

## MEMORANDUM

**DATE:** May 17, 2024

**TO:** Selectboard, Town of Wilmington  
Scott Tucker, Town of Wilmington

**CC:** Gretchen Havreduk, Town of Wilmington

**FROM:** Wayne Elliott, PE

**RE:** Route 9 Water & Sewer Extension  
Water Quality and Capacity  
A+E Project #22028

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As a follow-up to the Selectboard meeting on April 25, 2024, the Board asked us to address the potential concerns raised regarding the water quality and capacity as part of the Route 9 waterline extension project.

### WATER QUALITY

The water system operators have expressed concerns about the water quality and ability to maintain a chlorine residual towards the dead ends of the new waterline. We concur that this will be an operational challenge in the initial years because of the low water demands and increased water age. Extension of a waterline in one direction (dead end) without looping is not ideal, however there is not another better solution to provide water service to this area that would eliminate dead end lines. Also, fire protection is desired in this area, so this requires a minimum pipe size of 8" diameter, thus increasing the volume of water in the pipe.

There are several operational and structural measures that can be implemented at the existing storage reservoir and/or new waterline extension to reduce water age and maintain a chlorine residual. These alternatives are discussed below.

- 1. Sampling and Modeling** - During the preparation of the Water Asset Management Plan, a hydraulic model was developed for the water system. This is a very useful tool to simulate various conditions in the water system and can be used to assess the chlorine residual levels by gathering field sampling data. This approach was also discussed with the State DW staff and they provided input on recommended sampling points. This summer, collection of sampling data is recommended at the following locations:
  - Chlorine concentration entering the storage tank
  - Water age in the storage tank
  - Chlorine residual exiting the storage tank
  - Chlorine residual at the end of the existing 12" waterline on Route 9



Other data available on record with the Division for this water system can also be used for this analysis, such as, disinfection by-product (DBP) sampling results. Depending on the results of the data, one simple approach could be to increase the initial chlorine concentration prior to the storage tank if the disinfection by-product (DBP) are low.

- 2. Existing Storage Tank** – Managing water age starts at the existing water storage tank which has 2 cells and a combined total volume of 810,000 gallons. Chlorine is added for treatment upstream of the tank and no mixing is provided in this tank. Average water demands are about 80,000 gpd, and probably lower in the summer months so the water age typically exceeds 10 days with both cells being used. There are several options available to reduce the water age and/or better maintain a chlorine residual as follows.
  - a. Use One Cell** – The storage tank is used to meet the chlorine contact time, but if one cell can be used, then the water age can be reduced significantly by about 50%. No information was found in the 2019 O&M manual regarding the design assumptions for maintaining adequate contact time so it would need to be checked. One cell at 405,000 gallons still meets the minimum storage requirement of the average day demand plus fire flow. To meet a typical fire flow demand of 1,500 gpm for 2 hours plus the average day demand, a minimum volume of 260,000 gallons is required. This operational change could be implemented seasonally in the summer months when the water temperature is warmer.
  - b. Mixing** – Addition of mixing in one or both cells greatly improves maintaining a chlorine residual and minimizing the formation of disinfection by products. Two types of mixing can be performed, passive or active. For this application, we would recommend an active mixing system similar to the PAX. One mixer with controls and assembly is about \$25,000 plus installation and electrical related costs. This unit is about ½ hp and runs 24/7 so there will also be some increase in operation and maintenance costs.
  - c. Split Chlorination** - If chlorine loss becomes an operational problem, an alternate approach is split chlorination. This change would involve adding less chlorine to achieve primary disinfection, then chlorinating again as the water outlets the storage tank into the distribution system. This approach is a good solution to controlling disinfection by-products, but would require some capital improvements and will increase operation and maintenance costs.
- 3. Pipe Size** – This waterline extension consists of an 8” pipe size to supply both domestic and fire flow demands, but supplying both domestic and fire flow is not a requirement. To reduce the amount of water in the pipe, one option is to decrease the pipe size for some segments. An approach could be to maintain an 8” waterline to the intersection of Route 9 and 100, and south on Route 100 to supply fire flow, but downsize the new waterline from Route 100 east to Ballou Hill Road. This section of waterline along Route 9 could be reduced to a 4” waterline or smaller to supply only domestic demands with a flushing hydrant (blow-off) provided at the end near Ballou Hill Road. The volume of water in this

segment would be reduced about 75% from 5,115 to 1,280 gallons and further reduce water age.

- 4. Flushing** – Fire hydrants are being provided at the intersection of Route 9 and 100, and at the end of the waterlines on Route 100 and Route 9. These hydrants can be used for flushing purposes but the frequency required will vary by time of year and water demands. Since this is a new pipe with a clean interior, there should be limited growth of biofilm which tends to increase the disinfection demand but regular flushing will be required to prevent the growth of biofilm on the pipe interior, raise demand, and reduce water age. Automatic flushing stations can be provided at dead end lines but are costly and depending on where the flushing water is directed to, disinfection may be required.

The 2019 Operation and Maintenance Manual provides a brief discussion of system flushing procedures by annual unidirectional flushing for each fire hydrant. Since the demands on the new 8" waterline extension will be lower in the initial years, more frequent unidirectional flushing will be required if the chlorine residuals can not be maintained.

- 5. Pipe Isolation** - Once the new waterline is constructed, only the segments which will have active service connections should be placed into service. Isolation valves are provided at the intersection of Route 9 and 100. For example, along the section from Route 100 to Ballou Hill Road, the new pipe should remain out of service and empty until there is an active connection.
- 6. Booster Disinfection Facility** – If maintaining a chlorine residual near the intersection of Route 100 and 9 becomes difficult, addition of a booster disinfection facility is an option, however, this component is not directly addressed in the Vermont Water Supply Rules (WSR's). Discussions were had with William Nickerson, Engineering Section Supervisor, in the State Drinking Water and Groundwater Protection Division. He recognized that a booster disinfection facility is not covered in the WSR's, but is allowed. This facility would probably only be needed in the initial years and would include a small heated building containing a chemical feed/storage, monitoring system, and manhole structure for an injection point. This alternative would be a last resort as it is costly to construct and may not be needed beyond the initial years.

## **WATER SUPPLY CAPACITY**

The Town is in a unique situation because the State of Vermont Permit to Operate shows that there is adequate capacity available. However, as indicated by the water system operator, use of the Haystack surface water source may require the addition of treatment which will be at a significant capital cost and increase operation and maintenance costs.

An analysis of the existing water demands for the Asset Management Plan indicates that the Town will need to pursue additional water supply in the future, however, when this is required will depend on how quickly new development occurs within the water system service area.

The location of this new water supply should be in proximity to the water system infrastructure, so extension of the new waterline east along Route 9 and 100 provides the Town with a great opportunity to serve a new source. Based on discussions at prior meetings, we understand that there may be some suitable groundwater sources in this area. If the potential for a new groundwater source is identified for a specific property and the Town wants to further investigate, an option to purchase prior to any test well drilling and sampling should be executed. Depending on the water quality results for a new groundwater source, treatment would be preferable at the well if required, then this treated water can be pumped directly into the distribution system. This location for a new water source is much better for water quality and redundancy as the water flows in both directions.

Drilling costs have increased significantly in the past few years, but the test well drilling, pump testing, sampling, and permitting will cost about \$100,000, excluding the land purchase.

Discussions have continued regarding construction of a separate public water system to serve this area of Route 9 and 100 as it would require a new supply, distribution piping and storage tank. This alternative was evaluated in the study and the preferred approach for public infrastructure is consolidation with a municipal connection not separation as it is more cost effective in the long-term. There are many of these types of consolidation projects being constructed around the State in Swanton-Highgate, Alburgh, etc. and the State is supportive of this approach to extend municipal infrastructure. Also, with a separate water system, a new storage tank will be required and will make the water quality issues even worse in the early years. It will be very difficult to get sufficient turnover, and reduce the water age because of the larger water volume contained in the storage tank vs a waterline extension from Town.

A proposal was requested from a hydrogeologist, Hoffer Consulting Inc, to perform a groundwater availability study for this area. A proposal provided by HCI dated April 30, 2024, was provided to the Town.

## **RECOMMENDATIONS**

### **Short-Term**

To address concerns regarding the water age and maintaining adequate chlorine residual, the following short-term steps are recommended prior to construction:

1. Collect the sampling data over the summer so that the model can be used to simulate the initial low demand conditions and determine if other measures may need to be implemented to maintain the chlorine residual.
2. For the existing storage reservoir, experiment with operating one vs two cells to reduce the water age. This operating mode will need to be checked to confirm adequate contact time is provided.
3. For the new pipe section on Route 9 from Route 100 to Ballou Hill Road, reduce the pipe size from 8" diameter to 4" diameter with a flushing hydrant at the end to supply only domestic demands and reduce the water age.

4. Regarding the water supply concerns, initiate a study to identify potential groundwater sources in the Route 9 and 100 service area. The Town has already approved this proposal with Hoffer Consulting so this study is in progress.

Once these short-term recommendations are implemented and assessed, other long-term operating and structural measures can be further evaluated.