

PROCESS DESCRIPTION

The membrane operating system (MOS) for the Healdsburg wastewater treatment plant consists of a five parallel membrane tanks with a common overflow weir. The following gives a brief background into the design and configuration of the Healdsburg membrane bioreactors (MBR) system. The MOS design has been based on the following conditions:

Average Daily Flow: 1.6 mgd
Maximum Capacity: 4.0 mgd (this peak can be up to two weeks in duration with the winter storm season)

The system uses membrane modules with a surface area of 404 sq.ft. Each module contains thousands of hollow fibers made of chlorine resistant polyvinylidene fluoride (PVDF) material with a nominal pore size of 0.04 micron.

The MOS includes five membrane tanks for the 4.0 mgd capacity, each equipped with:

- 144 modules in 9 racks of 16 modules
- Each cell can accommodate up to 160 modules in 10 racks to provide room for 11% excess membrane area
- Total effective area per membrane tank is 58,176 sq.ft.

The system will operate based the levels in the biological tank, the filtrate pump variable frequency drive will adjust proportionally to the operating band in the biological tanks. As such, flux rate of each membrane tank will vary because of the variation in influent flow. However, for the design flows, the system will have operating instantaneous flux rates as follows:

Average Daily Flow

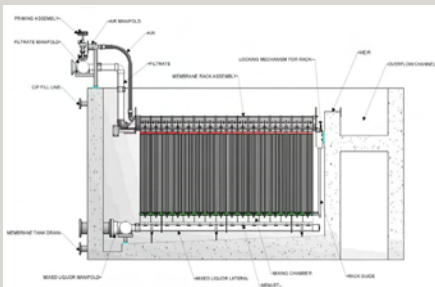
- 3 units in service, 2 in standby: 11.2 gfd (19.1 lmh) @ 20°C
- 4 units in service, 1 in standby: 8.4 gfd (14.3 lmh) @ 20°C

Peak Daily Flow

- 4 units in service, 1 in standby: 21.6 gfd (36.7 lmh) @ 20°C
- 5 units in service, 0 in standby: 17.3 gfd (29.4 lmh) @ 20°C

System Description

The mixed liquor (ML) is drawn from the biological system and pumped into one of the membrane tanks, approximately five times the average flow. Once the ML enters the membrane tank, it is directed into a ML feed manifold and lateral system. As the ML exits the jet manifold, air is introduced into the base of the module where it mixes with the ML.



This two-phase stream flow up around the modules scouring the membrane fibers as it passes. The concentrated return ML overflow the tank weir into a common trough before returning to the biological system, typically with dissolved oxygen concentration of between 5 and 7mg/L.

A single filtrate pump is provided for each membrane tank which applies a vacuum or suction pressure for filtration, typically between 0.5 psi and 8 psi. The filtrate produced from each membrane tank is combined after each filtrate pump and is directed downstream for further treatment.

To promote enhanced membrane life and minimal operational costs, the MemJet® system is designed to carefully manage the environment around the membrane. The environment is optimized in the following ways:

- Combined ML and air jet injection into the membrane module base, to reduce membrane dehydration and solids accumulation.
- Two-phase ML and air injection eliminates mal-distribution effects and solids polarization, commonly seen in overflow and continuous bleed systems.

During a membrane filtration process, membranes will gradually accumulate a filter cake and inorganic and organic foulants on the membrane surface increasing the amount of suction pressure required to produce a certain flow rate. To keep this change of pressure to a minimum, three major cleaning techniques are used at the facility: relaxation, maintenance clean, and clean in place.

The Healdsburg Wastewater Treatment Plant Story

As a result of a U.S. Court decision, the City of Healdsburg was ordered to construct an advanced wastewater treatment facility. The plant will have a design average dry weather flow of 1.4 mgd with a sustained peak of 4 mgd. The City and HDR (consultant) investigated two options: conventional BNR plant and MBR with Cannibal® solids processing. The MBR/Cannibal® process was selected as having the lowest present worth cost.

MBR treatment uses Siemens membranes and disinfection is provided by low pressure, high intensity UV lamps. The Healdsburg facility is one of the most advanced and innovative treatment facilities in California. Ultimately, virtually all plant effluent will be reclaimed for full, unrestricted reuse. The Cannibal® process is guaranteed to produce 0.15 pounds of biological solids (excluding inerts) per pound of BOD removed, compared to a normal biosolids yield of 0.4 to 0.55. Bids were received in June 2006, and Overaa & Co. of Richmond, California, was awarded the contract for \$29.35 million.

CITY OF HEALDSBURG MEMBRANE WASTEWATER TREATMENT FACILITY

Featured at the:
**American Membrane Technology Association
Technology Transfer Workshop
March 12 - 13, 2008
Santa Rosa, California**



**Facility Cost:
\$30 million**

Project Information Contacts

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SIEMENS

HDR

PROCESS EQUIPMENT DESIGN CRITERIA

INFLUENT WASTEWATER FLOWS

Average Day	1.6 mgd
Peak Hour	4.0 mgd

HEADWORKS

<u>Coarse Screens</u>	
Number	2
Type	WedgeSection
Capacity	7.5 mgd (each)
Opening Size	0.25 Inches

Grit Basin

Number	1
Type	Forced Vortex
Capacity	10 mgd

Fine Screens

Number	2
Type	Ultra-Fine
Capacity	4.0 mgd (each)
Opening Size	1 mm

BIOLOGICAL AND AERATION FACILITY

Aeration Basin Structure

Number of Trains	2
Number of Basins	2
Capacity	350,000 Gallons
Total Capacity	700,000 Gallons

Denitrification

Number of Trains	2
Number of Basins	4
Total Capacity	520,000 Gallons

Mixers

Number	8
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Membrane Feed (Mixed Liquor) Pumps

Number	6
Type	Submersible Non-Clog
Capacity	3,000 gpm @ 25 Ft

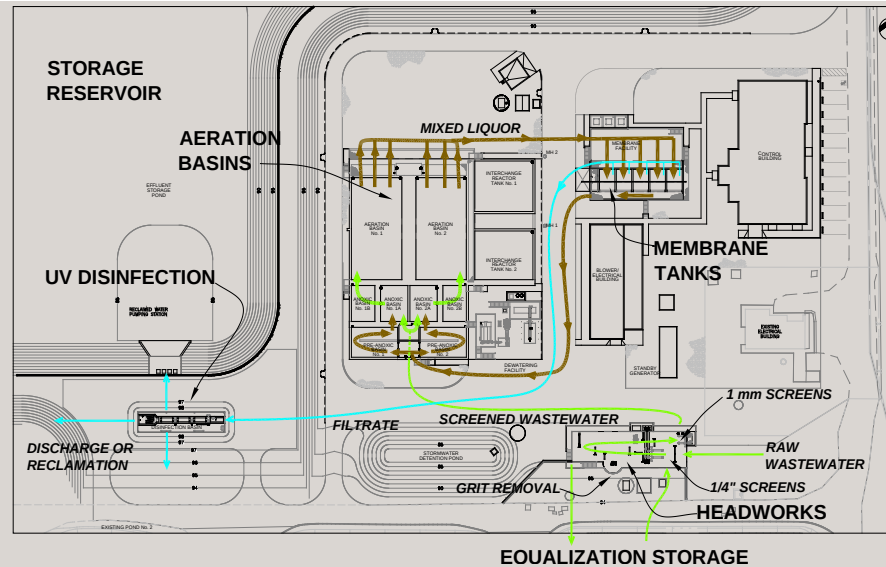
MEMBRANE FACILITY

Membrane Tanks

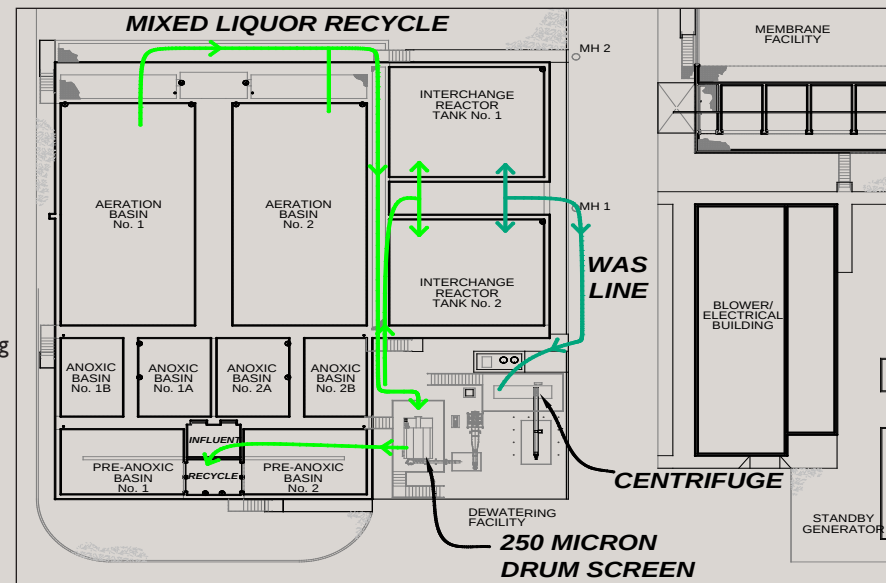
Number	5
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Membrane CIP Chemical Pumps

Number	2
Type	Gear
Capacity	500 gph, 1,000 gph



Liquid Stream



Solids Stream

MEMBRANE FACILITY

Filtrate Pump	
Number	5
Type	Rotary Lobe
Horsepower	20
Capacity	3,000 gpm @ 20 Ft
Drive	Variable

BLOWER BUILDING

Aeration Basins and Interchange Reactor

Tanks Air Supply Blowers

Number	4
Type	Multi-Stage Centrifugal
Capacity	2,100 scfm @ 100° F
Horsepower	150

DEWATERING FACILITY

Centrifuge

Number	1
Type	High Solids Dewatering
Capacity	Average 75 gpm
	Maximum 100 gpm

Rotary Drum Screen (for Cannibal® System)

Number	1
Length (approx)	164 Inches
Width (approx)	95 Inches
Opening Size	250 Micron

INTERCHANGE REACTOR TANKS (CANNIBAL®)

Tanks

Number of Tanks	2
Total Capacity	216,800 Gallons

Mixers

Number of Tanks	2
Type	Propeller

Sludge Feed Pump

Number	1
Type	Progressive Cavity
Capacity	150 gpm @ 20 psi

ULTRAVIOLET (UV) DISINFECTION

Number

Number	1
Banks	
Number	3
Modules per Bank	8
Lamp Type	Low Pressure, High Intensity
Lamp Configuration	Parallel

