

ACTIFLO® Clarifiers are Heart of Antioch, CA Recycled Water Facility



ACTIFLO basins at Delta Diablo



ACTIFLO recycle pumps

CHALLENGE

Due to a number of economic and ecological factors, the California State Water Resources Control Board requires power plant developers to evaluate the use of recycle water for cooling tower needs. For this reason, Calpine (a power plant developer) formed a public-private partnership between itself, Bechtel Enterprises and the Delta Diablo Sanitation District (DDSD) to build a new recycled water facility (RWF) in Antioch, CA for the supply of cooling tower make-up (CTMU) for two (2) area power plants. The power plants in question were the 550 MW Medanos Energy Center (MEC) and 880 MW Delta Energy Center (DEC), both having substantial cooling tower needs.

The RWF was to be designed to meet the state of California's stringent Title 22 standards for disinfected tertiary water as required for cooling tower use. To comply with Title 22 standards for cooling tower and irrigation uses, the treated water must meet the following requirements: (1) Filtered turbidity must be <2 NTU; (2) Filter influent must be monitored closely; (3) Filter feed water cannot exceed 5 NTU for more than 15 minutes; and (4) filter feed turbidity can never exceed 10 NTU. Due to frequent and prolonged turbidity spikes >5 NTU, the RWF could not meet the specifications without the use of a stable clarification system feeding the downstream filters. The ACTIFLO Process was chosen due to its stable performance during pilot testing and its reduced footprint.

PLANT OVERVIEW

The DDSD RWF consists of 13 MGD of Primary and Secondary treatment, the ACTIFLO Process, continuous backwashing filters, disinfection and a 2.4 MGD water storage reservoir and 7+ miles of recycled water distribution and return water pipelines to the power plants and irrigation districts. Cooling tower blowdown, RO reject and water from process drains, is returned to the DDSD chlorine contact equipment, where the flow is combined with the secondary effluent and is dechlorinated before discharge to the outfall. Without the use of the RWF, the outfall was receiving up to 14.2 MGD, this value is reduced to 9.9 MGD by using the RWF.

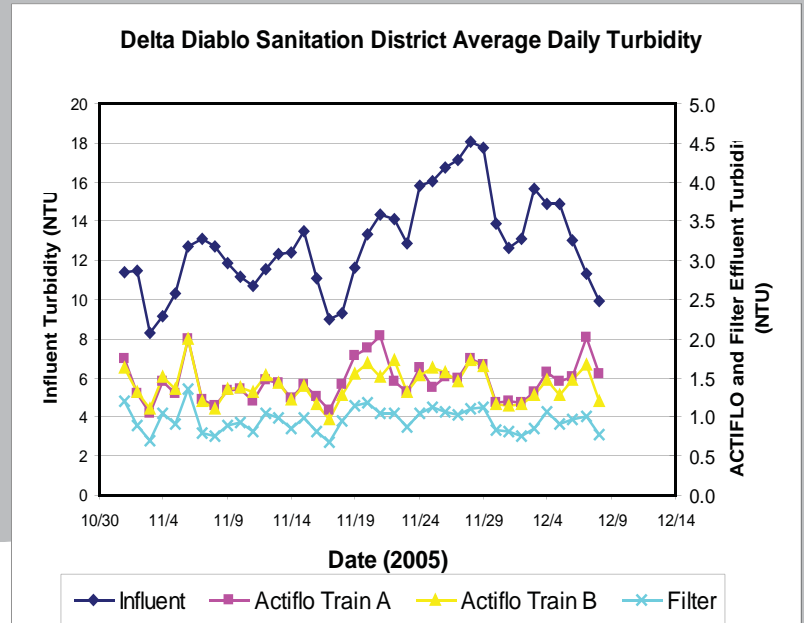
PROCESS SOLUTION

The RWF consists of primary and secondary clarifiers, two ACTIFLO Process microsand ballasted clarifiers, continuous backwashing filters and a storage reservoir. The Actiflo settled water turbidity is consistently 1.5- 2 NTU and 0.5-1.2 NTU out of the filters. The plant is run to optimize total water quality, and although the ACTIFLO Process is able to produce water with less than 1 NTU, the filters require water with some turbidity in order to ripen and operate efficiently.

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Effluent troughs



The ACTIFLO Process is designed to treat 14 MGD in a 2x7 MGD arrangement. Chemicals used include chlorine, aluminum sulfate, soda ash, and an emulsion polymer. Screened influent is injected with aluminum sulfate in front of the ACTIFLO Process coagulation tank. The pre-coagulated water is rapid mixed again with high intensity mixers prior to flowing into the injection basin. Treatment continues in the maturation tank where the remainder of the polymer is dosed and the ballasted flocs form and mature. Alum floc generally has a specific gravity of 1.05-1.2, while microsand has a specific gravity of 2.65, thus providing accelerated settling in the settling tank. Microsand ballasted floc enters the clarifier where it settles readily while clean water flows up through lamella tubes, thus polishing the effluent. Clarified water is collected in stainless steel launders before going to the downstream continuous backwashing filters. The average effluent turbidity out of the ACTIFLO Process is 1.5-2.0 NTU. The photo, above left, illustrates the ACTIFLO effluent which feeds continuous backwash filters with consistent feed characteristics.

Slurry pumps withdraw the sand/floc mixture from the bottom of the settling basin and send it to hydrocyclones that separate the floc from the microsand. The microsand is recycled back into the ACTIFLO system, where it is reinjected along with polymer in the injection tank. The hydrocyclone overflow solids are sent to the primary clarifiers at the front of the plant. The photo, above right, illustrates the recirculation pumps for the ACTIFLO Process.

The detention time through the ACTIFLO Process at full capacity is less than 15 minutes for a corresponding design treatment rate of 21gpm/s.f.. Each ACTIFLO system was installed with a coagulation/rapid mix basin with a design HRT of 1.5 minutes, an injection basin with a design HRT of 1.55 minutes, and a maturation tank with an HRT of 5.55 minutes. As well, each ACTIFLO train is equipped with hydrocyclone's to process sand/waste sludge.

As the graph illustrates, the influent turbidity ranges from 8-18 NTU. Coagulant additions generally range from 50-80 mg/L. Soda ash is added to maintain a neutral pH throughout the system. Emulsion polymer dosages range from 1.4-2.0 mg/L. Both of the ACTIFLO clarifiers produce water with <2 NTU effluent on a consistent basis, making the operation of the downstream continuously backwashing filters more efficient. Filtered water turbidity average 0.5-1.2 NTU to meet stringent California Title 22 standards.

CONCLUSION

Due to the effectiveness of the ACTIFLO clarifiers, the downstream filters at the DDSDD operate smoothly and efficiently, producing a high quality product for area power plants and irrigation districts to utilize as a low cost alternative.



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