



DISCUSSION
CITY OF INDEPENDENCE
September 15, 2021

Department Water/Sewer

Director Approval John Garris

AGENDA ITEM Discussion regarding the Southeast Liftstation and proposed path to move forward.

SUMMARY DISCUSSION Cease repair activities on the small pumps, repair the existing large pumps and install a large pump where the small pumps are currently installed in the east well so that the wet wells and pumps can receive proper preventive maintenance.

BACKGROUND The large and small pumps available to send off have been evaluated. The Southeast Lift Station has been running without issue since the last update. Currently, a single large pump is in use with a rental diesel-powered pump for emergency backup.

SUPPORTING DOCUMENTS Document detailing options for repair/replacement

Summary:

The large and small pumps available to send off have been evaluated. It is recommended to:

- cease repair activities on the small pumps,
- repair the existing large pumps, and
- install a large pump where the small pumps are currently installed (east well)
- so that the wet wells and pumps can receive proper preventive maintenance.

The costs to follow this option are:

- Large pump repair (for three large pumps) will cost approximately \$37,000 (less freight).
- Installing the large pump in the east well will cost approximately \$150,000 to \$170,000 (including \$37,00 repair cost).

Two alternatives to installing the larger pump in the east well have been considered:

1. Install a small pump in the east well. Pros: lower cost (\$80,000 to \$90,000). Cons: the small pumps have been unreliable, and a single small pump is not sufficient to provide coverage while the west well is being cleaned so two must be refurbished and installed.
2. Do not install any pumps in the east well. Pros: lowest cost. Cons: the west pit would not be able to be cleaned, emptied, or maintained creating the possibility of losing functionality of the station.

	Pros:	Cons:	Rough Total Cost (Includes Repairing All Large Pumps, No Freight)
Install Large Pump In East Well	<ul style="list-style-type: none"> • Large Pump Allows Normal Operation During Cleaning • Large Pumps Have Proven To Be Reliable In This Service 	<ul style="list-style-type: none"> • Highest Cost 	\$150,000-\$170,000
Install Two Small Pumps In East Well	<ul style="list-style-type: none"> • Lower Cost 	<ul style="list-style-type: none"> • Single Pump Unlikely To Keep Up With Demand, Cost Is For Two • Smaller Pumps Shown To Be Unreliable In This Service 	\$80,000-\$90,000
Do Not Install Any Pumps In East Well, Do Not Fix Third Large Pump	<ul style="list-style-type: none"> • Lowest Cost 	<ul style="list-style-type: none"> • Cannot Empty West Pit For Cleaning And Maintenance • Could Lose Station Function 	\$40,000

Current Condition:

The Southeast Lift Station has been running (more or less) without issue since the last update. Currently, we are using a single “large” pump with a rental diesel-powered pump for emergency backup.

Large Pumps:

Two of the three “large” pumps have been removed and sent to the shop for inspection. Removal of the last of the non-functional “large” pumps will have to wait until we can lower the liquid level in the pit to the point where we can access the retrieval chain attached to the pump.

In each case so far, the impellers of the large pump have failed at approximately 18,000 hours of service. Impeller failure appears to have been a result of cavitation as the pumps attempted to pump against check valves that had seized mostly shut, limiting the fluid exiting the pump.

The check valves have since been repaired and are operating normally.

Repair costs for the first two pumps is \$14,000 and \$15,000, totaling \$29,000. It can be reasonably estimated that repair of the third large pump would be a similar cost to the first two, in the \$15,000 range. The cost to repair all three pumps the pumps is \$44,000. Overall time is 10-12 weeks after receipt of the pumps.

Back when the large pumps started to fail, the City ordered an impeller and it has been delivered. This would lower the repair cost total for all three pumps to approximately \$37,000 and one pump would be back in service in 8 weeks.

All costs above are without freight.

Small Pumps:

Two of the three “small” pumps have been removed and have been sent into the shop for inspection. The to one of the pumps was such that it was recommended by the shop to not repair the pump, with the anticipated repair cost being \$23,500. A new pump would cost \$29,000. Should we forego the repair, the cost would be \$1,035.

It is not recommended by the manufacturer’s representative to repair the pump.

The other small pump has a suggest repair cost of \$11,000.

None of the costs above include freight.

One of the “small” pumps is detached from the retaining rails (likely due to high vibration) and is currently sitting at the bottom of the well, waiting for it to be drained so the pump can be retrieved. It is thought this pump might be functional as-is, but it is assumed that it would need to be repaired or replaced for the cost estimates.

Discussion of Previous Small Pump Failures:

Each of the small pumps has had a failure of the connection between the pump and the connecting shoe, and this failure has been occurred multiple times. Initially, the bolts worked themselves loose, but after a locking compound was applied to the bolt threads, the metal in the bolt has failed. The surface

of the bolt wasn't smooth as would be expected in a "shear" failure, but irregular as would be expected in a metal fatigue case.

At no point has there been a satisfactory explanation to the cause of the vibration that resulted in the connection failures of the pumps. These failures have caused the small pumps to rip themselves, suddenly and generally with high energy, from their supporting structure. At this time one of the supporting rail structures are no longer serviceable since they have been damaged during the failure of the pump supports.

Previously, vibration monitoring was suggested as a potential mechanism to diagnose the root cause of the vibration and failure. As of this writing, we have been informed that permanent vibration monitoring is not possible, so the ability to diagnose the root cause is doubtful, and the ability to automatically safeguard the system by shutting down pumps experiencing high vibrations is entirely absent. Further, operations personnel have no confidence that the small pumps can be made to be operationally reliable.

It is suggested that the small pumps and associated support systems (VFDs, etc.) that cannot be re-used be sold.

Discussion of Future Failure Mitigation:

Installation of four "large" pumps will provide approximately double the maximum capacity required to run the station. The "large" pumps have generally been operationally reliable, except for the three recent sequential failures all caused by the cavitation.

Future failure mitigation activities include:

- Checking check valve operation (weekly), repair as required
- Collecting manufacturer suggested data (at intervals as suggested by manufacturer)
- Rotating which pumps are in operation
- Annually cleaning out both wet wells to make sure there is no buildup of deleterious material (sand, etc.) that will lead to premature pump failure

Suggested Steps:

1. Authorize repair of the first two larger pumps.
2. Install the first larger pump to arrive (~8 weeks) and send the emergency diesel pump back to rental company.
3. Pump down, drain, and clean wet well currently used for small pumps. (Cost included in item 4. below)
4. Modify rails/piping/control systems/electrical equipment, etc. as necessary to accommodate a single larger pump in the east wet well.
5. Install single large pump in east wet well.
6. Pump down west wet well, drain and clean.
7. Retrieve final large pump and send for repair evaluation.
8. Decide on repair of final pump. If repaired, reinstall in west wet well.
9. Sell now-surplus small pumps and any associated equipment.

Total cost: \$150,000-\$170,000

There are two alternatives that have been considered to installing the larger pump in the east well:

1. Install a small pump in the east well. Pros: lower cost (\$80,000 to \$90,000). Cons: the small pumps have been unreliable, and a single small pump is not sufficient to provide coverage while the west well is being cleaned so two must be refurbished and installed.
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