RESOLUTION NO. 23-01

RESOLUTION TO ADVERTISE FOR BID TO REPLACE BOWSER STREET PUMP STATION

WHEREAS, the Bowser Street Pump Station in the City of Monticello is in need of replacement;

WHEREAS, cost estimates from McClelland Consulting Engineering, Inc. to replacement the entire pump station with new enclosures will cost $155,160.00 for pump cost, accessories, installation and engineering; and

WHEREAS, such project requires competitive bidding.

IT IS, THEREFORE, by the City Council of Monticello, Arkansas resolved as follows:

1. That the City advertise for bids for the completion of said project consistent with plans and specifications prepared or approved by McClelland Consulting Engineering, Inc.

ADOPTED on this 24th day of January, 2023.

Mayor

City Clerk

BOWSER ROAD PUMP STATION

Monticello Wastewater Treatment Plant-**West**
NPDES Permit Number AR0021822

Prepared for:

City of Monticello
203 West Gaines St
Monticello AR 71655

CERTIFICATE OF AUTH. McCLELLAND CONSULTING ENGINEERS No. 24 ARKANSAS-ENGINEER

STATE OF ARKANSAS LICENSED PROFESSIONAL ENGINEER No.17543 CHID H. KWELLE

12-13-2022

McClelland Consulting Engineers, Inc
7302 Kanis Rd
Little Rock AR 72204

December 9, 2022

Project Number 22-5782

MCE McCLELLAND CONSULTING ENGINEERS, INC.

MONTICELLO

BOWSER ROAD PUMP STATION

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MCE McCLELLAND CONSULTING ENGINEERS, INC.
DESIGNED TO SERVE

MONTICELLO

BOWSER ROAD PUMP STATION

Monticello Wastewater Treatment Plant - West

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1.0 BACKGROUND

The Bowser Road Lift Station is located behind 584 Bowser Road near some residential homes in the northwest city of Monticello. Record drawings and other relevant documented information were unavailable. Thus, it was difficult to ascertain the age of the lift station. In an attempt to unravel the age of the station, an employee of the city of Monticello (Monticello) used its length of service for the city of Monticello to estimate the lifespan of the lift station. Based on this approach, it was suggested the lift station was about or over 25 years. This was unsatisfactory given the outlook of the lift station.

As a result, the lift station was further probed. It was then determined that the lift station was built in 1974 indicating the station is approaching 50 years old. At the time it was designed and built, the total dynamic head (TDH) was 30 ft at a capacity of 75 gallons per minute (gpm) for each pump premised on the data garnered. It appears there had been some form of modification in the past to the lift station because of the significant differences observed between the depth of the 1974 wet well and the current wet well depth, coupled with substantial changes in the site elevations. However, the time of modification and the modification type are not entirely clear due to the lack of appropriate information. The locations of the lift station and the receiving manhole are shown in Figure 1.

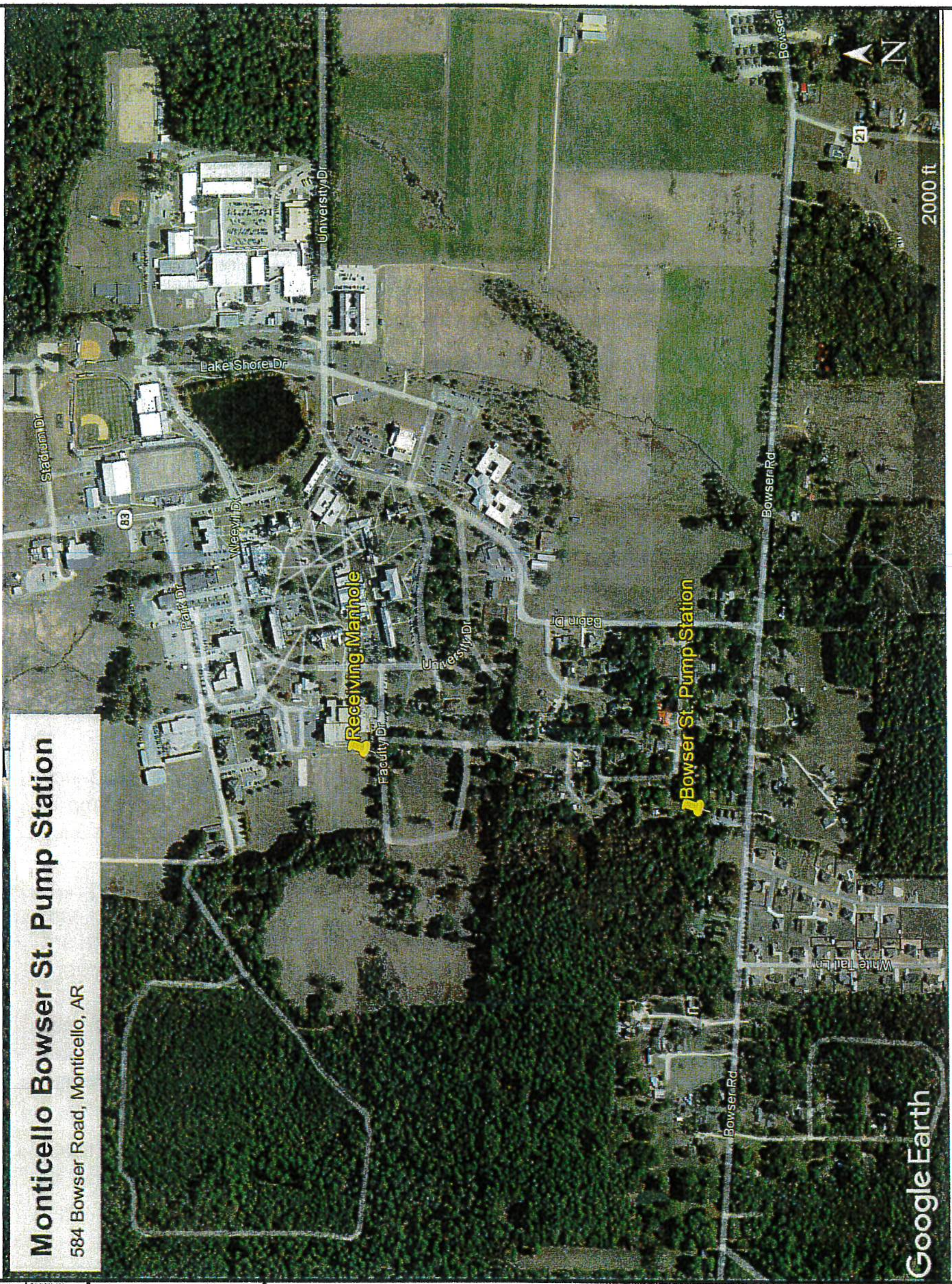
2.0 LIFT STATION AND CAPACITY

This section will give a brief description of the existing lift station and the wet well.

2.1 Lift Station

The lift station comprises two radial vane pumps and are surface mounted with 3-inch suction lines immersed in the raw wastewater of the wet well. This type of pump is characterized with low flows and low efficiencies. As the flow gets higher, the efficiency tends to become relatively better. The surface mounted pumps are housed in fiberglass enclosure directly above the wet well. That is, the pump equipment is completely above grade, and effectively isolated from the wet well. The pumps are operated in parallel; one pump serves as redundancy. The pumps are connected by a 3-way plug valve, and are self-priming pumps. They are 3-in pumps. Other elements of the station include check valves and elbows. Both pumps have air release lines with valves mounted independently in horizontal positions. The self-priming centrifugal pumps are manufactured by Gorman-Rupp, and are Super T Series capable of handling wastewater solids. The self-priming centrifugal pumps are v-belt looped over pulleys driven by electric motors.

The wet well is approximately a 5-foot inside diameter circular well that has floats indicating pump off and on positions. The bottom of the wet well is sloped. Figures 2 to 4 shows lift station and wet well.



W:\2022\22-5782 Monticello West - Bowser Street Pump Station\Design Drawings\Civil\22-5782- 8 X11 2-5.dwg, PRINTED ON: December 9, 2022 @ 8:36 AM

DESIGNED BY: CK	DRAWN BY: BRIN SR	THE LOCATIONS OF THE LIFT STATION AND MANHOLE	BOWER ROAD LIFT STATION MONTICELLO, ARKANSAS	MCE McCLELLAND CONSULTING ENGINEERS, INC. DESIGNED TO SERVE 7302 KANIS ROAD LITTLE ROCK, ARKANSAS 77204 (501) 371-0272 HTTP://WWW.MCE.US.COM
DATE: 12-08-2022	REVISION:			
SCALE: N.T.S.	JOB NUMBER: 22-5782			
FIG 1			©2022	

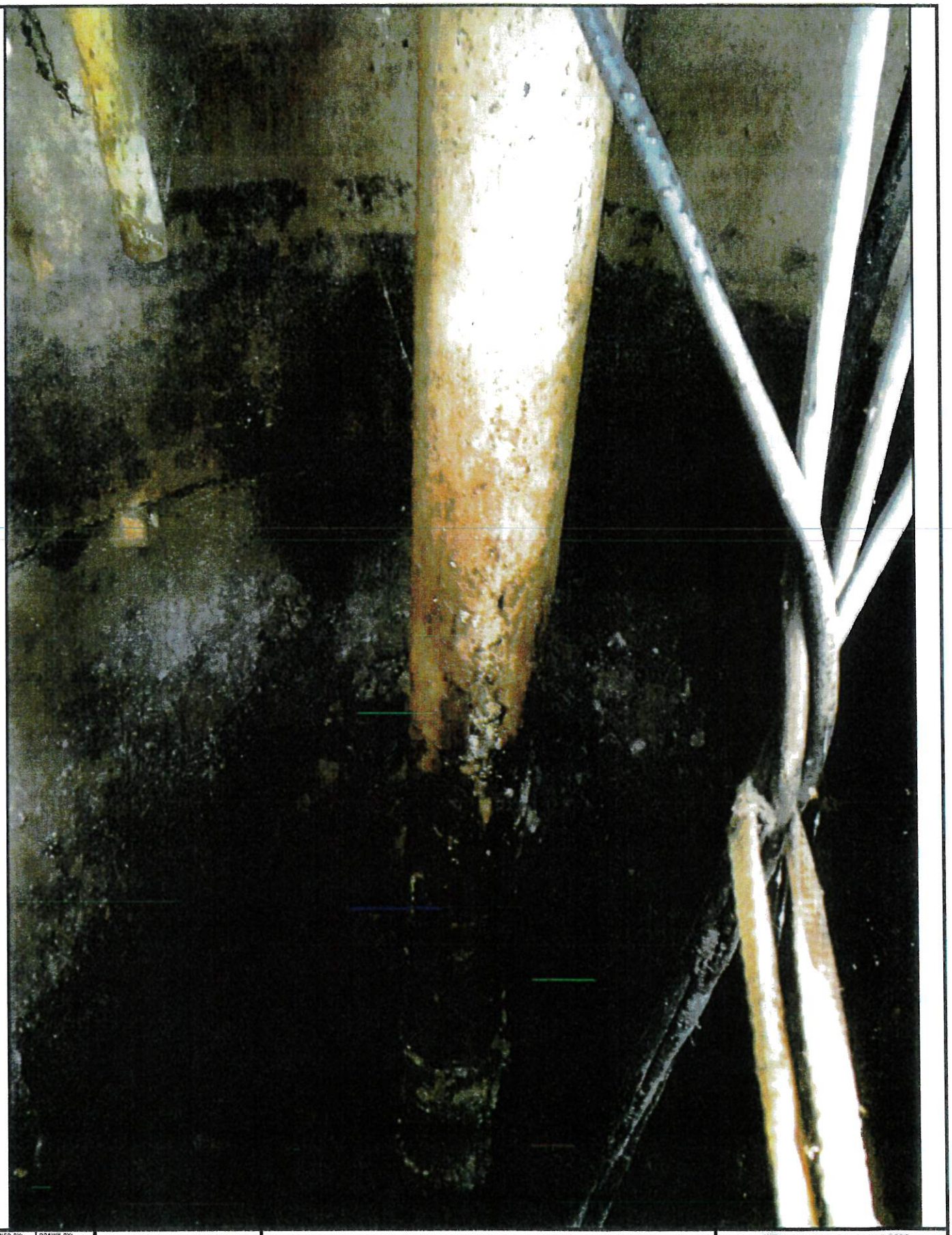


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FIG 4

INSIDE OF THE WET WELL FROM A DIFFERENT ANGLE

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2.1.2 Existing Station Equipment

The two horizontal self-priming centrifugal pumps are Super T Series manufactured by Gorman-Rupp. As shown in Figure 2 the pumps are numbered pump "A" and pump "B" with the same model no T3A3S-B. Pump "A" is at the right-hand and pump "B" is at the left-hand of Figure 2. The serial number for pump "A" is 1435305, and the serial number for pump "B" is 1617167. The size of the pump is 3" by 3" and each pump delivers 75 gpm at total dynamic head (TDH) of 30 feet.

2.1.3 Electrical Assessment

The pumps are run by two 3-hp motors. Each 3-hp motor is dedicated to a pump. The motor is manufactured by TECHTOP. The model number is GR3-CI-TF-182T-4-B-D-3 with the serial number 140354011. The technical characteristics of the motor are summarized in the following:

Frequency:	60 HZ	Horsepower, hp:	3
Speed, rpm:	1755	Volt:	230/460
Full load ampere (FLA):	8.0/4.0	SF:	1.25
KVA Code:	K	FLA (208 V) :	9.06
LRT (%FL) :	215	Nom Eff :	0.895
75% Nom Eff :	0.894	Frame :	182T
Enclosure (Enc.) :	TEFC	IP	55
Duty :	Cont.	Ins Cl :	F
Amb :	40°C	DE Brg :	6306-ZZ
Weight	93 lb	ODE Brg :	6306-ZZ
NEMA Design	B	Green Cert.	NEMA Premium
Motor Mounting Type	Rigid Base	Motor Mounting	Horizontal

The power factor seems to be 0.78 at nominal efficiency of 0.895 and a power factor of 0.717 at 75% Nom Eff. The computed torque of the motor was 8.23 ft-lb.

The motor starter is NEMA Size 1 with polyphase rating. The technical data of NEMA Size 1 include:

- 200/230 VAC 7.5 hp
- 380/460/575 VAC 10 hp
- 600 VAC Maximum
- Class 8536
- Type SCG3
- Coil No 31041-400-42

The electrical equipment at the lift station seems to be in good working condition. There is no onsite emergency generator, though the city of Monticello has portable generators for emergency scenarios. The station has electrical switch gear, which would be connected to the portable generator during power outages.

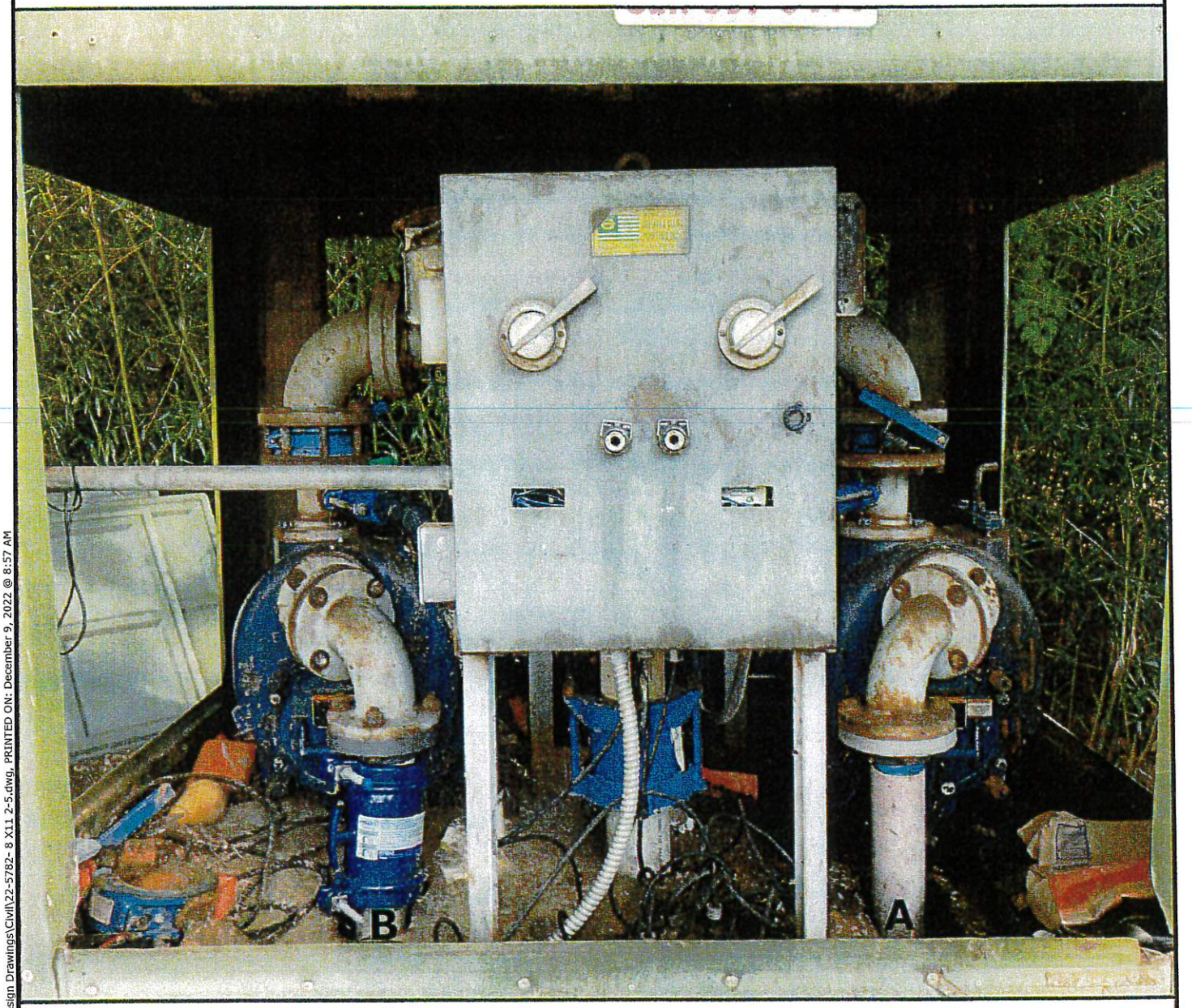

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FIG 2

THE TWO PUMPS IN THE LIFT STATION.

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FIG 3

INSIDE OF THE WETWELL AT AN ANGLE

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2.2 Capacity

The known firm capacity of the station is 75 gpm, which was at the time it was initially built. The areas currently served by the lift station were determined. The number of houses built in the areas was estimated to be approximately 85 homes. The number of homes was estimated independently by the city of Monticello and McClelland Consulting Engineers, Inc (MCE) and the estimated numbers were closely identical. It was assumed that the number of individuals in each home would be between 2 and 3. This was used to determine the average daily flow (ADF). A peaking factor of 4.14 was determined in conformance with Ten States Standards. Based on these considerations, the peak design flow was calculated to be 65 gpm. This value is less than the known firm capacity of the station.

3.0 SITE INVESTIGATIONS

The Bowser Road Lift Station was visited several times in the course of the study to acquire the necessary data. The initial site visit was made alongside a pump manufacturer's representative for Gorman Rupp. The purpose of the site visit was to determine whether the 3-in self-priming centrifugal pumps' speed can be increased to enhance the capacity of the pump rather than changing one of the 3-in pumps to a 4-in pump. As shown in Figure 2, the pumps are denoted Pumps "A" and "B".

The performance of pump "A" (the right-hand pump) was first evaluated. Shown in Figure 5 are the pumps with v-belts driven by electric motors. Pump "A" was first evaluated. When the pump commenced running, the suction vacuum gauge and a discharge pressure gauge were temporarily installed. The discharge pressure gauge was measured 20 ft H_2O head. The suction vacuum gauge pressure was measured 10 ft H_2O with a gauge correction of 4 ft H_2O. The sum of these measurements was 34 feet, which is somewhat close to the total dynamic head (TDH) of the pump at the time it was built. Subsequently, the speed of the two centrifugal pumps was determined to be 1150 rpm. The flow was determined to be approximately 117.5 gpm at 34 feet TDH using a speed of 1150 rpm and an efficiency of 35 percent. However, calculations show that the efficiency can be as high as 40 percent. This signifies that the pump might deliver up to 145 gpm based on the manufacturer's pump curve.

An attempt was also made to ascertain the possibility of pump "B" to deliver raw wastewater to the force main. Pump B was running but was not priming, therefore, it was unable to deliver wastewater to the force main. No vibrations or unusual noise was noted, though it was not measured.

3.1 Causes of Pump "B" Failure

There are a number of causes for the failure of self-priming centrifugal pumps to prime. Such probable causes of failure relative to the Bowser Road lift station include:

- A wear plate: Significant impeller clearance between the impeller and the wear plate might had contributed to the non-priming condition. Excessive clearance can

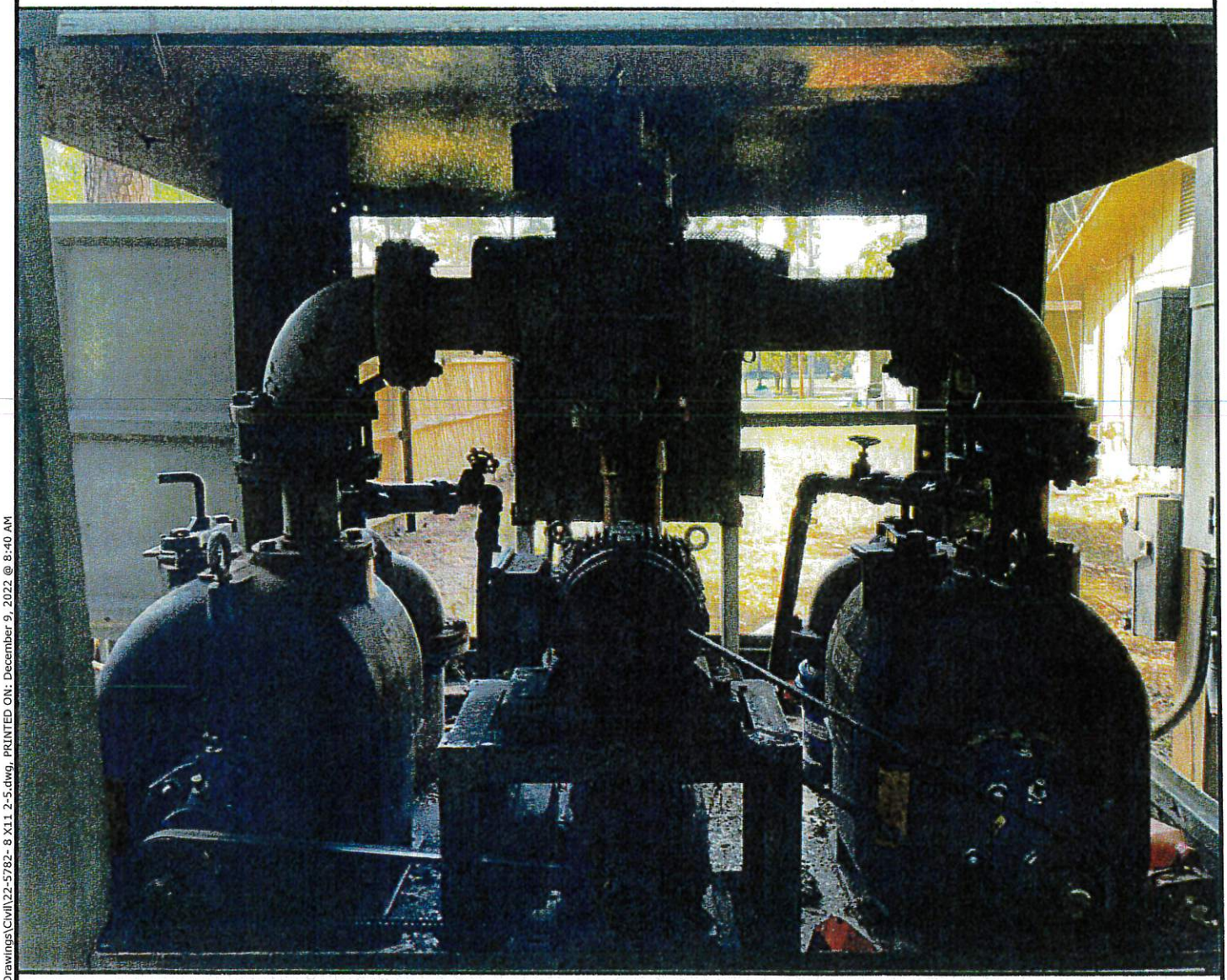

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FIG 5

THE REAR VIEW OF THE PUMPS WITH V-BELTS DRIVEN BY ELECTRIC MOTORS.

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pose difficulty in creating a low-pressure area at the eye of the impeller. The large clearance could be attributed to wear and, perhaps, improper reassembly. The large clearance can be adjusted to an ideal clearance.

- Suction line blocked: One possible reason for losing priming might be an obstruction or blockage in the suction line attributable to the solids present in the influent wastewater. A blockage in the suction line can cause the water in the pump casing to overheat and literally boil out of casing making the pump to lose prime.

- Debris in the impeller: There might have been some debris in the eye of the impeller that compromised the hydraulic capabilities of the pump and impeller to create an area of low pressure. This might had prevented the pump from self-priming. Since there was no unusual noise or vibrations noted during the pumping, this might not had occurred.

- Air leak in suction line: If there is an air leak in the suction, there would be continuously source of air as the pump forces air out of the discharge. This would cause the pump not release enough air to create a low-pressure area.

It appears the likely factor to occur would be excessive clearance between the impeller and the wear plate because of the infrequent maintenance of the pumps in the lift station.

3.2 Plug and Check Valves

The check valve of the pump "A" functioned properly when the pump was started, and delivered wastewater to the force main without any priming issues. However, the check valve of pump "B" malfunctioned when the pump was started. The pump was unable to deliver raw wastewater to the force main because it was not priming. It is very likely that the check valve might had also contributed to the non-priming of the pump; albeit, excessive impeller clearance might had also played some role.

The plug valve was literally not turning regardless of the amount of force applied. The apparent cause is a lack of maintenance. This condition of the plug valve raises a question on the reliability of the lift station. The plug valve ties the two pumps together, which means neither of the pumps can be isolated for any form of maintenance or emergency scenarios.

3.3 Pump Characteristics

The second and third site visits were made to understand the characteristics of the pump at the site. Pertinent wet well, and pump elevations were taken. In addition, the elevation where the force main discharges into the receiving manhole was taken. The distance between the lift station and the receiving manhole is approximately 1820 feet. Both suction pipe and discharge pipe seem to be PVC. It appears the station was built with cast iron.

Figure 6 presents the elevation view of the pumps and the site plan alongside important elevation points. Figures 7 and 8 show, respectively, the elevations of the wet well and the entrance of the force main into the receiving manhole.

3.3.1 System Head- Pump Head Curves

Suction losses, station and force main frictional resistances were determined, and a system-head curve, presumably, representing the current conditions of the sewer pipe was developed. The system-head curve was developed using Hazen-Williams (HW) equation with a resistance coefficient of 120. The pump-head curve was prepared from the manufacturer's curve using a rotational speed of 1450 rpm. The intersection of the system-head and pump-head curves represents the best operating point of the pump as shown in Figure 9. The total dynamic head (TDH) was 52 feet with a discharge flow of 107.5 gpm.

It appears that the HW resistance coefficient used for the system-head curve was overly conservative based on the data obtained at the site. It follows that the utilization of HW coefficient of 130 or 140 would have better approximated the existing conditions of the piping system and pump. If a HW resistance coefficient of 130 was employed, it would have resulted in a TDH of 45 feet with a discharge of 125 gpm.

3.3.2 Pump Speeds

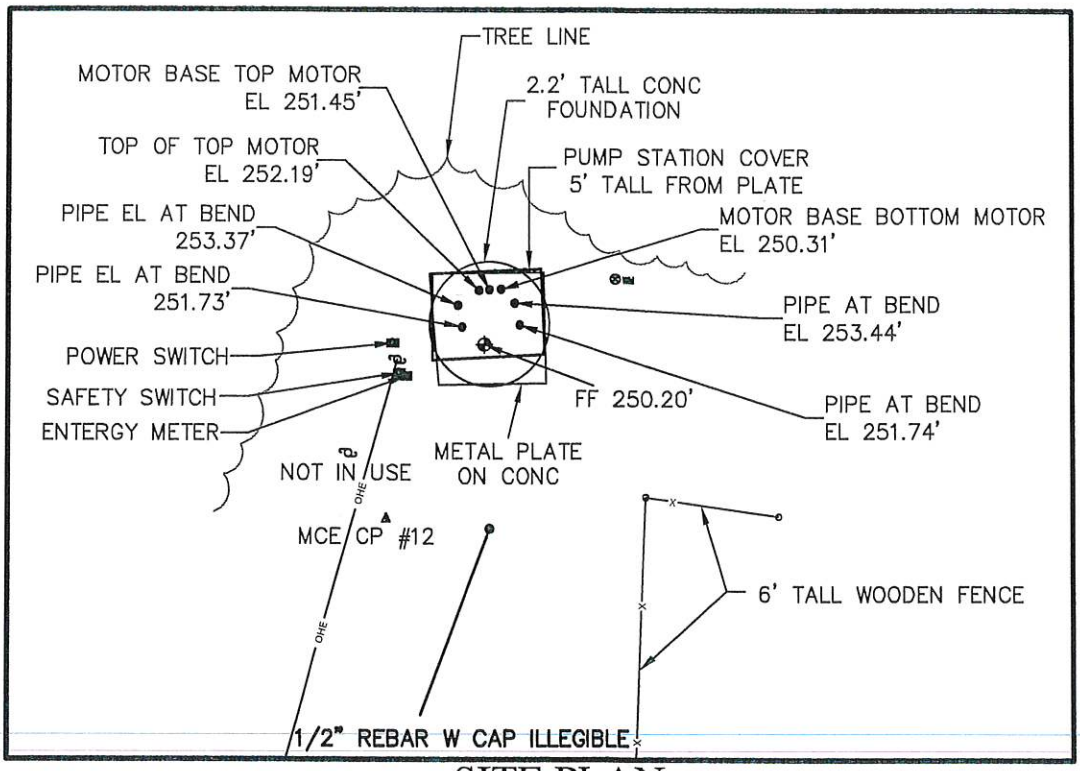
There are three types of pump speeds: rotational speed measured in rpm, specific speed (dimensionless) and suction specific speed (dimensionless).

The existing pump speed measured at the site was 1150 revolution per minute (rpm). This centrifugal pump speed cannot be increased because the 3-hp motor might not handle pump speed considerably greater than 1150. The prepared pump-head curve was at a speed of 1450 rpm and a motor horsepower of 5 was determined at this rotational speed.

The specific speed (N_S) tells the geometry of the pump and the performance characteristics of the impeller style. The pumps at the site were determined to be radial vane, and of non-clog impeller type. Radial vane pumps deliver low flows at high heads.

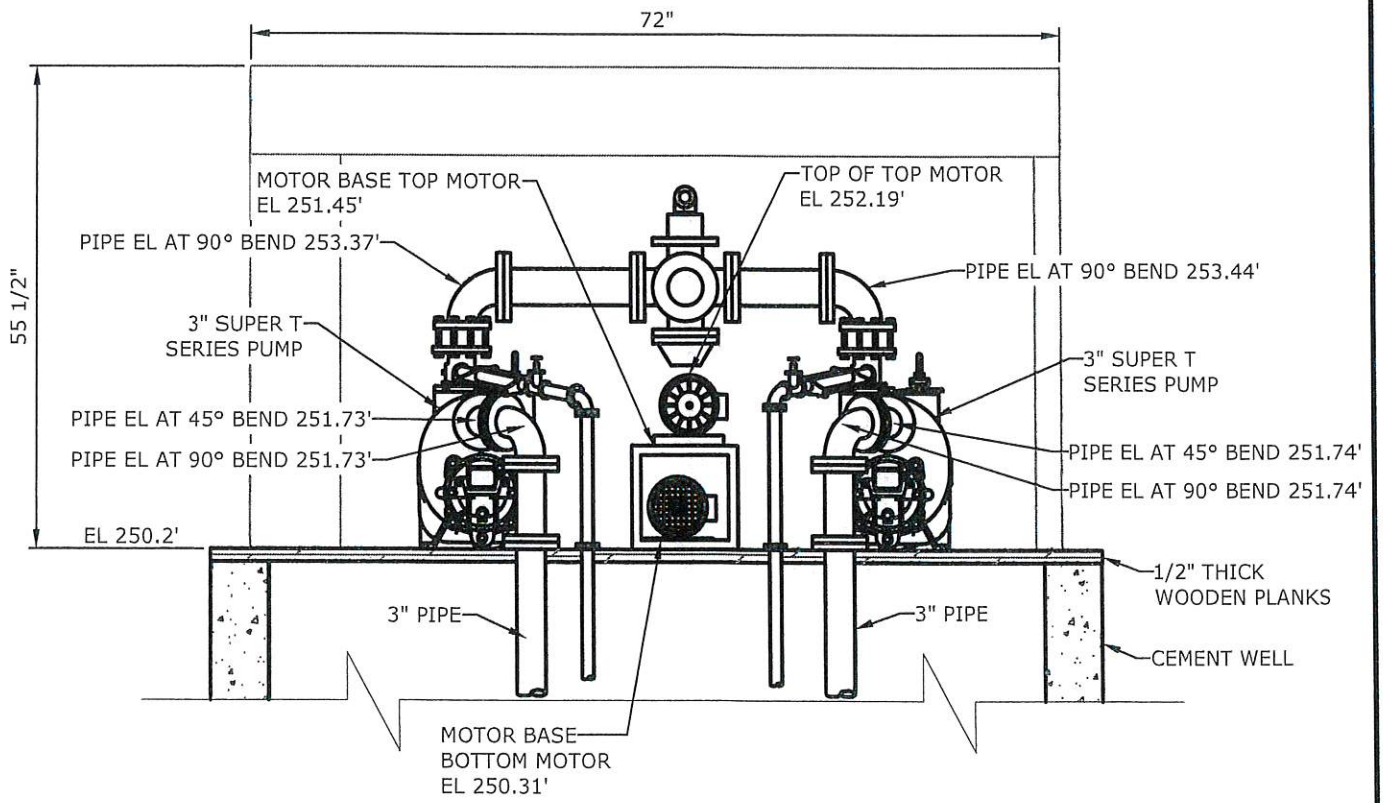
The suction specific speed (N_{SS}) tends to measure the health of a pump. The maximum N_{SS} recommended by the Hydraulic Institute (HI) is 8500. The Bowser Road station pump has suction specific significantly less than that recommended by HI. This implies that the pumps have a high stability and can operate over a wider range of flows without damaging the pump. This becomes important since the impellers were made of cast iron that does not provide significant cavitation resistance. In addition, municipal wastewater pumps often operate at flows above and below the preferred operating region (POR).

The suction energy of the pumps is very low indicating there would be no recirculation issues, and has no tendency to exhibit noise or damage from cavitation.



SITE PLAN

SCALE: 1'=5'



EXISTING LIFT STATION

NTS

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6

SITE PLAN & ELEVATION VIEW OF THE PUMP STATION

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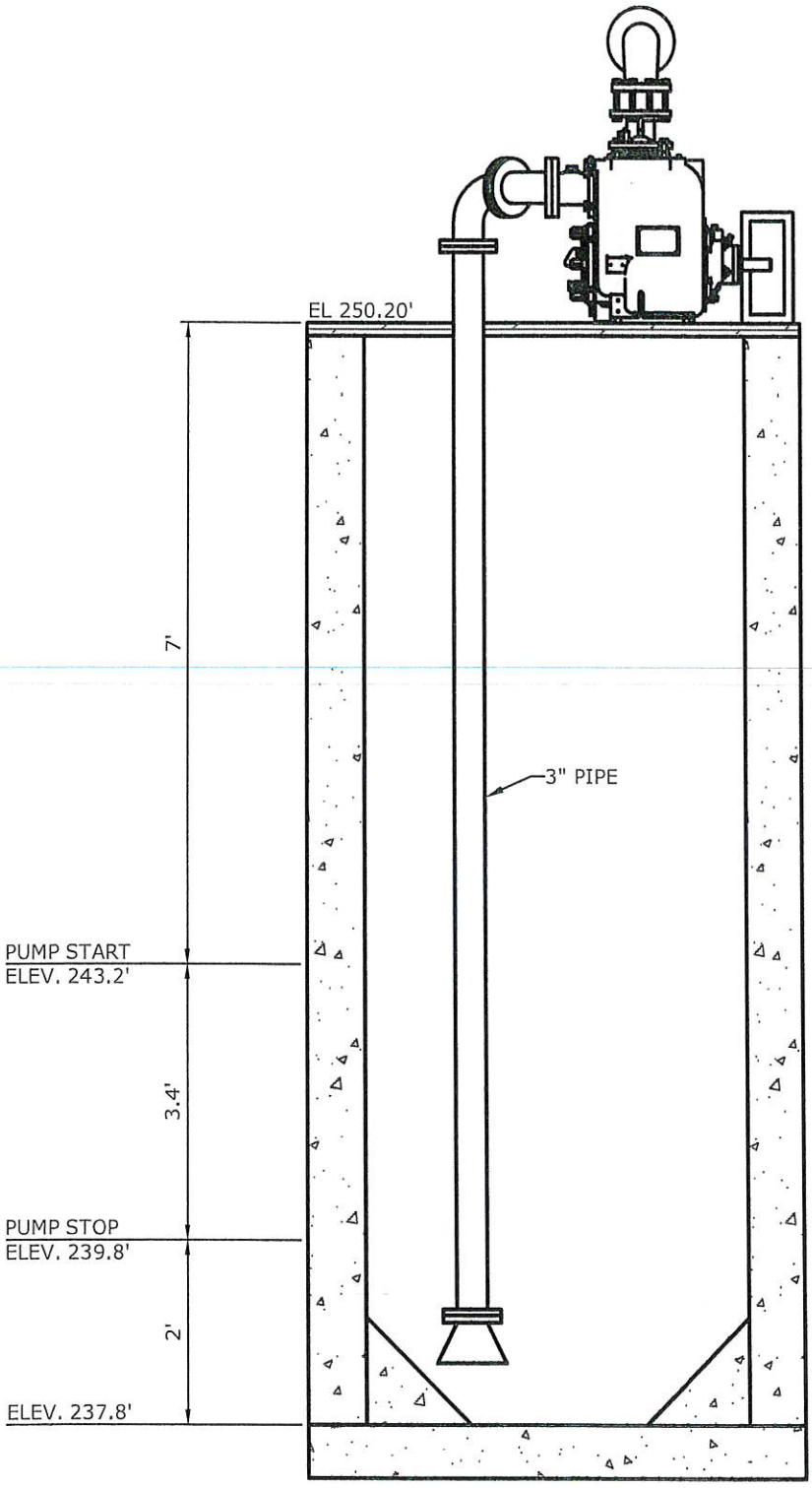

SUPER T SERIES PUMP (RIGHT SIDE VIEW)

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7

EXISTING LIFT STATION WITH WET WELL

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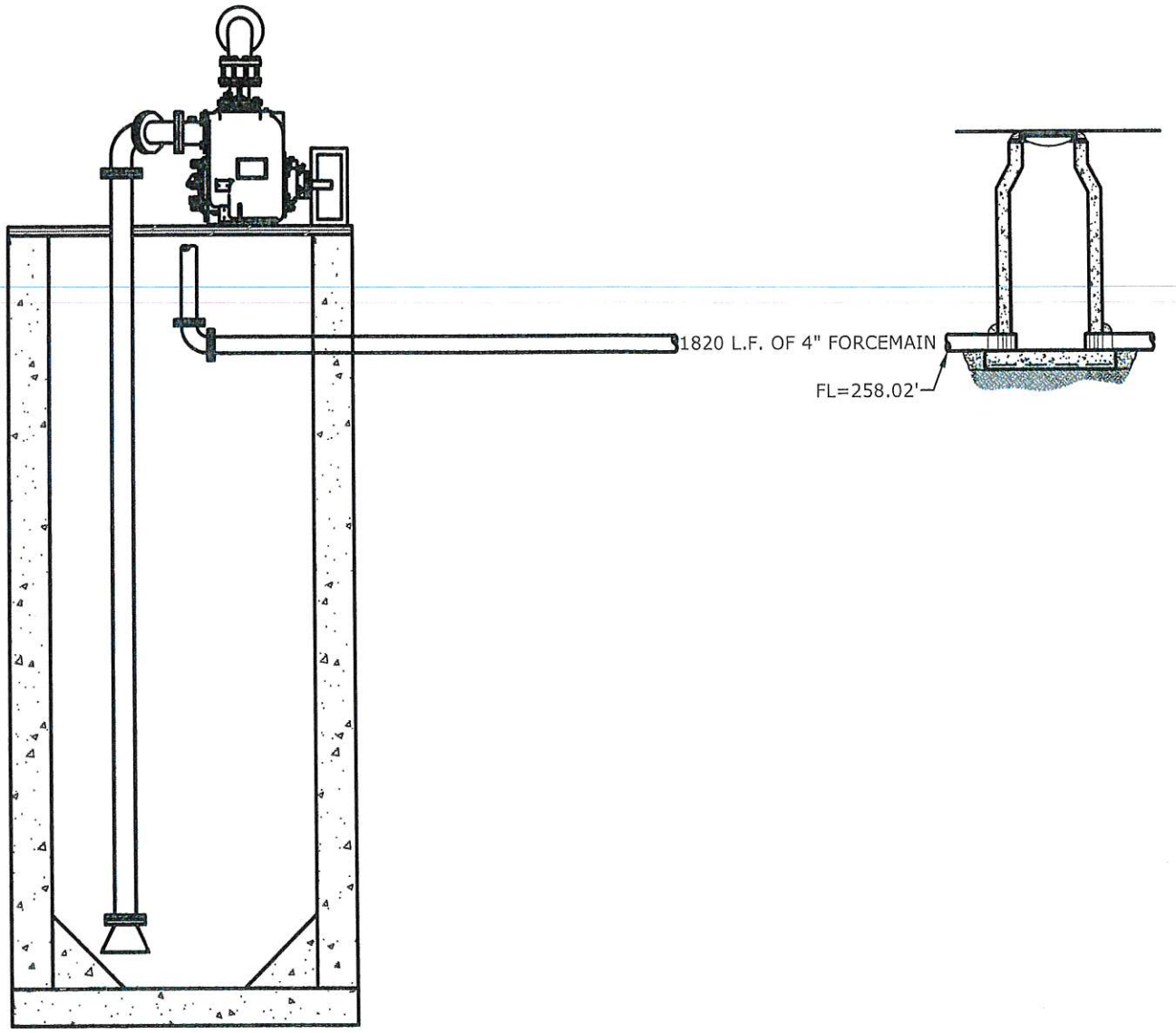

FORCEMAIN

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8	

LIFT STATION SHOWING FORCEMAIN AND RECEIVING MANHOLE

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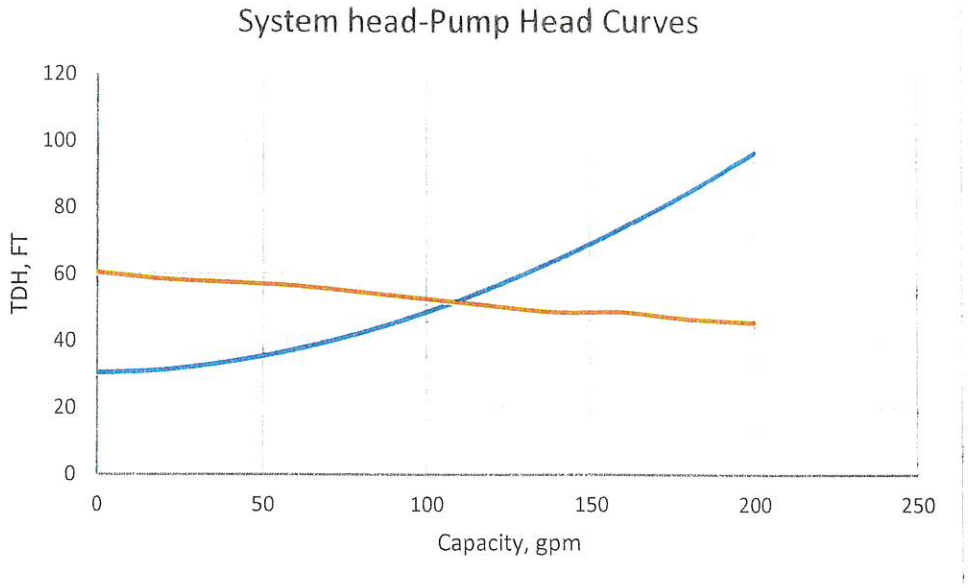

Figure 9: The System-Head and Pump-Head Curves of Bowser Pump Station.

4.0 COST ESTIMATES

Because the check valve of pump "B" was not in good working condition and the plug valve that connects the two pumps cannot turn, the pumps would be replaced. Replacement of the pumps can take place in several ways:

A. Rehabilitation of the Existing Station

- (2) 3" Super T Series CI W/FLG
- (2) 4" Discharge check valves (pumps A-right hand and B-left hand)
- (1) 4" Plug Valve, 3-way
- (2) 5 hp TEFC 230 V 3-Phase Motor
- (2) Sets of Pulleys, Sheaves and Belts
- (1) Control Panel 230 Volt 3-Phase

Cost of parts	= $34,750.00
Miscellaneous @ 15%	= $5,212.50
Construction @ 50%	= $17,375
Subtotal	= $57,337.5
Engineering @ 10%	= $5,733.75
Total	**= $63,071.25**

B. Replacing the Entire Pump Station with a New Enclosure

The total pump costs and its accessories	=$59,300.00
Installation	=$70,000.00
Subtotal	=$129,300.00
Miscellaneous	=$12,930.00
Engineering	=$12,930.00
Total	**=$155,160.00**

C. Replacing the Entire Pump Station with Existing Enclosure

The total pump costs and its accessories	=$59,300.00
Installation	=$25,000.00
Subtotal	=$84,300.00
Miscellaneous	=$8,430.00
Engineering	=$8,430.00
Total	**=$101,160.00**

Any of the above will require considerable planning among the city of Monticello, the city's consulting engineer and the contractor/ manufacturer.

5.0 SUMMARY

The Bowser Road pump station is approaching 50 years old. The existing pump "A", the right-hand pump was running at a rotational speed of 1150 rpm with a discharge flow that ranges from 120 to 145 gpm, depending on the efficiency employed on the manufacturer's curve. This flow range is twice the current peak flow of 65 gpm determined for the pump station, based on the number of homes that discharges to the pump station. Pump "B" the left-hand pump also was run at a rotational speed of 1150 rpm with no unusual noise or vibrations. Nevertheless, the pump was not able to deliver any flow because it failed to prime and the check valve was not properly functioning. The 3-way plug valve that connects the two pumps would not turn at all, making it increasingly difficult to maintain the pump station. This condition raises questions on the reliability of the pump station.

A new system-head curve was matched with the pump-head curve prepared at a rotational speed of 1450 rpm. It was determined that a 5-hp motor will be able to support a speed of 1450 rpm with a flow range from 125 to 130 gpm.

Based on the preceding, the following can be stated about the pump station:

- A 3-in pump with a 3-hp motor seems to be still suitable for the pump station, and capable of delivering flows greater than the peak flow that presently discharge to the station.
- At this point, a 4-inch pump is not needed at the station.
- The apparent cause of failure for pump "B" to prime is ascribed to malfunctioning of the check valve.
- The excessive clearance between the impeller and the wear plate played some role in the failure of the pump. In fact, it might had exacerbated the problem.
- The 3-way plug valve cannot turn; consequently; the pump cannot be isolated to adjust the clearance between the impeller and the wear plate.
- The reliability of the pump station is in question; therefore, the pumps need to be replaced.
- The pumps should be replaced with a 3-inch pump run by 5-hp motors
- The 5-hp motors can support rotational speeds from 1330 to 1500 rpm. This signifies that the speed can be adjusted in the future should the need arise.

1.28.22