Attachment B

BOLTON & MENK
Real People. Real Solutions.

12224 Nicollet Avenue
Burnsville, MN 55337-1649

Ph: (952) 890-0509
Fax: (952) 890-8065
Bolton-Menk.com

MEMORANDUM

Date: October 8, 2020

To: Todd A. Blomstrom, City Engineer/Public Works Director

From: Seth A. Peterson, PE

Subject: Lift Station 10
Arden Hills, Minnesota
Project No.: M20.121694

Introduction

Lift Station 10 is a wastewater pumping station in the City of Arden Hills, located at 3804 North Cleveland Ave, on the east side of the street and just south of the County Road E2 West and Cleveland North intersection. The current duplex submersible pump wet well/valve vault station was constructed in 1989. In the wet well side of the station are two Hydromatic submersible pumps with 3-horsepower motors, designed to pump 100 gallons per minute each. Flow exits the station through a 4-inch PVC force main which runs for approximately 976 feet before discharging into a trunk sewer manhole at the corner of County Road E2 West and New Brighton Road.

Lift Station 10 is over 30 years old and is in need of rehabilitation. One of the main concerns with the current configuration is flooding of the upstream manholes that occurs due to the operating elevations in the existing station. The invert of the gravity pipe which enters the wet well sits 1.12 feet above the structure invert. This does not allow enough depth for the pumps to be adequately submerged per the manufacturer's recommendations while also having an operating depth shallow enough to prevent wastewater from backing up the influent gravity pipe and into the first few upstream manholes during normal operation. One of the main goals of this project is to eliminate or at least minimize this backup.

Based on the City's comments and additional information about the station provided to Bolton & Menk, three main options for the project are considered: rehabilitation of the existing lift station, replacement of the existing submersible station with one of a similar type, or replacement of the existing station with a small prefabricated grinder station and new small-diameter force main.

Option 1 - Rehabilitation of the Existing Lift Station

The first option considered for rehab of Lift Station 10 includes replacing the existing pumps and piping in the wet well and valve vault. Major components associated with this option include the following:

- Install two new submersible pumps with purposely shallow operating conditions
- Obtain and install new lift station controls and SCADA equipment
- Install new piping in the existing Wet Well and Valve Vault

Based on new pump technology and the right pump selection, the maximum number of possible pump starts per hour could be increased from the standard ten (pump runs every six minutes) to 30 (pump runs every two minutes). Table 1 below demonstrates that if the starts per hour are allowed to increase, the standard operating depth (vertical distance between the All Off and Lead Pump On levels) can decrease. The decrease in the operating depth would reduce the maximum water level elevation that the station reaches during normal operation and reduce or possibly eliminate the occurrence of wastewater backing up into upstream manholes.

Table 1 - Operating Depths*

Starts Per Hour	Pump Runtime [min]	Volume [ft^3]	Design Value [ft]
10	6	20.05	0.71
15	4	13.37	0.47
20	3	10.03	0.35
25	2.4	8.02	0.28
30	2	6.68	0.24

**Based on an assumed 6-foot diameter manhole*

The margin between the All Off and the Low Water Level (LWL) can also be adjusted to provide more available volume in the wet well, which will help even more to decrease the flooding of manholes upstream. Table 2 below shows the new Lead Pump On elevation based on number of pump starts per hour and the distance between the All Off and LWL set points.

Table 2 - Lead Pump On Elevations

Starts Per Hour	Depth from All Off to LWL		
	0"	3"	6"
10	872.46	872.71	872.96
15	872.22	872.47	872.72
20	872.10	872.35	872.60
25	872.03	872.28	872.53
30	871.98	872.23	872.48

Through conversation between the City and Bolton & Menk, it was determined that the optimal acceptable solution is a 3-inch margin between the All Off and LWL set points, and 20 pump starts allowed per hour. This provides a Lead On elevation of 872.35', as underlined in Table 2.

With the bottom elevation of the upstream Manhole 2 at 872.44' and using the proposed parameters, the lead pump would turn on before wastewater would back up in the gravity pipe as far as Manhole 2 and the entirety of the gravity pipe would empty into the wet well before the station shuts off. Table 3, below, details the estimated costs associated with Option 1.

Table 3 - Option 1 Cost Estimate	
Item	**Cost**
Mobilization	$15,000
Allowance	$10,000
Site Grading/Restoration	$7,000
Existing Station Demo	$6,000
Bypass Pumping	$15,000
Pumps/Controls	$87,000
Electrical	$15,000
Control Panel Pad	$4,000
Site Work (Seeding, Drive, etc.)	$7,000
Valves, Piping, Misc.	$20,000
Construction Subtotal	$186,000
Contingencies (20%)	$37,000
Construction Total	$223,000

Option 2 - Replace the Existing Station

The second option includes constructing a new submersible lift station to replace the existing station. A new deeper precast wet well would provide a greater distance from the influent gravity pipe to the bottom of the structure, preventing flooding upstream. Significant components include the following:

- Construction of new duplex submersible lift station with precast wet well and valve vault
- Installation of new lift station controls and SCADA equipment
- Installation of two new submersible pumps and piping
- Demolition of existing wet well/valve vault lift station

Based on station operating data from recent years and the need to maintain minimum flow velocity in the force main, the new submersible pumps would be rated for the same 100 gallon per minute with a total dynamic head of 33 feet. Based on these parameters, the wet well would consist of a 6' diameter precast concrete manhole. However, to prevent the flooding of the manholes upstream the base elevation of the Lift Station would be 868.5', 25.5' below grade and deeper than the current wet well. Table 4 outlines the estimated costs associated with Option 2.

Table 4 - Option 2 Cost Estimates	
Item	**Cost**
Mobilization	$20,000
Construction and Utility Allowance	$15,000
Lift Station Structures	$150,000
Submersible Pumps/Control panel	$87,000
Piping & Valves	$25,000
Controls & Electrical	$15,000
Panel Pad	$4,000
Demolition/Removal	$15,000
Bypass Pumping	$3,000
Site Work (Grading, Drive, Seeding, etc.)	$15,000
Construction Subtotal	$349,000
Contingencies (20%)	$70,000
Construction Total	$419,000

Option 3 - Replace with Submersible Grinder Station

The third option for station rehabilitation consists of replacing the current submersible lift station with a small prefabricated lift station containing submersible grinder pumps. Details of the option include the following:

- Purchase and installation of a prefabricated grinder lift station
- Direct drilling of a new ~975-foot PVC force main (two or three-inch) to the existing outfall
- Demolition of existing wet well/valve vault station

A grinder station is a lift station structure that is shipped essentially prefabricated, including pumps, valving, and internal piping, and is then installed on-site. Typical grinder stations often include an optional corresponding control panel, but a buyer may choose to have station controls fabricated and provided separately.

The grinder station basin is usually constructed out of fiberglass or another composite material. Pumps range in size and are submersible grinder pumps designed to operate in low flow/high head conditions. As such, they are best suited to pump through a force main that typically ranges in diameter between one and three inches. At Lift Station 10 a 2-inch PVC force main would most likely be recommended.

Advantages of installing a grinder station include lower initial and operating costs for the station itself, and ultimately a more compact and unobtrusive site. This type of design would

work for Lift Station 10 because of the minimal flows that it receives: calculated to be less than three gallons per minute on average and less than five gallons per minute during peak periods. Due to the pump design and the need to maintain a minimum flow velocity in the force main, a new 2-inch force main would have to be installed as part of Option 3, probably using a direct drilling method. Table 5 summarizes the costs associated with Option 3.

Table 5 - Option 3 Cost Estimates	
Item	**Cost**
Mobilization	$15,000
Construction and Utility Allowance	$10,000
Grinder Station	$30,000
Piping & Valves	$3,000
2" Force Main	$45,000
Modifications to Outfall MH	$3,000
Electrical	$10,000
Panel Pad	$55,000
Demolition/Removal	$15,000
Abandon existing 4" Force Main	$10,000
Bypass Pumping	$3,000
Site Work (Grading, Drive, Seeding, etc.)	$12,000
Construction Subtotal	$211,000
Contingencies (20%)	$42,000
Construction Total	$253,000

Alternative Analysis

The goal of this project is to rehabilitate Lift Station 10, with the secondary goal of preventing wastewater from backing up the influent gravity sewer pipe and into upstream manholes. All three option address this issue with varying approaches and costs. Table 6, below, summarizes the advantages and disadvantages of each option.

Table 6 – Summary of Options		
	Advantages	**Disadvantages**
Option 1 (Rehab Station)	• Reuses existing infrastructure which is still in good shape, including structures and force main • Minimizes or eliminates flooding in upstream gravity manholes • Maintains existing station's capacity • Cost-effective	• Requires bypass throughout construction • Doesn't address basic structure elevation issues causing current wastewater backup
Option 2 (Replace Station)	• Brand new lift station • Potential to improve site layout • Reuses force main • Eliminates flooding in upstream gravity manholes	• Substantial excavations, site disruption • Requires either significant alterations to lift station site or bypass throughout construction • May require additional easement • Most expensive option
Option 3 (Grinder Station)	• Brand new grinder station • Potential to improve site layout • Station sized more appropriately for flows received (reduced power use)	• Requires either some alterations to site layout or bypass throughout construction • Requires new force main to be constructed • Station capacity would be reduced compared to existing

Option 1 is the least expensive option and with manipulation of the on/off levels is able to minimize flooding in the upstream manholes. This option also utilizes the existing infrastructure that is in good shape and will make the station more consistent with other lift stations in the City.