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Mainland Common Development, Halifax - Geizer Hill Water Booster Station Review

SDMM, at the request of WM Fares, has reviewed the municipal booster station capacity for the requested population density increase and the resulting domestic demands for this area. The booster station, commonly referred to as the Geizer Hill Booster Station, was designed in 2011/2012 and constructed in the summer of 2013. SDMM liaised with Halifax Water (HW), visited the station and reviewed available supporting design reports and technical data sheets pertaining to the booster station pumping capacity. Documents reviewed by SDMM as part of this exercise include the following:

- July 2011, Geizer Hill Water Booster Station (Design Brief) prepared by CBCL
- April 2012, Geizer Hill Development Capital Cost Contribution Study (Final Report) prepared by CBCL
- June 2013, Geizer Hill Water Booster Station Civil Drawing, C1(rev3) Record Drawing prepared by CBCL
- June 2013, Geizer Hill Water Booster Station Mechanical Drawing, M1(rev3) Record Drawing prepared by CBCL
- June 2013, Geizer Hill Water Booster Station Electrical Drawing, E3(rev3) Record Drawing prepared by CBCL
- November 2015, Goulds Pumps Commercial Water, Pump capacity curves prepared by Pumps Plus Limited
- June 2012, Design & Construction Specifications, Section 3.0 Water System prepared by Halifax Water
- June 2015, Design & Construction Specifications, Section 3.0 Water System prepared by Halifax Water
- May 2023, Design Specifications & Supplementary Standard Specifications, Section 3.0 Water System prepared by Halifax Water
- June 27, 2023, Mainland Common Development Site Plan prepared by WMFares Architects

Background

We understand that the booster station is required to service the top of Geizer Hill due to portions of the service area being higher in elevation than the adjacent water tower. The booster station has been set to supply domestic water at a minimum pressure of 40psi to the service area. The booster station was designed and constructed based on HW's 2012 specifications and accommodate the proposed concept plans and population densities established by the developer at the time.

Observations

Subsequent to the commissioning of the station in late 2013, the HW specifications have been updated with domestic demands increasing (2012 spec – 90 USG, 2023 spec – 99.2 USG).

In addition, the developer is proposing higher populations for their Mainland Common Development than those proposed in 2012. Together these factors increase the domestic demand required by the Geizer Hill booster station.

The type of development is not proposed to change rather only the population will increase; we understand that the fire flows will be the same as those proposed in 2012 and we have reviewed domestic station capacity. We have not reviewed fire flows or existing station fire pump capacity as part of this report.

Domestic Water Demands

The estimated peak domestic water demand once the service area is fully developed, based on both the 2012 & 2023 populations and HW specifications are presented in Table 1.

Table 1 - Domestic Flows for Peak Demand

Date	Peak Hourly Domestic Demand* (USGpm)					
	Current Development		Mainland Common		Total	
	Population	Flow	Population	Flow	Population	Flow
2012	1,416	221.2	1,303	203.6	2,719	424.8
2023	1,826	314.5	6,301	1085.2	8,127	1,399.7

*Peak Hourly Demand: 248USG/person/day

The increase in population proposed by the Mainland Common Development raises the total population of the service area to 8,127 people. The peak domestic water demand is estimated to be 1,399.7USgpm based on HW’s 2023 specifications.

In addition to peak hourly domestic demand SDMM reviewed the average daily, max daily and instantaneous peak flow demands for the service area as required by HW specifications; a summary of these flows is presented in Table 2.

Table 2 - Confirmation of Domestic Demand Conditions

2023 Population	Domestic Water Demand (USGpm)		
	Average Daily Demand (99.2 USG/person/day)	Max Daily Demand (129.0 USG/person/day)	Instantaneous Peak Flow Demand (0.156 USGpm/dwelling unit used)
8,127	559.9	728.0	496.7

*Instantaneous Peak flow Demand conservatively based on the entire 3185 residential units.

From our review we found that these latter flows are exceeded by the Peak Hourly Demand listed in Table 1. Therefore, the proposed peak hourly demand must be accommodated by the current booster station.

Booster Station Capacity

The domestic booster station is comprised of three domestic pumps in parallel; one lead pump and two lag pumps. HW’s 2023 specifications require that a domestic booster pump station be sized such that the lead and one lag pump can provide 80% of the anticipated peak domestic demand. HW’s 2023 specifications further require that the lead pump capacity be a maximum of 25% of the peak demand and one lag pump capacity shall be a maximum of 55% of the peak demand. From discussions with HW and as confirmed on site see Table 3 below for a summary of the pumps and motors in service at the Geizer Hill station.

Table 3 - Booster Station Pump Technical Data

	<i>Lead</i>	<i>Lag</i>	<i>Lag</i>
<i>Pump Model No.</i>	Goulds 3556, 1 ½ x 2-8 6” dia impeller	Goulds 3656, 3 x 4-8 6 1/16” dia impeller	Goulds 3656, 3 x 4-8 6 1/16” dia impeller
<i>Motor Size.</i>	10HP 3,490 RPM 575 Volt	20HP 3450 RPM, 575 Volt	20HP 3450 RPM, 575 Volt

To meet the requirements of 40psi at the highest elevations within the service area, the pump system must maintain a minimum of 95ft of head during periods of peak domestic demand. The local supplier of Goulds Pumps, Pumps Plus, provided the domestic pump curve for this station as shown in Figure 1. This curve indicates that with the addition of each pump, the system’s potential flow rate increase while maintaining the minimum head or pressure boost required for the area. The potential domestic supply as each pump comes on are presented in Table 4.

Figure 1 - Domestic Pump Package Curves

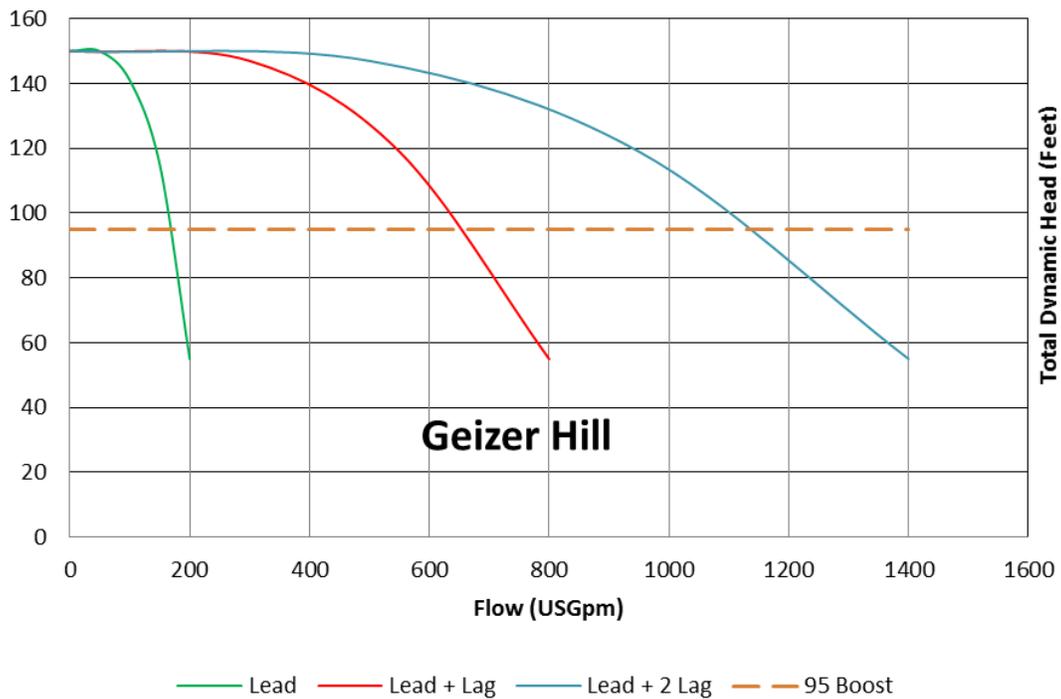


Table 4 - Domestic Pump Capacity

Minimum Head (ft)	Potential Flow (USGpm)		
	1 Pump	2 Pumps	3 Pumps
95	175	625	1,150

Once fully developed the area is estimated to require a peak hourly domestic water demand of 1,399.7USGpm. Based on the system curve, the lead pump and one lag pump together will push a maximum flow of 625USGpm while maintaining the required minimum 40psi (95ft of head). HW’s 2023 Specifications require that the lead pump capacity not exceed 25% of the peak demand, the lag pump not exceed 55% of the peak demand and that the lead and one lag pump together must be capable of providing 80% of the peak demand. Table 5 presents the potential flow at 95ft and the resulting equivalent peak flow percentage for each option; lead pump alone and lead plus one lag pump working together.

Table 5 - Lead & Lag Pump Flows

Item	Flow at 95ft Head (USGpm)	Equivalent Peak Flow* Percentage	Max. Flow Allowable Percentage
Lead	175	12.5%	25%
Lead & Lag	625	44.6%	80%

*2023 Peak Flow: Peak Hourly Domestic Demand: 1,399.7USGpm

These results confirm that the lead and lag pumps are NOT adequately sized to accommodate the entire increased population based on HW’s 2023 specifications as the lead pump will provide only 12.5% of the peak demand while the lead plus one lag pump will provide 44.6% of the peak domestic water demand for the service area. The existing combined lead pump plus 1 lag pump are only capable of providing 57.1% of the peak hour demand flow and 95.5% of the max day demand flow. As this is below the HW’s 2023 minimum specified 80% peak hour demand flow and the 100% of max day demand flow percentages, modifications to the station pumps will be warranted at a certain point of development.

Conclusion

This domestic booster station is comprised of three Goulds pumps that together service the top portion of Geizer Hill in Halifax. Further to our review above we estimate that the total population of this service area at full build out will be 8,127 people which will require a peak domestic hourly water demand of 1,399.7USGpm based on the HW’s 2023 Specifications. We note that the lead pump and one lag pump together are not able to provide sufficient capacity to meet the minimum requirements of Halifax Water’s 2023 Design and Construction Specifications. This confirms that modifications to the existing pumping capacity will be required at the current booster station to accommodate the increased density proposed for the Mainland Common Development at some point in the future to meet the fully developed demands whereas ideally, the Lead pump would need to provide 350USGpm @ 95ft of head (25% of peak demand) and the lag pump would need to provide 770USGpm @ 95ft of head (55% of peak demand). Based on preliminary calculations, the booster station pumps upgrade would be required after approximately 2,200 people have been added to the Mainland Common development (approximately 35% of the proposed development).

Please forward this on to Halifax Water for their review. If additional information is required, please contact SDMM to discuss.

Regards,

Servant, Dunbrack, McKenzie & MacDonald Ltd.

Original Signed

Ray Landry, P.Eng.
Project Engineer

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