

Adding Clarification

By Brian Sprague



The city of Greenfield, Ind., owns and operates a Class III, 3.2-million-gal-per day (mgd) activated sludge wastewater treatment facility (WWTF). In October 2002, proposed design improvements by Commonwealth Engineers, Inc., Indianapolis, were made to increase the daily average flow capacity to 4 mgd and the peak capacity to 10 mgd.

ARTICLE SUMMARY

Challenge: The Greenfield WWTF's problem was the washing out of solids in their secondary clarifiers during high-flow conditions.

Solution: The facility decided to upgrade their secondary clarifiers to increase capacity and make the process more efficient.

Conclusion: The new clarifiers produce secondary effluent that reduces suspended solids, provides reduced velocity and occupies less space.

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The Greenfield WWTF consists of: an automatic fine bar screen, two grit chambers, a dry well raw sewage lift station, two primary clarifiers, aerated flow equalization tanks, three aeration tanks, three final clarifiers, six rapid sand filters for AWT, chemical feed facilities consisting of alum or ferric chloride injection for the primary influent, primary effluent, aeration tank effluent and three polymer feed systems with wetting devices, mixing, and aging tanks feeding to the aeration tank effluent.

It also has a two-cell chlorine contact tank with sludge return capability, a decant tank sludge thickener, one aerobic and one anaerobic sludge digester, four sludge drying beds, one 2-meter belt press and two parshall flume flowmeters for influent and effluent flow measurement. Backwash water is directed to the aerated flow equalization tank. The contents are normally returned to the wet well; overflow is discharged to the chlorine contact tank. In 1990, minor improvements were made to add dechlorination and effluent re-aeration facilities.

The WWTF upgrade included the construction of new screening, grit removal and raw sewage pumping. The existing primary clarifiers were expanded from two to four tanks, with a total capacity of 483,272 gal. The existing aerobic digester was converted to a fourth aeration tank with a total aeration capacity of 1,248,691 gal. The existing clarifiers were reconstructed (with Envirex Trans-Flo) and a new 80-ft-diameter clarifier was added with new RAS/WAS pumping. The existing filters were refurbished. A new high-flow treatment process was added for reducing load to the filters or secondary treatment. A new ultraviolet (UV) disinfection system was also added.¹

The plant's main problem was the washing out of solids in their secondary clarifiers during high-flow conditions. The solution was to upgrade to Envirex Trans-Flo secondary clarifiers. The Trans-Flo systems were installed in three existing 20-x-80-x-11-ft concrete tanks that previously contained siphoning bridge clarifiers sludge removal equipment and increased the

Greenfield, Ind., wastewater treatment facility upgrades with Envirex Trans-Flo secondary clarifiers

three tanks' overflow rate. Secondary capacity was increased further by operating the Trans-Flo systems in parallel with one new Envirex single 80-ft-diameter-x-14-ft SWD Rim-Flo Tow Bro system.

A Secondary Clarifier

The Envirex Trans-Flo secondary clarifier combines, in a single rectangular basin, a Rim-Flo peripheral side feed and takeoff clarifier, a Tow-Bro hydraulic sludge removal system and a chain-and-scraper collector mechanism. This design produces a secondary effluent that is lower in suspended solids and a fresher, more concentrated sludge. As a result, Trans-Flo clarifiers can occupy a smaller space with lower construction and equipment costs than conventional clarifiers. Influent is introduced into a channel extending the entire length of the tank, greatly reducing the velocity, and enters the tank through the inlet orifices.

Flow moves downward, then transversely across the tank, then up and back to the effluent channel. The full tank volume is used, short-circuiting is eliminated and solids settle uniformly.

Settled solids are moved a short distance by the chain-and-flight mechanism to multiple hydraulic sludge removal headers. The flights move at 1 ft per minute (0.3 m per minute), preventing disturbance to the sludge blanket.

The sludge removal headers are equipped with a series of orifices that continuously remove settled sludge uniformly across the width of the tank. The thickest layer of sludge blanket is always removed first so that the solids required to maintain the activated sludge process are returned quickly without unnecessary dilution.

Because solids deposition is uniform along the tank's length, sludge removal headers are evenly spaced to keep the average detention time of the settled solids in the range of 20 minutes. This assures a fresher and more concentrated sludge, returned to the aeration basin.

"The Trans-Flo upgrade performed 100% better than the previous rectangular siphoning clarifiers," said Mark Libby, plant operator.

"The solids would be completely washed out of the previous rectangular siphoning clarifiers during storms and now that no longer happens," said Eddie Williams, assistant plant superintendent.

Plant personnel also commented that they have not experienced any mechanical problems since their primary and Trans-Flo secondary clarifiers were placed online more than four years ago. While their previous molded 720 collector chain would break, leaving them with significant repair work and cost, the Envirex NCS720S molded collector chain has operated with no problems. WWD

References

1. Contract documents and specifications for the City of Greenfield, Ind., prepared by Commonwealth Engineers, Inc., October 2002.

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