

# EXECUTIVE SUMMARY

## BACKGROUND

The purpose of this study was to conduct an independent and comprehensive evaluation of the Town's water system and to identify recommendations for improvements to sustain the reliability of the system to meet expected demand conditions and satisfy regulatory requirements over the next 20-year planning period.

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

In general, the Weston water system is in good condition for its age, is relatively strong in terms of its hydraulic capability and capacity and is managed efficiently; some significant improvements however are warranted.

The Town has a serious *active* storage deficit and from an operational and engineering standpoint, the active storage in the system under existing conditions is essentially zero. Active storage is the portion of total storage that is available for use based on system hydraulics. Wright-Pierce noted the deficit back in 2008 in conjunction with the upgrades to the Wellesley Street booster pump station upgrade project. The impact of the deficit is that the system has no storage capacity to fight fire under maximum day conditions and there is no peak storage volume. Recommendations to address this issue will require the additional of approximately 2.5 MG's of active storage volume. Because the existing tanks are reaching the end of the useful life, the addition of storage can be made when replacing the tanks.

In addition, several distribution improvements are recommended to alleviate lack of fire flows and to reduce high velocities in mains from the pump station and to the Paines Hill tank.

Additional recommend improvements were developed to address identified deficiencies, and for improving the operational capacity and reliability of the system. Specific details and prioritization of the recommendations is included in the Capital Improvement Plan located at the end of this Section. Table ES-1 presents the recommended improvements and cost estimates in year 2019. Table ES-2 presents a recommended Capital Improvement Funding Plan.

## **POPULATION AND WATER DEMAND TRENDS AND PROJECTIONS**

Existing population and water demand trends were used as the basis for making projections of need over the next 20-year period (see Section 3 for specific details). The results of this analysis include the following:

- The Towns existing residential population is slightly more than 11,000 persons of which approximately 95% are served by the public water system. Weston's population is projected to increase to from approximately 11,389 persons in 2017 to slightly more than 12,000 in 2037.
- Over the past 5-year period, water demands have remained relatively stable averaging 1.85 million gallons per day (MGD) while maximum-daily demands peaked in 2016 at 5.45 MGD and have averaged 4.44 MGD. Average-day demands are projected to increase from approximately 1.85 MGD to approximately 1.96 MGD in 2037 while maximum-day demands are projected to increase from an average of 4.44 MGD to approximately 4.70 MGD in 2037. Residential water use comprises approximately 87% of the demand base; the remaining demands are comprised of municipal, commercial, industrial, and agricultural users.
- Per capita water use is a measure of individual water use per person and is useful to understand the use characteristics of a community. Weston has the highest per capita water use of any public water system in the state. This is entirely contributable to high summertime irrigation use. Over the past five (5) year period, per capita water use in Weston has ranged from approximately 105 to 135 gallons per capita per day (gpcd), averaging 118 gpcd. The performance standard for per capita water use under the Water Management Act is 65 gpcd.
- Over the past 5 years, unaccounted-for water has ranged from approximately 11% to a little over 15% and averaged just under 14% of the total demand.

## SUPPLY AND TREATMENT

Weston obtains all its drinking water from the MWRA. MWRA's water source is a pristine supply that is treated and meets or exceeds all the requirements of the USEPA and MassDEP for quality (see Section 2 for further details).

- Conveyance of water from MWRA to Weston is through a single connection and the Towns Wellesley Street pump station. The single connection represents a significant vulnerability. If it were to fail, Weston could be completely out of drinking water. *A second feed from the MWRA is recommended.*
- The Town of Wellesley is currently investigations alternatives for a new pump station to serve Wellesley and potentially other neighboring systems including Weston. The scope of that work was not advanced at the time of this study. *It is recommended that the Town engage Wellesley regarding their current study. Alternatively, we recommend that the Town open dialog with MWRA to explore the addition of a second connection to Weston.*

## DISTRIBUTION

The evaluation of the distribution system was performed using a computer hydraulic model developed specifically for the study (see Section 4 and 5 for further details). System deficiencies and recommendations for improvements include the following:

- System Pressures
  - Generally, pressures throughout the system fall within reasonable limits. Isolated areas of low pressure (less than 35 psi) exist in close proximity to storage tanks. Abnormally low pressures exist in areas of the northeast section of the system. Piping improvements and a booster pump station for the Kings Grant neighborhood are recommended to maintain normal working pressures to these areas.
  - Isolated areas of high pressure (greater than 110 psi) exist in the southeast area of the system. Pressure reducing valves can be added in the system or at service connections to control higher pressures.

- The Town should develop policy to limit new service connections above a maximum serviceable gradeline of 281.65 feet to reliably provide 35 psi.
- Pipe Velocity - several mains in the system should be upsized to reduce velocities in the system. High velocities increase pumping requirements and create imbalance in the hydraulics between storage tanks.
- Critical Mains - The most "critical" main in the system is the transmission main between the MWRA and the Towns Wellesley Street booster pump station. Loss of this main would result in significant if not complete loss of water service throughout the Town. As noted previously, a redundant main/connection to MWRA is recommended.
- There are numerous dead-end mains throughout the system, many exist on small cul-d-sacs. Dead-end mains can contribute to poor water quality. Nearly all the dead-end mains have higher than average water age. It is unlikely that many of the dead-ends can be looped because of their proximity from other parts of the system and environmental constraints.
- Most of the piping network is manufactured of modern material such as cast iron or ductile iron. Yet nearly 60% of the system piping is more than 50 years old.
- The Town has done an excellent job in eliminating asbestos cement pipe from the system. Only a fraction of asbestos cement pipe remains in service.
- The Towns current yearly pipeline replacement program is significantly underfunded. The Town should target replacement of 1-2% of the total system length per year. It is recommended that the yearly pipeline replacement budget be increased to a minimum of \$1.8M per year.
- Several areas of the system were found to be deficient in fire flow capacity. Piping improvements are recommended to satisfy recommended fire flow requirements.

## STORAGE

Storage is necessary to stabilize pressure fluctuations, to provide a cushion to the system during peak demand periods, and for firefighting and emergency purposes. As noted above, there is a serious storage deficit in the system that requires immediate attention. See Section 5 for further details. Findings and recommended improvements for storage include the following:

- Despite their age, the existing steel storage tanks are in good to fair condition but nearing the end of their useful life. Both the Doublet Hill and Cat Rock tanks will require recoating within 10-15 years if they are not replaced.
- Structurally, the Paines Hill tank is in fair to good condition. Aesthetically, the tank is in poor condition and requires significant interior and exterior rehabilitation.
- Under existing conditions, the system has essentially no active storage; this condition will worsen over time if not addressed. The lack of storage is directly related to the construction of buildings well above the serviceable gradeline of the water system. The lack of storage requires the Wellesley Street booster pumps to operate more than recommended and there is no surplus capacity for firefighting purposes under maximum day demand conditions. 2.50 million gallons (MG) of additional active storage is required to satisfy existing and future storage needs. This is to be provided with the replacement of the existing tanks at Paines Hill and Cat Rock and increasing their overflow elevation. Until additional active storage volume is added, new development should be curtailed. A study is recommended prior to implementing this recommendation to define design criteria, hydraulics, construction and integration sequencing and identification of suitable land to construct the tanks.

## PUMPING

The Town maintains two pump stations; the Wellesley Street booster pump station which supplies all water from the MWRA to the system and; the Black Oak booster pump station which serves the Black Oak neighborhood.

- The capacity of the Wellesley Street pump is adequate through the planning period. The pumps will require replacement within the next 10-15 years. However, if the Town proceeds with the

recommended improvements to storage and changes to the hydraulic gradeline, the pumps should be replaced in conjunction with the tank changes which will require new pumps to match the new hydraulics of the system.

- The Black Oak booster pump station was installed in 2016. The station has adequate capacity through the planning period.

## **MISCELLANEOUS**

- Hydrant Flushing - The Towns yearly flushing program has been successful in minimizing potential water quality issues in the system.
- SCADA - the current Supervisory Control and Data Acquisition System (SCADA) which is used to control the operation of the pump station and monitor conditions within the distribution system is 10 years old and should be replaced within the next 2-5 years. The current system is outdated.
- Valve Exercise - A routine valve exercise program is recommended. Main transmission valves should be exercised yearly. Smaller distribution valves should be operated at a minimum of every five years. The Town is currently working on the incorporation of valve exercising program in conjunction with the hydrant flushing program.
- Staffing - As compared to similarly sized water systems, Weston appears to be adequately staffed. However, each system is unique and has different needs. The decision to add more staff should be made by management as needed to meet the Level of Service goals.
- Level of Service - As part of the study, a Level of Service (LoS) document was developed for that will be used to govern the operation of the water system. The LoS establishes targets and priorities to meet the needs and expectations of the customers and whose mission is to provide high quality and safe water to its customers.

**TABLE ES-1  
RECOMMENDED IMPROVEMENTS\***

Project	Purpose of Improvement	Length (feet)	Existing Diameter (inch)	Proposed Diameter (inch)	Unit Cost	Construction Cost	Total Project Cost*
<b>Priority Improvements (1 - 5 years)</b>							
Tank Alternatives Study	Define design criteria and implementation of tanks	-	-	-	-	-	\$50,000
Replace Paines Hill Tank & inlet/outlet pipe	System Operations, Storage, Hydraulics, Age	n/a	12	20	n/a	\$3,520,000	\$4,750,000
Demolish and Restore Route 128 Well site	Liability	n/a	n/a	n/a	n/a	\$25,000	\$25,000
Second Connection To MWRA	Address Reliability & Criticality	650	n/a	24	\$500	\$325,000	\$439,000
Routine Pipe Replacement (2019-2023)	reliability	40,500	n/a	varies	\$225	\$9,000,000	\$9,000,000
<b>Secondary Improvements (6 - 10 years)</b>							
Replace Cat Rock Tank & Level Instrument Vault; demolish Doublet	System Operations, Storage, Hydraulics, Age	n/a	n/a	n/a	n/a	\$4,510,000	\$6,035,000
Upgrade Wellesley Street BPS	reliability	n/a	n/a	n/a	n/a	\$1,000,000	\$1,350,000
Replace/Upgrade SCADA	Reliability/Obsolete equipment	n/a	n/a	n/a	n/a	\$300,000	\$405,000
Replace inlet/outlet from Cat Rock tank to North Avenue; North Avenue south to Lexington Street	Fire Flow Improvement at ISO Location #10, #10.1, #14	5,000	10	16	\$350	\$1,750,000	\$2,363,000
Booster Pump Station for Kings Grant Neighborhood	Low Pressure and Fire Flow	n/a	n/a	n/a	n/a	\$500,000	\$700,000
Connect existing mains at intersection of Newton Street/Wellesley Street/Alphabet Lane	Pipe Looping	25	N/A	12	\$250	\$6,250	\$8,000
Connect Warren Plaza to Jericho Road	Pipe Looping	225	N/A	8	\$200	\$45,000	\$61,000
Routine Pipe Replacement (2024-2028)	reliability	40,500	n/a	varies	\$225	\$9,000,000	\$9,000,000
<b>Long-term Improvements (11-20 years)</b>							
Replace Wellesley Street from the pump station to South Avenue	Reduce Velocity	2,550	20	30	\$400	\$1,020,000	\$1,377,000
Replace South Avenue from Wellesley Street to Highland Street	Reduce Velocity	2,475	10	24	\$400	\$990,000	\$1,337,000
Replace Brown Street from Wellesley to Winter Street	Reduce Velocity	2,025	10	12	\$250	\$506,250	\$683,000
Replace Wellesley Street from South Avenue to School Street	Reduce Velocity	7,900	16	20	\$400	\$3,160,000	\$4,266,000
Replace Highland Street from South Avenue to Paines Hill Tank	Reduce Velocity	6,500	12	24	\$400	\$2,600,000	\$3,510,000
Replace Chestnut Street from Highland Street to Wellesley Street	Reduce Velocity	5,200	12	16	\$350	\$1,820,000	\$2,457,000
Connect ends of Scotch Pine Road, replace Scotch Pine Road, Shady Hill Road, and Ledgewood Road	Fire Flow Improvement at ISO Location #7	3,150	8	12	\$250	\$787,500	\$1,063,000
Replace Woodchester Drive from Ledgewood Road to Wellesley Street		1,900	8	16	\$350	\$665,000	\$898,000
Routine Pipe Replacement (2029 - 2038)	reliability	81,000	n/a	varies	\$225	\$18,000,000	\$18,000,000

\* estimated cost in 2019. See Table ES-2, Capital Improvement Plan for costs in year the improvement is scheduled.

**TABLE ES-2  
CAPITAL IMPROVEMENT PLAN**

Project Description	HIGH PRIORITY					MEDIUM PRIORITY					LOWER PRIORITY	Total*	
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030-2040		
Tank Alternatives Study	\$50,000												\$50,000
Replace Paines Hill Tank & inlet/outlet pipe	\$300,000	\$3,643,000	\$950,000										\$4,893,000
Demolish and Restore Route 128 Well site	\$25,000												\$25,000
Second Connection To MWRA				\$465,000									\$465,000
Replace Cat Rock Tank & Level Instrument Tank			\$300,000	\$4,000,000	\$2,278,000								\$6,578,000
Upgrade Wellesley Street BPS					\$150,000	\$1,403,000							\$1,553,000
Replace/Upgrade SCADA						\$100,000	\$378,000						\$478,000
Replace inlet/outlet from Cat Rock tank to North Ave; North Ave south to Lexington Street						\$250,000	\$2,100,000	\$438,000					\$2,788,000
Booster Pump Station for Kings Grant Neighborhood									\$200,000	\$689,000			\$889,000
Connect existing mains at intersection of Newton Street/Wellesley Street/Alphabet Lane							\$9,500						\$9,500
Connect Warren Place to Jericho Road							\$72,000						\$72,000
Replace Wellesley Street from the pump station to South Avenue											\$1,997,000		\$1,997,000
Replace South Avenue from Wellesley Street to Highland Street											\$1,997,000		\$1,997,000
Replace Brown Street from Wellesley to Winter Street											\$990,000		\$990,000
Replace Wellesley Street from South Avenue to School Street											\$6,185,000		\$6,185,000
Replace Highland Street from South Avenue to Paines Hill Tank											\$5,090,000		\$5,090,000
Replace Chestnut Street from Highland Street to Wellesley Street											\$3,563,000		\$3,563,000
Pipe Improvements for Fire Flow											\$2,843,000		\$2,843,000
Routine Pipe Replacement	\$1,800,000	\$1,854,000	\$1,908,000	\$1,962,000	\$2,016,000	\$2,070,000	\$2,124,000	\$2,178,000	\$2,232,000	\$2,286,000	\$28,710,000		\$49,140,000
<b>TOTAL</b>	\$2,175,000	\$5,497,000	\$3,623,000	\$5,962,000	\$4,444,000	\$3,823,000	\$4,683,500	\$2,616,000	\$2,432,000	\$2,975,000	\$51,375,000		\$89,605,500

\*2019 costs from Table 8-1 inflated 3%/year.

# Weston Water System Master Plan

Planning for the Future

August 2019

Robert Williamson, PE  
Brianna Wentworth



# Presentation Overview

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**Weston Water System  
Master Plan Overview  
Water-use Characteristics  
Findings  
Recommendations**

# Weston's Water System



# Master Plan Overview

Engineering evaluation of the adequacy of the system.



## Supply

- Quantity
- Quality



## Pumping

- Capacity
- Adequacy
- Physical Condition



## Distribution

- Capacity
- Fire Flow
- Pressure
- Velocity
- Water Age
- Physical Condition



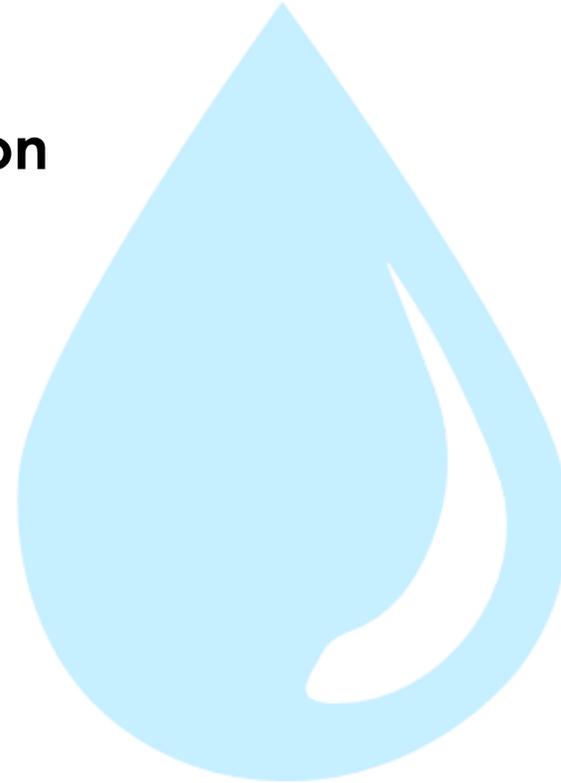
## Storage

- Capacity
- Active Volume
- Turnover
- Location
- Physical Condition

# Findings – Water Use Characteristics

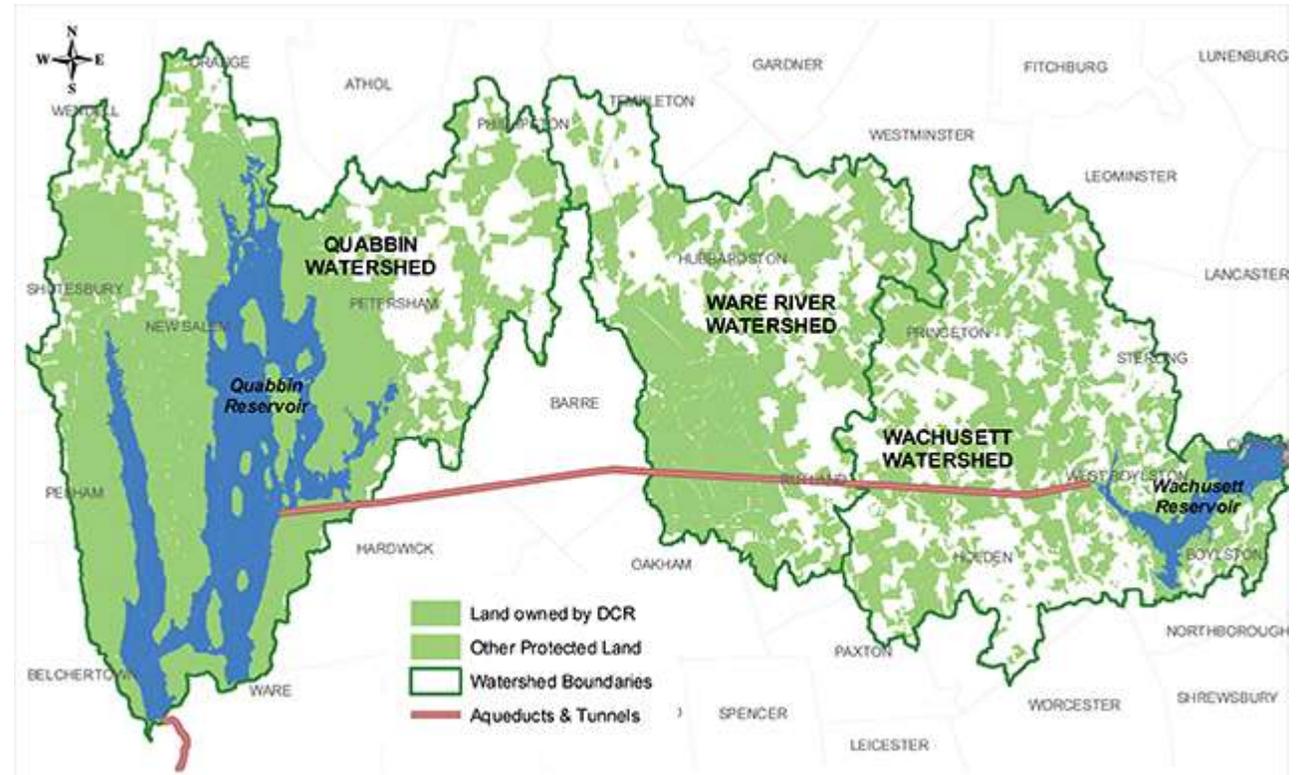
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- Approximately **95%** of the community is served by the system
- Average-Day demand – **1.85 MGD**
- Maximum-Day demand – **5.45 MGD**
- Per capita use – **135 GPD\*** \*Attributable to irrigation
  - State Standard – **65 GPD**
- Unaccounted-for water – **11 to 14%**
  - State standard – **10% or less**
- Demand projected to **increase moderately**



# Findings – Water Supply

- MWRA source from Quabbin and Wachusett Reservoir's. Ample supply for Weston.
- High quality source water treated to meet or exceed all State and Federal requirements.
- Single connection to MWRA is vulnerability.



# Findings – Pumping

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## Wellesley Ave BPS

- Serves entire system. Pump system and controls upgraded in 2008.
- Pumping capacity exceeds max day demand.
- Upgrades required within 10 years.

## Black Oak BPS

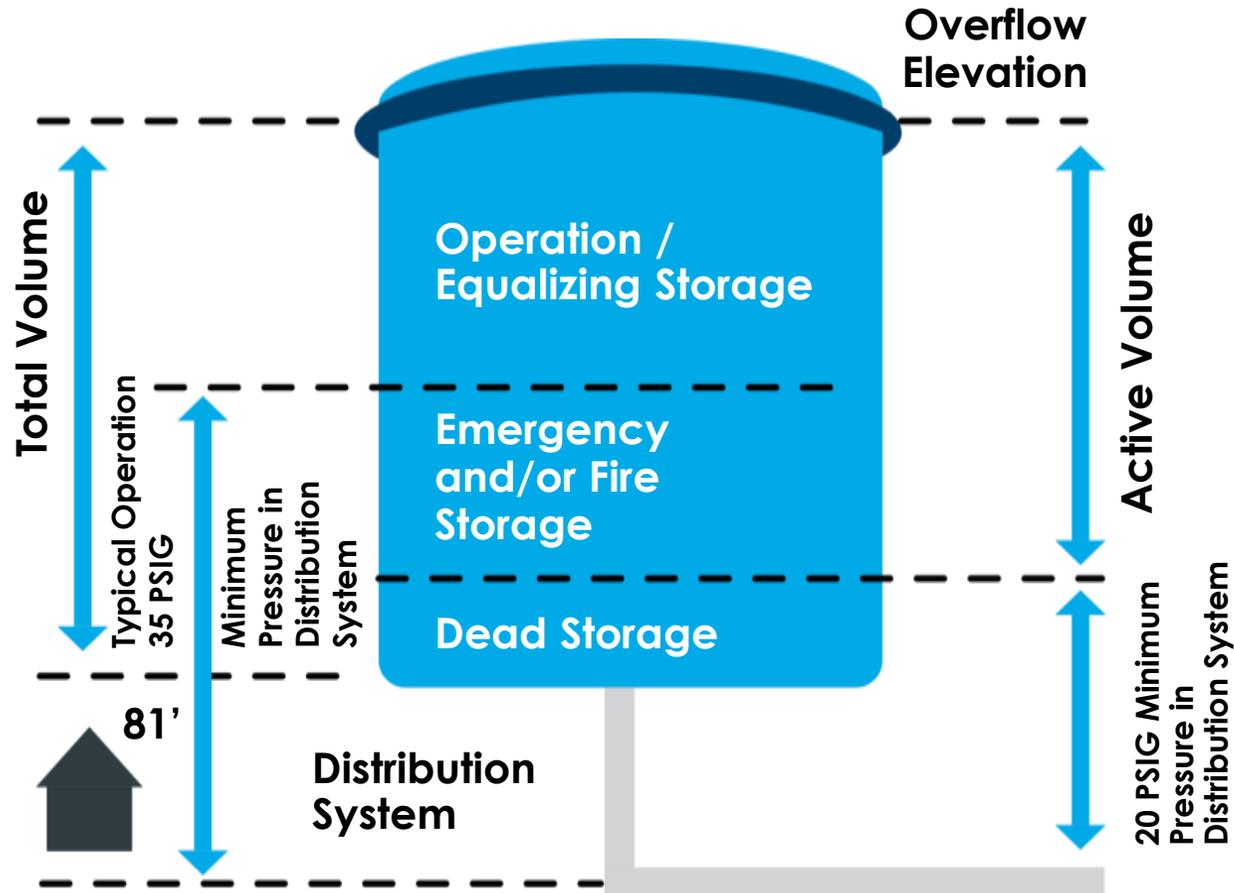
- Serves Black Oak/Nobscott neighborhood. Constructed in 2015.
- Provides max day demands and fire flow.
- Adequate for decades.

# Findings – Distribution Piping & Hydraulics

- **102 miles** of 6 – 20". **More than 60%** installed prior to 1970.
- Pressures vary from **less than 35 to +110 psi**.
  - Standard is 35 – 80 psi.
- **High velocities** throughout the system impact hydraulics.
- **MWRA connection** is most critical pipe.
- **Improvements recommended** for fire flow.
- Pipeline replacement program is **under-funded**.
- **3 tanks** - Paines Hill, Doublet Hill, Cat Rock
  - 2.63 MG's total capacity. 0 MG's active capacity.
  - 2.5 MG active needed.



# Recommendations – Storage



- 2.5 MGD active storage needed.
- Increase tank overflow elevation by replacing existing tanks.

# Recommendations - Distribution

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1. Second MWRA connection
2. Pipe improvements for fire flow and hydraulics
3. Increase yearly pipeline replacement program funding



# Priority Projects

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\*2019 costs from Priority Projects inflated 3%/year.