



A packaged wastewater treatment system designed for superior effluent quality and multiple membrane products

**APPLICATION:** Municipal Wastewater

**CAPACITY:** 71 m<sup>3</sup>/d (18,670 GPD)

**LOCATION:** Craig, Montana, USA

**COMMISSIONED:** December 2017

## CHALLENGE

The Town of Craig, located outside of Helena, Montana is situated on the pristine Missouri River and is a haven for fly fishermen. The town was looking to construct a new robust wastewater treatment facility to handle the seasonal wastewater flows from the community, which mainly consists of tourist-focused shops, restaurants and lodging. The facility was designed to replace existing septic tanks in various locations and provide a connected sewer system for the town. Effluent quality requirements included BOD<sub>5</sub> < 5 mg/L, TSS < 5 mg/L, T-N < 5 mg/L, pH of 6-9 s.u. and Total Coliform < 2.2 cfu/100 mL.

## SOLUTION

A membrane bioreactor (MBR) was selected as the preferred treatment process in order to meet the permitted effluent quality. A packaged plant was preferred by the client for ease of installation and compact footprint. The stainless steel system was placed inside a small building with lab and office facilities to protect equipment, instrumentation and operations staff from harsh environmental conditions. The biological treatment system is designed to handle an average daily seasonal flow rate of 18,670 GPD with a maximum peak hour flow of 54 gpm during seasonal highs.

Raw water is first screened through a 2 mm rotary drum screen and transferred to the equalization tank to suppress the flow variation of the facility. This provides a more consistent flow and organic loading rate to prevent biological upsets which lead to poor treatment and foaming issues. From the flow equalization tank, the wastewater is pumped to a biological treatment train comprised of pre-anoxic, aerobic and post-anoxic zones. The mixed liquor from the biological trains flows by gravity to two, redundant membrane trains.

Screening equipment was rated for Class 1, Div. 1 hazardous location and was installed in a separate room than the packaged system. Carbon dosing to the post-anoxic zone was provided as supplement to enhance final nitrate polishing. A compact ultraviolet (UV) reactor was installed on the final effluent to provide further disinfection.



Figure 1: Town of Craig WWTP Building



Figure 2: Packaged Plant MBR System at Craig WWTP

## FLEXMBR™ SYSTEM

The flexMBR™ is a universal system designed to fit several MBR modules covering an acceptable membrane surface area range, for both flat sheet and hollow fiber products. A robust control system that accommodates a range of membrane manufacturers' operating parameters, including air scour rates, filtration cycles, cleaning frequency or other process control parameters such as sludge wasting to control MLSS, is also incorporated.

The supporting ancillary equipment was selected in order to facilitate various operating conditions, including: flow ranges for permeate pumps, air scour rates for membrane blowers, permeate and air header connections that are universal to the various module types and chemical dosing systems to satisfy the range of cleaning approaches.

The membrane modules were pre-installed on the platforms prior to shipping to provide a plug and play system. Toray TMR-90 modules were pre-approved and installed in the system, however, the system was also designed to accommodate other flat sheet and hollow-fiber membrane products.

The packaged plant approach contributes to a reduction in installation labor and on-site time for commissioning since the system can be fully tested at the factory. Figure 2 shows the packaged system components, including the treatment train, permeate/CIP pump skid, blower and RAS pump skid, chemical dosing skid, autosampler and control and power panels.

## RESULTS

The packaged MBR system provides superior effluent quality and meets even the most stringent discharge requirements as shown in the results below.

The benefits of a pre-assembled, pre-tested system include significantly less site installation labor and commissioning time to provide an efficient construction timeline. In addition, the use of the flexMBR™ product allows the end user to take advantage of other membrane products in the future should they chose to do so.

As the MBR industry moves towards standardization, there will continue to be advances in membrane technology. MBRs designed with flexibility allow users to take advantage of those advances.

Parameter	Effluent (mg/L)	DEQ-2 Criteria (mg/L)
BOD	3.4	< 5
TSS	< 1.0	< 5
TN	3.5	< 5
TKN	1.4	N/A
Ammonia	0.43	N/A
TP	0.1	N/A
pH	7.8	6-9
Total Coliforms (CFU)	< 1.0	< 2.2