

# Innovation in Municipal Wastewater Pumping has Already Occurred ... It Just Needs to be Recognized



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I have sold pumps and pumping systems into the municipal and other market segments for almost 40 years. I now find myself replacing those old, outdated pumps and controls. I don't consider that I am old and outdated, though. (No matter what some may think.) Everywhere we turn today, there are articles describing an industry roundtable finding, a publication noting deficiencies in our industry, or our government agencies asking questions. All are asking for, and looking for, "innovation" and sustainability.

Before I go on, I want to recognize The Water Environment Foundation (WEF) who published an abstract regarding the "*Municipal Wastewater Pump Station Design Problems and Solutions*." The study was written by Jeff Chapin, P.E., who has 32 years of experience in wastewater pumping design experience. What he covered, and what is still prevalent today is, in part, what I want to discuss here.

Mr. Chapin defined twelve problems and solutions associated with pump station design issues. They are in his order: 1. Concrete Corrosion Protection, 2. Corrosion Resistant Materials, 3. Pump Protection from Influent Sewage Debris, 4. Pump Selection Based on Total Dynamic Head Calculations, 5. Energy-Efficient Operation, 6. Pump Station Appearance, 7. Surge Protection, 8. Rehabilitation of Existing Pump Stations, 9. Odor Control, 10. Prevention of Leakage into the Pump Station Structures, 11. Provisions for Future Expansion and 12. Grit Deposition in Wet Wells Sized for Future Flow Rates.

I feel that these deficiencies endure. They cost municipalities and their rate payers additional burdens of increased and sustained maintenance and added fees required to continue to provide service. As you will see, with innovation, all of these are addressed. Following are some of the details of the twelve problems that are present today:

### **1. Concrete Corrosion Protection**

The study addressed the problem of corrosion caused by hydrogen sulfide ( $H_2S$ ) and the need for coatings and the maintenance or applying of plastic liners to wet wells; all adding costs from their uses.

### **2. Corrosion Resistant Materials**

The report called out the serious degradation of all carbon steel and coated metal components, again due to the hydrogen sulfide corrosion. The solutions described the specified use of 316 stainless steel for all exposed components and fasteners as well as fiberglass grating and ladders; all adding greatly to additional costs.

### **3. Pump Protection from Influent Sewage Debris**

The study found that many wet wells needed basket screens, or other methods to handle and contain debris to protect the pumps. It also pointed out that the debris had to be manually removed, the wet well cleaned by hand often, to be effective. The recommended solution was to add an additional vault, 12' in diameter, and comminutor and screens with grinders. It made note of the fact that the rakes and screens must be regularly cleaned by hand. Again, these solutions are at great additional costs.

### **4. Pump Selection Based on Total Dynamic Head Calculations**

The total dynamic head (TDH) calculations for the typical wet well lift station can vary widely with pipe diameters, pipe materials, and length of runs. Some current system designs lend themselves to possible oversizing or even undersizing of the pump when pipe ages are considered. Solutions are to use actual field surveys and measurements, consider all gravity feeding possibilities, and to use much care to size the pumps properly.

### **5. Energy-Efficient Operation**

A problem cited was the 50 year-old practice of using two pumps sized for peak flow rates. One pump is considered a stand-by. Findings have indicated that there is excessive on and off pump cycling through the longer force mains causing increased energy

usage and high costs. The suggested solution was to install a small jockey pump in the wet well that runs almost continually and limits the larger pumps to operating fewer times per day to affect some savings. (As we all know, the two greatest costs in municipal wastewater handling is energy costs and the cost of personnel.)

## **6. Pump Station Appearance**

The exterior appearance of an existing lift station has little to do with the surrounding neighborhood. Typically placed in areas of newer homes or apartments that are “upscale,” exteriors need to match the surrounding architecture.

## **7. Surge Protection**

A problem stated is when the pumps cycle on or off or there is a power failure, high surge pressures can damage piping. The suggested solution is to install surge relief valves at each pump and use soft start/stop electrical equipment.

## **8. Rehabilitation of Existing Pump Stations**

The WEF study found that after approximately twenty years of service that parts are no longer available for electrical controls, pumps and valves that need to be replaced. Also, structures, roads and electrical service are often in need of replacement. A partial solution offered is that each pump station needs to be examined separately to determine what rehabilitation measures are needed. Pumps and valves and other mechanical equipment items are replaced. Typically, dry pit submersible pumps are used to replace shaft pumps. New electrical controls are installed. Corrosion resistant materials are installed to replace corroded materials or epoxy coatings are applied to existing surfaces. (Costs, anyone?)

## **9. Odor Control**

Sewage piping designed for future ultimate design flows is often way oversized for initial flows resulting in long pipe retention times and septic odors to the consternation of the neighborhood. The suggested solution was adding a chemical feed system to the lift station. (Again, costs!)

## **10. Prevention of Leakage into the Pump Station Structures**

The problem stated is cracks or joints in precast concrete manhole structures used to construct new pump stations that can result in groundwater leakage into the pump station which must be pumped

to the treatment facility resulting in unnecessary costs and reduced capacity. WEF suggested using butyl caulking for a remedy.

## 11. Provisions for Future Expansion

Rapid growth experienced in some areas over the past few years can result in pump stations being undersized to convey projected flow rates. If provisions for future expansion are not included in the design, the entire pump station or major components of the pump station may have to be replaced. The solution for future expansion include the selection of pumps with higher than required motor horsepower to allow the future installation of larger diameter impellers capable of pumping increased flows. (Energy costs?)

## 12. Grit Deposition in Wet Wells Sized for Future Flow Rates

Another problem identified in the design criteria for submersible pump wet well sizing can lead to excessive grit deposition in the wet well due to initial low flow conditions. The grit can result in serious odor problems and is difficult to remove. The solution presented is to provide temporary solid concrete block filler in the wet well areas subject to grit deposition or provide baffle walls to reduce the wet well area during initial low flow conditions. In the future when the flows approach the design flow rate, the blocks or baffle walls can be removed.

Remember how I started? "Innovation in Municipal Wastewater Pumping has Already Occurred...It Just Needs to be Recognized." Some of us have recognized that innovation has *already* occurred. In fact, it occurred over 15 years ago in Europe. A company in France developed a wastewater pumping system that eliminates every one of the 12 issues mentioned above! Let me explain:

1. *Concrete Corrosion Protection* is accomplished as the emission of  $H_2S$  no longer exists as it is now contained within the enclosed pumping system. This system operates providing a clean and dry lift station. Even the impellers are designed to mix air into the pumped fluid to further reduced the  $H_2S$ .
2. *Corrosion Resistant Materials* are inherent as all the equipment is stainless steel;
3. *Pump Protection from Influent Sewage Debris* is no longer a problem as the pumps automatically shred debris and are automatically self-cleaning; without human intervention.
4. *Pump Selection Based on Total Dynamic Head Calculations* is resolved as this system is designed and constructed to determine the flows to be managed by operation at capacity on only one motor. As the system has two motors, there is 100% back up or pumping at 200 percent if needed;

5. *Energy-Efficient Operation* is controlled as the system automatically adapts to the incoming flow, up to the limit of the total flow of the 2 motors, i.e., from 0 to 200 percent of the nominal flow. The performance of this system is between 2 and 4 times higher than the flow rate achieved by traditional duplex wet well pump down or pumping in a batch mode to surge at the treatment plant.
6. *Pump Station Appearance* with this innovative system eliminates the wet well and it also eliminates the need for a separate vault for the valves. All valves are contained in the clean and dry former wet well reducing the footprint size. Electrical service can now be below ground for safety and/or appearance as well.
7. *Surge Protection* in this innovative solution includes and uses a soft start ramp on start-up and a deceleration ramp before stopping each pumping unit to eliminate valve shock and water hammer. These soft starts and stops also eases stress on aged piping systems.
8. *Rehabilitation of Existing Pump Stations* is unique as your current wet well can be converted to a clean, dry lift station without the expense of the corrosion resistant materials. Or as part of a new lift station installation project, the innovative system enables engineering and installations costs to be significantly reduced.
9. *Odor Control* is attained at no additional expense. This innovative system inherently operates clean and dry with no hydrogen sulfide escaping to the atmosphere. The impellers are designed to mix air into the pumped fluid further reducing the H<sub>2</sub>S.
10. *Prevention of Leakage into the Pump Station Structures*; while this is not a function of the pumping system to rectify, the innovative system has recognized this as an occasional issue. There is available a stainless steel package, drop-in, plug and play complete system. The in-ground stainless steel equipment room has a 25-year warranty against leakage.
11. *Provisions for Future Expansion*; with this innovative system units can be supplied in variable flow from 0 to 400 percent and linking networks, etc. In the event of extensions being planned to the collection network, you can choose the corresponding model for the maximum future output with the knowledge that from the start, the system can operate constantly at the bottom of its range without excessive consumption. e.g. An innovative system with rated power of two 4 HP motors used at 30 percent of its operating range will actually consume 30 percent of the power of only one of its motors, i.e., 1.2 HP.
12. *Grit Deposition in Wet Wells Sized for Future Flow Rates*. The innovative system in its design allows sand to be transported away in the flow and larger pieces of grit to be caught in the rear part of the body, or the "stone trap"

designed for this purpose, where they can be easily removed via the service hatch.

Now that you know there *is* an innovative and sustainable solution to these current and ongoing problems, you must be asking how you can get this system to reduce your costs and provide sustainability.

The system is called the DIP System® for "Direct Inline Pumping." It is manufactured in France by S.I.D.E. Industries. It is patented and proven by years of use. There are currently over 1,100 DIP Systems operating in France alone. Even Disney World® Paris recognized the benefits. All units for installation in North America will be shipped from Manhattan, KS. The DIP System is currently available through Steel Toe Group in Lenexa, KS. For more information, call (800) 475-0101 or visit [www.SteelToeGroup.com](http://www.SteelToeGroup.com).

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