

World's Largest Kubota MBR plant Retrofitted with FibrePlate™

City of Delphos WWTP Retrofit Project Summary

The Delphos WWTP was built in 2005 and commissioned in 2006. With a design capacity of 14.4 MLD (3.8 MGD) and peak flow of 29 MLD (7.7 MGD), the Delphos plant then was the second largest MBR in North America. The initial plant design used flat sheet membrane technology, supplied and commissioned by Kubota Membrane USA Corporation.

In 2015, Delphos launched a membrane replacement program as the original membranes were at the end of their practical life, and the plant was experiencing increased fouling incidents, sludging and membrane failures. There were concerns in replacing the membranes with the same type of flat sheet technology due to the high cost of operations, maintenance and power consumption.



To ensure that the best technology was selected, over (10) options were reviewed and studied by the City of Delphos administration, including GE W&PT (now Suez), Kubota Membrane Corporation USA, Koch Membrane Systems, Microdyn-NADIR and others.

Fibracast Ltd was ultimately selected to provide Delphos with its advanced FibrePlate™ hybrid UF membranes by meeting client needs; reduced operating costs, support and effluent quality improvement. FibrePlate by way of its unique membrane design and high packing density, was able to meet the required operational flow rates, all within a significantly smaller footprint. A smaller footprint meant lower civil work costs and reduced needs for ancillary operating equipment. Since FibrePlate operates using a unique “Dual Scour” membrane technology, operating costs were also reduced by way of lower aeration rates, lower TMP and cleaner membranes surfaces.

The original Delphos plant design required (5) five large Kubota membrane treatment trains to treat a plant capacity of 3.8 MGD. FibrePlate, with its high membrane packing density, only required one (1) of the original treatment trains in which to meet plant flow requirement of 3.8 MGD ADF with a peak flow of 7 MGD. As a result, four of the previously required Kubota membrane treatment trains were no longer needed and thus redundant for the new FibrePlate operations. By the freeing up (4) four very large membrane treatment trains Delphos was afforded a new and unexpected opportunity; more tankage in which to optimize their existing biological processes.

Due to the size and logistics of the plant, the retrofit required Train 5 to be divided into (3) new separate trains with the installation to occur in (3) three phases; Phase I, FibrePlate™ UF membrane train was installed and commissioned in December 2015. Phase II, a second FibrePlate™ train was installed and commissioned in June 2018 and for Phase III, a third FibrePlate™ train is anticipated for installation and commissioning in Q3 2021. Each membrane train consists of (4) Cassettes populated with (84) FibrePlate membrane modules with one spare cassette space.



Figure 1.0 – Delphos train elimination with FibrePlate installation



Figure 2.0 – FibrePlate 28-Module Cassette (42,000 ft² membrane area)



Figure 3.0 – Delphos aerial view of membrane tanks with Train 5 retrofit

Three (3) FibrePlate™ membrane trains, fit easily into a single (1) Kubota membrane tank train, resulting in the existing other (4) trains, redundant with space now available for other plant uses and/or biological optimization. All ancillary equipment associated with the

redundant (4) trains such as blowers, RAS pumps, cleaning systems, etc. were no longer required.



Before
Example of 1 of 5 membrane tank pipe galleries



After
Removal of redundant piping, valving and actuators not needed with FibrePlate operation



Figure 4 – FibrePlate Membrane Tank at Delphos – Train 2 in the center being installed

In 2018, the second Fibracast membrane train (on the right) was commissioned. The third train anticipated to be commissioned and in service by the end of Q3 2021.

Table 1 – Summary of the operating flows on Train 1 (FibrePlate train).

Flow	Train 1
Average Daily Flow ADF (MLD)	3.64
Maximum Weekly Flow MWF (MLD)	4.96

Table 2 - Typical average permeate quality parameters.

Parameter	Train 1
Turbidity (NTU)	<0.1
CBOD5	1.6
TKN (mg/L)	n.d.
TP (mg/L)	1.49 – 2.21
TSS (mg/L)	0.6

Table 3 – Summary of Delphos WWTP OPEX Annual Savings



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Avg. Flow, Gallons/hr	36,186.88
Operating Hours, hr/yr	4,658,640.61
Previous Operating Energy, kWh	531.81
Fibracast Operating Energy, kWh	61.83
Savings, kWh/yr	4,117,011.59
% Savings	88%
Electricity Cost, \$/kWh	0.06
Savings, \$/year	263,488.74
Total Incentives, \$	97,285.72
Project Cost, \$	2,447,623
Net Cost, \$	2,350,337.28
Simple Payback Period, yr	8.92

Source: Ohio AEP Presentation, City of Delphos WWTP