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City of Buffalo

Comprehensive Lift Station Evaluation

Buffalo, Minnesota

W13.108218

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Certification

Comprehensive Lift Station Evaluation

for

City of Buffalo

Buffalo, Minnesota
W13.108218

July 6, 2017

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

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License No. 45055

Date: 7/26/2017

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I. INTRODUCTION

This report includes a comprehensive study of the City of Buffalo's Lift Stations No. 1, No. 2, No. 3 and No. 4 and the associated sanitary sewer forcemains for each of these lift stations. The age and condition of Lift Station No. 3 necessitates studying options for future improvements and possible replacement of this lift station. Lift Stations No. 1 and No. 2 are two major lift stations for the City and pump to Lift Station No. 3. Lift Station No. 2 has incurred overloading problems in the past and the forcemain from Lift Station No. 2 has ruptured twice in the past several years. Therefore, these two lift stations and associated forcemains have been included in the study. Lift Station No. 4 is the other major lift station that pumps directly to the wastewater treatment plant and utilizes common forcemains with Lift Station No. 3. Hence, Lift Station No. 4 and associated forcemains were also included in the study.

Additionally the City of Buffalo is planning ahead for improvements along Trunk Highway 25 from 1st St. S. to Settlers Parkway that are currently scheduled for construction in 2022. This work will occur along existing lift station forcemain routes and proposed forcemain routes. This report reviews the lift stations and forcemains located along this route so that any forcemain improvements needed along this route can be pro-actively planned for and completed concurrently with the proposed trunk highway improvements to reduce project cost and reduce construction inconveniences to the public by completing all necessary improvements in this area at the same time.

II. EXISTING SYSTEM

The City of Buffalo has 27 lift stations throughout the City. The area of focus affects Lift Stations No. 1, 2, 3, and 4. Figure 1 shows a general location of the lift stations within the City and the service area for each lift station. Two of the twenty-seven lift stations (Lift Stations No. 3 & 4) currently pump directly to the wastewater treatment facility (WWTP). The other lift stations all pump to either Lift Stations No. 3 or 4 for subsequent pumping to the WWTP.

A. Lift Station No. 1

Lift Station No. 1 consists of a precast concrete wetwell with submersible pumps. It receives wastewater from the general area north of Buffalo Lake, west of Highway 25 and south of Highway 55. It was constructed in 1977 and converted to a submersible lift station in 2003. The lift station is located along the north side of Buffalo Lake along County Road 35 within the Buffalo Utility Campus property. Lift Station No. 1 pumps into Lift Station No. 2 through a six (6) inch cast iron forcemain constructed in 1977. The wastewater is pumped again by Lift Station No. 2 into Lift Station No. 3 and then pumped one more time by Lift Station No. 3 to the wastewater treatment plant. Lift Station No. 1 contains 50 HP Fairbanks Morse pumps designed to pump at 750 gallons per minute (gpm) at 160-ft of total dynamic head (TDH).

The lift station is in generally good condition with regards to controls, pumps and structures. The six inch forcemain is relatively small for the design flow of these pumps and requires relatively large pumps and motors to overcome the headloss of the forcemain. The forcemain has not experienced any breaks recently, however the forcemain material is cast iron from the 1970's which has a history of being susceptible to breaks.

B. Lift Station No. 2

Lift Station No. 2 also consists of a precast concrete wetwell with submersible pumps that was built and constructed in the same time frame as Lift Station No. 1. It receives wastewater from Lift Station No. 1 and the general area east of Buffalo Lake, east of Highway 25 and south of Highway 55. It discharges into a ten (10) inch cast iron forcemain that is routed into

Lift Station No. 3. The forcemain was constructed in 1977 and has had two breaks in the past five years. It appears the forcemain pipe is weak and susceptible to breaks. Lift Station No. 2 contains 60 HP pumps designed to pump at 1,200 gpm at 120-ft TDH.

The lift station structure was constructed in 1977 and modified in 2003 to include a new valve vault. The lift station is in generally good condition but is subject to surcharging during precipitation events.

C. Lift Station No. 3

Lift Station No. 3 was originally constructed in 1977 and consists of a concrete wetwell and a buried steel dry pit which contains the pumps and piping. It serves the area southeast of Buffalo Lake and west of Highway 25. It was originally designed with two 40 HP centrifugal Fairbanks Morse pumps. A larger 100-HP pump was added in 1999. The larger pump has a design capacity of 1,600 gpm at 140-ft TDH. The station pumps through a 14-inch DIP forcemain nearly 3 miles (14,972-ft) to the WWTP. The forcemain was constructed in 1977. The firm capacity of this station is 1,700-1,800 gpm.

The steel dry pit is 40-years old and is in fair to poor condition. A separate coatings inspection report for this structure is included in the appendix. The coatings are in poor condition and exhibit severe corrosion. The lift station is located adjacent to Buffalo Lake and has site limitations due to the adjacent lake and County Road 12. Groundwater is very high in the area making lift station reconstruction difficult.

D. Lift Station No. 4

Lift Station No. 4 is also a wetwell and steel dry pit style construction. It was originally constructed in 1995 with two (2) 125-HP pumps. In 2003 two (2) additional 125-HP pumps were added to the lift station. Each pump is designed to pump 2,700 gpm at 130-feet TDH. The system has two 14-inch forcemains which merge into one 18-inch main near Lift Station No. 3. The individual forcemains are 14-inch diameter PVC with a length of about 7,600-feet constructed in 1995. These forcemains then combine into one 18-inch diameter PVC line with a length of about 15,000-feet before discharging at the wastewater treatment facility. Two pumps are dedicated to each 14-inch main with normal design to have 1 pump on each main pumping. The static lift of the system is 44-feet. This lift station receives wastewater from one 24-inch diameter gravity sanitary sewer main servicing the entire area north of Highway 55 and the area between Highway 55 and Highway 25 south of 3rd St. S. Table 1 below presents the current pumping capacity of this station.

The steel dry pit coatings were recently inspected. A separate coatings inspection report for this structure is included in the appendix. The steel structure is in generally good condition with some minor spot coating repairs needed.

Table 1
Lift Station No. 4 Pumping Rates[1]
City of Buffalo, Minnesota

	Pumping Rate
1-Pump	2,500-2,700 gpm
2-Pumps (same 14-inch forcemain)	2,800-3,000 gpm
2-Pumps (separate 14-inch forcemain)	3,700-3,900 gpm[1]
4-Pumps	4,200-4,400 gpm
Design Capacity of Incoming 24-inch Gravity Sewer Line	3,500-4,000 gpm

[1]Station designed for 2-125-HP pumps at peak flows, with backup pump for each.

III. PROPOSED MODIFICATIONS

A. Lift Station No. 1

The lift station currently pumps to Lift Station No. 2 which pumps to Lift Station No. 3 then to the WWTP. Although Lift Station No. 1 is in good condition the forcemain is an older cast iron main which is hydraulically limiting. There are pumping limitations downstream also. Lift Station No. 2 surcharges during precipitation events and Lift Station No. 3 is in poor overall condition.

The lift station pumps approximately 1/2-mile through a 6-inch forcemain to Lift Station No. 2. The route has approximately 15-ft of static lift. It is proposed to replace the existing forcemain between Lift Station No. 1 and No. 2 and extend the new forcemain for Lift Station No. 1 past Lift Station No. 2 south along Highway 25 into Lift Station No. 4. This would re-route the flow into Lift Station No. 4 rather than into Lift Station No. 3. It would require approximately 7,700-ft of new 12-inch forcemain. The improvements will create a more energy efficient system by reducing the times the wastewater is pumped.

Utilizing the existing 6-inch main up to Lift Station No. 2 would require replacing the pumps with larger pumps. While the lift station structure could fit larger pumps, the controls and generator would require an upgrade. Replacing the 6-inch main and constructing a new 12-inch main to Lift Station No. 4 would significantly reduce friction loss due to the larger size and lower fluid velocity in the forcemain. This would offset the additional static head and allow the existing pumps, controls and generator to remain in place. The installation of a meter and meter manhole on the new forcemain near Lift Station No. 1 should be considered to assist operators in monitoring the flows with respect to maintaining a minimum cleansing velocity on the new larger forcemain.

A new forcemain would also provide additional capacity at this lift station above the current design capacity of 750 gpm. Ultimately, a 12-inch forcemain would be able to accommodate a future development area as shown in Figure 1 in the appendix. To accommodate this entire future development area, reconstruction of Lift Station No.1 would be required to substantially increase the size of the structure, pumps and controls in the future. Timing of the lift station reconstruction would be dependent upon the pace of new development in the Lift Station No. 1 service area. More minor interim improvements to the pumps and controls could be made to accommodate a portion of the future development area.

A proposed forcemain route is shown in Figure 2 in the appendix. A cost estimate of the forcemain improvements is presented below in Table 2.

Table 2 City of Buffalo Lift Station No. 1 Forcemain Improvements					
	Item	**Qty**	**Unit**	**Unit Price**	**Total**
1	Mobilization	1	LS	$30,000	$30,000
2	Connect To Existing Sanitary Sewer	2	EA	$10,000	$20,000
3	12" Sanitary Sewer Forcemain (Open Trench)	2600	LF	$60	$156,000
4	12" Sanitary Sewer Forcemain (Directional Drill)	5100	LF	$95	$484,500
5	Sanitary Maintenance Manhole, Des. 4020-72"	2	EA	$7,500	$15,000
6	Air Release Manhole	2	EA	$10,000	$20,000
7	Meter and Meter Manhole	1	EA	$25,000	$25,000
				Construction Subtotal:	**$750,500**
				Contingency:	$112,600
				Estimated Construction Cost:	$863,100
				Engineering, Construction Inspection, Testing, Legal and Administration Costs:	$215,775
				Estimated Total Project Cost:	**$1,078,875**

B. Lift Station No. 2

Lift Station No. 2 currently pumps through a 10-inch forcemain approximately 2 miles into Lift Station No. 3. It is proposed to reroute this forcemain into Lift Station No. 4. The new route would be reduced to approximately 1-mile of 8-inch forcemain. The existing pumps, controls and generator could continue to be used for this application.

The service area for Lift Station No. 2 requires approximately 450 gpm of pumping capacity. The removal of flows from Lift Station No. 1 from this station will result in excess pumping capacity which would allow for future growth or potentially downsizing pumps in the future to save on pumping costs.

The proposed forcemain route is shown in Figure 3 in the appendix. A cost estimate of the forcemain improvements is presented in Table 3 below.

Table 3 City of Buffalo Lift Station No. 2 Forcemain Improvements					
	Item	**Qty**	**Unit**	**Unit Price**	**Total**
1	Mobilization	1	LS	$20,000	$20,000
2	Connect To Existing Sanitary Sewer	2	EA	$10,000	$20,000
3	8" Sanitary Sewer Forcemain (Open Trench)	2600	LF	$45	$117,000
4	8" Sanitary Sewer Forcemain (Directional Drill)	2200	LF	$65	$143,000
5	Sanitary Maintenance Manhole, Des. 4020-72"	2	EA	$7,500	$15,000
6	Air Release Manhole	1	EA	$10,000	$10,000
				Construction Subtotal:	**$325,000**
				Contingency:	$48,800
				Estimated Construction Cost:	$373,800
				Engineering, Construction Inspection, Testing, Legal and Administration Costs:	$93,450
				Estimated Total Project Cost:	**$467,250**

C. Lift Station No. 3

Lift Station No. 3 will receive significantly lower flows with the proposed forcemain modifications of Lift Stations No. 1 and 2. There are a variety of alternatives available for this lift station. A summary of the alternatives are:

1. Install new pumps in the concrete wetwell, abandon the steel dry pit and
    a. Continue utilizing the existing 14-inch forcemain to the WWTP (Recommended Option)

       OR

    b. Install a new forcemain into Lift Station No. 4 (Long Term Option)
2. Complete relocation of Lift Station No. 3

Each of these options are discussed in further detail below:

1. Install new pumps in the concrete wetwell (Recommended Option)

   This option would abandon the steel dry pit and install two submersible pumps in the existing concrete wetwell. This structure is approximately 6-ft by 10-ft and would fit the size pumps required for this alternative. The wetwell cover would be replaced with a new cover and new access hatches. After the pumps and associated equipment is removed, the existing dry pit would be filled with sand and abandoned in-place.

   A new valve vault would be required to house the check valves and isolation valves for the submersible pumps. The pumps will be smaller than the existing pumps. The control system and variable frequency drives would need to be modified to operate this system with the new pumps. The generator would be of sufficient size with no changes

required. The design pumping rate would be 900 gpm to maintain scouring velocity in the existing 14-inch forcemain. The service area requires approximately 600 gpm of peak pumping capacity. The existing 14-inch forcemain from Lift Station No. 3 to the WWTP would be utilized until such time that this forcemain requires replacement due to condition of the pipe.

A cost estimate for this option is included in Table 4 below.

Table 4
City of Buffalo Lift Station No. 3
Cost Estimate
Convert Wetwell to Submersible Lift Station

	Item	Cost
1	MBI	$30,000
2	Site Work	$50,000
3	New Submersible Pumps	$60,000
4	Valve Vault and Piping	$55,000
5	Meter and Meter Vault	$25,000
6	Demolition of Existing Structures	$20,000
7	Bypass Pumping and Piping	$80,000
8	Electrical and Controls	$75,000
9	Modify Cover and Clean Existing Wetwell	$20,000
	Construction Subtotal	**$415,000**
	Contingency	$60,000
	Engineering, Construction Inspection, Testing, Legal And Administration Costs	$100,000
	Estimated Total Project Cost	**$575,000**

b) Install a New Forcemain to Lift Station No. 4 to Replace the Existing 14-inch Forcemain to the WWTP (Long Term Option)

Lift Station No. 3 currently pumps through a 14-inch forcemain to the WWTP. This forcemain is 40 years old and in average condition. At the time that this forcemain requires replacement, one option to consider rather than replace nearly 15,000 feet of this main to the WWTP, is to re-route this forcemain to Lift Station No. 4. This route will be shorter and less costly than a complete forcemain replacement to the WWTP. An 8-inch forcemain would be able to serve the reduced flow demands of this lift station. The existing 14-inch main from Lift Station No. 4 could also potentially be utilized in reverse service. These options could be utilized with either the existing pumps or with new submersible pumps in the wetwell. If this option is selected, further analysis will be required on Lift Station No. 4 to determine if the forcemains from Lift Station No. 4 to the WWTP will require an upgrade prior to re-routing flows from Lift Station No. 3 to Lift Station No. 4. Additionally, further upgrades to Lift Station No. 4 may be required to accommodate the additional flows from Lift Station No. 3. It is recommended that another comprehensive review of the sanitary sewer system be completed at that time.

2. Relocate Lift Station

Lift Station No. 3 is located on the shore of Buffalo Lake and in a relatively tight footprint. Any major underground modifications of this site will be difficult due to

groundwater levels and changes in construction permitting and erosion control. Alternate sites have been reviewed for this reason. Most of this area has been developed and make construction of this deep lift station more difficult and costly. Therefore it is recommended the existing wetwell and site be used as long as feasible as alternate locations will be a significant cost.

D. Lift Station No. 4

Lift Station No. 4 would see increased flows with the addition of Lift Station No. 1, Lift Station No. 2 and potentially Lift Station No. 3 in the future. The proposed Lift Station No. 4 design flows are presented below in Table 5

Table 5
City of Buffalo Lift Station No. 4
Proposed Lift Station Design Flows

Flow to LS 4 from:	Flow Rate	Unit
Existing 24-inch Sewer Line	4,000	gpm
Lift Station No. 1	750	gpm
Lift Station No. 2	750	gpm
Future Allowance	750	gpm
Total Design Flow	6,250	gpm

The existing capacity of Lift Station No. 4 is about 3,800 gpm. Due to the increased flows from Lift Station No. 1 and Lift Station No. 2, the design capacity of Lift Station No. 4 must be increased. Proposed options to increase the pumping capacity include:

1. New 18-inch forcemain from Lift Station No. 4 to the existing 18-inch forcemain near Lift Station No. 3 (Recommended Option – Phase 1)
2. New 18-inch forcemain from Lift Station No. 4 to the WWTP routed along Highway 25 (Recommended Option – Phase 2)
3. New Lift Station No. 4 wetwell, pumps and forcemain

<u>Options to increase Lift Station No. 4 pumping capacity:</u>

1. New forcemain from Lift Station No. 4 to the existing 18-inch forcemain near Lift Station No. 3 (Recommended Option – Phase 1)

   This phased approach would maximize use of the City's existing infrastructure by utilizing the existing forcemain, but add a new forcemain between Lift Station No. 4 and the existing 18-inch forcemain near Lift Station No. 3. Assuming Lift Station No. 1 and Lift Station No. 2 are rerouted to Lift Station No. 4, Lift Station No. 4 will need more capacity to handle these increased flows, while Lift Station No. 3 will see significantly lower flows. A new 18-inch forcemain is proposed to be constructed from Lift Station No. 4 towards Lift Station No. 3. The existing 14-inch forcemains from Lift Station No. 4 towards Lift Station No. 3 would also remain in use. All three forcemains coming from Lift Station No. 4 would pump towards Lift Station No. 3 and connect to the existing 18-inch and 14-inch forcemains that run to the WWTP.

   Lift Station No. 3 is currently dedicated to the 14-inch forcemain. With the reduced flows expected at Lift Station No. 3 after both Lift Station No. 1 and Lift Station No. 2 are rerouted to Lift Station No. 4, the 14-inch main is oversized for the flows that Lift Station No. 3 would require. It is proposed that Lift Station No. 3 and No. 4 share the forcemains back to the WWTP. This will require slightly higher head pumps to allow

them to share forcemains, but will allow the system to meet forcemain capacity with limited new piping. The new system would have approximately 5,000 gpm capacity, or around 7.2 million gallons per day. This is relatively similar to the current system's overall design capacity but moves a higher share of this flow to Lift Station No. 4.

It should be noted that this option limits the additional future development area for the Lift Station No. 1 and Lift Station No. 4 service area until Phase 2 is completed as noted below. However, when additional capacity of the system is required then the City could proceed with Phase 2, constructing a new forcemain along Highway 25 from Lift Station No. 4 to the WWTP to increase system capacity.

Figure 4 shows the proposed route of the new forcemain segment. The forcemain size would be 18-inch allowing it to be utilized well into the future, even after Lift Station No. 3 is re-routed into Lift Station No. 4 and the existing 14-inch DIP forcemain from Lift Station No. 3 to the WWTP along CSAH 12 is abandoned (as discussed in paragraph III.C.1.b above). This option capitalizes on the existing 18-inch PVC forcemain from Lift Station No. 3 to the WWTP along CSAH 12 which has a significant amount of remaining useful life and can remain in operation well into the future with this plan. This will eliminate the need for a dual 18-inch forcemain along TH 25 from Lift Station No. 4 to the WWTP. Table 6 below includes costs for this option.

Table 6
City of Buffalo Lift Station No. 4
New Forcemain to Lift Station 3

	ITEM	QTY	UNIT	UNIT PRICE	TOTAL
1	Mobilization	1	LS	$54,000	$54,000
2	Connect To Existing Sanitary Sewer	1	EA	$10,000	$10,000
3	18"Sanitary Sewer Forcemain (Directional Drill)	3350	LF	$180	$603,000
4	Sanitary Maintenance Manhole, Des. 4020-72"	1	EA	$7,500	$7,500
5	Air Release Manhole	1	EA	$10,000	$10,000
6	15' Permanent Easement	1.15	AC	$30,000	$34,500
	Subtotal (Along TH 25 From LS 4 To 17th St.):				**$719,000**
1	Mobilization	1	LS	$25,000	$25,000
2	Connect To Existing Sanitary Sewer	1	EA	$10,000	$10,000
3	18" Sanitary Sewer Forcemain (Directional Drill)	5800	LF	$100	$1,044,000
4	Sanitary Maintenance Manhole, Des. 4020-72"	2	EA	$7,500	$15,000
5	Air Release Manhole	2	EA	$10,000	$20,000
	Subtotal (Along 17th St. from TH 25 To LS 3):				**$1,114,000**
	Contingency (15%):				$275,000
	Estimated Construction Cost:				$2,108,000
	Engineering, Construction Administraton, Testing, Legal And Administration Costs (25%):				$527,000
	Estimated Total Project Cost:				**$2,635,000**

2. New Forcemain Routed along Highway 25 to WWTP (Recommended Option–Phase 2)

Lift Station No. 4 currently pumps with a combination of 14-inch and 18-inch forcemains. These are hydraulically limiting at the proposed increased design pumping rates. As described in Phase 1 above, the addition of an 18-inch forcemain from Lift Station No. 4 to Lift Station No. 3 in Phase 1 increases the total system pumping capacity to about 5,000 gpm. At the time that additional system capacity is required or when the existing 14-inch DIP forcemain along CSAH 12 between Lift Station No. 3 and the WWTP needs to be removed from service due to pipe condition, an additional 18-inch forcemain from Lift Station No. 4 to the WWTP will be required. The route of this forcemain is proposed to run south along Highway 25 as shown in Figure 5. This route will be less expensive and easier to maintain than installing a new forcemain along the same route as the existing dual 14-inch and 18-inch forcemains.

An additional single 18-inch forcemain is proposed and will result in a peak pumping rate of 6,250 gpm with both mains from Phase 1 and Phase 2 in use. The dual main allows for 2 pumps to be dedicated to each main. This allows the pumps to more easily achieve and maintain 2 feet per second scouring velocity, and allows redundancy in case of a main break. The existing pumps are able to achieve this pumping rate as the larger pipe reduces friction loss. An option for a single 24-inch main was also reviewed. A 24-inch main would potentially work but would not offer the redundancy or safety factor of the dual mains and would not maximize in place infrastructure.

The existing forcemains would be recommended to be kept in place as an emergency bypass if ever needed.

This is a long-term solution for the City. Table 7 presents the estimated costs of this option.

Table 7
City of Buffalo Lift Station No. 4
New Forcemain Routed Along Highway 25 to WWTP

	ITEM	QTY	UNIT	UNIT PRICE	TOTAL
1	Mobilization	1	LS	$79,000	$79,000
2	Connect To Existing Sanitary Sewer	2	EA	$10,000	$20,000
3	18"Sanitary Sewer Forcemain (Directional Drill)	24,000	LF	$180	$4,320,000
4	Sanitary Maintenance Manhole, Des. 4020-72"	6	EA	$7,500	$45,000
5	Air Release Manhole	7	EA	$10,000	$70,000
6	90 Degree Bend Maintenance Structure	2	EA	$7,500	$15,000
7	15' Permanent Easement	7.7	AC	$30,000	$231,000
				Subtotal:	**4,780,000**
				Contingency:	$717,000
				Estimated Construction Cost:	$5,497,000
				Engineering, Construction Inspection, Testing, Legal And Administration Costs:	$1,374,250
				Estimated Total Project Cost:	**$6,871,250**

3. New Lift Station Wetwell, Pumps and Forcemain

This option would replace the existing wetwell and steel dry pit with a new cast-in-place concrete wetwell and dry pit style lift station. The proposed location would be adjacent to the existing lift station to allow an easier connection to the existing collection system. Due to the depth and size of the structure, a significant area would be needed for excavation and work area.

The new structure would be sized with a larger wetwell and space for larger pumps to increase capacity in the future as needed. This option should be considered in conjunction with Option 2 (Phase 2) for the new forcemain construction along Highway 25 to the WWTP. This would allow redirecting flow from Lift Station No. 3 to Lift Station No. 4 and eventual abandonment of the old 14-inch forcemain route along County Road 12 from Lift Station No. 3 to the WWTP. However, it should be noted that the WWTP will become hydraulically limiting and may require additional capacity upgrades for peak flows over approximately 8.5 mgd.

The project will require significant right-of-way procurement and costs will be largely affected by the final design and layout. For budgeting purposes, the current cost of this type of lift station is about $3.5-4.5 million for the lift station structure with additional cost for the forcemain and right-of-way acquisition. A detailed project cost estimate will be prepared when this phase of the project proceeds.

IV. SUMMARY

There are several items within the City of Buffalo's sanitary sewer system that should be addressed within the next several years. The steel dry pit at Lift Station No. 3 is in poor condition and requires replacement. The forcemain from Lift Station No. 2 to Lift Station No. 3 has experienced two breaks in the past five years and is showing signs of weakness. The capacity of Lift Station No. 2 is inadequate during large rain events.

To address the above noted deficiencies, the proposed Trunk Highway 25 improvements scheduled for 2022 provides a great opportunity to complete sanitary sewer improvements concurrently with the Trunk Highway 25 improvements, saving costs and minimizing construction impacts. Numerous options for upgrading the lift stations, forcemains and pumping systems to address these issues have been analyzed and discussed in this report.

The recommendations are based on an approach to maximize the use of the City's existing infrastructure to the fullest extent possible, minimize long term operation and maintenance costs, minimize construction costs up front, and maximize the return on investment. To accomplish these goals, a phased approach is recommended. The list of recommended improvements in order of priority are shown in the following Table 8.

Table 8 Recommended Improvements				
Order of Priority	**Project Description**	**Estimated Construction Year**	**Project Cost (2017 Price)**	**Project Cost w/ Inflationary Factor**
1.A	New Forcemain from LS 4 to Existing 18-inch Forcemain by LS 3	2021	$2,635,000	$2,951,000
1.B	New Forcemain from LS 1 to LS 4	2022 (Concurrent with TH 25 Improvements)	$1,078,000	$1,240,000
1.C	New Forcemain from LS 2 to LS 4	2022 (Concurrent with TH 25 Improvements)	$467,250	$537,000
2	Convert LS 3 to Submersible Lift Station	2022/2023	$575,000	$661,000
Subtotal Phase 1 Lift Station Improvements:			**$4,755,250**	**$5,389,000**
3	Replace LS 4 with New LS Next to Existing LS 4	TBD - Based on development needs, condition of LS 4, or condition of forcemain from LS 3 to WWTP	$4,500,000 +	TBD
4	New Forcemain from LS 4 to WWTP	TBD - Based on development needs, condition of LS 4, or condition of forcemain from LS 3 to WWTP	$6,871,250	TBD
5	Redirect Flow from LS 3 to LS 4 & Abandon Existing Forcemain from LS 3 to WWTP	TBD - Based on condition of forcemain from LS 3 to WWTP	TBD	TBD

*Note: Inflationary factor of 3% per year was used where indicated

From an engineering perspective, the proposed improvements are feasible, cost effective and necessary. The City and its financial consultant should determine the economic feasibility of the proposed improvements.

APPENDICES

Buffalo
CITY OF BUFFALO, MINNESOTA

Lift Stations 1, 2, 3, 4 Locations & Service Areas

City of Buffalo, Wright County

Figure 1
May, 2017

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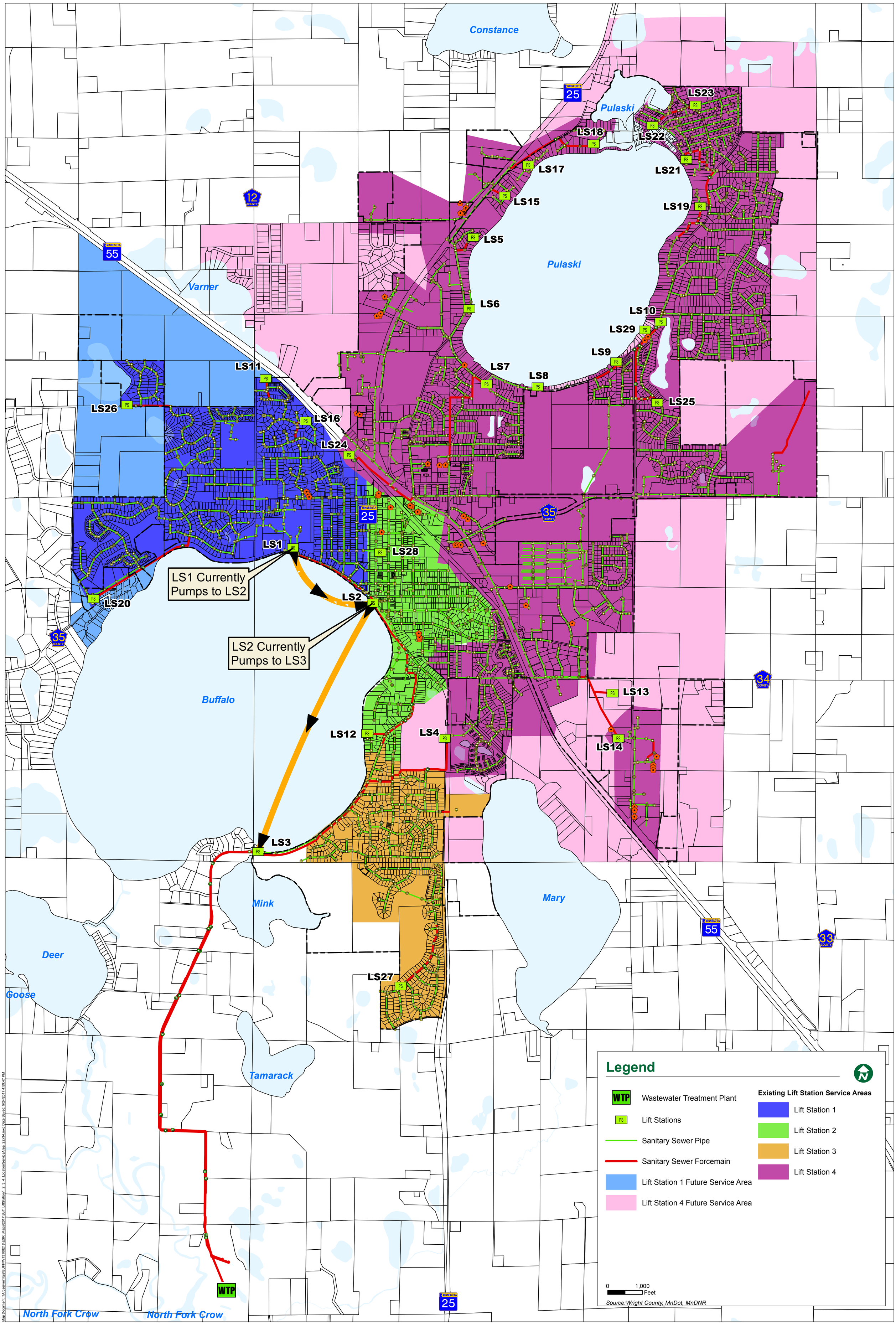

Legend

- WTP — Wastewater Treatment Plant
- PS — Lift Stations
- Sanitary Sewer Pipe
- Sanitary Sewer Forcemain
- Lift Station 1 Future Service Area
- Lift Station 4 Future Service Area

Existing Lift Station Service Areas

- Lift Station 1
- Lift Station 2
- Lift Station 3
- Lift Station 4

0 1,000 Feet

Source:Wright County, MnDot, MnDNR

Map Document: \\Arcserver1\gis\BUFFW1310821\ESRI\Maps\2017Buff_LiftStation1_2_3_4_LocationServiceArea_22x34.mxd Date Saved: 5/24/2017 4:59:47 PM

Sanitary Sewer Proposed Forcemain - LS No. 1 to LS No.4

City Of Buffalo, Wright County

Figure 2

May, 2017

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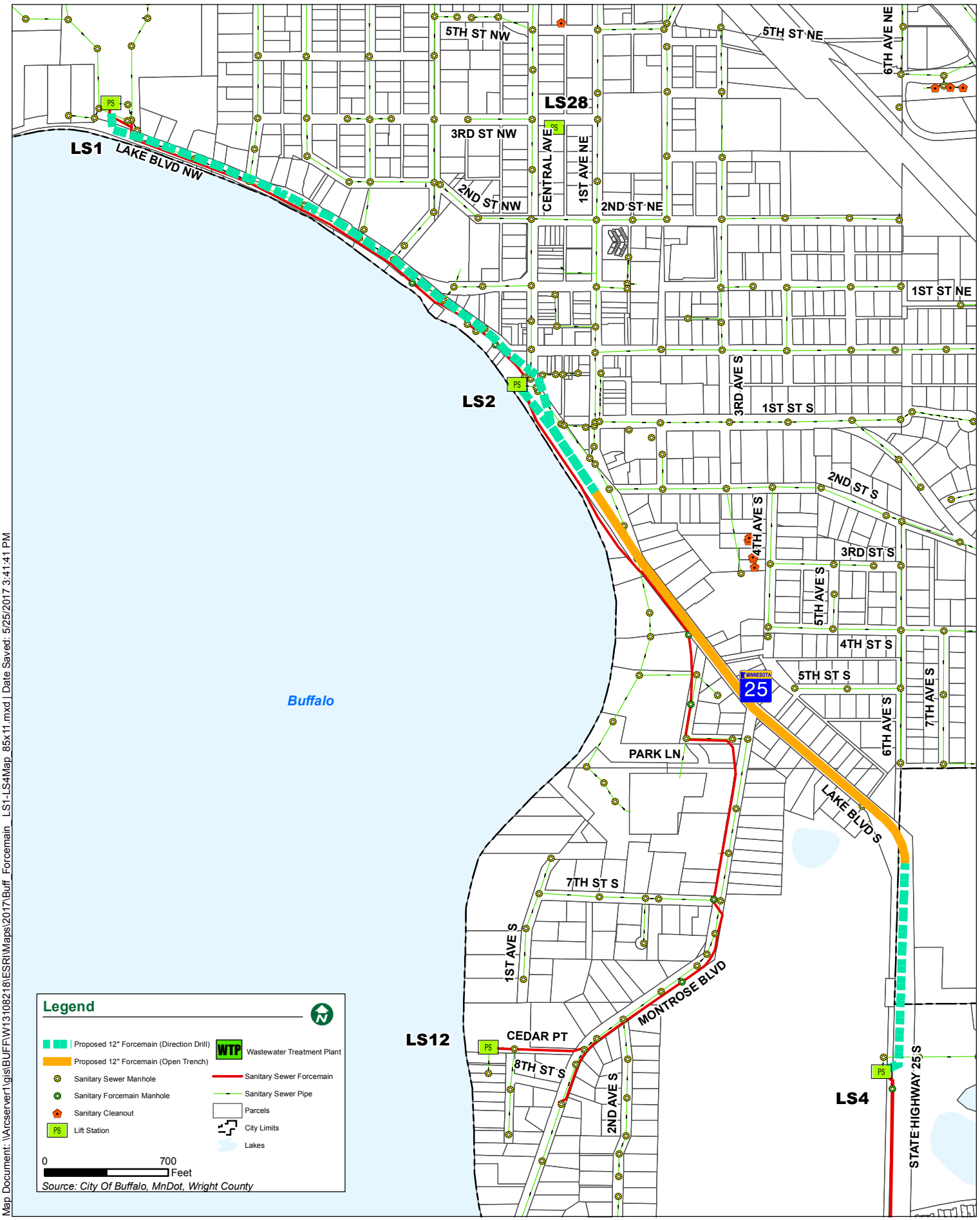

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Sanitary Sewer Proposed Forcemain - LS No. 2 to LS No. 4

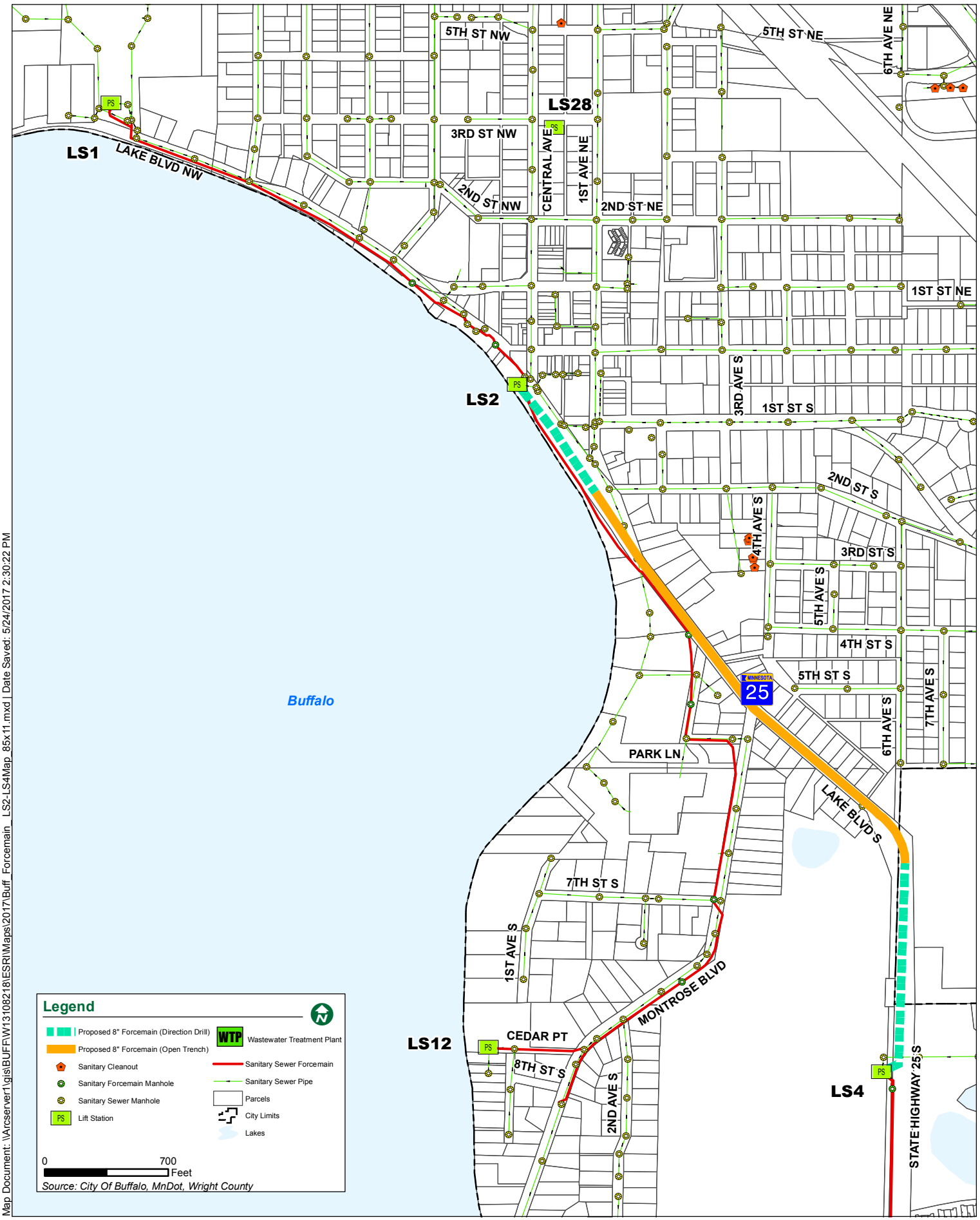
City Of Buffalo, Wright County

Figure 3

May, 2017

BOLTON & MENK

Real People. Real Solutions.



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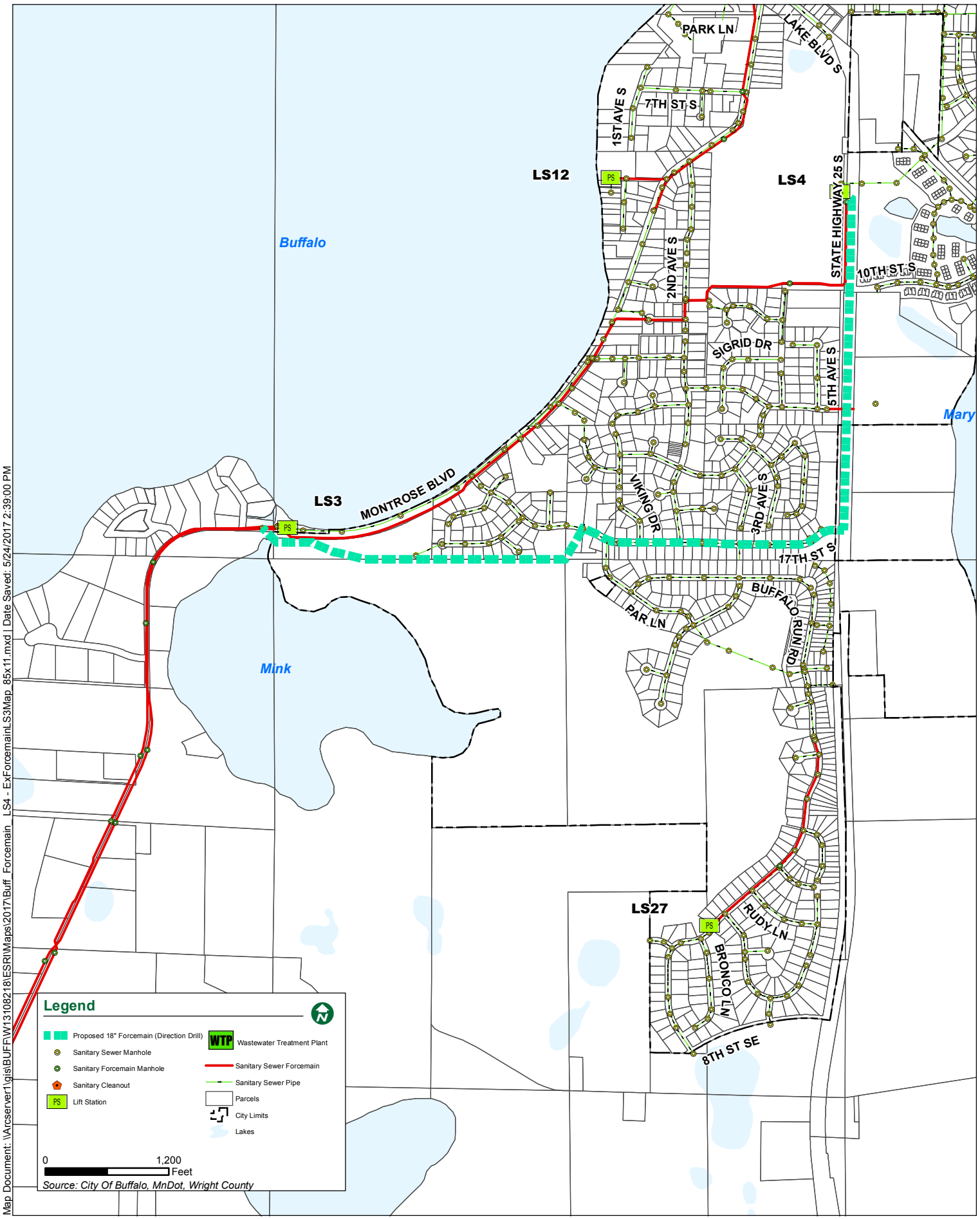
Sanitary Sewer Proposed Forcemain - LS No. 4 to Ex Forcemain by LS No.3

Figure 4

City Of Buffalo, Wright County

May, 2017

BOLTON & MENK
Real People. Real Solutions.



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Sanitary Sewer Proposed Forcemain - LS No. 4 to WWTP

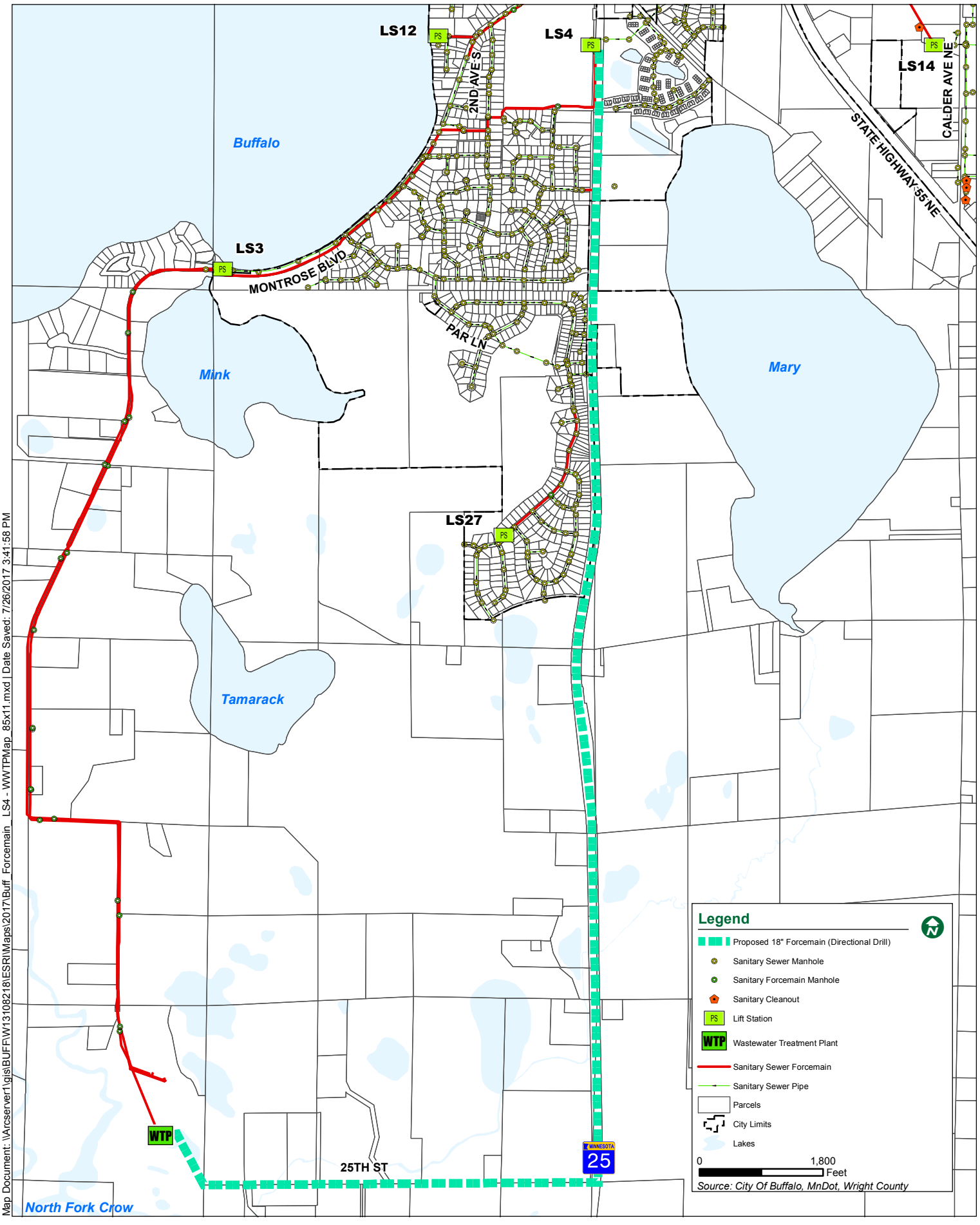
City Of Buffalo, Wright County

Figure 5

July, 2017

BOLTON & MENK

Real People. Real Solutions.



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Lift Stations No. 3 and No. 4 Coatings and Structure Evaluation Report

BOLTON & MENK

Real People. Real Solutions.

April 1, 2017

Preliminary Engineering Inspection and Evaluation

Lift Stations #3 and #4

City of Buffalo, Minnesota

Project No. W13.108218

Submitted by:
Bolton & Menk, Inc.
2040 Highway 12 East
Willmar, MN 56201-5818
P: 320-231-3956
F: 320-231-9710

Preliminary Engineering Inspection and Evaluation Report

for the

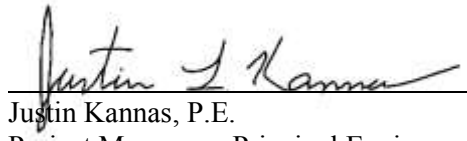
Lift Stations #3 and #4

in the

City of Buffalo, Minnesota

Project Number W13.108218

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By: 

Justin Kannas, P.E.
Project Manager – Principal Engineer
License No. 45055

Date: April 1, 2017

TABLE OF CONTENTS

A. INTRODUCTION

An inspection and evaluation was performed on lift stations #3 and #4, both located in Buffalo, Minnesota. The inspection and evaluation was performed on January 12, 2016 as a follow up to the similar type evaluation with report provided in February 2012. The areas observed were below the ground level at approximately 30 feet depth. The lift stations were in operation during the time of observations.

B. INSPECTION METHODS

A visual inspection and evaluation was performed on the interior portion of the lift stations. The inspections performed gathered steel wall thickness measurements and general observations of the interior protective coating conditions.

An ultrasonic thickness gauge was used to determine the steel shell wall, floor, and ceiling wall thicknesses. Steel thicknesses readings were achieved through both the existing protective coating and on bare steel substrate. Some of the readings may vary slightly due to rough surfaces (interior and exterior), corrosion, and thick coatings. However, the differences should be minimal and should not affect the type of data to be collected when compared to the data collected in February of 2012.

The previous inspection report from February 2012 was provided for reading comparison.

C. EVALUATION SUMMARY LIFT STATION #3

Steel Thicknesses: The ultrasonic thickness readings taken in Lift Station #3 were recorded (in red) next to the original readings taken and recorded on the February 2012 report. This report is attached. The readings varied slightly by approximately .010" to .030" in thickness. A portion of this difference in thickness could have been variations due to the surface condition as described above and/or uneven surfaces on the opposite side caused by external corrosion. From the data received during the inspection, there appears to be a very minimal loss (approximately .020") due to corrosion since the original evaluation in 2012.

General Coating Observations (#3): The protective coatings are in fair to poor condition. The floor is in poor condition and exhibits severe corrosion with complete coating failure in several areas. The walls and ceiling are in fair to poor condition with

areas of visible corrosion. The access pipe coating is in fair to poor condition. See attached photos for current visual coating appearance conditions.

D. EVALUATION SUMMARY LIFT STATION #4

Steel Thicknesses: The ultrasonic thickness readings taken in Lift Station #4 were also recorded next to the original readings taken and recorded in the February 2012 report. Again, the readings appeared to have varied slightly in thickness due to surface conditions. From the data received during the inspection, there appears to be a very minimal loss (approximately .015" - .020") due to corrosion since the original evaluation in 2012.

General Coating Observations (#4): The protective coatings are in fair condition; however, there are a few small spots of coating failure. These areas (approximately three) are all at the intersection where the shell wall meets the floor. One area presents a very minor but active "through wall" leak. The floor, wall, and ceiling are all in fair condition. The coatings on the piping, pumps, and valves are in fair condition. There are a few coating failures on the piping/equipment. See attached photos for present visual coating appearance conditions.

E. RECOMMENDATIONS

Interior Wet: Based on the information provided from the 2012 evaluation report and in comparison with the results of the present (2016) ultrasonic thickness measurement evaluation of the steel wall, it appears evident by the differences that there is minimal steel wall section loss. This applies to both the #3 and #4 lift stations. It is recommended that the steel wall be monitored at regular intervals for visual appearance and ultrasonic measurement for determining further section loss. There is one area (#1) in **Lift Station #4** that presents a through wall leak. It is recommended that this area be repaired by welding, or be covered by welding a steel plate over the leak.

The protective coatings on the interior of **Lift Station #3** are in fair to poor condition. It is recommended that these protective coatings be completely removed and replaced.

The protective coatings on the interior of **Lift Station #4** are in fair condition; however, there are a few small areas of coating failure. It is recommended that these areas exhibiting coating failure receive coating spot repair at the time of weld repair.

F. SUMMARY

Given the results from the ultrasonic thickness measurements, it is recommended that the steel wall thicknesses be monitored and compared every 3-5 years.

Given the overall coating conditions and the amount of corrosion of the interior of the lift stations, it is recommended that **Lift Station #3** receive a coating rehabilitation in the next 1-2 years or that plans be made to completely replace the lift station steel can structure in the near future.

Additionally, it is recommended that the active leak and coating spot repairs in **Lift Station #4** be performed in the next 1-2 years. Both rehabilitation projects could be performed simultaneously.

Inspection and Report Performed By:

James R. Connor
NACE Certified Coatings Inspector #33440
AWS Certified Welding Inspector #92110161
Bolton & Menk, Inc.

Report Reviewed By:

Justin Kannas, P.E.
Project Manager – Principal Engineer
License No. 45055
Bolton & Menk, Inc.

Photograph #: 1
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: Site view of Lift Station #3

Photograph #: 2
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of piping, valves, pump, etc.…and shell wall and floor

Photograph #: 3
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of piping, valves, pump, etc.…and shell wall and floor

Photograph #: 4
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of pipe and shell wall

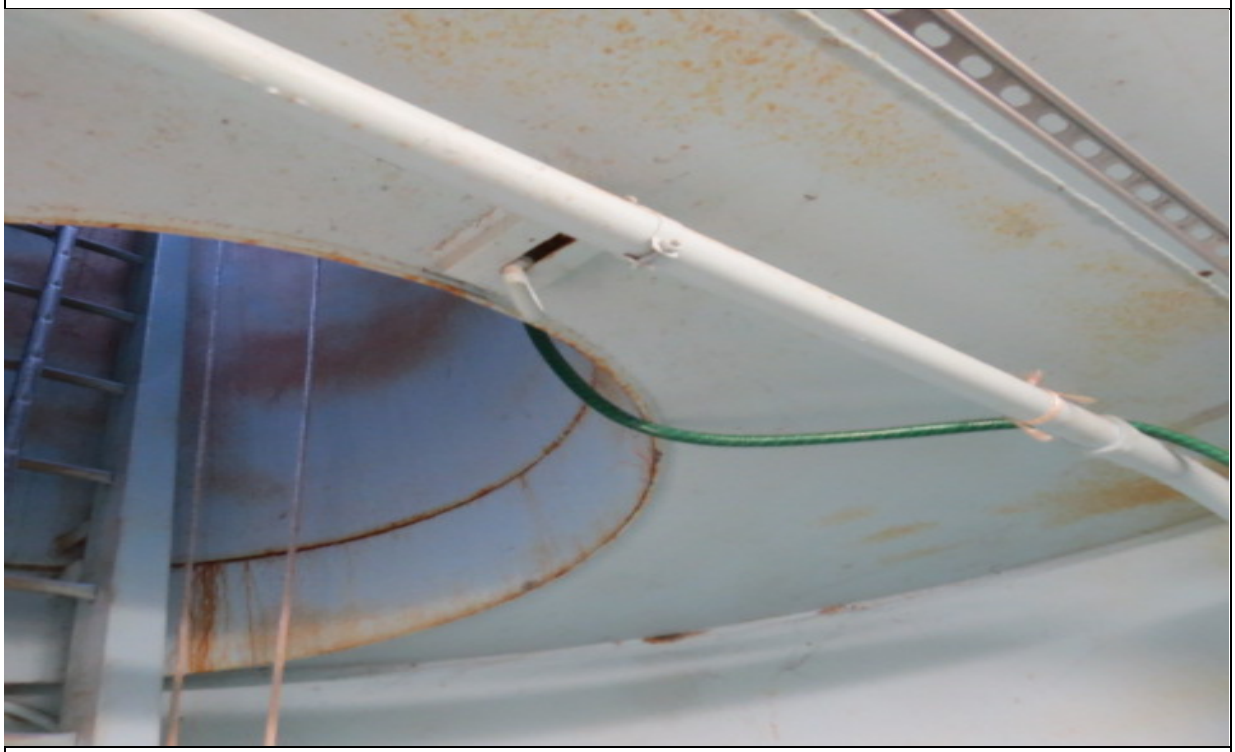
Photograph #: 5
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of piping and shell wall and floor

Photograph #: 6
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of sump pump

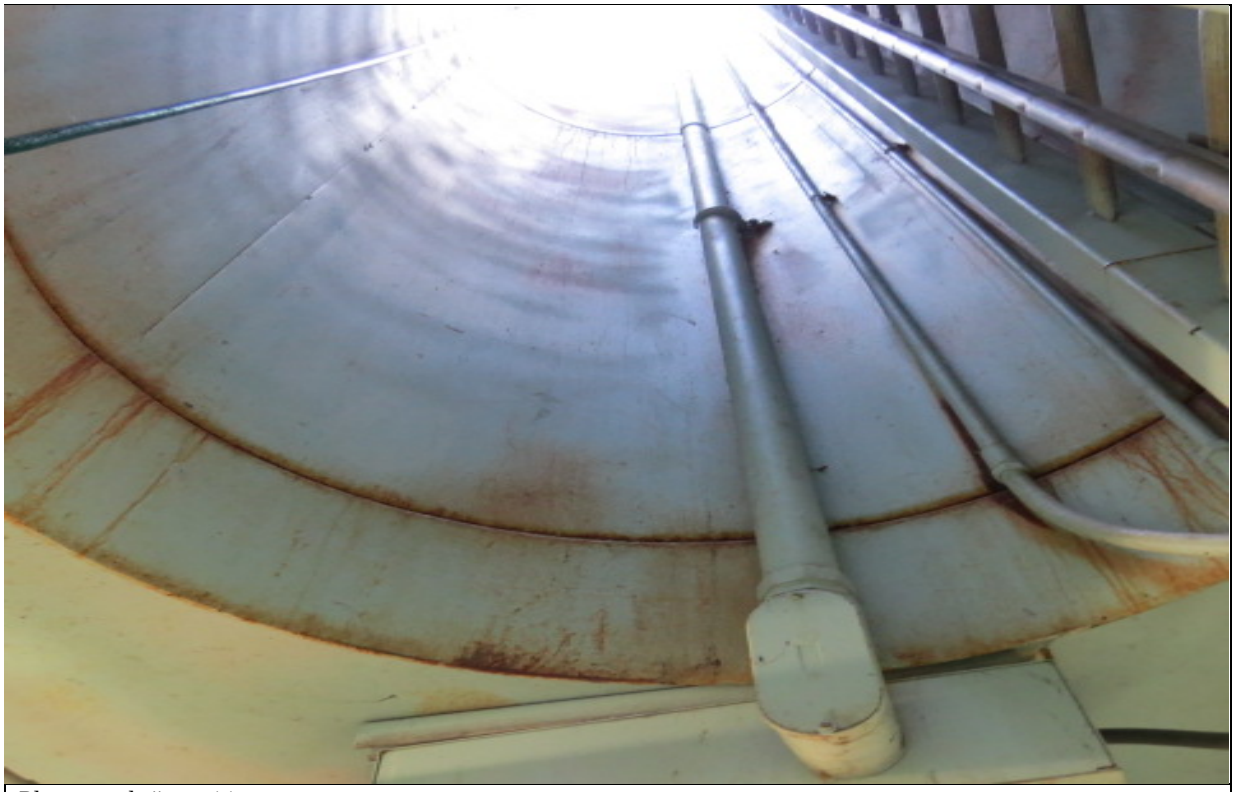
Photograph #: 7
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: Close up view of chamber floor corrosion

Photograph #: 8
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of pipe at ceiling

Photograph #: 9
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of chamber ceiling



Photograph #: 10
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of chamber ceiling



Photograph #: 11
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of access pipe from chamber (below)

Photograph #: 12
Date: January 12, 2016 – Lift Station #3 (Buffalo, MN)
Subject: View of access pipe and ladder from chamber (below)

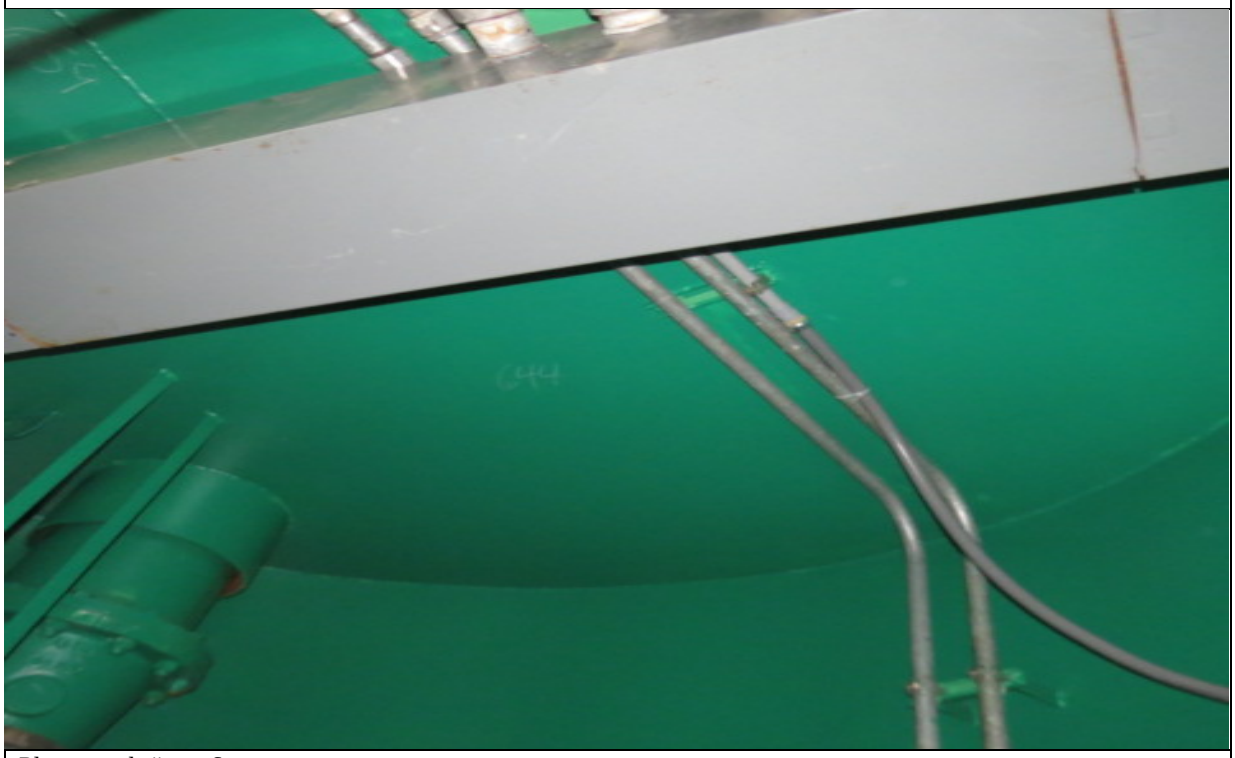
Photograph #: 1
Date: March 29, 2016 – Lift Station #4 (Buffalo, MN)
Subject: Site view of Lift Station #4

Photograph #: 2
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of ceiling, walls, equipment, piping, pumps, etc… in chamber.

Photograph #: 3
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of floor, walls, equipment, piping, pumps, etc… in chamber.

Photograph #: 4
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of chamber area at dehumidifier (possible leak #3)

Photograph #: 5
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of floor area in chamber



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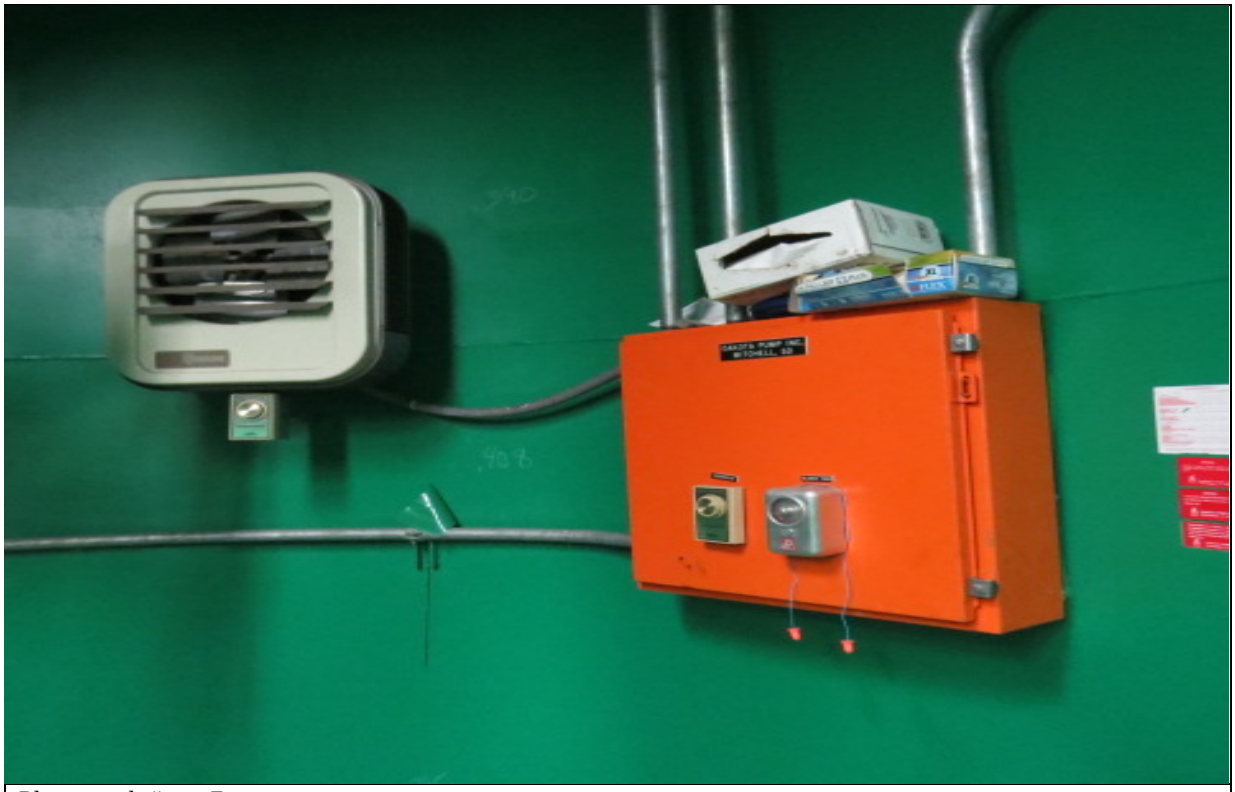
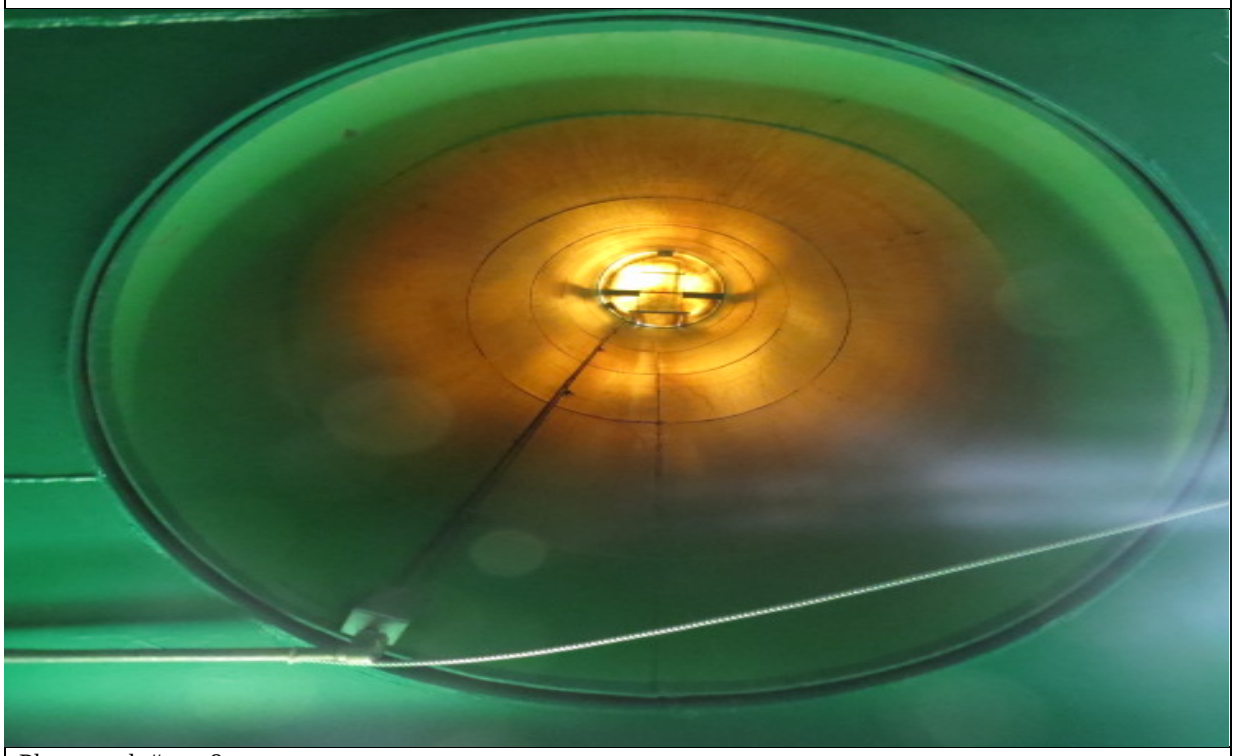
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of ceiling area in chamber



Photograph #: 7
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of heater and electrical box in chamber



Photograph #: 8
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of secondary/alternate access tube

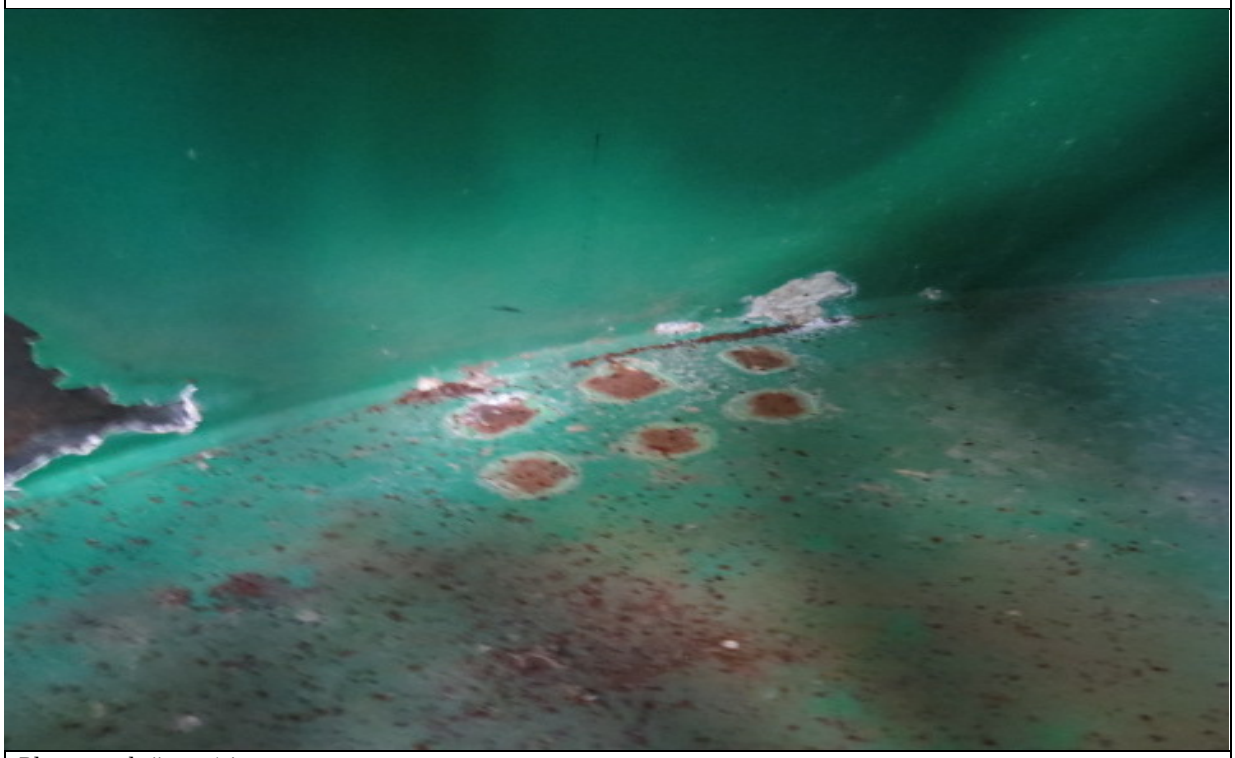
Photograph #: 9
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of access tube and ladder

Photograph #: 10
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: Area of leak #1 (note: evidence of active leak)

Photograph #: 11
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: Close up of active leak #1

Photograph #: 12
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View at area of “possible “ leak #2

Photograph #: 13
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: Close up view of “possible “ leak #2



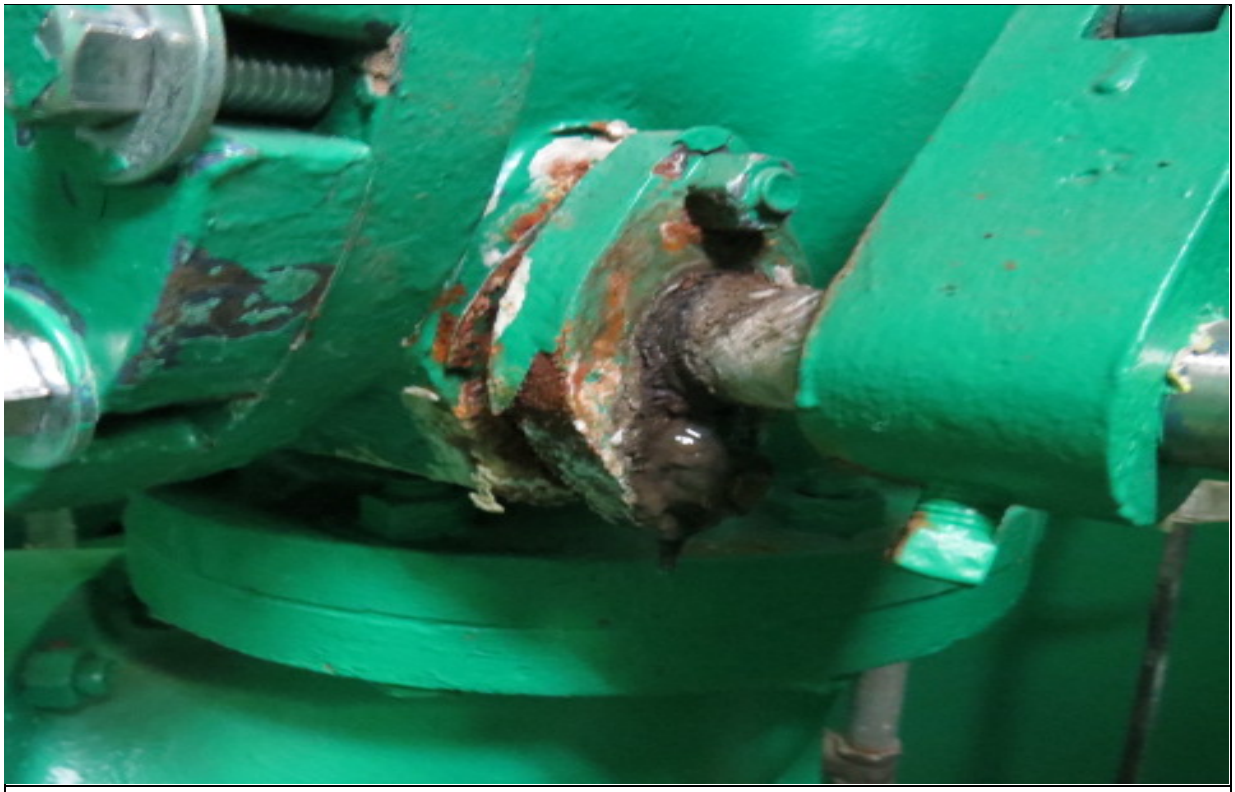
Photograph #: 14
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: Close up view of “possible “ leak #2

Photograph #: 15
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View at area of “possible “ leak #3

Photograph #: 16
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of sump pump

Photograph #: 17
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of sump pump

Photograph #: 18
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of sump pump and leaking valve



Photograph #: 19
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: Close up view of leaking valve

Photograph #: 20
Date: January 12, 2016 – Lift Station #4 (Buffalo, MN)
Subject: View of chamber ceiling and walls near access pipe

DFNTS
Rev 3/04

BRAUN INTERTEC

Daily Field Notes

Project No.: BL-12-00844

Report No.: LIFT STATIONS 3 & 4

Location: BUFFALO, MN

Date: 2/21/12 & 1/12/16

Personnel	Classification	Regular Hours	Overtime Hours
BRYCE HANSON			
JAMES CONNOR			

Areas and work performed this day: ULTRASONIC THICKNESS INSPECTION

AN ULTRASONIC THICKNESS INSPECTION WAS PERFORMED ON THE "PUMP ROOM" VESSELS AT LIFT STATIONS #3 AND #4 LOCATED IN BUFFALO, MN.

ATTACHED WITH THIS REPORT YOU WILL FIND THE VESSEL "PART" SKETCH FOR EACH LIFT STATION. EACH VESSEL PART (TOP, FLOOR, WALLS) WILL ALSO CONTAIN THE THICKNESS READING TAKEN.

SOME OF THE READINGS MAY BE THICKER DUE TO IRREGULAR SURFACE, CORROSION, OR DUE TO PAINT THICKNESS. WHEN POSSIBLE; THE LOOSE COATING AND/OR CORROSION "RUST WAS SCRAPED TO GET THE BEST POSSIBLE SURFACE CONDITION.

NOTE: THERE WERE 3 AREAS IN THE VESSEL AT LS 4 THAT APPEARED TO HAVE HAD LEAKS AT THE FLOOR TO WALL WELD SEAM AREA. ONE OF THESE AREAS HAD AN "ACTIVE" LEAK AT THE TIME OF INSPECTION.

Weather: _____

Performed By: _____

Submitted To: _____

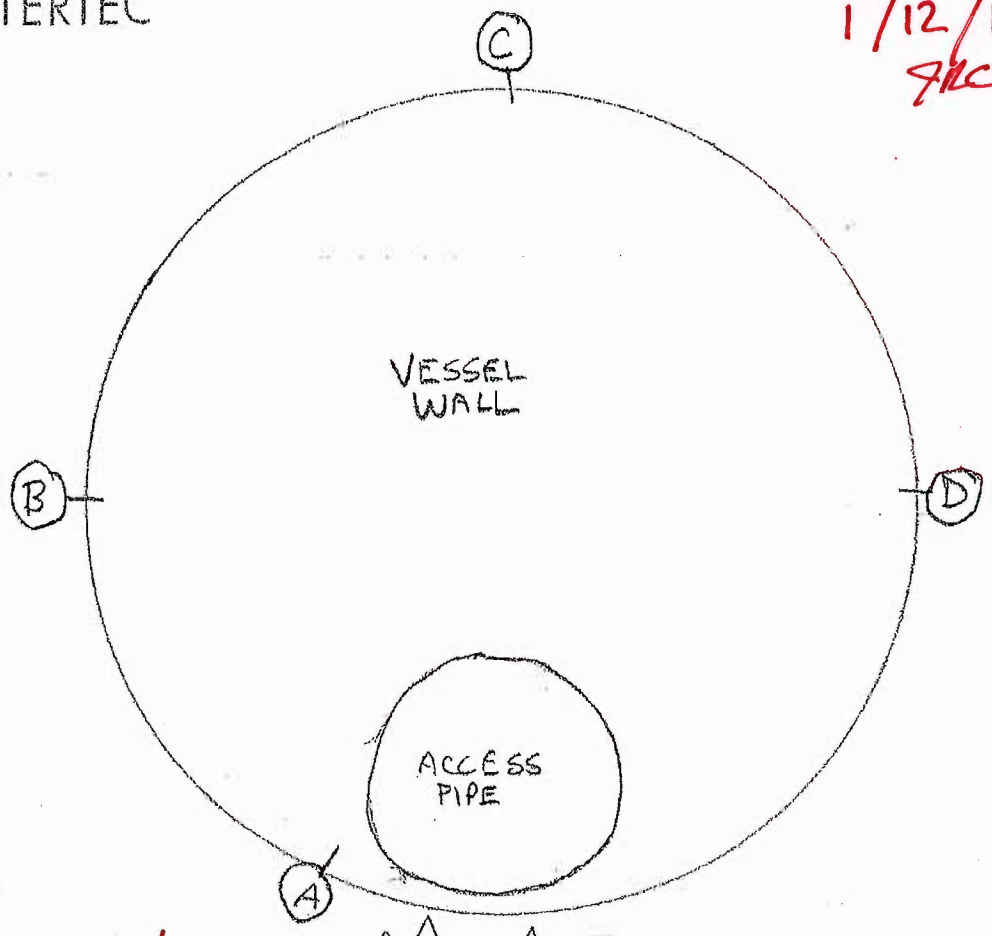
White copy to Braun Intertec file. Blue copy to Project Site Representative.

BRAUN
INTERTEC

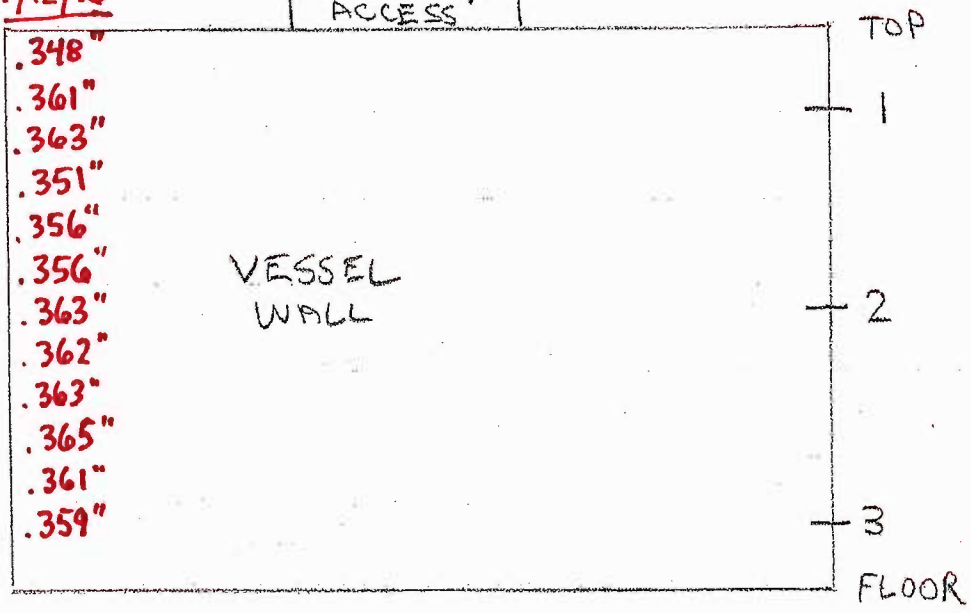
LS 3

2/21/12
BUFFALO, MN
SRC

1/12/16
SRC



	2012	1/12/16
1-	.384"	.348"
2-	.380"	.361"
3-	.377	.363"
1-	.377	.351"
2-	.366	.356"
3-	.358	.356"
1-	.371	.363"
2-	.372	.362"
3-	.378	.363"
1-	.378	.365"
2-	.375	.361"
3-	.391	.359"

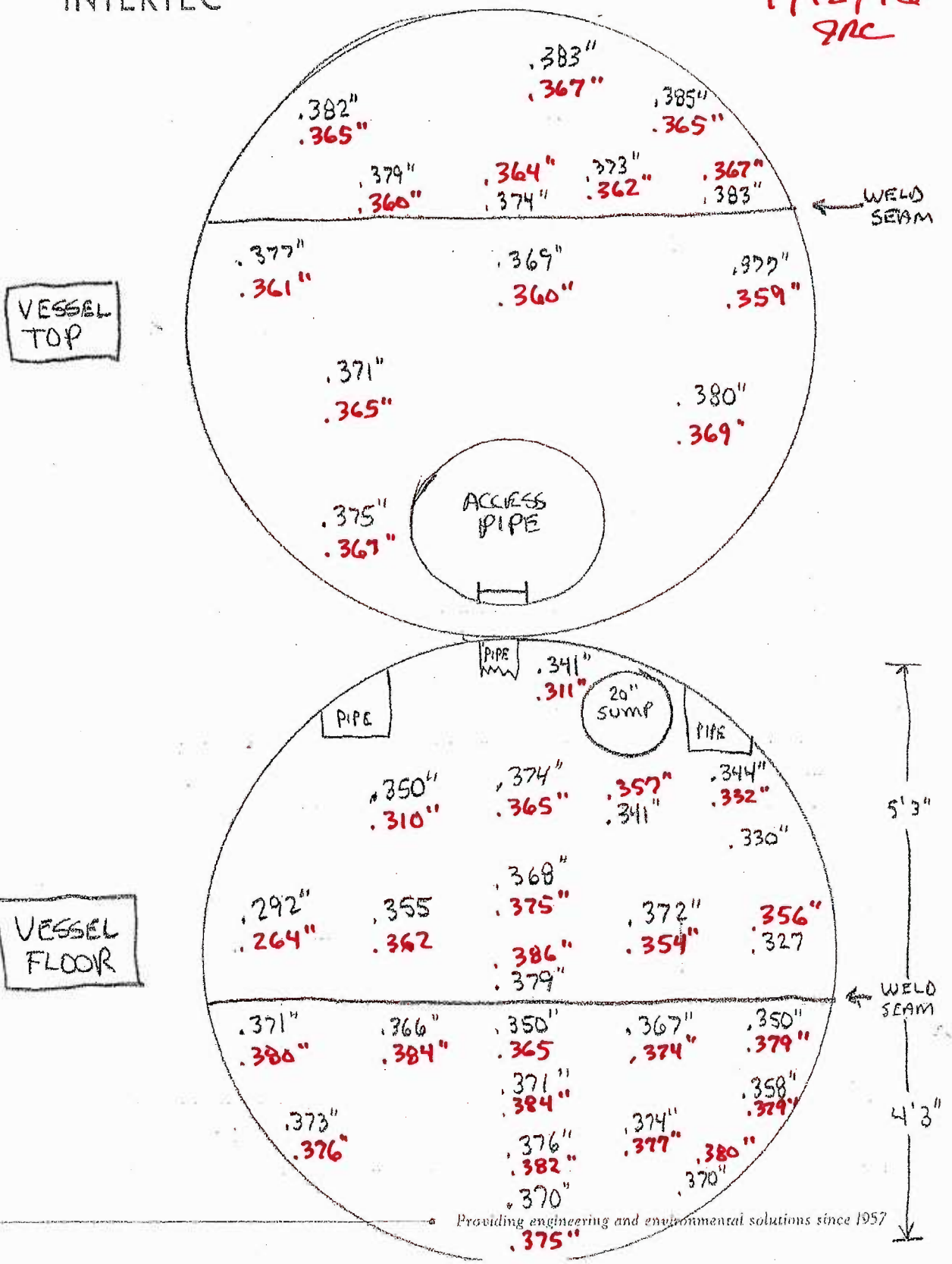


BRAUN
INTERTEC

LS 3

2/21/12
BUFFALO, MN
JRC

1/12/16
JRC

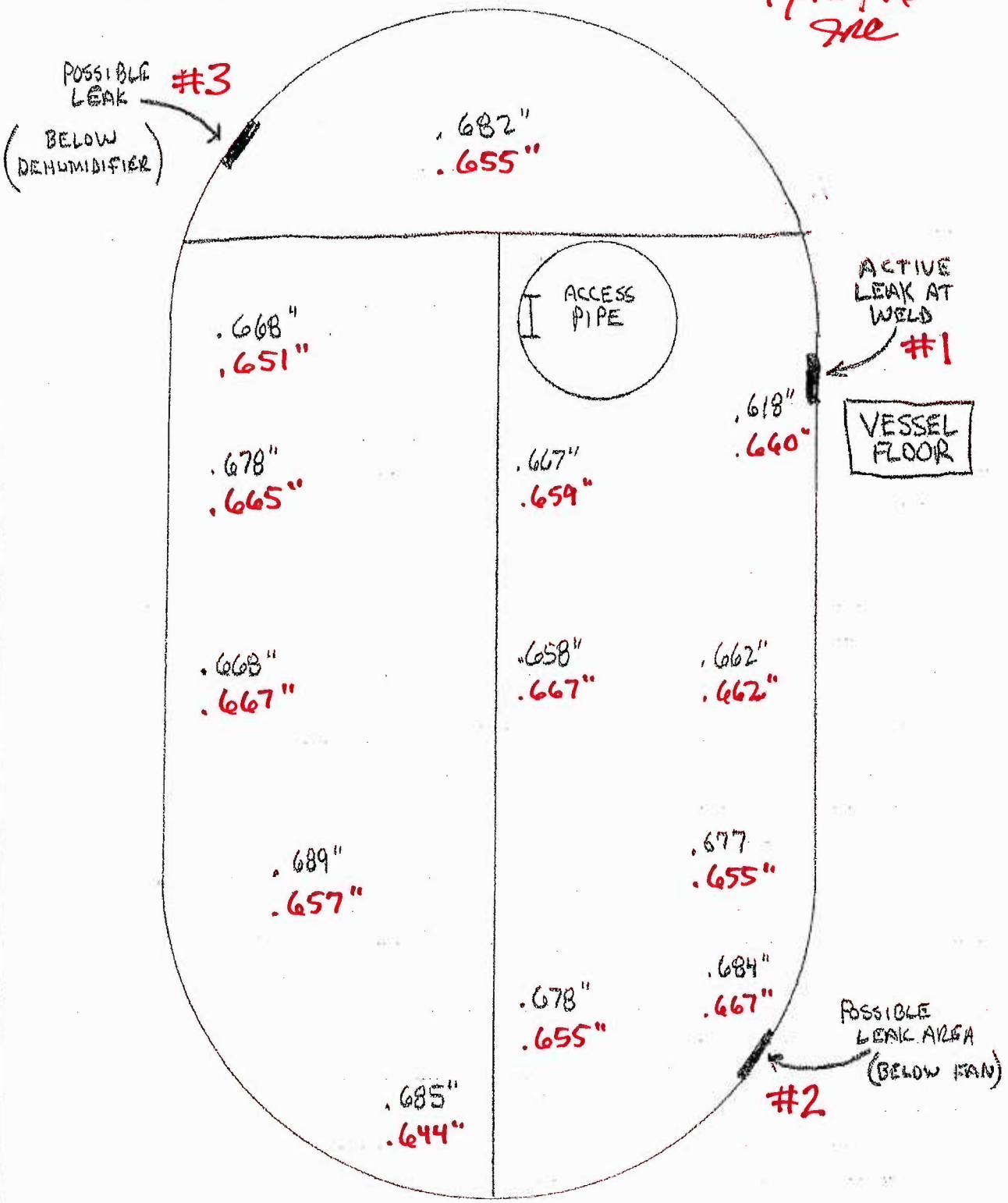


BRAUN
INTERTEC

LS 4

2/21/12
BUFFALO, MN
SRC

1/12/16
SRC

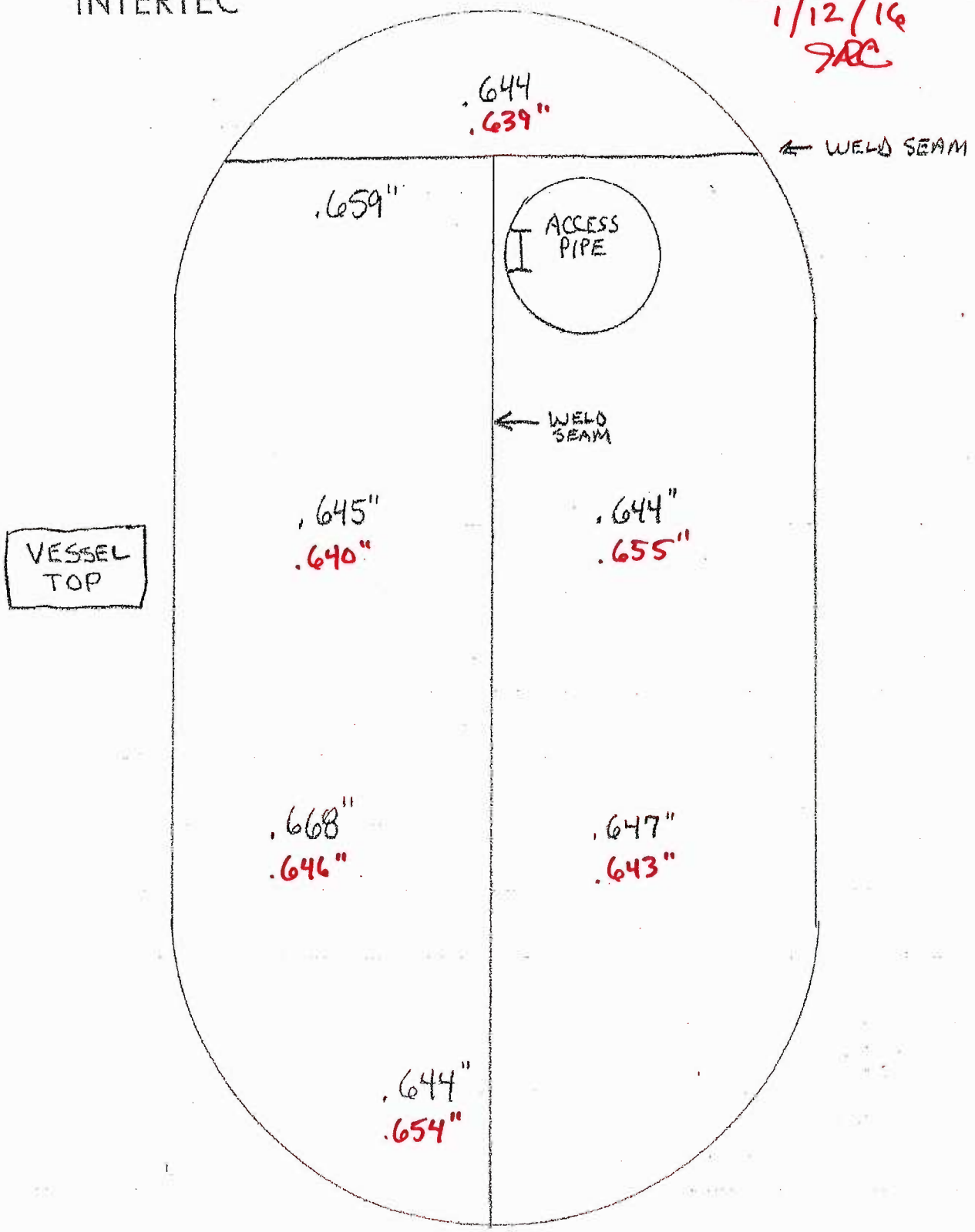


BRAUN
INTERTEC

LS 4

2/21/12
BUFFALO, MN
SRC

1/12/16
SRC

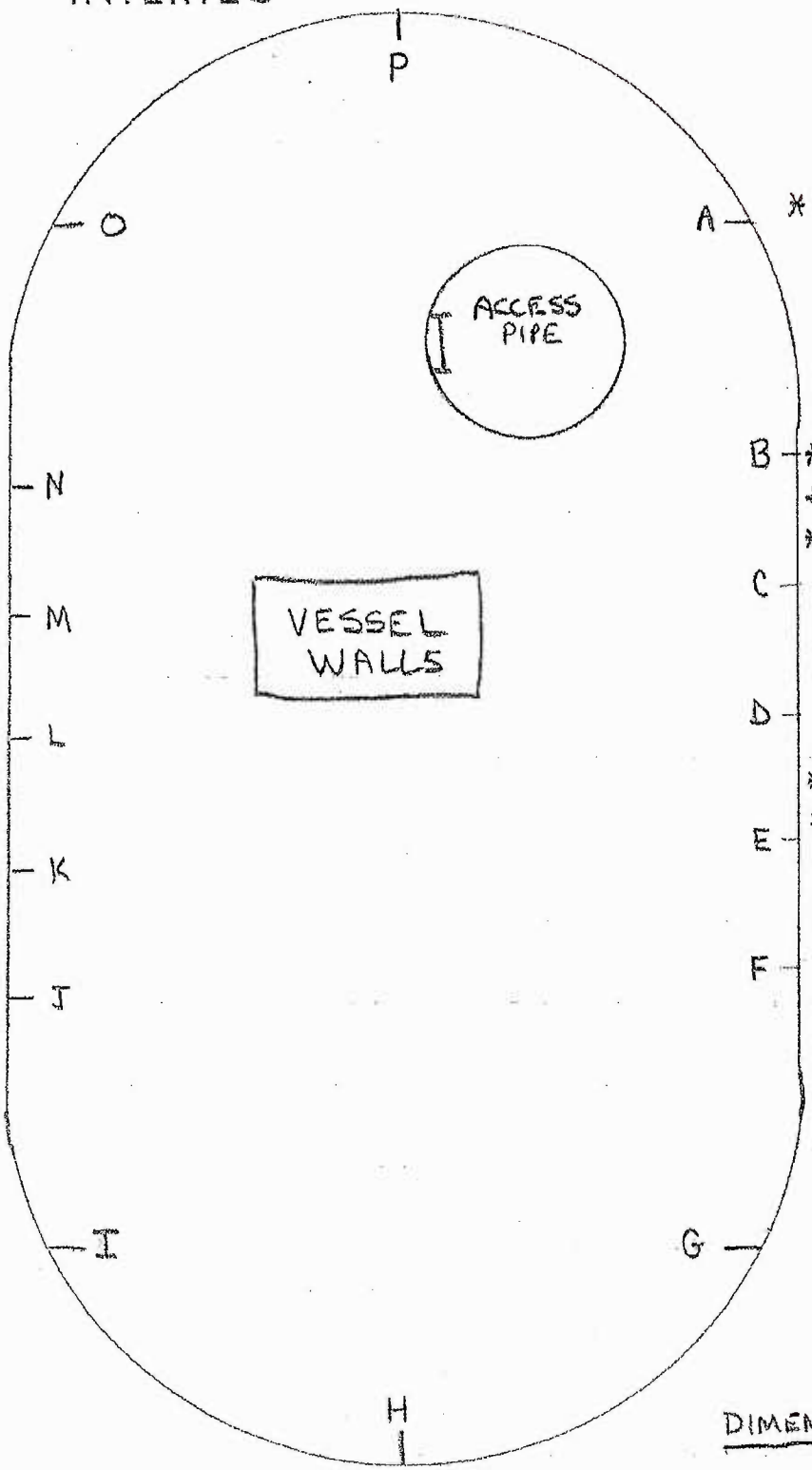


BRAUN
INTERTEC

LS4

2/21/12
BUFFALO, MN
QRC

1/12/16
QRC



(ALL READINGS IN INCHES)

		BOTTOM	MID	TOP	
*	A	.401"	.402"	.399 .401"	.400 .403"
	B	.665"	.655	.667 .658	.659 .659
	C	.672	.651	.670 .658"	.654 .642
	D	.654	.647	.657 .648	.656 .649
	E	.664	.653	.662 .649	.669 .652
	F	.672	.661	.654 .642	.654 .642
*	G	.388	.390	.381 .383	.389 .397
*	H	.379	.385	.394 .382	.379 .381
*	I	.388	.380	.396 .387	.403 .397
	J	.659	.647	.660 .649	.665 .642
	K	.644	.638	.638 .631	.636 .628
	L	.655	.646	.660 .653	.647 .634
	M	.653	.645	.663 .655	.651 .640
	N	.648	.631	.659 .653	.638 .638
*	O	.385	.391	.409 .399	.406 .403
*	P	.395	.402	.408 .406	.390 .393

* LOCATIONS ON VESSEL HEAD. APPEARS TO HAVE THICKNESS TRANSITION

DIMENSIONS ARE 11' X 35'