

# 2015 Well #3 MAINTENANCE PROJECT COMPLETION REPORT

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*Completed December 18th, 2015*

*Updated January 20<sup>th</sup>, 2015*

## GENERAL PROJECT INFORMATION

	Description
<b>Project Name</b>	<i>Well #3 Maintenance and Reconditioning</i>
<b>Project Description</b>	<i>The Village of Western Springs conducted reconditioning and maintenance of well #3. Maintenance included the reconditioning of the well pipe, repair to the pump/motor, and inspection of the well shaft.</i>
<b>Project Manager</b>	<i>Tom Healy, Layne: Water, Mineral and Energy</i>
<b>Project Sponsor</b>	<i>Matthew Supert, Director of Municipal Services</i>
<b>General Contractor</b>	<i>Layne: Water, Mineral and Energy</i>

	Budget	Starting	Final	Variance
<b>Execution Date</b>	<i>02/23/15</i>	<i>02/23/15</i>	<i>02/23/15</i>	<i>0 days</i>
<b>Start Date</b>	<i>10/05/15</i>	<i>10/05/15</i>	<i>10/05/15</i>	<i>0 days</i>
<b>Finish Date</b>	<i>11/20/15</i>	<i>11/20/15</i>	<i>12/03/15</i>	<i>13 days</i>
<b>Days</b>	<i>47</i>	<i>47</i>	<i>60</i>	<i>13 days</i>
<b>Total Budget</b>	<i>150,000</i>	<i>\$134,783</i>	<i>\$162,915.98</i>	<i>\$28,132.98</i>

## PROJECT SUMMARY

Well #3's maintenance and reconditioning was a budgeted and scheduled item for the 2015 calendar year. The Village's budget for the project was \$150,000. The contractor, Layne: Water, Mineral and Energy provided the Village an original estimated budget and scope of work at \$150,000. This project scope included an averaged estimated amount of work for the pipe and well reconditioning, but noted that additional costs may be required once the well pipe and pump/motor were pulled and inspected. Previous maintenance projects on well #4 and well #1 were in line with the initial cost and project estimated guidelines.

The well #3 overhaul was originally scheduled to begin in the spring of 2015. Unfortunately, the Village experienced some minor issues with well #1 that needed to be addressed prior to the commencement of the work on well #3. After the issues with well #1 were resolved, the work for well #3 was rescheduled for the fall of 2015 when system demand was anticipated to be lower.

Near the end of the summer the project's preliminary schedule for kickoff was scheduled for late October. Beginning in August and through September the Village noted a rapid decrease in the overall output and reliability of well #3, necessitating the maintenance schedule to be accelerated to early October.

The project commenced on October 5<sup>th</sup> and proceeded with approximately two weeks of removal of the well pipe from the well. Once removed the pipe was moved offsite for inspection and reconditioning which included sandblasting of the pipe and relining the interior of the pipe.

One of the bowls on the pump was found to be cracked and the spare motor at the public works yard was commissioned to be swapped in. The previous well #3 motor was repaired and will be now stored as a spare at the public works garage.

Layne crews re-mobilized on November 9<sup>th</sup> to do a cleaning of the well shaft liner and final televising of the well shaft. Installation of the well pipe commenced on November 11<sup>th</sup> and was completed on November 21<sup>st</sup>.

Flushing of the well began November 23<sup>rd</sup> and the first sample sent to the lab for testing was taken on November 25<sup>th</sup>. The Village completed all sample testing of the well on December 2<sup>nd</sup> and the well was put back in service on December 3<sup>rd</sup>.

# PROJECT ISSUES

## HIGH SYSTEM DEMAND AND WELL #1 USE

Throughout the duration of the project, the Village experienced abnormally high levels of demand in the system in the October and November. Typical system demand information since 2008 is listed in the table below. The 2014 data showed total plant effluent was approximately 47 million gallons for October and November, which averages approximately 1.5 millions of gallons per day (MGD).

Usage for 2015 however was abnormally high, reporting in at 59.550 and 53.942 millions of gallons for October and November. This calculates out to approximately 1.80-1.90 MGD for each month.

Village of Western Springs  
Plt.Eff. Pumpage:2008-2016  
Expressed in million gallons (MG)

	2008	2009	2010	2011	RO retrofit 2012	2013	2014	2015	2016	High	Avg.
Jan	40.807	41.599	42.725	39.759	38.455	47.283	56.158	52.002	25.887	56.158	42.742
Feb	39.425	38.777	37.813	35.847	36.663	47.985	45.847	47.168	0.000	47.985	36.614
Mar	42.737	41.686	37.899	36.828	39.586	59.632	47.364	52.572	0.000	59.632	39.812
Apr	40.068	41.159	37.884	35.409	41.050	48.425	45.289	47.779	0.000	48.425	37.451
May	45.162	47.452	46.320	43.051	50.710	54.292	51.089	53.086	0.000	54.292	43.462
Jun	44.889	46.714	38.965	42.573	64.621	54.008	52.715	50.362	0.000	64.621	43.872
Jly	56.838	53.713	51.809	57.144	65.463	66.370	55.906	58.311		66.370	58.194
Aug	55.854	55.867	48.247	46.976	53.522	67.196	55.864	65.953		67.196	56.185
Sep	43.535	49.812	42.414	43.029	48.350	62.810	51.156	58.812		62.810	49.990
Oct	39.247	40.562	40.753	40.736	46.767	53.637	47.647	59.550		59.550	46.112
Nov	37.106	38.816	35.485	35.551	45.974	47.397	47.036	53.942		53.942	42.663
Dec	39.793	42.027	38.400	37.981	46.011	51.444	49.823	56.262		56.262	45.218
<b>Total</b>	<b>525.461</b>	<b>538.184</b>	<b>498.714</b>	<b>494.884</b>	<b>577.172</b>	<b>660.479</b>	<b>605.894</b>	<b>655.799</b>	<b>25.887</b>		<b>542.315</b>
<b>ADC</b>	<b>1.436</b>	<b>1.474</b>	<b>1.366</b>	<b>1.356</b>	<b>1.577</b>	<b>1.810</b>	<b>1.660</b>	<b>1.797</b>	<b>0.071</b>		<b>1.486</b>
Note: Average Daily Consumption (ADC)					66 M breaks 111 M breaks 71 M breaks 49 M breaks						

Well #4 has an output of is approximately 1.1 million gallons per day after treatment. Even during our historical usage some amount of well #1 would have been needed to meet the 1.5 MGD for system demand. The abnormally high demand for the months of October and November required well #1 to be used to supplement the system at a rate much higher than anticipated. Output rates for well #1 were similar to and, in some cases exceeded those comparable monthly usages that were observed during the RO construction period during the summer of 2012.

Village of Western Springs  
Well #1 Pumpage:2008-2016  
Expressed in million gallons

	2008	2009	2010	2011	Raw 2012	2013	2014	2015	2016	High	Avg.
Jan	0.062	0.032	0.064	0.067	0.064	0.060	0.058	2.677		2.677	0.386
Feb	0.030	0.064	0.064	0.067	0.654	0.061	0.056	4.203		4.203	0.650
Mar	0.064	0.064	0.064	0.058	0.865	0.104	0.057	1.810		1.810	0.386
Apr	0.064	0.143	0.138	0.063	2.846	0.090	0.041	1.496		2.846	0.610
May	0.063	0.063	0.065	0.063	8.364	0.061	0.052	2.395		8.364	1.391
Jun	0.062	0.062	0.064	0.058	16.527	0.059	0.049	1.664		16.527	2.318
Jly	0.063	0.064	0.069	0.068	8.062	0.060	0.048	0.574		8.062	1.126
Aug	0.069	0.065	0.067	0.068	10.835	0.065	0.048	0.419		10.835	1.455
Sep	0.094	0.063	0.064	0.064	6.140	0.058	0.047	0.842		6.140	0.922
Oct	0.539	0.063	0.064	0.065	6.997	0.073	0.000	17.022		17.022	3.103
Nov	0.127	0.064	0.127	0.064	2.853	0.057	0.410	13.568		13.568	2.159
Dec	0.032	0.063	0.064	0.085	0.062	0.099	2.104	0.903		2.104	0.427
Total	1.269	0.810	0.914	0.790	64.269	0.847	2.970	47.573			

The cause for the higher system demand is not entirely known at this time. Early observations, by Village staff, speculated that a warm and dry autumn may have been a contributing factor to the increased need for the well and subsequently watering restrictions were enacted in an attempt to alleviate some of the demand on the system.

Further evidence, at this point, would indicate that additional investigation is needed for the high amounts usage during the past two months. Due to the severity of this usage, there is a high probability that there may be an undiscovered leak in the distribution system. The Village typically conducts an annual leakage survey of the distribution pipe in the spring to locate leaks in the system which may have surfaced. Due to the high output numbers currently observed, staff will begin to schedule a leak detection survey after the first of the year, if weather conditions allows.

### CRACKED BOWL FOR WELL #3 PUMP

The 400 horsepower Byron Jackson Type H submersible pump was pulled, cleaned, sandblasted and inspected. Upon disassembly and inspection of the pump it was discovered that the bronze casing failed due to corrosion, resulting in the check valve flappers and a holding pin falling into the top of the bowl. These pieces caused the S.S. impeller shaft to become worn down into an hour glass shape and eventually breaking off. These pieces became lodged in the top bowl casing and wore down the underside of the casing vanes causing a split. This was the cause of the drop in production for the well observed in late August and through September.

Work required the replacement of two 23MQ all bronze bowl castings and two 12MQ bronze impellers. While materials were being sourced the standby motor was taken from storage at the public works facility and placed into service. The current Type H motor will now be placed into storage as a backup.

## **PROJECT TIMELINE DELAYS**

- 11/12 – High Winds
- 11/13 – High Winds
- 11/17 – Storm conditions
- 11/19 – Electrical test error, had to remove some pipe. Found pinhole in cable insulation. Repaired.
- 11/21 – Well pipe installation was completed, flushing of well began.
- 11/23 – Issue with control transformer on electrical panel. Contacts fixed that afternoon.
- 11/24 – First sample taken and sent to lab. Village needed to get its samples cleared. Thanksgiving holiday impacted timing since lab was closed 11/25-11/29.

## **ADDITIONAL OBSERVATIONS**

### **Project Start Date**

The well #3 maintenance project was a project that was scheduled and budgeted for the 2015 calendar. Typical well maintenance for all of the Village's wells happens on a 10-15 year cycle. Well #1 received maintenance in 2014 and Well #4 last received maintenance in 2010. With the completion of well #3 maintenance in 2015 the Village does not anticipate additional maintenance until 2020-2025 for well #4.

The project was initially scheduled to take place during the spring of 2015, but was postponed until the fall due to some reliability issues associated with well #1's transmission pipe running under the railroad tracks near Wolf Road and Hillgrove Avenue. There was concern that the age of the pipe may be problematic and any issues with that pipe could negatively affect operations on the BNSF railway. During the summer of 2015, the Village conducted lining of the transmission main for well #1 to ensure the reliability and integrity of that transmission main under the BNSF right of way.

Once the lining was completed, the follow up schedule for the well #3 project was to begin in late October or early November, which is typically when system demand decreases. This would have allowed the Village to minimize the use of well #1 during the maintenance period. Plant operators saw a marked decrease in the production of well #3 through the end of August and into September, which caused the Village to accelerate the maintenance program on well #3. This will lead to two primary follow up actions which need to be explored by the Municipal Services Department.

### **Explore causes of high demand**

The largest immediate concern is the observed increased system demand. Investigations will need to be made as to what is causing the plant to need to output more water. This process will begin with a leak detection survey conducted by the Village, which is an acoustic monitoring survey to find underground leaks within the system. Once completed, follow up assessment to system usage will be required.

The Village has seen an overall upward trend in water output requirements to the system since 2008. It has been speculated, but not fully investigated, as to whether the continual change over in the Village's housing stock to large square footage homes is leading to some of the increased demand. While overall plant output has continued to rise over the past decade, overall billed volumes have not necessarily kept pace. It is difficult at this point to make a correlation to the percentage of the increase to new homes, largely due to the age and types of meters installed. While this issue may not be directly related to the well #3 maintenance, it is an issue that should be explored further by the Village in the coming year.

## **Potential options to alleviate well #1 usage**

The largest single issue associated with the current well #3 maintenance was the need for well #1 to go to distribution. Well #1 currently cannot go through the RO treatment plant because it cannot provide the necessary feed pressure to get through the plant. Increased need for the use of well #1 resulted in significant iron and hardness problems for some residents in the Village. The Village has, on numerous occasions, explored various replacement options for well #1. Future capital improvement projects have identified possible ways to address the aging well, which was constructed in 1924.

### **Well #3 & #4 Pipe Replacement**

One of the largest lead time issues associated with the well maintenance is the reconditioning of the well pipe. During the standard maintenance procedure, the pipe is removed from the site for inspection, reconditioning and relining. This process takes 2-4 weeks depending upon the volume of pipe that needs to be reconditioned. It may be possible during future maintenance cycles to purchase pipe ahead of the scheduled maintenance and replace any pipe that is needed opposed to reconditioning it. This process may decrease the maintenance period by several weeks.

Current pipe prices are approximately \$47-\$50 per lineal foot which may add as much as \$80,000 to the maintenance process.

### **Treatment options for well #1.**

While well #1 cannot run through the water treatment plant, potential permanent and temporary treatment options should be explored for the well site. Any treatment options would likely not provide the full softening capabilities of the RO plant, but they could possibly allow for the Village to address some of the iron issues that were experienced during this maintenance period.

The major issues with any mobile treatment options are the site location and size. The well is located in a very small location near the BNSF right of way. Very little existing open space is available around the well. The construction of any facilities within the BNSF right of way is probably unfeasible and the proximity of Wolf Road and several major sewer systems through that area also present challenges. Expansion to the east into the commuter parking facility may be possible, or in the case of a temporary treatment situation the closure of Burlington Avenue may be feasible.

It will also need to be determined if any treatment options, especially temporary or mobile treatment equipment, limits the potential output of the well.

No cost options are known at this time for either a temporary or permeant treatment system.

### **Construction of well #5**

The construction of a 5<sup>th</sup> well within the Village is an item that has been discussed on numerous occasions as far back as the 1980's. This past year, beginning in May and concluding in October of 2015, the Infrastructure Commission reviewed feasible locations within the Village for a potential well #5.

This option would allow for the Village to completely eliminate the existing shallow well and as a result the issues associated with running it. The new deep well would also allow for the Village to continue to run two wells through the water treatment plant while another well is offline. This option, however, is also the most expensive putting the construction of the 5th well at approximately \$1-1.5 million. An additional \$1-\$2 million may be required depending upon the location of the well, the installation of a transmission main, and the possibility of land acquisition.

## **Additional Water Sampling in the Community**

In response to resident questions from the December 7<sup>th</sup> Board meeting, the Water Department will be expanding its water sampling and reporting through the beginning of the new year. Samples will be taken at each subdivision within the community at two week intervals, and the results will be made available on the Village's website at [wsprings.com/water](http://wsprings.com/water). The expanded sampling will continue as needed for the first 2-3 months into 2016. Village staff is currently in the process of confirming sample sites and scheduling sampling times with residents in each subdivision.

The following data will be sampled and reported.

1. Total Hardness
2. Calcium Hardness
3. Alkalinity
4. Iron
5. pH
6. Turbidity
7. Fluoride
8. Total Dissolved Solids
9. Total Chlorine
10. Free Chlorine
11. BacT

## Appendix A: Project Event Timeline

09/17/15	Tower Topics Mailed to residents with notification of well maintenance
10/05/15	Commencement of project and shutdown of well #3. Well #1 begins going to distribution.
10/05/15	Removal of well #3 pipe, pump and motor begins.
10/12/15	Village begins receiving calls of discolored water.
10/15/15	High system usage is observed .
10/19/15	Removal of pump, motor and well pipe is completed. Offsite work begins.
10/21/15	Village implements watering restrictions to alleviate system demand.
10/22/15	FAQ is posted on Village website regarding well maintenance.
11/05/15	Well repair rig is moved back onsite in preparation for pipe installation.
11/09/15	Clean and brush well liner
11/11/15	Re-televiser well, conduct final inspection.
11/11/15	Reinstallation of well pipe begins.
11/12/15	Work postponed due to high wind conditions.
11/13/15	Work postponed due to high wind conditions.
11/16/15	Installation of pump and motor.
11/17/15	Work postponed due to severe weather.
11/18/15	Majority of pipe installation completed.
11/19/15	Work crews find electrical fault and must remove pipe.
11/20/15	Pipe pulled and issue found with a pinhole in insulation cabling. Pipe installation resumes.
11/21/15	Pipe installation is completed.
11/23/15	Flushing of well begins for testing. Fault found in control transformer.
11/24/15	Flushing of the well.
11/25/15	First sample taken to lab for testing. Flushing continues.
11/30/15	Lab closed over Thanksgiving holiday. Flushing continues and additional sample taken.
12/02/15	Confirmation of two passed samples. Reassembly of well head begins.
12/03/15	Well begins going back to distribution. Construction of enclosure begins.
12/04/15	Enclosure of well building is completed.

## Appendix B: Cost Summary

Please note that the current cost summary is preliminary as of 12/18/15, and changes may be made as invoices and work is reviewed and finalized.

Date:	QNTY	UNTS	DESCRIPTION	PRICE	TOTAL
5-Oct	8.5	hr	Large Pump Service Rig & 3 man crew - mob & setup equipment	\$ 563.00	\$ 4,785.50
6-Oct	8	hr	Large Pump Service Rig & 3 man crew - pulling pump	\$ 563.00	\$ 4,504.00
	2	hr	Serviceman w/ Service Truck	\$ 204.00	\$ 408.00
	1	LS	Power tong usage	\$ 450.00	\$ 450.00
7-Oct	8	hr	Large Pump Service Rig & 3 man crew - pulling pump	\$ 563.00	\$ 4,504.00
	2	hr	Serviceman w/ Service Truck	\$ 204.00	\$ 408.00
	1	LS	Power tong usage	\$ 450.00	\$ 450.00
8-Oct	8	hr	Large Pump Service Rig & 3 man crew - Finish pulling pump	\$ 563.00	\$ 4,504.00
	3	hrs	Byron Jackson Technician - mob to site and remove broken motor coupling bolt	\$ 204.00	\$ 612.00
	1	hrs	Pump Serviceman & helper - load scaffolding & motor vessel for BJ motor servicing onsite	\$ 318.00	\$ 318.00
9-Oct	8	hr	Large Crane & 2 man crew - Service motor; load motor, bowl, & cable; & haul/unload in yard.	\$ 420.00	\$ 3,360.00
12-Oct	8	hrs	Large Crane & 3 man crew - Load pipe at job & haul/unload in yard.	\$ 563.00	\$ 4,504.00
13-Dec	1	LS	Television Survey of well	\$ 1,550.00	\$ 1,550.00
			MACHINE SHOP/YARD LABOR		
			unload pump in yard for inspection; Disassemble, clean & inspect bowl assembly;		
			Perform prelim checks of 400HP BJ motor; & power wash & sandblast 8" T&C pipe for inspection.		
	8	hrs	Machinists	\$ 169.00	\$ 1,352.00
	6	hrs	Helper - assist is bowl disassembly	\$ 140.00	\$ 840.00
	6.5	hrs	Sandblast crew	\$ 339.00	\$ 2,203.50
	6	hrs	Serviceman & helper - power washing	\$ 318.00	\$ 1,908.00
	8	hrs	Byron Jackson motor technician	\$ 175.00	\$ 1,400.00
9-Nov	8	hrs	Large Pump Service Rig & 3 man crew - setup and prepare to brush the 12" liner	\$ 420.00	\$ 3,360.00
10-Nov	4.5	hr	Large Pump Service Rig & 3 man crew - finish setup equipment & brush liner	\$ 420.00	\$ 1,890.00
11-Nov	1	LS	Re-Televised the well	\$ 1,550.00	\$ 1,550.00
12-Nov	3.5	hr	Yard Crane & 3 man crew - loading in yard	\$ 409.00	\$ 1,431.50
14-Nov	8	hr	Large Pump Service Rig & 3 man crew -	\$ 563.00	\$ 4,504.00
	8	hr	Large Crane	\$ 102.00	\$ 816.00
16-Nov	8	hr	Large Pump Service Rig & 3 man crew -	\$ 563.00	\$ 4,504.00
	2	hr	Serviceman w/ Service Truck	\$ 204.00	\$ 408.00
	1	LS	Power tong usage	\$ 450.00	\$ 450.00
18-Nov	10	hr	Large Pump Service Rig & 3 man crew -	\$ 563.00	\$ 5,630.00
	10	hr	Additional Helper	\$ 143.00	\$ 1,430.00
	2	hr	Serviceman w/ Service Truck	\$ 204.00	\$ 408.00
	1	LS	Power tong usage	\$ 450.00	\$ 450.00
19-Nov	5	hr	Large Pump Service Rig & 3 man crew - finish reinstalling pump	\$ 563.00	\$ 2,815.00
	5	hr	Additional Helper - finish reinstalling pump	\$ 143.00	\$ 715.00
21-Nov	8	hr	Large Pump Service Rig & 3 man crew - Set pump down, make splice, get all ready to test on Monday	\$ 563.00	\$ 4,504.00
	2	hr	Serviceman w/ Service Truck	\$ 204.00	\$ 408.00
23-Nov	8	hr	Large Pump Service Rig & 3 man crew - hook up pump-off eqm't, start loading, & wait on starter issue to start	\$ 563.00	\$ 4,504.00
	2	hr	Serviceman w/ Service Truck	\$ 204.00	\$ 408.00
24-Nov	6	hr	Pump Serviceman & Helper - setup and run pumping test	\$ 318.00	\$ 1,908.00

24-Nov	6	hr	Pump Serviceman & Helper - setup and run pumping test	\$ 318.00	\$ 1,908.00
25-Nov	6	hr	Large Pump Service Rig & 3 man crew - Set spool; tear down rig and move out; and flush well.	\$ 563.00	\$ 3,378.00
30-Nov	7	hr	Serviceman w/ Service Truck - pumping to take bacti samples	\$ 204.00	\$ 1,428.00
1-Dec	6	hr	Serviceman w/ Service Truck - pumping to take bacti samples	\$ 204.00	\$ 1,224.00
2-Dec	6	hr	Serviceman w/ Service Truck & Helper - install building beam, re-connect piping, load pump-off eqm't; & final c	\$ 347.00	\$ 2,082.00
			MACHINE SHOP/YARD LABOR		
			Repairs bad pipe thread ends; replace both surge control valves; replace bad pipe couplings;		
			Fully inspect 400HP Byron Jackson motor; sandblast & epoxy coat all pipe, in & out; replace		
			bad pipe; rebuild & reassemble all bronze bowl; re-furbish surface plate; & BJ motor		
			work (work on existing & prep for shipment back to factory; & check over Village spare for use)		
	48.5	hrs	Machinsts	\$ 169.00	\$ 8,196.50
	14	hrs	Helper	\$ 140.00	\$ 1,960.00
	14	hrs	Machinist w/ pipe rethread lathe	\$ 175.00	\$ 2,450.00
	3	hrs	Machinist w/ mill - machine holes in pump house I-Beam (now easily removable)	\$ 169.00	\$ 507.00
	881	ft.	Sandblast crew - Sandblast & epoxy coat pipe, inside & out	\$ 25.00	\$ 22,025.00
	3	hrs	Serviceman & helper - start loading pump	\$ 318.00	\$ 954.00
	18	hrs	Byron Jackson motor technician - final inspection of motor pulled; inspect spare, & prep motor to go back to B	\$ 175.00	\$ 3,150.00
				<b>Subtotal Labor</b>	<b>\$ 127,509.00</b>

Date:	QNTY	UNITS	DESCRIPTION	PRICE	TOTAL
	1	ea	Byron Jackson 2300 volt flat cable	\$ 6,461.00	\$ 6,461.00
	6	ea	8" 8 round pipe couplings	\$ 198.00	\$ 1,188.00
	4	ea	8" 8V pipe couplings with API monogram	\$ 187.00	\$ 748.00
	2	ea	8" 8V surge control valves	\$ 1,316.00	\$ 2,632.00
	2	ea	12MQ good, used bronze impellers	\$ 600.00	\$ 1,200.00
	2	ea	12MQ good, used bronze bowl castings	\$ 1,600.00	\$ 3,200.00
	302	ft.	8" Schedule 40 T & C Line Pipe	\$ 47.00	\$ 14,194.00
	8	gals	Byron Jackson motor oil	\$ 29.00	\$ 232.00
	1762	ft.	1/4" Toro plastic airline	\$ 0.50	\$ 881.00
	1	ea	Spilce kit for new Byron Jackson flat cable	\$ 54.30	\$ 54.30
	101	LBS	Bronze stock for wear rings	\$ 9.00	\$ 909.00
	1	ea	1-15/16" S.S. impeller shaft	\$ 1,260.00	\$ 1,260.00
	2	ea	1-15/16" bronze suction bushings - F013BRZ	\$ 137.84	\$ 275.68
	2	ea	1-15/16" bronze discharge bushings - BJ937	\$ 89.60	\$ 179.20
	12	ea	1-15/16" bronze intermediate bushings	\$ 143.30	\$ 1,719.60
	2	ea	200/460 airline guages	\$ 24.00	\$ 48.00
	1	ea	100 psi pressure gauge	\$ 14.00	\$ 14.00
	16	ea	Byron Jackson 12MQ casting o-rings	\$ 13.20	\$ 211.20
				<b>Subtotal</b>	<b>\$ 35,406.98</b>
				<b>Project Total</b>	<b>\$ 162,915.98</b>

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