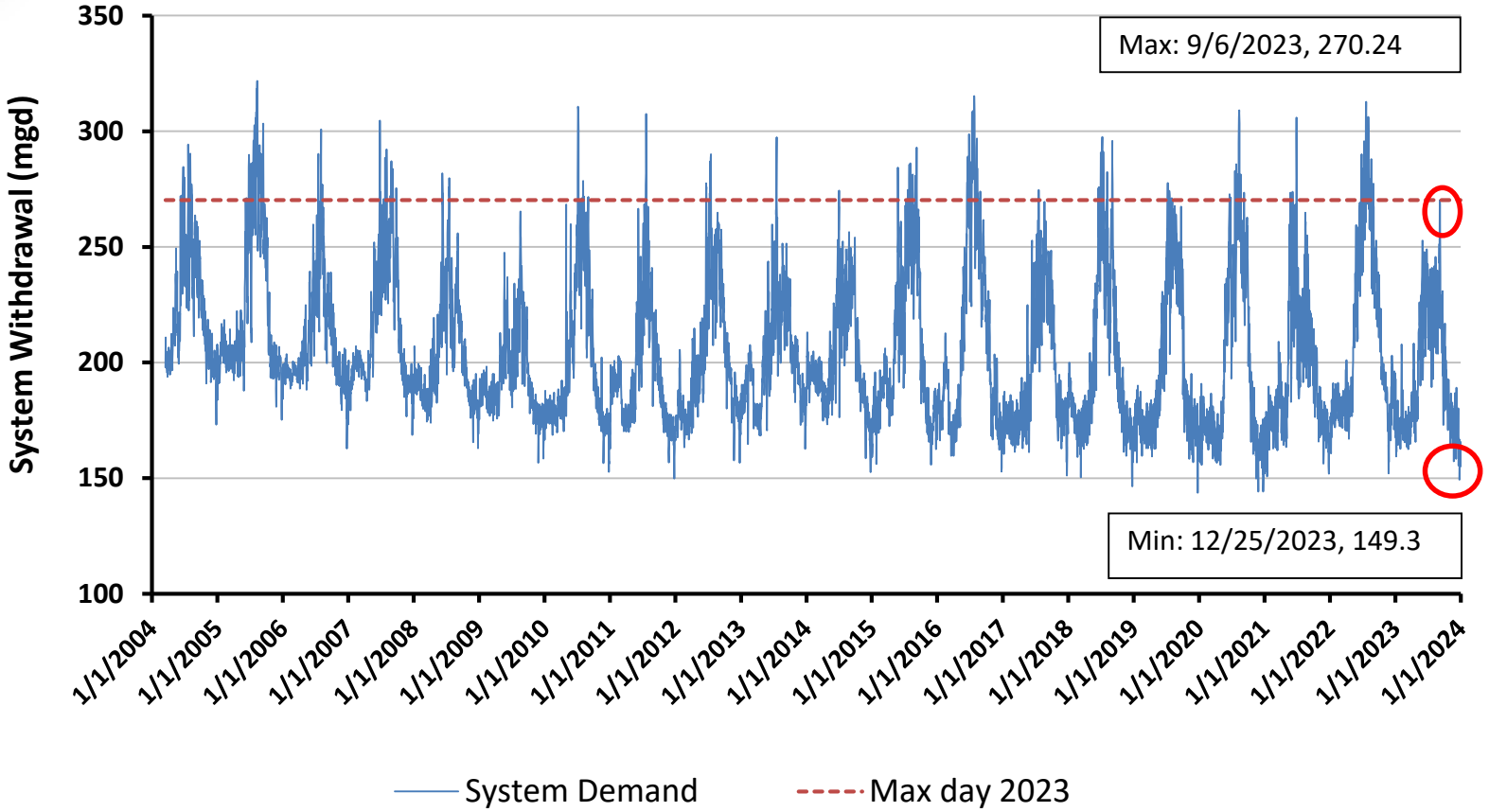
Reservoir Withdrawals Dropped Substantially Since 1980's



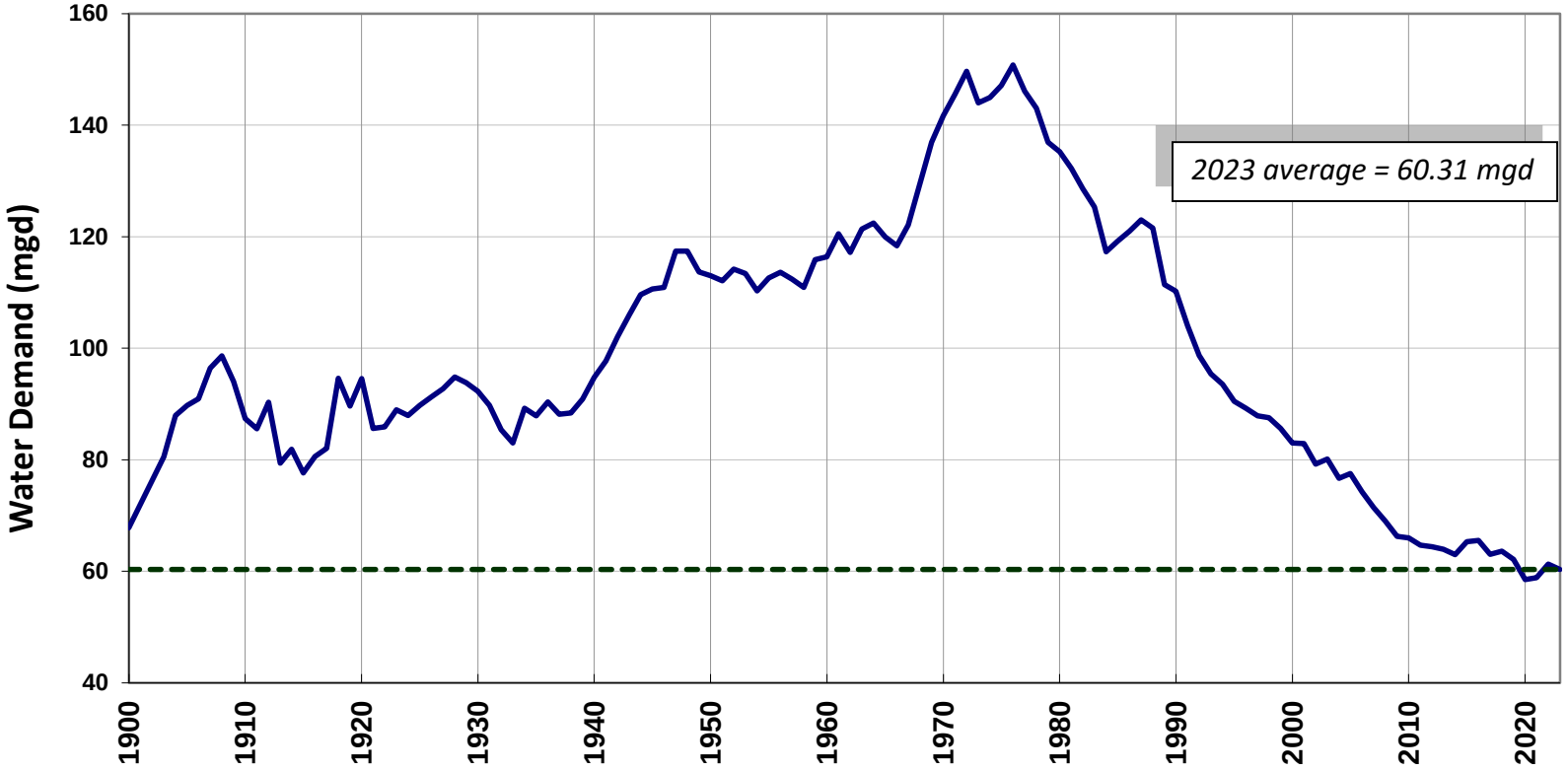
Total Consumption by MWRA Communities (1980 to 2023)



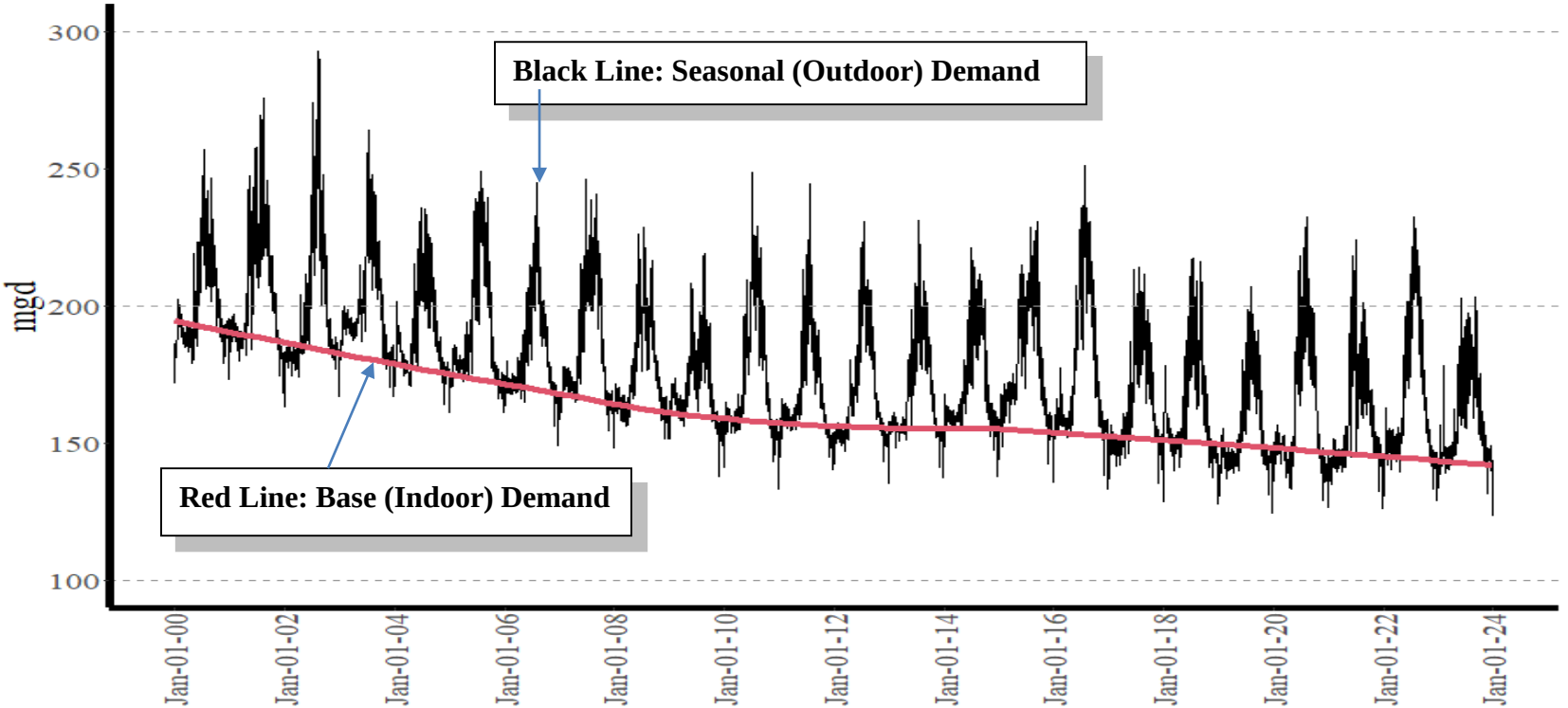
Daily System Withdrawals (2004 to 2023)



Boston Water Demand (1900 to 2023)

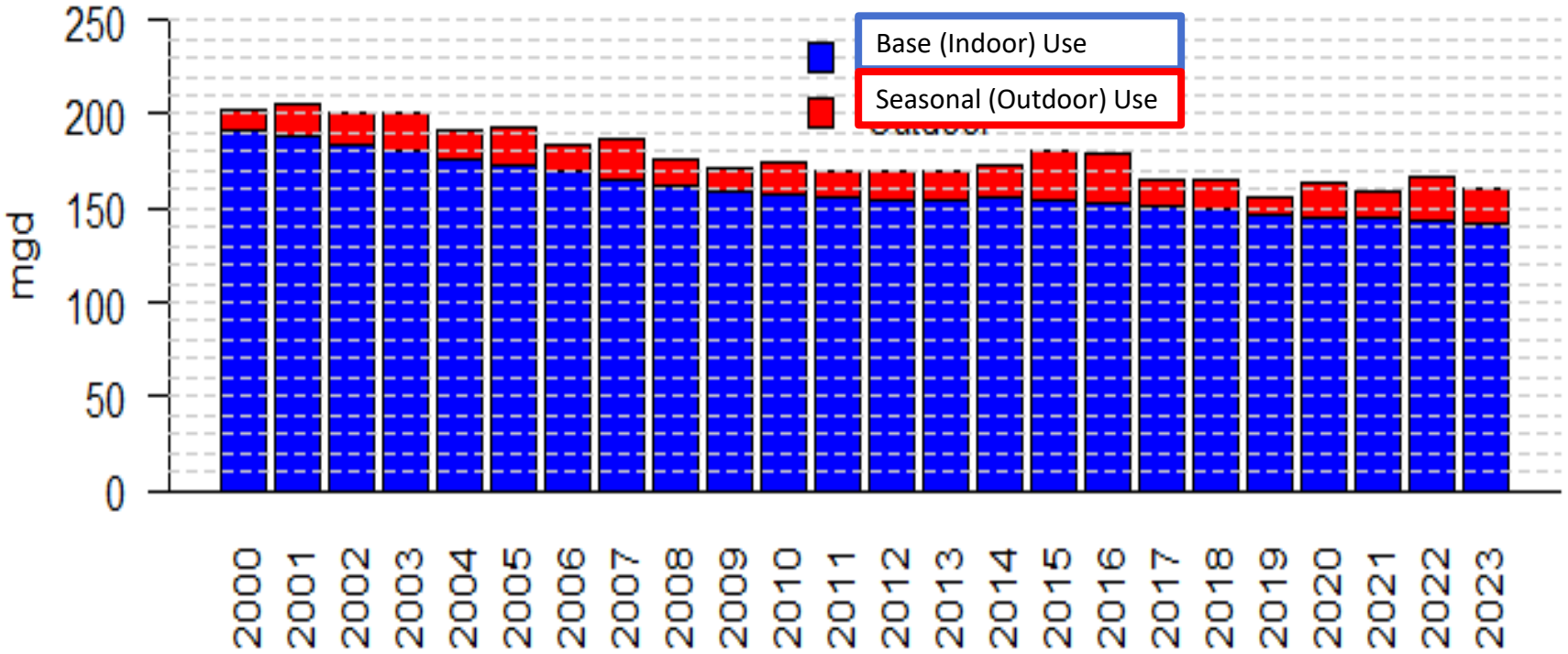


Base (Indoor) Demand vs. Seasonal (Outdoor) Demand

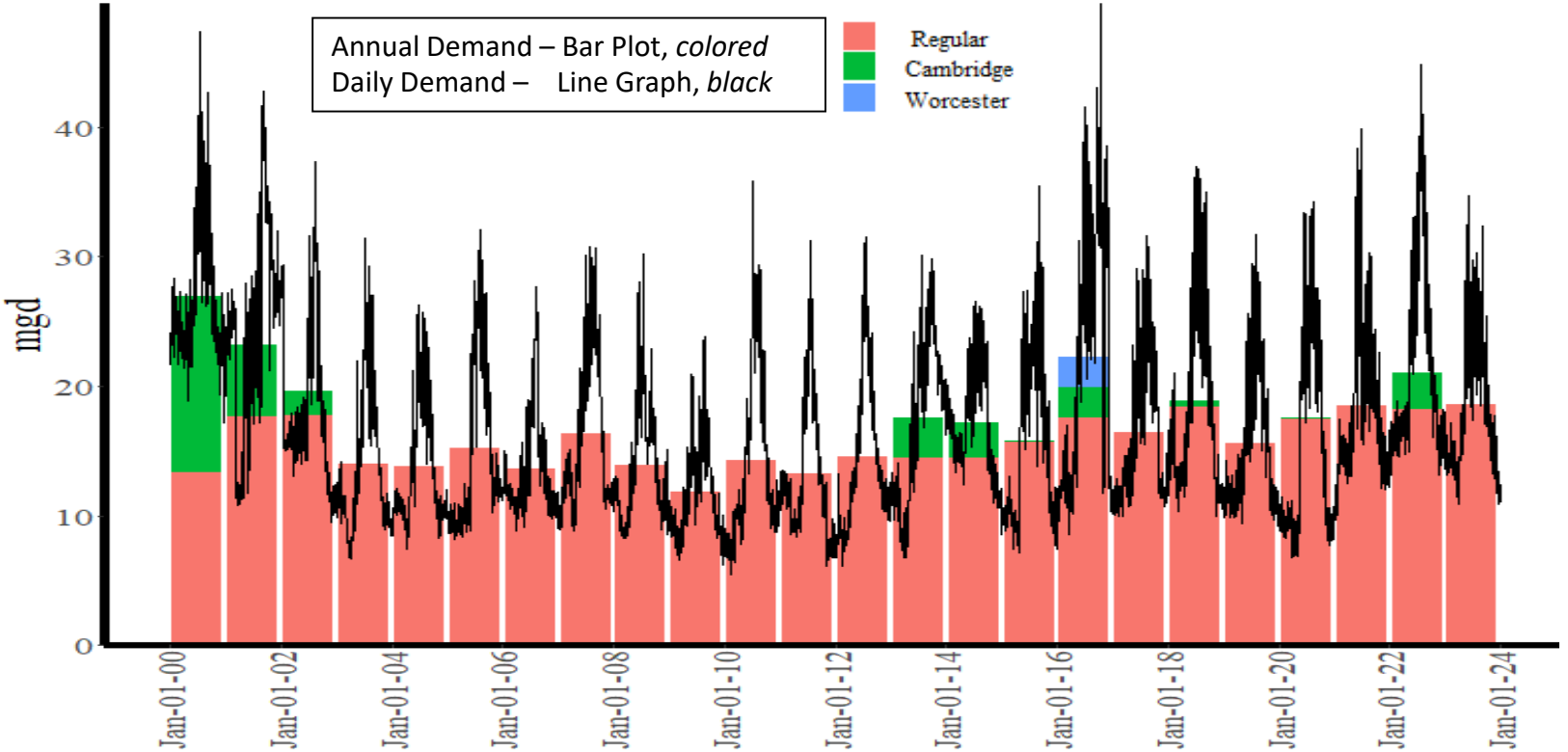


Based on fully supplied communities demand (1999 to 2023)

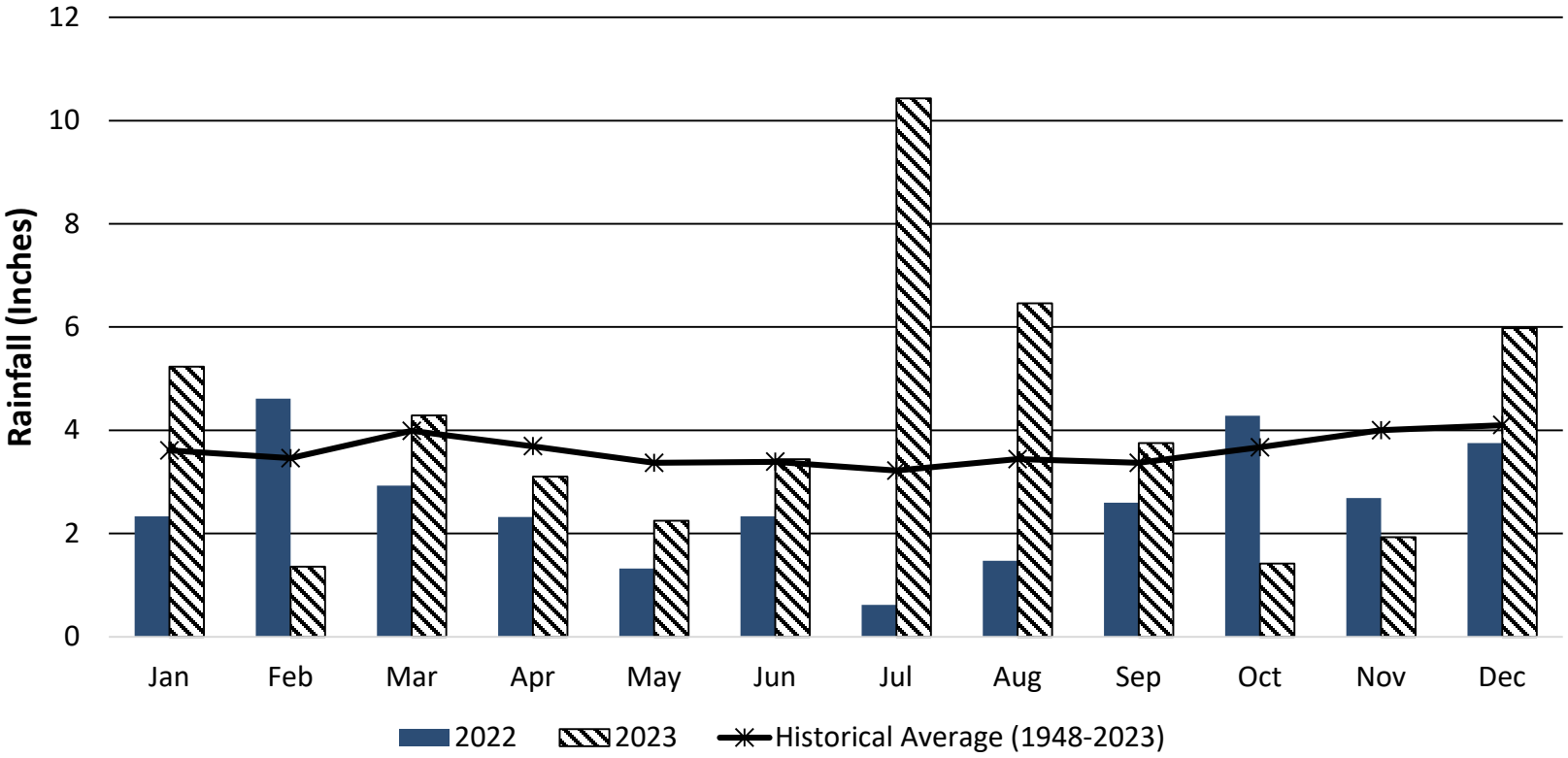
Fully Supplied Communities (Annual Based and Seasonal Use)



Partially Supplied Communities Have More Variable MWRA Demand



Boston Monthly Average Rainfall (inches)



Conclusion for 2023: Lowest water demand since 1950

- The system stayed in the normal operating range during the entire year.

- Despite adding new customers to the system, water demand in 2023 was the lowest since 1950.