

Date: **5/3/2022**

Project No.: **20805A**

To: **Laurie Bent**

From: **Rob Williamson & Amy Coppers-Costantino**

Subject: **Conservation and its Relationship to Storage Tank Design**

This is a lengthy reply to the question of “can reductions in water use from water conservation reduce the size/volume of new water storage tanks”. We thought it best to put this in a separate reply and not directly in email.

A little engineering is needed to help frame the question and answer. We’ll do our best to keep it as basic and simple as possible

Storage Needs

1. Water storage in water systems is provided and needed for a variety of basic reasons:
 - To provide reserve volume (a.k.a. equalization storage volume) during days of high (peak) demands which exceed the capacity of the pumping system or the maximum daily demand plus fire flow needs, whichever is greater. Pumps are designed to meet the maximum daily demand only. Peak hourly demands can be anywhere from 1.5 to 4 x’s maximum daily demands. Providing pumps to handle these flows would be impractical.
 - To provide reserve volume for firefighting purposes.
 - The volumes must be provided at an elevation well above the highest served service elevation.
2. The volume required in storage for peak hourly demand days is typically equal to 25-30% of the *projected* maximum daily demand.
3. Storage volume, particularly for new storage tanks, should be sufficient to meet *projected* demands at least 20 years into the future.

Projections of Demand

1. Water systems and their related infrastructure (pipes, storage tanks and pumps) should be sized to handle the maximum expected/*projected* demands in the system at least 20-years into the future.
2. For systems that are primarily residentially based users, there is a close relationship between a community’s population and water consumption. *Projections* of demand are made by considering past and projected *population* growth and applying historical and projected demands to population. *Projections* consider past use and then applying *projections* of future water needs based on factors including available zoning, *projections* for each category of water use (residential, commercial, industrial, etc.), and local, regional, and national planning *projections*.

3. *Projections* can include estimates of reduced water use due to the implementation of conservation measures. However, *projections* which include assumed reductions from the implementation of conservation measures are typically very minimal (and should be) because studies show that changes in water use from conservation can be difficult to monitor and apply to the public. For Weston, no reductions in water use were assumed in the *projections* from implementation of more aggressive conservation measures because historically Weston has shied away from policies which limit or prohibit certain water uses and it requires significant change in the overall culture and view towards conservation. See “Weston’s Current Conservation Practices” below for further information.
4. It is important to note that the MWRA assumes the following when projecting future demands:
 - Current levels of conservation and efficiency among existing users will remain the same and there will be no increase in efficiency.
 - New residential use will be less efficient than current average use.

The water demand projections in the Water Master Plan are consistent with projected demands assumptions of the MWRA who provides water service to Weston.

Weston’s Current Conservation Practices

1. “Green” Community. This program, sponsored by the American Planning Association, advances practices that improve environmental quality, address climate change, and reduce development impacts on natural resources.
2. Routine leak detection of piping system.
3. Water Conservation By-Law which affirms the Towns right to regulate water use in accordance with Mass General Law. Our understanding is that these rights have never been imposed.
4. Promotes “Water Smart”, a program which encourages water conservation practices by the US Bureau of Reclamation.

Other measures that are typically implemented to help conserve water includes (1) increasing block water rates, (2) monthly or quarterly billings, (3) monitoring and notifications to largest water users, and (4) implementation of water conservation education programs to residents, and (5) monitoring/fining for irrigation usage during a NE Drought Region restrictions/action and (6) requirement for separate irrigation meters. Weston currently implements (1) and (4). (2) and (3) are expected to be implemented upon completion of the on-going Advanced Meter Read infrastructure project. Weston also monitors water usage during a drought but has found it difficult to enforce a fine/penalty when water usage is observed.

What are the Theoretical Reductions that can be achieved from Implementing Water Conservation?

This is a very difficult issue to answer with any certainty. While there are plenty of sources that publish figures in water reduction because of water conservation, our opinion is that they are offered/developed assuming perfect conditions. Most conservation practices are voluntary and difficult to enforce. Ones that are mandatory or enforceable, have typically been in place for many years and any benefits from them have already been realized and are reflected in historical demands.

For instance:

1. Use of low flow fixtures in new building construction. Codes requiring the use of low flow fixtures have been in-place for decades. Low flow fixtures can result in significant savings in water use (10-20%), but unless it was regulated that all homeowners are required to change out older fixtures with newer low flow devices, the reduction from new construction is nominal.
2. In Weston, analysis of water use indicates that the largest potential gain in reducing water use is from reducing water use from irrigation. However, without individual water meters dedicated to irrigation, the total use from irrigation is difficult to estimate.

How Would Reductions in Water use from Conservation, Impact the Required Storage Volume for Weston

Again, referring to the categories of storage, the only storage volume category that can be impacted by conservation is the equalization volume. Equalization volume is calculated as 25% of the projected maximum day demand. The projected maximum day demand for Weston in 2037 was 4.7 million gallons per day (MGD). 25% of 4.7 MGD is 1,175,000 gallons.

For sake of discussion, the following reductions in overall volume could be realized assuming the various gains by implementing conservation:

- 5% = 59,000 gallons
- 10% = 118,000 gallons
- 15% = 177,000 gallons

These estimates do not consider the potential reduction in the projected maximum day demand from potential reductions in conservation. To do so however would be purely speculation and are not recommended.

At best we would not suggest considering reductions of more than 5% from implementation in conservation. A reduction of 59,000 gallons from the tanks would barely change the dimensions of the tank. More importantly, the reductions in volume would not reduce or in any way eliminate the need to increase the height of tanks to serve the system.