WATER REUSE FILTRATION FOR GOLF COURSE IRRIGATION

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Abstract. *One of California's most impressive golf courses is demonstrating a high degree of conservation by utilizing highly treated recycled water for irrigating the grounds. With today's emphasis on water conservation, irrigation nozzles and emitters are getting smaller and smaller increasing the importance of a reliable filtration system. Effluent from a local wastewater treatment plant has unique qualities that must be considered when thinking about using it as a source for irrigation. After switching over to this reuse source the original filtration system at this golf course began rusting away and the control system was not adequate for the application. This paper will investigate the parameters to consider when looking at reuse water for irrigation and how they influence the design. Only if the filtration system works properly can the sprinklers stay free of debris keeping the greens green.*

Keywords. Filtration, Filters, Automatic Filters, Self-cleaning Filters, Water Reuse, Irrigation, Golf Course Irrigation, Effluent Reuse

Introduction

The Links at Bodega Harbour in Bodega Bay, CA is located just an hour north of the Golden Gate Bridge. This Scottish style links has whitecaps from the roaring Pacific Ocean as a backdrop to the lush green grass of the course and a deep blue sky overhead as shown in Figure 1.

Densely manicured turf, as highly desired on golf courses today, requires vast amounts of water to replace moisture lost to the atmosphere through evapotranspiration. Historically, this water came from the same surface or ground water supplies utilized for potable needs. With the growing population and industrialization of areas such as Northern California, human and recreational water needs start to compete. While The Links is known as one of California's premier golf courses, the general public may not know how this course is "green" in more ways than the obvious. Conservation minded management uses highly treated reuse water from a municipal wastewater treatment plant to meet the high water demands of actively growing turf. Reusing water from this source is becoming more and more popular (and necessary) in many parts of the world. Not only does it provide a much needed resource for recreational areas but also helps preserve estuaries and coastal regions from changes in salinity and nutrients that can degrade or at least alter such environments. Along with noble actions however, come secondary problems.

Figure 1. The Links at Bodega Harbour

Operation

Wastewater in a nearby urban area is treated at a wastewater treatment plant in a contemporary fashion. However, instead of simply being discharged to the ocean or a stream leading to the ocean, the effluent from the treatment plant undergoes additional filtration to remove organic and inorganic solids and extensive disinfection. The effluent then is piped to a 33 million gallon reservoir and stored as reuse water until needed for irrigation at The Links. Water is then withdrawn from the reservoir by the golf course's irrigation system for application to all the turf and landscaping on the course. A good system maintains the uniformity needed to see that every square foot of turf gets its share of water and nutrients.

Problem

With today's emphasis on water conservation, orifices in nozzles and emitter in irrigation systems are getting smaller and smaller. No longer do we have the luxury of being able to apply excessive amounts of irrigation water to recreational sites. Reuse water in the reservoir picks up wind-blown debris, small fish, snails, algae, insects and other critters. Pumps transfer water loaded with solids to the irrigation system. Once in the irrigation system these solids can quickly plug the fine orifices causing "brown" greens and other turf problems. Costly labor is required to clean and often replace plugged emitters. Fine robust filtration systems are a necessity today to prevent such happenings. The Links had an old irrigation filtration system but in 2004 the filters were rusting away and the control system was no longer reliable. Something had to be installed to replace the old system as soon as possible while using more appropriate materials of construction to prevent premature failure.

Solution

A dependable long term solution was found using three filters with weave-wire 316L stainless steel screens as positive barriers to organic and inorganic suspended solids. The manufacturer offered a complete line of automatic self-cleaning filters with the capability of fabricating manifolds and filter connections to fit right into the existing piping system. To prevent future corrosion problems, filters with stainless steel bodies were selected off the shelf. The Links at Bodega Harbour needed immediate action so three all stainless steel filters with high-performance multi-layer screens were shipped the day after they were ordered. Actual installation and start-up took only a day resulting in the system shown in Figure 2.

Figure 2. Three High Performance Stainless Steel Filters

Operating in parallel, the three filters easily handled the 1500 gpm flow rate using less than 1% of the flow for the self-cleaning operation. Even during the cleaning process water is provided downstream at all times since individual filters do not have to come off-line to clean themselves. The control system was specifically designed to clean each of the three filters sequentially taking only 8 seconds per filter. The cleaning cycle is initiated by either a differential pressure switch with a preset threshold or an adjustable timer inside the control panel. A solenoid control valve is a key component in the cleaning process used by many filter manufactures. If this valve plugs with debris, such as algae or sand, the filters will fail to operate properly. This problem was eliminated by using only solenoid control valves having large 5/8 inch openings that are virtually clog-free. The automatic flush cycle eliminates a lot of maintenance work and the new controller provides flexibility and dependability. A full description of how the filter operates is given in the Appendix and diagramed in Figure 3.

Conclusion

The earth's hydrologic cycle is the ultimate water reuse system. However, societal demands can no longer wait on "nature's way." We are learning to accelerate this cycle in ways that are safe for humans and non-detrimental to the environment of which we are a part. By utilizing wastewater effluent in non-potable ways, we can prolong the time, perhaps indefinitely, before much more drastic steps are required to provide safe water for human consumption. Irrigating golf courses with reuse water is one positive step in the right direction. As the praxis changes, new problems must be addressed. The Links at Bodega Harbour saw finer filtration needs, accelerated corrosion problems and a need for more sophisticated controls when switching to reuse water. These problems were solved with the installation of a new filtration system with greater capacity, more appropriate materials of construction, greater control capabilities, better reliability and expedient service. Automatic self-cleaning screen filters are proving themselves as desirable options for treatment of reuse water for many applications including membrane pretreatment. As more of these applications for reuse water become apparent, new problems will need addressing in unique ways.

Appendix

The operation of the filters used at this site is simple yet effective. Dirty water enters the ***inlet*** flange as shown in Figure 3 then passes through the ***coarse screen*** from outside-in removing large hard objects. The pre-screened water then flows to the inside of the ***fine screen***. As water passes from inside-out in the ***fine screen***, suspended solids are stopped if they are too big to pass through the screen openings. Clean filtered water then leaves the filter through the ***outlet*** flange. As more and more material builds up on the inside surface of the fine screen a pressure drop in the system begins to build. When a preset pressure drop threshold (7 psi) is reached across the fine screen, the controller is signaled to initiate a cleaning cycle. The first step in the cleaning cycle is to open the ***rinse valve*** to atmospheric pressure which quickly drops the pressure in the ***hydraulic motor chamber***. Because the hollow ***dirt collector*** connects the end openings in the ***nozzles*** to the ***hydraulic motor chamber***, water quickly moves from the ***nozzle*** openings, through the ***dirt collector*** into the ***hydraulic motor chamber*** and out the ***rinse valve*** to a drain. Since the ***nozzle*** opening is touching (optional selfadjusting nozzle) or nearly touching (standard nozzle) the screen surface, water rushes backward through the screen (outside-in) in a small area (about the size of a “dime”) at a velocity exceeding 50 ft/sec. This intense energy pulls off the stickiest material and expels it from the system though the ***rinse valve***. The ***hydraulic motor*** then rotates the ***dirt collector*** while the ***piston*** moves the ***dirt collector*** linearly. The tight spiral movement of each ***nozzle*** on the ***dirt collector*** assures that every square inch of ***fine screen*** surface is sucked clean of all debris in 5 to 12 seconds. The next cleaning cycle will begin when the pressure drop threshold is met again or until a preset time interval has been reached.

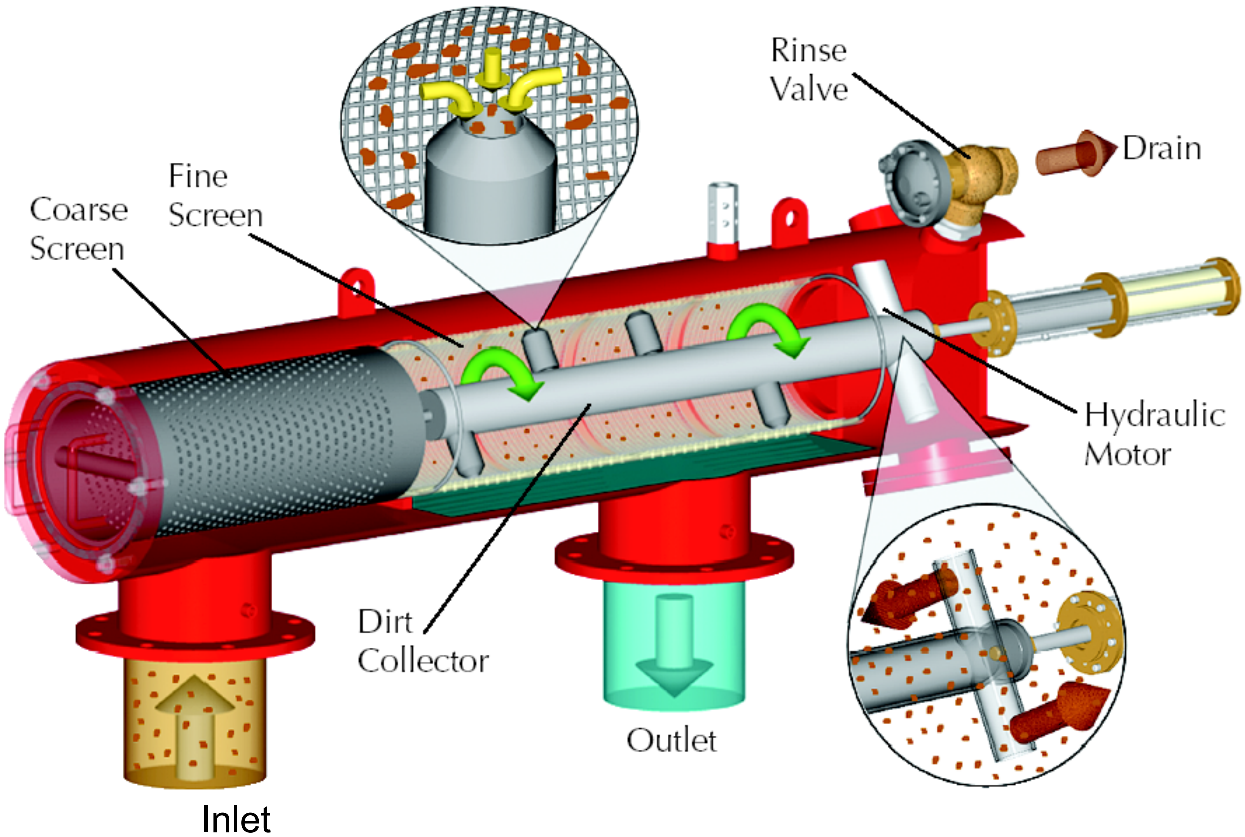

Figure 3. Automatic self-cleaning screen filter.

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