



AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

SUCCESS STORIES

PLANT NAME AND LOCATION

BASIN CREEK WATER TREATMENT PLANT - BUTTE, MT

DESIGN DAILY FLOW

7 MGD

AQUA-AEROBIC SOLUTION

Aqua MultiBore® C-Series CERAMIC MEMBRANE SYSTEM with (4) 100-Module Trains

Aqua MultiBore® C-Series Ceramic Membrane System Solves Disinfection By-Product (DPB) Challenge at Butte-Silver Bow, Montana

The Basin Creek Reservoir in Butte, MT served its community with pristine water from both sides of the Continental Divide for nearly 100 years. In 2010, a pine beetle infestation killed most of the trees surrounding the reservoir, many of which fell into the water, increasing the natural organic matter (NOM) level. As a result, Butte-Silver Bow (BSB) Water Utility received a violation notice from the Montana Department of Environmental Quality for exceeding their Maximum Contaminant Limit (MCL) for a certain type of disinfection by-product (DBP). This violation prompted the construction of the Basin Creek Water Treatment Plant (WTP).

In order to maintain the use of the reservoir, filtration needed to be added to reduce the NOM and in turn, the DBPs. Initial efforts focused on site selection, pilot testing, hydraulic analysis, distribution system modeling, and process selection. Based on these initial efforts, a pressurized membrane filtration process was selected and, ultimately, an Aqua MultiBore® C-Series ceramic membrane system was procured by BSB to produce safe and secure drinking water.

The elevation difference between the reservoir and the distribution system allowed the opportunity to use gravity as the driving power to run the filtration plant. The C-series ceramic membrane offers high pressure ratings, allowing BSB to better capitalize on the gravity power. The reservoir pushes water through the membrane and directly into town, so when users in the city turn on their showers or water their lawns, more water flows through the Basin Creek WTP. HDR's Project Design Manager, Nathan Kutil states, "It's very unique in that it is on-demand, but it is also powered by gravity." Chief Operator of the new plant, Jim Keenan, adds, "it saved a lot of infrastructure cost, and a lot of pumping cost – that was a big advantage of this design."



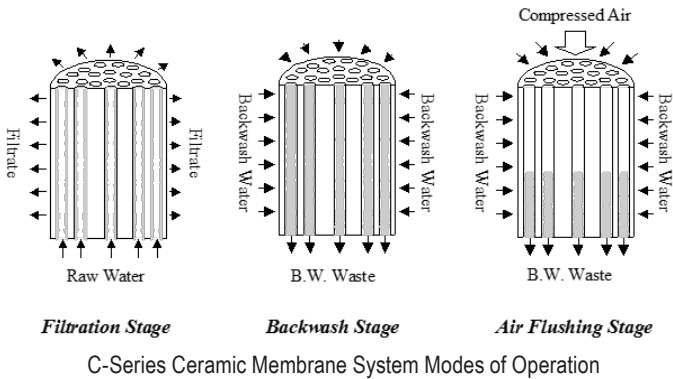
Basin Creek Water Treatment Plant - Butte, MT

In addition, the Basin Creek WTP was designed to be incredibly efficient; most water treatment plants waste about 10% of the water, but this treatment plant wastes less than ½ a percent of the water it treats – an overall plant recovery of about 99.98%. At the 7 MGD design flow, the plant wastes less than 14,000 gallons, very close to zero liquid discharge (ZLD).

"It's the first ceramic membrane gravity-powered, on-demand plant in the country," notes Keenan. "We've been really pleased with how well the system works and how efficient it is. I really think that we have the most durable, longest-lasting, superior-quality product and I am really excited about that. I think it's the future of water plants and the example is right here in Butte, MT."

Aqua MultiBore® C-Series CERAMIC MEMBRANE SYSTEM PROCESS

The membrane system has (3) main stages of operation: filtration, backwash, and air flushing. The filtration stage lasts until the trans-membrane pressure (TMP) increases to a preset value, which typically occurs after 2-6 hours, while the backwash and air flushing stages each last for 5-10 seconds. After backwashing, the modules return to filtration at a lower TMP, and the sequence is repeated.



DESIGN CHARACTERISTICS

Butte's primary membrane system consists of four trains, each with 100 modules arranged in (10) 10-module rows. The backwash water from this system is settled and treated with a backwash recovery train consisting of (2) 6-module rows. For both systems, each row has a complete set of valves such that it operates independently of the other rows; therefore, backwashes and cleanings are performed on one row at a time with the other row(s) in the train remaining in filtration.



Primary Ceramic Membrane Train - Butte, MT

AVERAGE OPERATING DATA - 2017

Since startup in May of 2017, both primary and recovery membrane systems have performed well, with overall system recovery exceeding expectations. The table below shows the performance of the primary system during the first eight months.

PARAMETER	VALUE	GOAL
Finished Water Flow, mgd	2.6 – 5.6	7.0 max
Trans-Membrane Pressure, psi	1.9 – 5.0	10 max
Membrane Permeability, gfd/psi	9.1 – 15.6	6.5 min
Turbidity, NTU	0.01 – 0.02	0.15 max
Total Organic Carbon, mg/L	1.8 – 4.9	---
Total Trihalomethanes, µg/L	12 – 23	80 (MCL) ¹
Haloacetic Acids, µg/L	11– 30	60 (MCL) ¹
<i>Cryptosporidium</i> oocysts	> 4 log removal	4 log removal

¹MCL is the Maximum Contaminant Level specified in the USEPA Primary Drinking Water Standards

Aqua MultiBore® C-Series CERAMIC MEMBRANE SYSTEM ADVANTAGES

- Short and infrequent backwashes result in very high recoveries
- Only 5 out of more than 20,000 elements have been replaced in 20 years
- Single-piece ceramic element with two seals is very unlikely to break or leak
- Independent 10-module rows increase flexibility and decrease footprint
- Inside-out filtration enables a high cross-flow velocity for maximum cleaning
- Material is very resistant to corrosion and high pressures/temperatures
- Systems are simple to operate and maintain
- Extremely uniform 0.1 µ pores result in high fluxes
- Used membranes can be recycled