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Municipality of Lakeshore  
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**Reference: Maidstone Water Tower - Isolation****Introduction**

The Municipality of Lakeshore (Town) has successfully completed the replacement of the existing Belle River elevated water tower with a new 5,800 m<sup>3</sup> elevated water tower (BRWT) located at 1562 Oakwood Ave. directly adjacent to the existing Denis St. Pierre Water Pollution Control Plant on Rourke Line Road. This replacement fulfils a number of recommendations made in the original 2009 Lakeshore Water & Wastewater Master Plan (2009 LWWWMP) with respect to system storage in the Belle River Water Supply System (BRWSS).

Replacement of the existing Maidstone Water Tower (MWT) is contemplated within the next 20-year planning period pending system growth as envisioned in both the original 2009 and updated 2018 LWWWMP's. Meantime, it was envisioned that the MWT would remain in service operating in unison with the new BRWT to take advantage of and utilize its storage capacity until it has outlived its usefulness and/or functionality.

Following the completion of the BRWT, operational issues were subsequently encountered with the MWT necessitating operational staff to modify normal system operation in order to mitigate potential structural damage from freezing weather due to potential long periods of non-cycling water levels. In light of this, the MWT sustained major ice damage to its inlet/outlet piping system during the 2017/2018 winter season and subsequently taken offline pending further review by the Town.

To assist the Town in assessing the repair work required to place the tower back into service, the original constructor, Landmark Municipal Services was engaged to carry out a detailed condition assessment of the tower in May 2019. The assessment identified a number of deficiencies including replacement of the majority of inlet/outlet piping & valves, replacement of existing fall arrest systems, extensions of existing access ladders and cable tray systems, a total exterior paint overcoat along with interior paint liner repairs and Scada system upgrades. Bringing the MWT back online would also require the installation of recirculation pumps to refresh and use the water in the tower. The estimated capital cost to undertake the above work is in the neighborhood of approximately \$1.9 Million as detailed below:

|   |             |
|---|-------------|
| Accessories & Fall Arrest               | \$50,000    |
| Painting - Long-term                    | \$800,000   |
| Valve Chamber Repairs                   | \$200,000   |
| New Logo Painting                       | \$55,000    |
| SCADA System & Sensors                  | \$75,000    |
| Installation of Recirculation Pumps     | \$125,000   |
| 3 Phase Hydro Service Line              | \$125,000   |
| Upgrade 400mm dia. Watermain Connection | \$100,000   |
| 10% Contingency                         | \$150,000   |
| Sub-Total                               | \$1,680,000 |
| Engineering 13%                         | \$220,000   |
| Total Excluding Taxes                   | \$1,900,000 |

Due to these very high costs coupled with the Tower's limited system benefit on account of its design top water level being approximately 8.045 meters lower than that of the BRWT, the Town engaged Stantec to assess the feasibility of isolating the MWT from the distribution system until such time that a new water tower and/or trunk distribution system upgrades can be constructed in the western sector of the Town as envisioned in the 2018 LWWWMP.

## Evaluation

The Belle River Water Supply System (BRWSS) consists of one pressure zone with system pressures generally governed by a combination of both the pressure head developed by the high lift pumping system at the Lakeshore water treatment plant (LWTP) and water levels in the BRWT and MWT elevated water towers.

Water storage is a very important element in a water distribution system. The principal advantages of distribution storage are that it can moderate the demands placed on major supply sources and production facilities as well as on major transmission mains and thus allowing sizes and/or capacities of each of these water supply system elements to be reduced while also stabilizing system pressures. Reserve supplies of water in distribution storage also generally provide a redundant source of water during emergencies, such as fires, watermain breaks, and pump station power outages.

In general, the major purposes of system storage in the BRWSS can be summarized as follows:

- Maintain steady system pressure & level of reliability
- Provide operational equalization
- Provide emergency reserve
- Provide additional fire flow supply
- Mitigate damaging effects of pressure surges

There are two types of distribution storage used in the BRWSS; in-ground reservoirs and elevated storage tanks. In-ground reservoirs utilize a direct pump system where a pumping system is required to pump water from the reservoir up to system pressures. Elevated storage tanks utilize an indirect pump system where water “floats” on the system’s hydraulic grade line (HGL) and flows by gravity from the tank into the distribution system.

An in-ground reservoir having a storage volume of 9,922 m<sup>3</sup> is located at the LWTP. An elevated water tower (BRWT) having a storage volume of 5,800 m<sup>3</sup> is located in the Rourke Line Road/Oakwood Ave area in Belle River adjacent to the Denis St. Pierre WPCP, while a 2nd elevated water tower (MWT) having a storage volume of 1,500 m<sup>3</sup> is located in the northwestern section of the service area along County Road 22 at Wallace Line Road in Maidstone. In total, the BRWSS has a total available storage capacity of 17,222 m<sup>3</sup>.

A hydraulic computer model of the BRWSS was originally developed in the 2009 LWWMP and updated in the 2018 LWWMP to include all new watermains and developments. This updated model was used to predict system behavior for this review using current population projections and the following criteria:

- Current maximum day demand of ~18,000 m<sup>3</sup>/day
- Provide minimum residual pressure of 40 psi in majority of distribution system under peak hourly flow demand conditions
- Provide minimum fire flow targets of 400 lgpm for rural residential areas, 1,000 lgpm for urban residential areas and 3,000 lgpm for institutional/commercial/industrial/ areas while maintaining a minimum residual pressure of 20 psi in remainder of distribution system under maximum day flow demand conditions
- BRWT to operate in unison with or without the MWT

## Impact on System Storage Requirements

Present and future 20-year (2035) storage requirements for the BRWSS were established in the 2018 LWWMP at approximately 13,995 m<sup>3</sup> for current demands and service populations and 18,660 m<sup>3</sup> for future projected demands and service populations.

The BRWSS currently has a total available storage capacity of 17,222 m<sup>3</sup> which exceeds the Ministry of Environment, Conservation & Parks (MECP) guidelines by approximately 3,237 m<sup>3</sup> or 23%. Isolating the MWT from the BRWSS reduces total available storage capacity to 15,722 m<sup>3</sup>, however, still exceed MECP guidelines by approximately 1,727 m<sup>3</sup> or 12%.

As system demands and service populations increase with time over the next 20-year planning horizon, system storage requirements would also increase to a point where deficit conditions are predicted. This deficit would then be mitigated by the planned construction of a new 5,800 m<sup>3</sup> elevated water tower as envisioned in the 2018 LWWWMP. However, the trigger date for constructing this new tower could be deferred to beyond 2035 as discussed below.

It was also envisioned in the 2018 LWWWMP that the advancement of the trunk watermain infrastructure along County Road 22 west of County Road 25 would ultimately affect its functionality and render the MWT obsolete.

Further to the above discussion and very rarely used in practice; Ministry guidelines allow system storage requirements to be reduced where water treatment plants have significant spare capacity available such as at the LWTP where over 50% spare capacity is currently available. When applied towards system storage, it would reduce storage requirements from 13,995 m<sup>3</sup> to 8,245 m<sup>3</sup> for present demands and service populations and from 18,660 m<sup>3</sup> to 14,996 m<sup>3</sup> for future demands and service populations.

Isolating the MWT from the BRWSS would reduce total available storage to 15,722 m<sup>3</sup>, however, still far exceed MECP guidelines by approximately 7,477 m<sup>3</sup> or 90% for present demands and service populations and 726 m<sup>3</sup> or 5% for 20-year (2035) future projected demands and service populations when excess WTP capacity is considered. With surplus storage now being available at the future 20-year horizon, this would enable the construction of the new water tower to be postponed until beyond 2035.

In conclusion, isolating the MWT from the distribution system is not expected to have any detrimental impacts on meeting system storage requirements currently or over the foreseeable future to 2035 and beyond.

#### Impact on Water Distribution System

To evaluate the impact of isolating the MWT from the water distribution system, the updated BRWSS hydraulic computer model developed in the 2018 LWWWMP was employed to predict system behavior and system capabilities during both peak hour and maximum day + fire flow conditions under current demand conditions in accordance with MECP Design Guidelines.

The model predicted that without the MWT in-service, adequate system pressures at or greater than the 40-psi benchmark were still maintained throughout the urban and rural areas of the Belle River water service area both east and west of the Belle River under peak hour flow conditions. Water levels in the BRWT were also being maintained within its operating range.

However, similar with the MWT in-service, system pressures without the MWT in-service of less than 40 psi were observed in the southwestern industrial and rural areas, generally south of the County Road 22 and west of Patillo Road. Pressures in this area were also observed to drop to as low as 28 psi at the extreme southwestern boundary of the service area near Highway 401 and Manning Road. The primary reason for the lower pressures in this area are due to a combination of the relatively large pressure losses being experienced in the existing old cast iron 300mm dia. trunk watermain running along County Road 22 from County Road 25 (Puce River) westerly to Patillo Road and the rising ground elevations towards Highway 401. These low-pressure problems have been documented in past water supply studies and has led to past and current servicing arrangements with the neighboring Tecumseh Water Supply System (TWSS).

Similar with the MWT in-service, peak hour flows without the MWT in-service were also observed to being conveyed to all regions of the service area at acceptable flow velocities ( $\leq 1.5$  meters per second [m/s]) and head-loss gradients ( $\leq 3.0$  metres per kilometer [m/km]).

In terms of fire protection capabilities, the following predictions were observed without the MWT in-service under maximum day + fire flow conditions:

- i. Similar with the MWT in-service, that the “minimum recognized” fire flow target of 30 L/s (400 lgpm) could be achieved while maintaining minimum system pressures of 20 psi throughout the system within the following areas:
  - Generally, east of Manning Road and Pike Creek and west of Ruscom River, all north of the CPR Corridor in the east and north of County Road 42 in the west.
- ii. Similar with the MWT in-service, that the “Urban” fire flow target of 76 L/s (1,000 lgpm) could be achieved while maintaining minimum system pressures of 20 psi throughout the system within the following areas:
  - Generally, east of Patillo Road and west of Golfview Drive, all north of the CPR Corridor.
- iii. Similar with the MWT in-service, that the “Industrial/Commercial/Institutional” fire flow target of 227 L/s (3,000 lgpm) could be achieved while maintaining minimum system pressures of 20 psi throughout the system within the following areas:
  - Generally, east of West Puce River Line Road and west of Duck Creek, all north of the CPR Corridor.

In summary and similar to the MWT in-service, the BRWSS without the MWT in-service is generally capable of maintaining a satisfactory level of service for the current needs of the service area within both the rural and urban areas. Slightly less than adequate system pressures can occur in the south-western rural areas while less than target fire flow availability predominates in the western urban areas same as with the MWT in-service. This deficiency would remain until all distribution system upgrades envisioned in the 2018 LWWWMP are constructed.

However, in light of this, the Town is encouraged to accelerate the replacement of the existing 300mm dia. cast iron watermain along County Road 22 from West Puce River Line Road westerly to Pike Creek to mitigate the very minor reduction (~100 lgpm) in level of fire protection from isolating the MWT while improving the level of service and fire flow protection to the western service area as envisioned in the 2018 LWWWMP.

Under further analysis, it was also observed that advancing the replacement of the existing 300mm dia. watermain along County Road 22 with a larger 400mm dia. (or larger) trunk watermain from West Puce Line to Wallace Line as envisioned in the 2018 LWWWMP would reduce pressure losses to a point where the hydraulic grade line would consistently rest above the MWT’s top water level and render it ineffective. This new trunk watermain infrastructure would also improve fire flows to the west above that provided with the MWT in-service. A comparative evaluation of isolating the MWT from the BRWSS is summarized in the following table:

| Description                                     | Advantages   | Disadvantages  |
|---|--|--|
| Isolation of MWT from Water Distribution System | <ul style="list-style-type: none"> <li>• Simple and requires no capital expenditures</li> <li>• Maintains present control philosophy with no changes</li> <li>• Can be achieved in shortest time period</li> <li>• Reduces operating &amp; maintenance costs</li> <li>• No increase in staff or administrative personnel to operate &amp; maintain</li> <li>• Maintains ability to accommodate ongoing implementation of development and other activities as envisioned in planning documents which have positive impacts on the socio-economic environment</li> <li>• No environmental impacts</li> <li>• Would ultimately need to be demolished</li> </ul> | <ul style="list-style-type: none"> <li>• Reduces system storage reserves. However, reduced system storage still meets MECP guidelines</li> <li>• Removes MWT as an emergency standby option to existing BRWT Tower,</li> <li>• Minor reduction in level of fire protection (~100 lgpm) to western quadrant of service area. However, minimum levels of fire protection still maintained with minimal impacts to public health and safety.</li> </ul> |

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It is anticipated that isolating the MWT will not have any significant effect on wildlife, vegetation or the habitat characteristics of any particular species. It is also anticipated that isolating the MWT will not have any serious impact on existing land uses, cultural activities, heritage resources or any other community program. It is still anticipated that isolating the MWT will still permit ongoing implementation of development and other activities as envisaged in planning documents that have positive impacts on the socio-economic environment.

The capital cost to isolate the MWT is anticipated to be minimal and consisting of staff time only. The capital cost to demolish the MWT is estimated in the \$400,000 range.

## **Conclusions**

In our opinion, the BRWSS is operating well and in compliance with MECP guidelines. Isolating the MWT from the distribution system is not anticipated to have any detrimental impacts on the performance of the water distribution system currently and over the 20-year planning horizon to 2035 and beyond until it can be demolished and system performance restored with new trunk watermain infrastructure along County Road 22 and a new elevated water tower as envisioned in the 2018 LWWWMP.

Sincerely,

**Stantec Consulting Ltd.**



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