



AQUA-AEROBIC SYSTEMS, INC.  
A Metawater Company

# SUCCESS STORIES

## PLANT NAME AND LOCATION

KUNMING PUZHAO WWTP - KUNMING, YUNNAN PROVINCE, CHINA

## DESIGN DAILY FLOW / PEAK FLOW

26.4 MGD (100,000 m<sup>3</sup>/day) / 34.3 MGD (130,000 m<sup>3</sup>/day)

## AQUA-AEROBIC SOLUTION

4-BASIN Aqua MSBR® System, 8 (12-disk) AquaDisk® Filters utilizing OptiFiber PA2-13® pile cloth media

## KUNMING PUZHAO WWTP IN CHINA OPERATES COMPLETELY UNDERGROUND, BELOW A PUBLIC PARK

The Kunming Puzhao Wastewater Treatment Plant (WWTP) located in Kunming, Yunnan Province, China is unique because it was built completely underground, due to limited land space available to accommodate such a large capacity plant. The facility operates below a public park that is surrounded by residential buildings.



Aerial view of the public park and residential area located above the Kunming Puzhao underground treatment plant.

Kunming Economic and Development District considered a few different treatment technologies for the new plant such as a membrane bioreactor (MBR), moving bed biofilm reactor (MBBR), and anaerobic/anoxic/oxic (A/A/O) system, but chose an Aqua MSBR® Modified Sequencing Batch Reactor with AquaDisk® Cloth Media Filters. The Aqua MSBR and AquaDisk filter technologies offered advantages of a small footprint and enhanced nutrient removal capabilities so the plant could meet its stringent permit limits for BOD<sub>5</sub>, COD, TSS, Total Nitrogen and Total Phosphorus in order to discharge into the nearby Baoxiang Creek.

Construction was planned in two phases. Phase I was completed in June 2015 and included all of the civil work. In December 2015, the plant was operating at a flow rate of 13.2 MGD (50,000 m<sup>3</sup>/d) with (1) Aqua MSBR basin and (2) 12-disk AquaDisk filters.

Although operating with half of the designed Phase I equipment, the plant was actually in its full design capacity from a hydraulic standpoint. Phase II is expected to be complete in 2018 with the addition of (2) more Aqua MSBR basins and (4) more AquaDisk filters.



An AquaDDM® Direct-Drive Mixer with a local control station in one of the Aqua MSBR® system basins to produce anoxic mixing.

Ms. Zhao, Deputy Director of Environmental Protection, Bureau of Kunming Economic and Development District, is very pleased with the operation and performance of the Kunming Puzhao WWTP and the customer support it has received from Aqua-Aerobic Systems, Inc. and its representative, CorStar.

## Aqua MSBR® SYSTEM PROCESS

The Aqua MSBR system features a combination of anoxic, anaerobic and aerobic cells with batch settling derived from sequencing batch reactor (SBR) technology. It eliminates the need for separate primary and secondary clarifiers while operating in a continuous flow/discharge mode with a full reactor volume at a constant liquid level. The system includes two sequencing cells and a variable number of specific function cells, depending on the effluent objectives of the plant. A 7-Cell configuration provides enhanced nutrient removal and functions as follows:

**Cells 1 & 7 - Sequencing Cells** alternate four phases:  
1) Anoxic Mixing and Mixed Liquor Recycle, 2) Aeration, Mixing and Mixed Liquor Recycle, 3) Pre-settle, and 4) Clarification. As Cell 1 progresses through phases 1-3, Cell 7 will remain in Phase 4 and vice versa.

**Cell 2 - Phase Separator Cell** is designed to concentrate recycled mixed liquor or solids feed stream to the anaerobic cell and promote an optimal environment to enhance phosphorus release within the anaerobic cell.

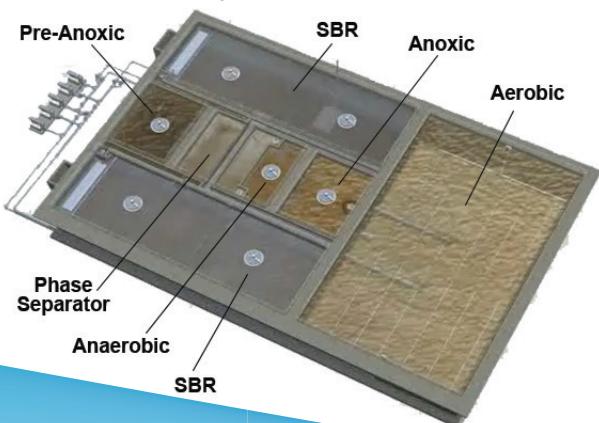
**Cell 3 - First Stage Anoxic Cell** is designed to provide denitrification and promote an increased concentration of volatile fatty acids (VFAs) in the Anaerobic Cell.

**Cell 4 - Anaerobic Cell** is designed to promote phosphorus release under optimized conditions.

**Cell 5 - Second Stage Anoxic Mixing Cell** is designed to provide denitrification.

**Cell 6 - Aerobic Cell** is designed to provide oxidation of carbonaceous material, nitrification, and the biological uptake of phosphorus.

The two sequencing cells are ideally equipped to assume multiple functions ranging from anoxic mixing, aerobic mixing, quiescent settling, sludge wasting and clarification. Each features a patented air weir that effectively controls effluent flow. Each specific function cell may be designed for optimum conditions with respect to wastewater characteristics and specific effluent objectives.



## AquaDisk® FILTER PROCESS

Clarified effluent from the Aqua MSBR system enters the concrete filters and flows by gravity through the cloth media of the stationary hollow disks. The filtrate exits through the hollow shaft which supports the individual disks and flows to the effluent channel. As solids accumulate on the surface of the media, the water level surrounding the disks rises. Once a predetermined level is reached, the disks rotate and the media surface is automatically vacuum backwashed clean. Heavier solids settle to the bottom of the filter tanks and are then pumped back to the plant headworks. Final effluent is discharged into the nearby Baoxiang Creek.

## OPERATING DATA - DECEMBER 2015 - Phase I

LOADING	DESIGN INFLOW	Avg INFLUENT	Avg EFFLUENT*	PERMIT EFFLUENT
Avg Flow mgd	13.2	6.6	NA	NA
Peak Flow mgd	18.1	9.0	NA	NA
BOD <sub>5</sub> mg/l	220	50	3	10
COD mg/l	450	100	11	50
TSS mg/l	250	70	non-detectable	10
TN mg/l	45	30	6	15
Total P mg/l	7	4	0.3**	0.5

\*Effluent quality after cloth media filters

\*\*Estimated to be 0.8 mg/l without addition of 25 ppm metal salt

## Aqua MSBR® SYSTEM ADVANTAGES

- No need for separate clarifiers
- Unique flow-through system
- Basin configuration optimized
- Existing aeration equipment can be utilized
- Superior performance even in low-strength, low-temperature wastewaters
- Fully automated control system
- Better sludge flocculation; no sludge collection mechanisms
- Low TSS discharge; effective nitrification, denitrification and phosphorus removal

## AquaDisk® FILTER ADVANTAGES

- Utilizes engineered cloth filtration media
- Produces consistent, reuse-quality effluent
- Requires lower backwash rates
- Tolerates extreme variations in load
- Filters continuously during backwash
- Low operation and maintenance
- Operates in a small footprint
- Eliminates sand media and underdrains