# Sauers Engineering, Inc.

Civil & Environmental Engineers

## MEMORANDUM

**To:** Mr. Vince Rogers, General Manager
Spalding Community Services District
502-907 Mahogany Way
Susanville, CA 96130

**From:** Dean Marsh, P.E.

**Subject:** **Spalding Community Services District Sewer Lift Station Evaluation**

**Date:** November 4, 2024

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Sauers Engineering, Inc. is pleased to provide this evaluation report relative to the sewer lift stations owned and operated by Spalding Community Services District.

The District currently owns and operates a total of four sewer lift stations. The lift stations were constructed as part of the original Septic Tank Effluent Gravity collection system that was installed between 2006 and 2007 and have operated for about 17 years. Since the pump stations only pump septic tank effluent, the stations have a unique configuration and utilize submersible pumps that resemble vertical multistage well pumps. Unlike most sewer pumps, the pumps are incapable of handling solids, but solids handling is not a requirement.

A. District Concerns

District staff has highlighted several concerns with the existing pump stations. The following discussion summarizes a few concerns and presents a brief discussion of the issues.

1. Soil Settlement

Soil around several of the stations has appeared to settle in recent years. Settling appears to be particularly problematic at Stations 1 and 4. Station 2 has reportedly also had some settling issues, but the problems appear to be less severe.

The concern with soil settling around the stations appears to be the result of poor construction techniques. Evidence suggests that during the initial construction, adequate compaction was not achieved in the deepest excavations.

The general areas of settling can be interpreted from Figures 1 and 2 which show the elevations of edges of concrete and center of manholes for Stations 1 and 2 respectively. At station #1, measurements show that the concrete slab around the pump wet wells is typically about 0.2 -0.3 ft lower than the western edge of the generator slab and the slab over the valve vault. For Station #2, differences in elevation between the various slabs is minimal. Although Station #4 was not surveyed, the visual evidence of the settling issues is very apparent. In some ways, the issues at Station 4 are more problematic because portions of the station were

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constructed in the middle of the road and visual observations suggest certain areas have settled by as much as 3-4 inches.

It is evident at Stations 1 and 4 that the locations that have the most issues with settling are in the area round the vertical wet wells that house the pumps. Settlement around the pumps is more likely when considering the construction process and the fact that these areas have the deepest excavation and consequently the greatest depth of compacted fill. When placing fill in an open excavation or trench, the fill is normally placed in lifts of a maximum depth. Since the compactive effect of a typical trench compactor only goes to a certain depth, each layer of fill must be thoroughly compacted before placing the next lift. When pipes and conduits are also placed at various locations within the excavation, the compactive effort becomes more challenging since the compaction efforts must avoid damage to the pipe and conduits.

When placing fill in an excavation, many Contractors have a tendency to place deeper lifts in order to speed up the process. If an inspector is not present to perform in place density tests or to watch the depths of lifts, moisture content and compaction effort, then the problem is buried and may not be noticed for a number of years.

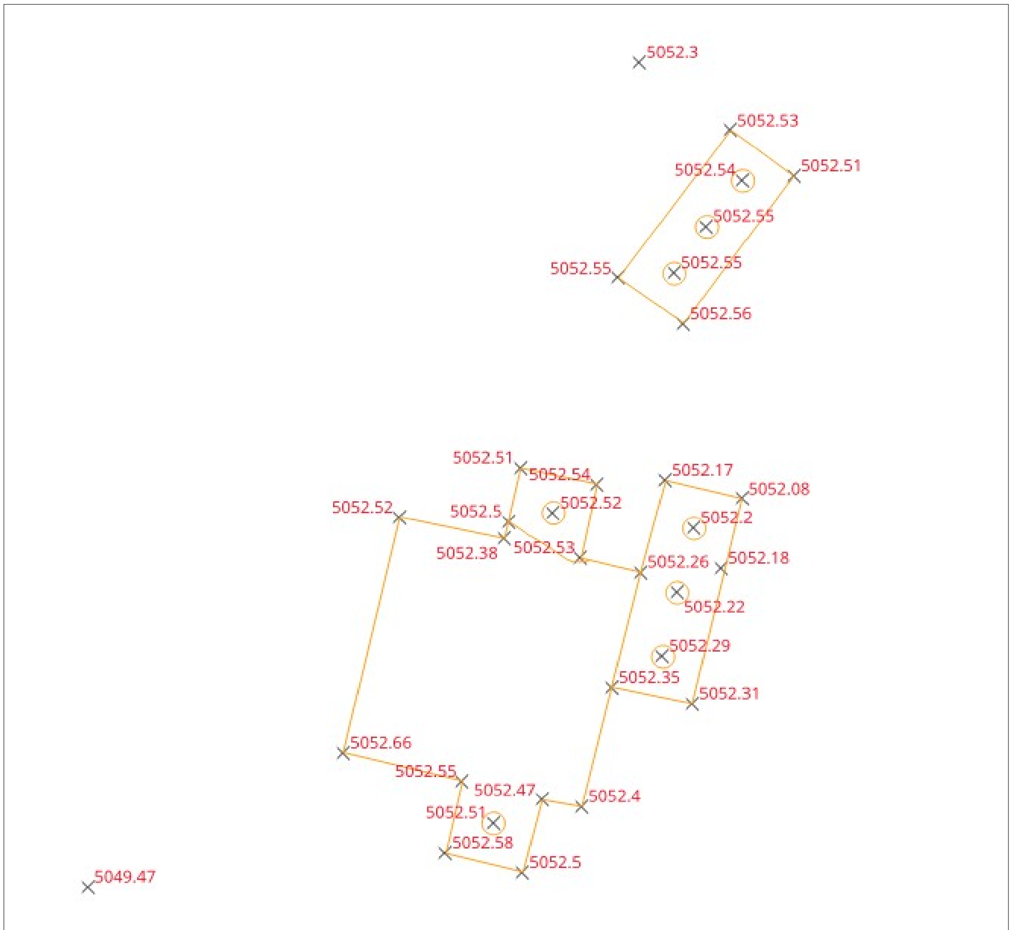

*Figure 1: Station #1 Concrete Sections with GPS Elevations*

The settling is demonstrated by the fact that the concrete slabs and lids which were placed over the top of the pumping wet wells have dropped over time. Specifically, at Station #1, the slab over the wet wells was surveyed to be about 3-4 inches lower than the other concrete on site. Original drawings called out the slabs to have the same finish grade elevation. Operators have reportedly had to trim the HDPE pipe inside of the manhole cover in order to get the lids to sit flush. This is further evidence to support the theory of consolidation of the surrounding soil structure. The bottom end of the vertical HDPE pipe is positioned on native undisturbed soil. As the surrounding soil consolidates, the wet well pipe appears to rise while the concrete and manhole lid appears to fall.

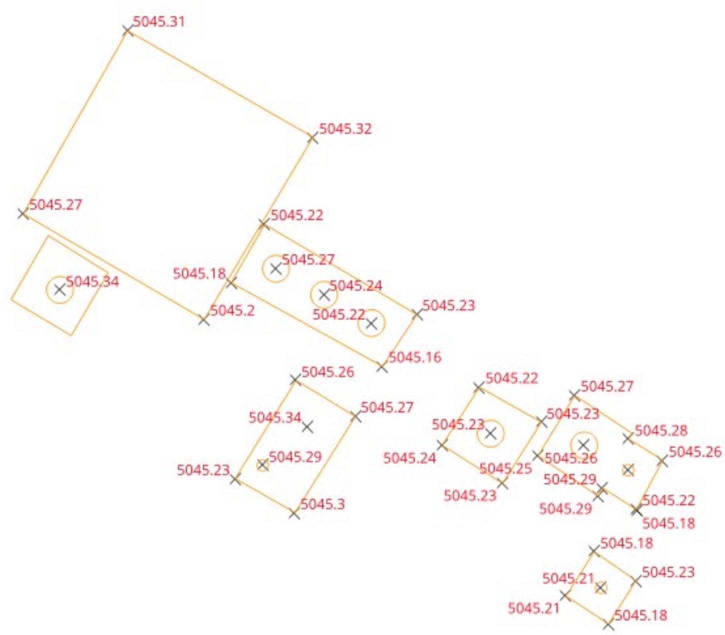


*Figure 2: Station #2 Concrete Sections with GPS Elevations*

2. Pitless Adapters
   The discharge from each submersible pump utilizes a brass pitless adapter typical of a submersible well pump. The brass pitless adapters appear to be in need of replacement due to significant corrosion. The pitless adapters at Station #1 appear to have failed and it is understood that at least one of them has been replaced. Due to the depth of the pitless adapters and the alignment of the HDPE casing, operators have been unable to reinstall the pump due to the depth and angle of the pitless adapter shoe.

Concern exists with the pitless adapter fitting at the remaining pump stations. Given the condition of the fitting at Station #1, it would not be surprising if this ended up being a component needing replacement at each of the stations. With 3 pumps at each station, the District has a total of 12 pumps in operation. At some point, each of the pitless adapters will likely need replacement.

As with most pitless adapters, the original units installed at the Spalding lift stations were made of brass. Due to the sulfides in the wastewater and the potential for sulfuric acid, a stainless steel version would likely have been more corrosion resistant.

For some reason, at Station #1, it appears that the pitless adapters were installed quite deep. The deep installation may have resulted from a need to raise the pad elevation due to being within a potential flood elevation. It looks like the pad was raised, but the rest of the equipment remained at the originally installed height. The result of this makes it very difficult to install the pump in the pitless adapter since the mechanism where the two surfaces come together is too deep to be able to get the mechanism to line up.

3. Station #1 Generator and Control Cabinet Location
   Both the generator and the electrical controls at Station #1 were installed over the top of the storage tank with a layer of compacted fill between the top of the tank and the concrete slab. Concern has been expressed regarding this configuration and the settling that has occurred around the site. The justification for the generator and controls being on top of the storage tank at Station #1 is also unclear. This configuration obviously saves space but since the station appears to be within the County Right of Way, it is unclear why there would be a space limitation.

   The added load of the equipment over the top of the tank should not be a concern since the tanks are installed in traffic areas at other sites and are assumed to have an H20 traffic load rating.

   The slab supporting the generator and controls does demonstrate some differential settlement. Figure 1 shows that the generator slab is showing a slight slope toward the direction of the pump wet wells. Elevations are lower in the northeast direction and higher towards the southwest.

   One concerning issue with the generator and controls is the cracking shown in the concrete covering the tank access shown in Figure 3. The crack exists between the main slab and a section of concrete slab was extended from the main slab to surround the tank opening manhole. Several contributing factors could contribute to a crack at this location.

a. As previously discussed, it is apparent that there is a general slope to the northeast in the direction of the wet wells where the pumps reside. The portion of concrete around the opening where damage exists may be less prone to settling due to the manhole risers extending from the top of the tank which will tend to support the concrete from underneath. As the surrounding soil consolidates, the manhole risers will support the slab projection thus causing the described damage.

b. Proper concrete construction techniques were not followed with the concrete work at this site. The extension over the access to the tank should not have been monolithic with the main slab. This is a classic case where a control joint should have been provided since differential stresses will inevitably cause a crack at the interface. The concrete around the opening on the other end of the tank is constructed in a similar way and it is surprising that a fracture does not exist there.

c. Lastly, due to the cold winter temperatures in this area and the weight of the generator and electrical controls, a perimeter footing that extends below the potential frost line would have been justified. Moist soil in the winter with freezing conditions could potential cause differential stresses on concrete work.

*Figure 3: Damaged concrete at Station #1 adjacent to generator and controls slab*

4. Station #1 Valve Vault Depth
   The depth of equipment in the valve vault at Station #1 is quite deep, presents challenges to operators and likely creates confined space entry challenges as defined by OSHA.

   The Record Drawings for the station do not call out elevations except for the invert of the storage tank and the finish grade for the slabs. However, it appears as though the site was raised to be higher than the surrounding area to possibly be out of a flood elevation. The raised site makes the depth of the check valve assemblies quite deep. If a remodel of the site was proposed, a valve vault at a shallower depth would make operations easier. There is no hydraulic requirement for the pump discharge lines to be so deep.

5. Challenges with Pump Removal
   The pump configuration at the lift stations are unusual when compared to traditional sewer lift stations. Since each individual pump is installed in a vertical casing that resembles a water well installation, the District must higher a contractor with a small crane in order to remove the pumps. Such a requirement limits the Districts ability to pull the pumps without the use of an outside contractor and increases O&M costs. A more conventional system with submersible pumps on slide rails would allow District operators to remove the pumps with something smaller such as an A frame with a chain hoist or with a small boom truck.

B. Discussion and Recommendations
It is apparent that the Spalding lift stations have multiple issues that present challenges and concerns with District staff. Some of the problems such as challenges with the pitless adapters and the cost of pump removal are just unanticipated operational challenges due to the unique configuration defined by the original design. Unfortunately, these issues are consistent across all four stations. Problems from the settling of fill around the pump wet wells are likely due to substandard construction techniques. It seems that a decision must be made as to whether the District focuses only on the settling issues or if a larger project is justified which would address the majority of the operational challenges moving forward.

1. Replacement of Compacted Fill

If the only issue of concern was with the settling of the compacted soil, a focused solution could remove the problematic fill material around the pumps and wet wells and replace it with a more closely monitored compacted fill or with a slurry cement product that does not require a compaction. Due to the depth of the wet wells, the total volume that would require removal is higher than one would expect. A preliminary estimate suggests that over 100 $yd^3$ would need to removed and replaced.  Additionally, for the Station #1 site, the excavation's proximity to generator and controls could present challenges with shoring such that it might be difficult to not disturb other components.

Due to the complexity of protecting the existing equipment and the depth of the required excavation, conceptual estimates for a focused project that would remove and replace the fill material would likely be in the range of $100,000 per site.

Since such a project would likely require an outside source of funding, then it might be worth considering a larger project that addresses more of the concerns moving forward. If the funding ends up in the form of a loan, then it may be justified to be more selective in which issues are addressed and at which sites.

2. Pump System Replacement

If sufficient funding can be made available, there is justification for a more extensive project that addresses as many of the District concerns as possible so as to minimize future O&M expenses. Such a project would replace the pumps, wet wells and valve vaults with a more conventional configuration that is easier to maintain.

The standard in the industry for sewer lift stations uses submersible pumps with a slide rail system similar to that shown in Figure 4. The slide rail system allows pumps to be easily removed with more conventional equipment such as a chain hoist on a jib crane or a small winch on a boom truck. The existing storage tank would remain as part of the system so as to provide emergency storage and to provide long cycle times for the pumps. The most economical option would include a fiberglass wet well in the range of 48-60 inch diameter.

As a potential project is considered, it would also be appropriate to also evaluate the current status of existing electrical equipment and generators. Our impression is that most of the electrical equipment appears to be in good condition and could potentially be used for a new duplex pumping system at each site. However, discussions with Aqua Sierra controls has raised concerns with certain components such as the proprietary Orenco pump controllers and the cellular modems. Given the age of the existing controls, new pump controls and telemetry could also be warranted. Such a project could relocate the controls at Station #1 so that they are not on top of the storage tank.

There are many variables when it comes to estimating costs for lift stations. Recent costs for very simplistic submersible sewer lift stations suggest that a basic lift station with simplistic controls could be constructed for about $400,000 to $500,000 per site. A proposed project addressing specific needs at each of the four sites might see numbers on the lower end of the scale due to the economy of multiple sites. These are very rough numbers and better defined estimates could be provided following a detailed design, but such an estimate would establish an order of magnitude for purposes of considering potential funding options.

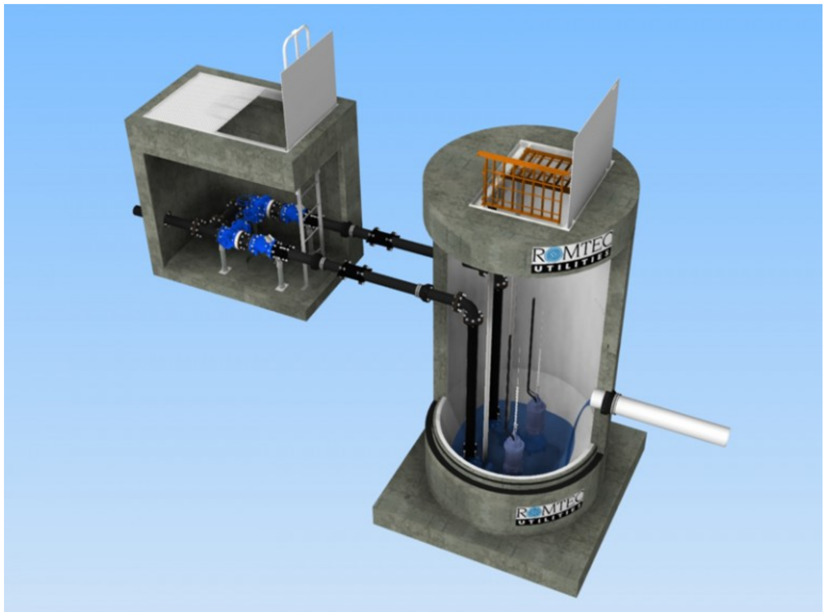


*Figure 4: Typical Submersible Sewer Lift Station Configuration w/ Concrete Wet Well*