Memorandum

To: Jim Miller, Director of Engineering and HR

From: Katie Morrow, Utilities Engineer

Date: June 19, 2018 (Updated January 2019)

Subject: Sydenham Water System – Capacity Analysis

Background

In 2015 UK completed a capacity analysis for the Sydenham water treatment plant owned by South Frontenac Township. The analysis was completed to determine the uncommitted reserve capacity of the plant and the ability of the plant to accommodate additional demand. In 2015 the results of the analysis suggested that there was potential for the plant to be approaching capacity nearing the year 2020. Several assumptions were made during the previous analysis related to population served, committed development, and residential demands.

A data request for specific information was submitted to the township and the following was received in response:

- Number of Accounts: 278
  - Metered: 210
  - Unmetered/Unconnected: 68
  - No Consumption 22
  - Consumption < 20m^3 /quarter 29
- Vacant Lots within Service Boundary: 20
- People per Account: 2.5
- Population Within Service Boundary: 695

Results

Ministry of Environment and Climate Control method D-5-1 is an industry standard for determining uncommitted reserve capacity and was therefore used for this analysis. Using the above given information, in combination with published design guidelines, the D-5-1 analysis was completed and the results are shown in Table 1.

Table 1 – MOECC D-5-1 Calculation

a	Plant Capacity	m^3/day	900
b	Maximum Daily Flow (taken from plant flow data)	m^3/day	521
c	Reserve Capacity (a-b)	m^3/day	379
d	Population Currently Serviced		453
e	Max Daily Per Capita Flow	m^3/cap/day	0.823
f	Committed Properties within Service Area	Units	119
g	Committed Population Growth (f x 2.5)	people	298
h	Committed Reserve Capacity (e x g)	m^3/day	272
i	Uncommitted Reserve Capacity (c - h)	m^3/day	107
j	Additional Population that could be serviced (i / e)		130
k	Additional Residential Units that could be serviced (j / 2.5)	units	52

The following discussion provides definitions and details related to each parameter in Table 1.

Plant Capacity

Plant capacity was obtained from field testing results completed at the plant. Under the Drinking Water Works Permit the plant is permitted to distribute up to 1,290m^3/day however, due to processes within the plant the capacity is closer to 900m^3/day.

Maximum Daily Flow

The maximum daily flow, or maximum day demand (MDD) is defined as the largest volume of water delivered to the system in a single day. For Sydenham the MDD of 521 m^3/day was obtained from taking the average of all the MDD over the last five years.

Reserve Capacity

Current unused plant capacity, calculated by subtracting the MDD from the plant capacity.

Population Currently Served

This is used to calculate the maximum daily per capita flow (explained next) and is not to be confused with the population of the service area/boundary. For clarity, the population currently served is the population currently connected to the water system and actually using water. From the information above, provided by the Township, it was concluded that there are 159 accounts actually using water. This was determined by the following:

Total Accounts	=	278
Accounts not connected	=	- 68
Accounts with no consumption	=	- 22
Accounts with low consumption	=	- 29
Accounts Using Water	=	159

Population = 159 accounts x 2.5 people/account = 397.5 people

The seniors home in the village would be counted as one account however there are 55 units within the complex. It was assumed that there is one person per unit and as such this number was added to 397.5 to obtain a total population currently served equal to **453 people**.

Maximum Daily Per Capita Flow

The following calculation was used to determine the maximum daily per capita flow.

Maximum Daily Per Capita Flow = (Average annual water production over the last five years / 365 days / Population Served) x 2.75

It was identified that approximately 10,013m^3 of consumption was not residential use and was therefore subtracted from the average annual water production used to calculate per capita consumption. The average annual water usage or production was reduced from 59,418m^3 to 49,405m^3. The 10,013m^3 will be accounted for in the calculation for Committed Reserve Capacity.

Using values specific to Sydenham the calculation is:

Maximum Daily Per Capita Flow = (49,405m^3 / 365 days / 453 people) x 2.75 = 0.823m^3/person/day

The 2.75 is the MOECC recommended value (called a peaking factor) to take the *average* daily per capita flow to the *maximum* daily per capita flow.

Committed Properties within the Service Area

These are properties that fall within the service area (ie. have a watermain fronting the property) but aren't yet connected, or aren't using the water. The Township has an obligation to commit plant capacity to these properties to ensure the capacity is available if/when they decide to connect. The following property types would fall under this definition.

- Vacant lots which are not yet developed (value = 20);
- Developed lots where the customer has not yet connected to the water system (value = 68);
- Developed lots where the customer has connected to the water system but are not using the water (value = 51).

Adding together the above, the number of committed properties is 119.

Committed Population Growth

This is the assumed population growth directly associated with the committed properties defined above. The calculation is as follows:

Committed population growth = 119 properties x 2.5 people/property = **298 people.**

Committed Reserve Capacity

Using the the maximum daily per capita flow and the committed population growth, the committed reserve capacity is 0.823m3/cap/day x 298 people = 245m^3/day

The 10,013m^3 removed from the calculation of daily per capita consumption needs to be accounted for as it is still water being treated, distributed, and consumed. Although it is not direct residential usage, it is considered to be a portion of the Reserve Capacity that is Committed, as follows.

245m^3/day + (10,013m^3/year / 365 days) = **272m^3/day**

Uncommitted Reserve Capacity

Uncommitted reserve capacity is the difference between the Reserve Capacity and the Committed Reserve Capacity and represents the capacity available to service additional properties or developments which do not currently have capacity committed to them.

Uncommitted Reserve Capacity = 379m^3/day – 272m^3/day

= **107m^3/day**

Additional Population That Could Be Serviced

This is the number of additional people/population that could be serviced with the uncommitted reserve capacity calculated above.

Additional Population = $107m^3$/day / $0.823m^3$/cap/day

= **130 people**

Additional Residential Units That Could be Serviced

This is a translation from the additional population to the number of additional units and is calculated simply by the following:

Additional Residential Units = 130 people / 2.5 people per unit

= **52 additional units**

Conclusions

It can be seen from the above discussion and results that there is sufficient capacity to service all customers currently within the water service area, which meets the criteria of the original design.

Based on the information provided it is estimated that an additional 52 residential units could be serviced using the uncommitted reserve capacity. These properties would be new additional properties which are not currently within the service area. In other words, the distribution system could potentially be expanded to accommodate these additional properties.

Please don't hesitate to contact me should you have any questions or concerns related to the above.

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