The Waste in our Wastewater
Debris in collection and treatment systems

Observations from Florida experiences

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The Waste in our Wastewater

The purpose of this paper is to make observations, and suggest topics of further consideration including the collection of more information regarding the impacts of accumulated debris material in wastewater collection and treatment systems throughout Florida.

Waste in wastewater includes both intended and unintended waste. Our collection and treatment systems are designed to remove the biological waste, or the 'poo' which is intended. Other waste, or debris, is not intended. Debris can be naturally occurring or litter. Natural occurring debris includes sand and often times, grit. Natural occurring debris such as sand accumulates as a result of inflow and infiltration (I/I). I/I increases with aging infrastructure and can be exasperated by significant rainfall events. Litter includes rag material, and fats, oils, and greases (FOGs). Litter debris has been discarded into the wastewater by users of the system, commercial or residential. A distinction is made since the corrective measures and associated costs are significantly different. For example, reducing infiltration of sand is basically one capital consideration. Only the cost to replace or "line" collection pipes is considered. Whereas, reducing the amount of FOGs requires capital and may also require changes in behavior (i.e., putting grease traps in place and using them).

Debris accumulates in structures throughout wastewater collection and treatment systems. Typical structures include: pipes, manholes, lift stations, wet wells, grit chambers, aeration basins, tanks, digesters and other requisite structures.

Generally speaking, all wastewater collection and treatment systems must manage debris. Plant managers do a good job managing debris, and an even greater job managing around it when they must.

Many wastewater collection and treatment systems must negotiate around debris issues until the adverse effects become critical. There is obviously much awareness about the existence of debris. Design and policy considerations to reduce or manage debris are continuously improving. Wastewater collection and treatment systems have their own personality. Until the system is placed in operation, debris management cannot be fully implemented. Once placed in operation, plant operators are the best source regarding debris in their system. The practical reality is that debris does not always accumulate where it is designed to accumulate.

Debris can wreak havoc on the treatment process while increasing costs and reducing overall efficiencies throughout the system. There is much literature available on sand and grit issues related to wastewater treatment. This paper uses sand and grit to represent debris specifics. USEPA guidance dating back to the passage of the Clean Water Act identifies the importance of removing sand and grit. Sand and grit are unintended consequence of an imperfect conveyance system. Many vital services like wastewater require infrastructure below the earth's surface. Infrastructure (especially gravity systems) below the earth's surface (pipes, structures, etc.)

typically has joints, seams, gaps, cracks and shifts over time. These creates openings which allow sand and grit to enter the pipe. Once in the pipe they must go somewhere. Debris either accumulates in the pipe or ends up in a structure. As pipes ages the number of openings often increase.

Sand and grit can cause abnormal wear and tear on system components including pumps and other mechanical components. Debris, generally speaking, can greatly impact efficiencies of both mechanical and biological systems. Mechanically speaking, sand and grit can adversely affect operational aspects of the collection and treatment system including full or partial plugging of outlets and/or pump suctions. When accumulated sand and grit cover air bubble diffusers on the bottom of aeration basins, the consequence is a drastic increase in energy required to deliver the air to the wastewater for aeration. This increases energy costs. While intuitively understood, reducing the design capacity due to accumulated sand and grit does require unintended operational allowances to compensate. Sand and grit can unnecessarily increase the volume and weight of sludge increasing the cost of handling and disposal.

Small amounts of debris may only be a nuisance; however a lot of debris can cause significant damage to mechanical and pumping systems, especially over time.

Debris can increase operation and maintenance cost due to down time, energy needs and labor. Intuitively there is much recognition that accumulating debris is never good. It is compounded for this industry since people not familiar with the distinction between dirty water and water that is dirty (with debris). So, what is the big deal with the debris? The big deal is that the unintended debris can wreak havoc on the operation and maintenance of the wastewater collection and treatment systems. Often times, costs to remove debris are compared to zero cost (or “do nothing”). But the “do nothing” alternative really does not cost zero. Our collection and treatment systems are designed for wastewater and its impurities, not for handling unintended debris.

As wastewater collection and treatment systems budgets remain tight, plant managers must prioritize critical expenditures, including debris management. And like most debris, at some point, it accumulates to the point that it must be removed. That point is unique for every structure in each system. One of the challenges associated with debris, especially sand and grit, is that it is difficult to see and sometimes it gets managed using a tried and unreliable strategy - “Out of sight, Out of mind!”

Each system (or structure) is unique, creating variability in the cost of removing debris. Access to and frequency of removing debris are the largest cost drivers for the removal of debris. Figures 1 and 2 illustrate trends associated with the costs to remove debris. Accessibility is critical to removal. Frequency is also important. The longer debris remains in the structure the more challenging removal can be. Frequency affects significantly the hauling and disposal costs. Predictability and certainty are allies of plant managers, understanding the true cost of debris is important. Occasionally, maintenance cost must be compared to the “do nothing” option, as well as, the capital cost to retrofit alternative solutions.

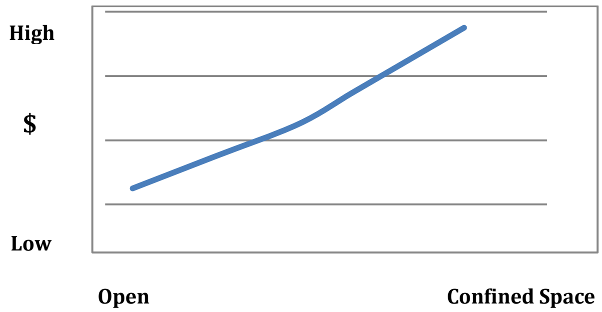

FIGURE 1 - ACCESSIBILITY OF DEBRIS

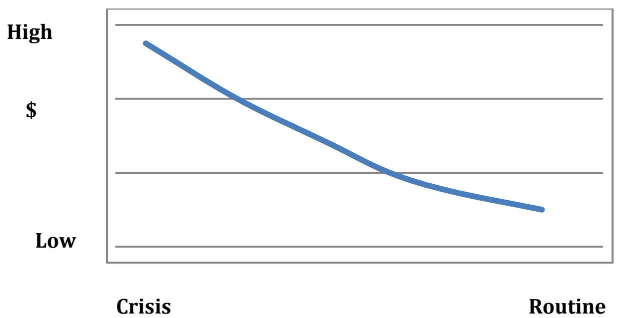

FIGURE 2 - FREQUENCY OF CLEANING

Efficiency of both the mechanical and biological systems must be taken into account regarding the cost of not removing debris. Labor and energy represent the largest component of operations and maintenance costs for most wastewater treatment facilities and collection systems requiring significant pumping.

Efficiency of the biological treatment is a function of capacity. Reducing the design capacity requires adjusting over time the design parameters such as mixed liquor concentrations. Plant managers balance these well. However, when accumulated debris gets collection or treatment systems to their "tipping point" the result can be costly.

The overall risks to be considered include: catastrophic, equipment, and regulatory risks. Figures 3 and 4, illustrate the cost associated with capacity and energy impacts related to the accumulation of debris, respectively.

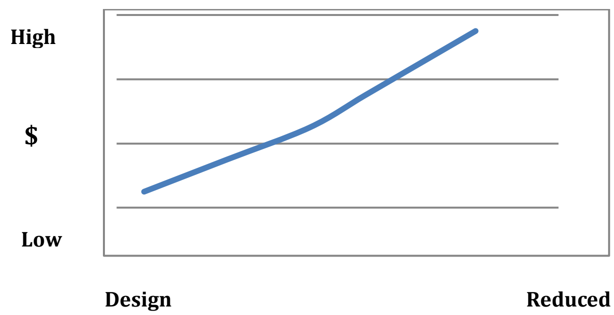

FIGURE 3 – DESIGN CAPACITY AVAILABLE

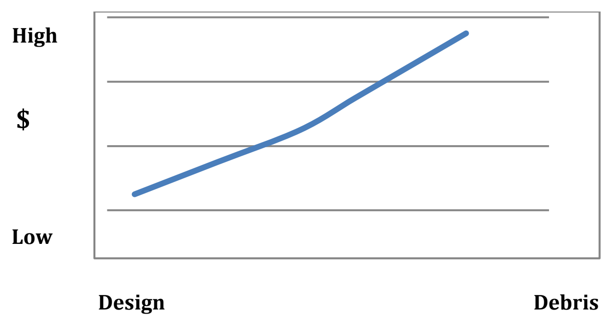

FIGURE 4 – ENERGY REQUIRED

Further Considerations

Based on the observations made in this paper four (4) areas are identified for further consideration:

1. What does the data say about debris? Is there data? If not, what data would be helpful?
2. What are the costs associated with removing debris?
3. What are the costs associated with not removing debris?
4. What is the “tipping point” for our collection or treatment systems? What is the cost of “tipping”?

Debris is intended for landfills. The sooner it gets there, the sooner the business of removing biological waste can be done cheaper. Let’s Grit’er Done!

Disclosure

It is difficult to obtain a complete perspective and understanding of a subject. The agenda of everyone, especially outsiders, is always suspect. Unfortunately, to understand the level of detail that matters one must be immersed in a subject. Unless a person is able to be a volunteer most of us require a job. And that is the link that connects our interest. Recognizing the importance of transparency, our company manufactures equipment that can remove debris from structures in the wastewater collection and treatment systems while they remain in operation.

This paper is not intended to promote our equipment. In fact, it is not mentioned. The observations made in this paper are based in more than 25 years of experience as a professional engineer, policy maker, and business owner with a desire to understand thoroughly the industry (or neighborhood in which we live and work).

About the Author

Denver J. Stutler Jr., was raised in St. Petersburg, Florida and attended the University of Central Florida where he received his BSE and MSE in Civil Engineering. Mr. Stutler's career of more than 25 years includes a unique combination of both public and private service at an executive level.

Currently, Mr. Stutler is the Chief Executive Officer of US Submergent Technologies. Mr. Stutler served as Secretary of the Florida Department of Transportation (FDOT). Prior to joining FDOT, Mr. Stutler served as Chief of Staff for Governor Bush. He began working in the Bush Administration as the Chief of Staff for the Department of Environmental Protection (FDEP) after serving on the gubernatorial transition team.

Prior to entering public service in 1999, Mr. Stutler was a Principal with Camp Dresser and McKee, Inc., an international environmental engineering firm. He served as Senior Fellow for Senator Connie Mack (R-FL) in the 105th Congress, where his duties included environmental and water related appropriations and policy. Mr. Stutler was a delegate in 1994 to the NATO sponsored research conference on Remediation and Management of the Degraded River Basins in Vienna, Austria. Additionally, he participated in an Engineering Ministries International Project team to Kinshasa, Republic of Congo (formerly Zaire), Africa, to engineer infrastructure improvements.

Bibliography

"Grit Removal, Treatment Of Wastewater, Assignment Help." http://www.expertsmind.com/topic/treatment-of-wastewater/grit-removal-915668.aspx

"Wastewater Treatment." Battle Creek Clean Water Partners. http://bcwater.org/waterfacts/wastewatertreatment.asp

Hydro International. "Advanced Grit Management - Advanced Grit Management." http://www.advancedgritmanagement.com

Andoh, Robert Y. G. "Busting the Grit Chamber Sizing Myth." http://www.wwdmag.com/grit-removal-equipment/busting-grit-chamber-sizing-myth

Andoh, Robert Y.G., and Neumayer, Adam. "Fine Grit Removal Helps Optimize Membrane Plants - WaterWorld." http://www.waterworld.com/articles/print/volume-25/issue-1/editorial-feature/fine-grit-removal-helps-optimize-membrane-plants.html

Andoh, Robert Y.G. "Weighing Your Grit Removal Options." *Water & Wastes Digest*, April 2009, pages 38 & 40.

Dayton, Scottie. "Sand Dollars." www.tpomag.com. www.tpomag.com/editorial/2012/06/sand_dollars

Dayton, Scottie. "True Grit." www.tpomag.com. www.tpomag.com/editorial/2009/12/true-grit

Dayton, Scottie. "Wastewater Treatment Systems." www.tpomag.com. www.tpomag.com/editorial/2011/11/wastewater_treatment_systems1

Herrick, Pat. "Grit Happens, You Don't Know What You're Missing." Speech, Indiana Water Environment Federation from Hydro International, Wastewater Division, Indianapolis, IN, November 16, 2010.

Moss Kelley Inc. "Grit Characterization in Florida Wastewater Plants." www.mosskelley.com.

Kiepper, Ph.D., Brian, and Casey Ritz, Ph.D. "Importance of Grit Removal from Commercial Shell Egg Processing Wastewater." www.caes.uga.edu/publications/pubDetail.cfm?pk_id=7998

Osei, Kwabena, and Robert Andoh. "Optimal Grit Removal and Control in Collection Systems and at Treatment Plants." http://cebd.asce.org.

Oyler, Kenny. "Headworks: Removing Inorganics and Preventing Wear." Water & Wastes Digest | The Solutions Source of the Water & Wastewater Industry. http://www.wwdmag.com/print/17473

Smith & Loveless Inc. "Understanding Important Characteristics of Vortex Grit Removal." PISTA Grit Removal System. www.smithandloveless.com

Weis, Frank. "Considerations for Grit Removal System Selection - WaterWorld." Water Management & Technology for water resources using water treatment, wastewater treatment & water recycling. http://www.waterworld.com/articles/print/volume-24/issue-1/editorial-feature/considerations-for-grit-removal-system-selection.html

Menendez, P.E., Marco R. with Black & Veatch. "How We Use Energy at Wastewater Plants…And How We Can Use Less" www.BV.com

Hunter, Gary; deBarbadillo, Chris and Pond, Dean with Black & Veatch. "The Testing of Grit Systems: Understanding Fact and Fiction." www.BV.com