CASE STUDY

Wastewater Reclamation

CLEAN MEMBRANES

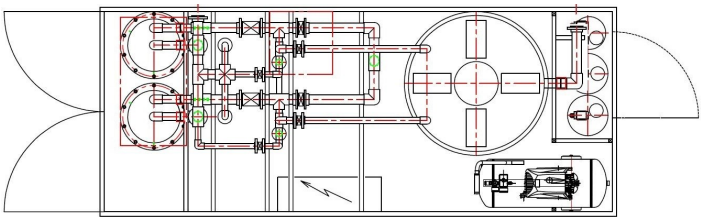
Clean Membranes Successfully Pilots an Innovative Membrane Technology for Generating Class A Reclaimed Water from Municipal Wastewater

In conjunction with the **Town of Amherst**, MA and with funding support from the **Massachusetts Clean Energy Center** (MassCEC), **Clean Membranes** completed a 6-month pilot study in 2017 to demonstrate the ability of its **C²-UF WR** ultrafiltration membrane system to cost-effectively produce reuse quality water from municipal wastewater treatment plant (WWTP) effluent.

The pilot study was designed to be responsive to MassCEC's policy objectives, which included 1) the application of innovative water treatment technologies to assist cities and towns with recovering wastewater resources for non-potable reuse, and 2) increasing energy efficiency. The Town of Amherst's active participation in the pilot study reflected its interest in finding cost-effective alternatives to public water supplies in order to meet its growing demand for non-potable water.

Clean Membranes' **C²-UF WR** wastewater treatment system incorporates Polymem's innovative Gigamem™ membrane module technology with ultrafiltration elements made from their highly fouling-resistant Neophil™ PVDF, developed jointly with Arkema.

The containerized C²-UF WR pilot system features two compact Gigamem® modules with Neophil™/PVDF membrane fibers.



Schematic of the Containerized C²-UF WR system used in the pilot study

C²-UF WR Exceeds MA Requirements for Class A Reclaimed Water (314 CMR 20.00)

Parameters	Class A Reclaimed Water- Effluent limits, 314 CMR 20.17	Pilot Effluent
pH	6.5-8.5	6.79 – 6.96
BOD_5	<10 mg/L	<2 mg/L **(BDL)***
TSS	<5 mg/L	0 – 0.2 mg/L
Turbidity	Average <2 NTU within any 24-hour period; None >5 NTU more than 5% of the time within a 24-hour period; None >10 NTU at any time	Daily average NTU ranged from 0.039 – 0.141; No results >5 NTU
Fecal coliform	Median of no detectable fecal coliform/100 ml over continuous seven-day sampling periods; Not to exceed 14/100 mL	<1 CFU/100 mL **(BDL* in all samples)**
TN	<10 mg/L	5.463 – 6.416 mg/L

* BDL = Below detection limit

C²-UF WR, Reclaiming 150,000 gpd of Municipal Wastewater, Saves Money

Average Cost of Municipal Water	Cost $/HCF
2017 Amherst Water Rate (State Average)	**3.80 (4.20)**
2017 Amherst Sewer Rate (State Average)	**3.75 (6.08)**

Cost** of Reclaimed Water with C²-UF WR	Cost $/HCF
UF system cost (20 year asset life)	0.318
UF system equip maintenance	0.164
UF membrane replacement	0.093
System power	0.063
System chemicals	0.052
System Operating labor (<1 hr/day)	0.188
Post-treatment chlorination/ equipment	0.100
Total cost**	**0.978**

** Some cost savings values are specific to Amherst, MA;
Cost savings for other municipalities will be analyzed with consideration for local data inputs

400 West Cummings Park, Suite 1625 ○ Woburn, MA 01801 ○ 781-491-0394 ○ www.cleanmembranes.com