Wastewater Reuse With Membrane Bioreactor Technology

55th Annual Wastewater Workshop

Hilton Doubletree Hotel, Columbus Ohio

March 24, 2018

Dr. Thomas H. Marshall, P.E.

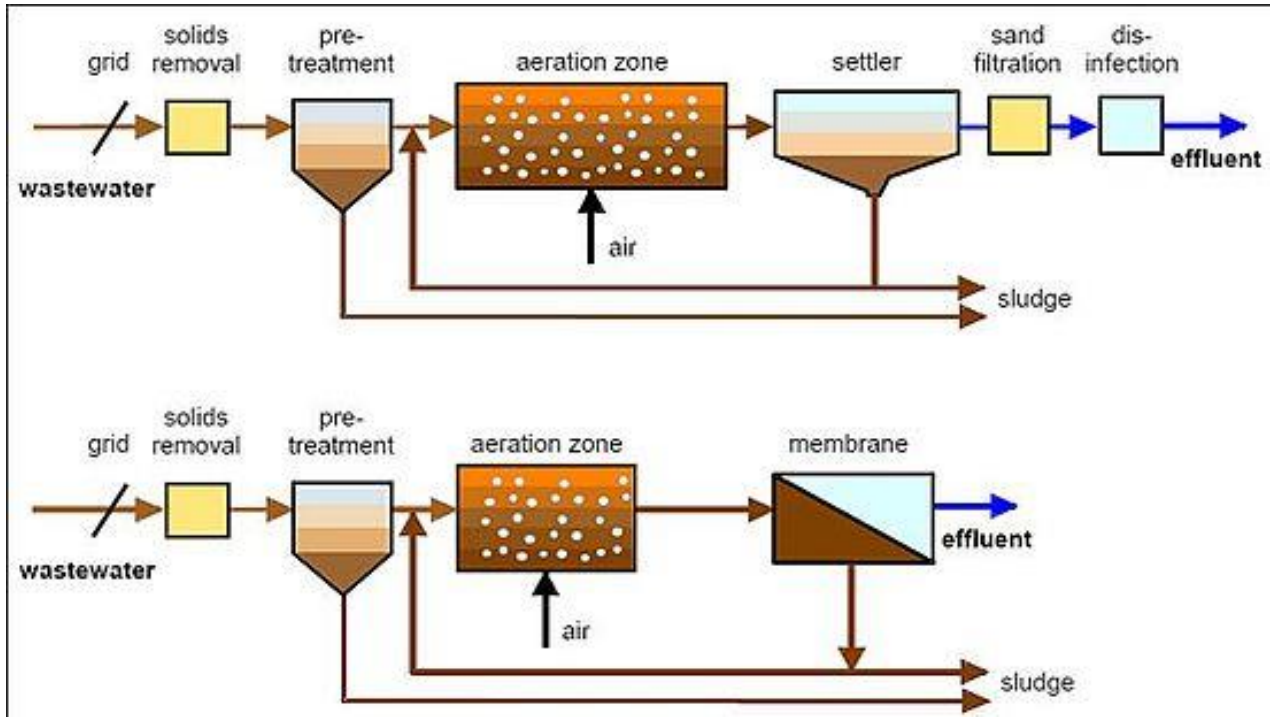
Four Presentation Learning Objectives

1. Gain Knowledge of Membrane Bioreactor Technology for WWTP's
2. Become Familiar with Reuse Standards
3. Understand the Design Build Process for WWTP's in Ohio
4. Synthesize Information Through a Case Study of the Village of Galena MBR Design Build Project

Look Down Here To See Where We are in the Presentation

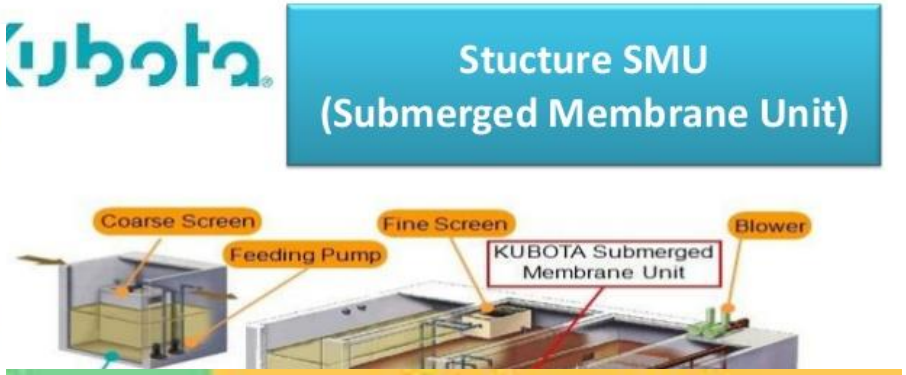
What is MBR Technology

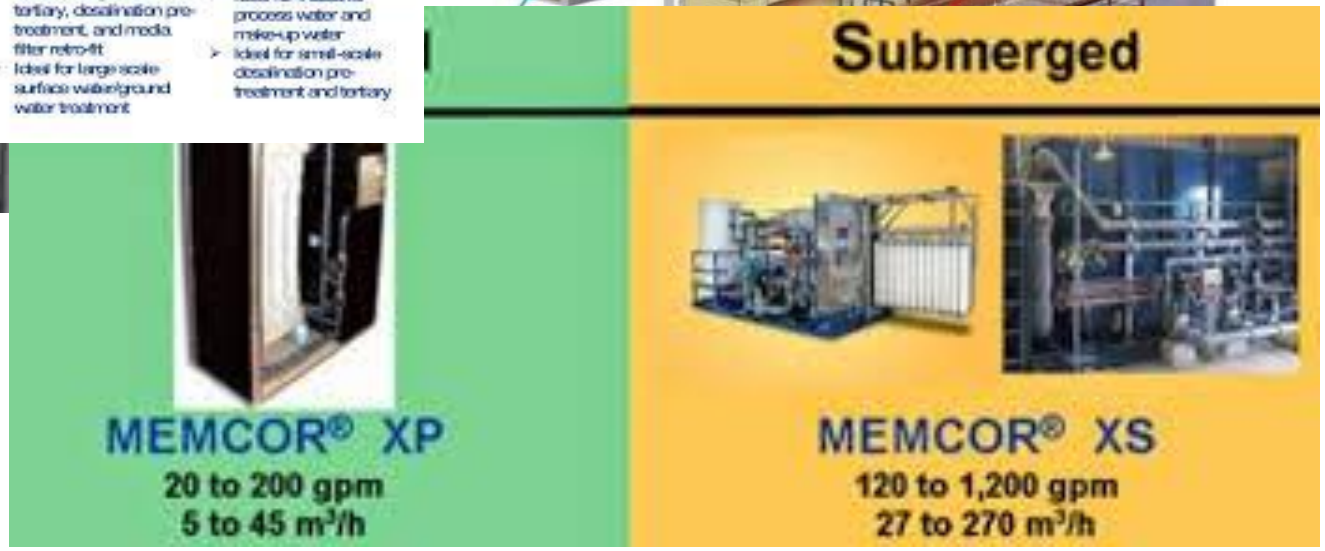
- **Membrane bioreactor** (**MBR**) is the combination of a membrane process like microfiltration or ultrafiltration with a biological wastewater treatment process, the activated sludge process. (Wikipedia)



1. Gain Knowledge of Membrane Bioreactor Technology for WWTP's

MBR Manufactures





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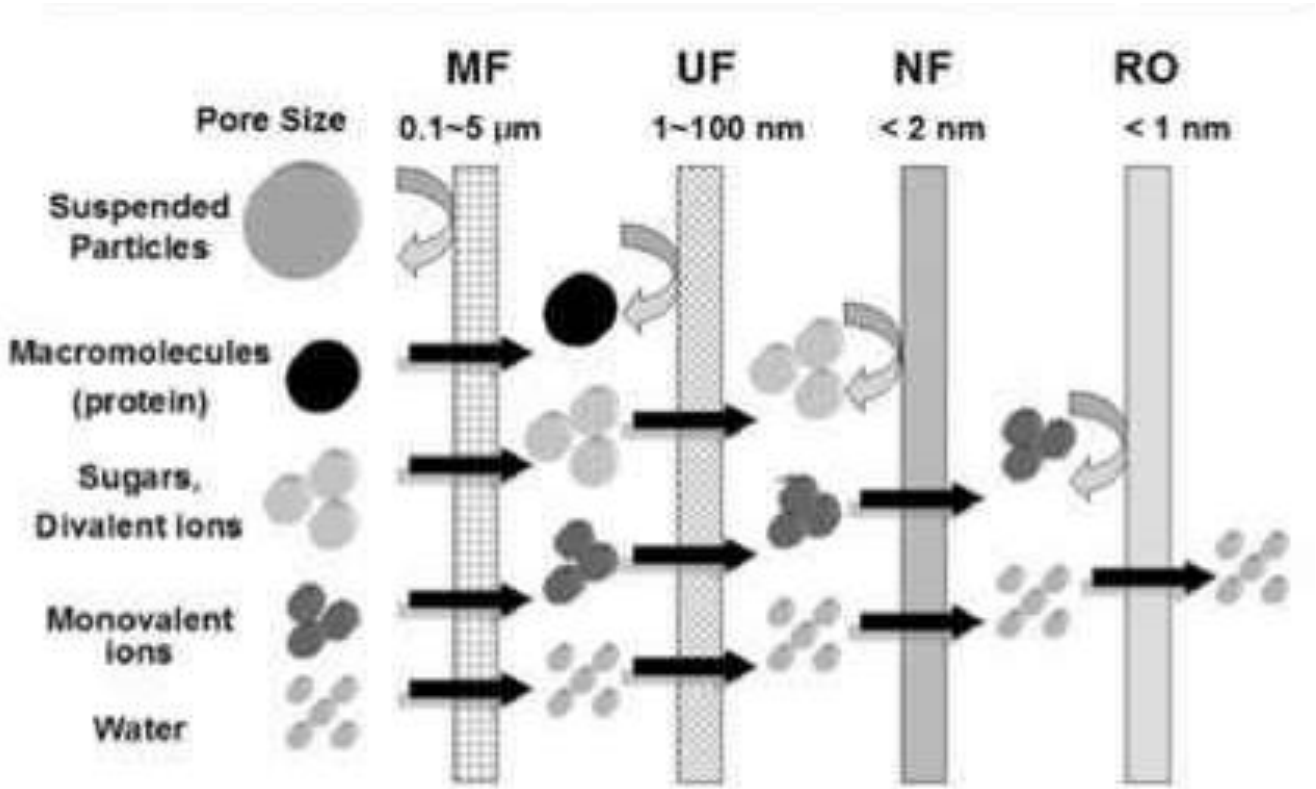
Membrane Filtration Classification



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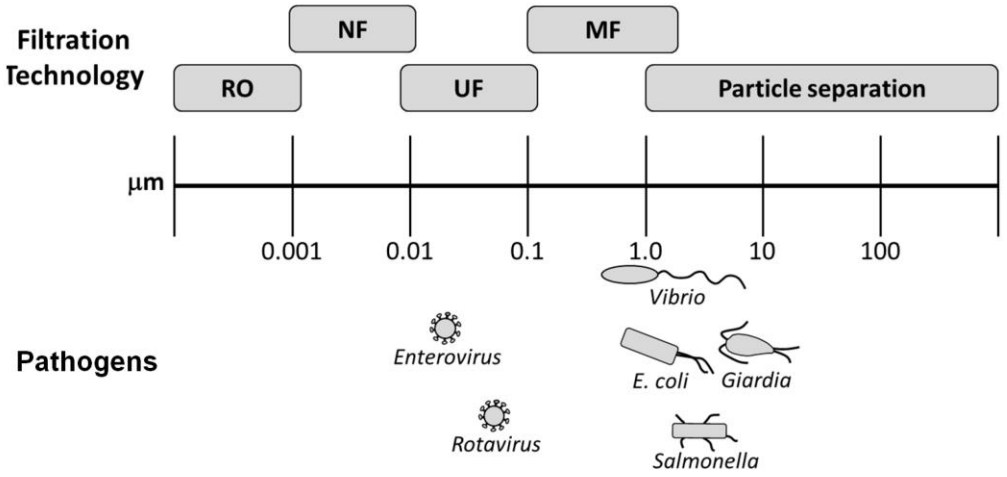
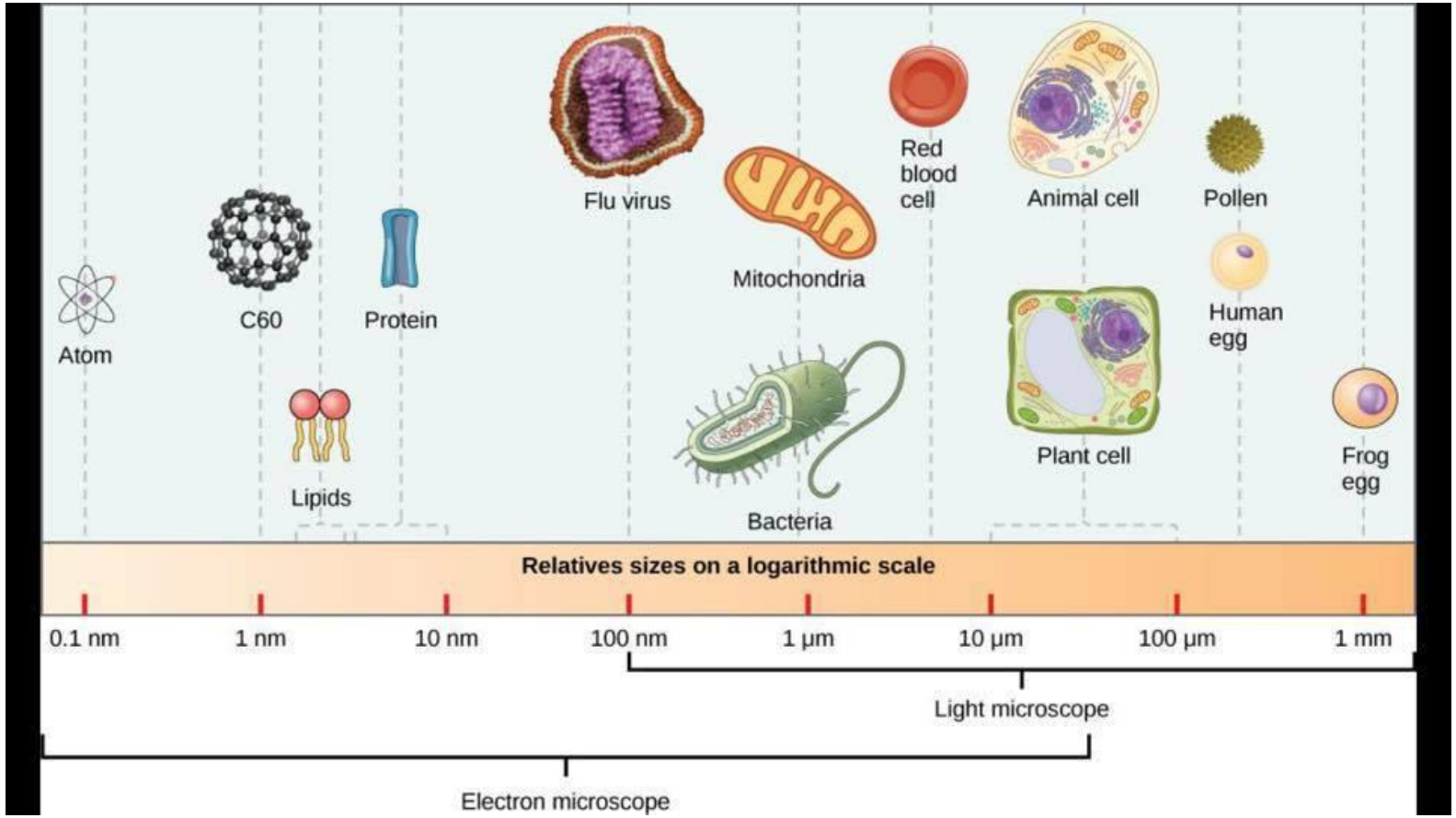
Membrane Technology Removes Pathogens



2. Become Familiar with California Title 22 Reuse Standards

Hard to Remove ALL Viruses



2. Become Familiar with California Title 22 Reuse Standards

Wastewater Reuse Standards

CALIFORNIA WATER REUSE REGULATIONS

These regulations are part of the California Code of Regulations (CCR):

Title 22

Division 4 – Environmental Health

Chapter 3 – Recycling Criteria

Article 5.1 – IPR for Groundwater Replenishment-Surface Applications

Article 5.2 – IPR for Groundwater Replenishment – Subsurface Applications

2. Become Familiar with California Title 22 Reuse Standards

Title 22 Reuse Standards

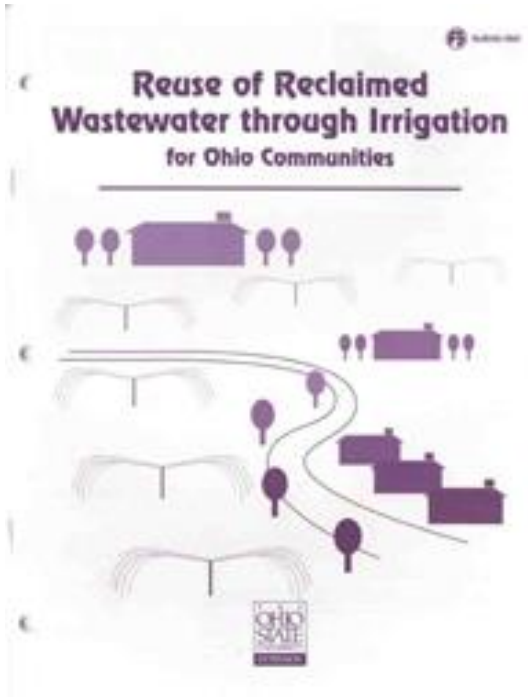
- Goal is implied in Title 22, §60301.230. Disinfected tertiary recycled water, which requires a 450 CT, “or (2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater.”

Does graywater need 5-log treatment?

- §60301.320. Filtered wastewater. “(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:
  - (1) 0.2 NTU more than 5 percent of the time within a 24-hour period; and
  - (2) 0.5 NTU at any time.”

Wastewater Reuse in Ohio

- Grey Water Reuse Regulated in Ohio for Small Systems
  - **ORC 3701-29-17 - Gray water recycling systems and alternative toilets.**
- Treated Wastewater Effluent for Irrigation
  - **ORC 3745-42-13 - Land application systems**



2. Become Familiar with California Title 22 Reuse Standards

3. Understand the Design Build Process for WWTP's in Ohio

Design Build in Ohio

- Governed by **ORC Chapter 153: PUBLIC IMPROVEMENTS**
  - **Obtaining services of criteria architect or engineer.**
  - **Submitting statement of qualifications.**
  - **Announcing contracts available for professional design or design-build services.**
  - **Evaluation of design-build firms.**
  - **Authority of design-build firm.**

From Delaware to Galena

- 2004 Delaware Design Build
  - Only Charter City Could Attempt
  - No OEPA Permitting Process
- New ORC Provisions
  - Any Municipality
  - Criteria Engineer Needed
  - OEPA Facilitates Process

3. Understand the Design Build Process for WWTP's in Ohio

Village of Galena – Case Study

- Need for Plant Upgrade
- Multiple Design Attempts with Cost Overruns
- Up Against Wall in Fall of 2017
- Needed Cost and Schedule Control
- Converted Design–Bid–Build Project to Design-Build Project
- Hired Criteria Engineer

4. Synthesize Information Through a Case Study of the Village of Galena MBR Design Build Project

Village of Galena – Case Study

- Downrated Design Drawings to 60% for PTI Review
- Issued RFQ for DB Teams
- Shortlisted to Three DB Offerors
- Issued RFQ to Shortlisted Offerors
- Selected Best Offeror – Fixed Price Maximum Value
- Awarded Contract

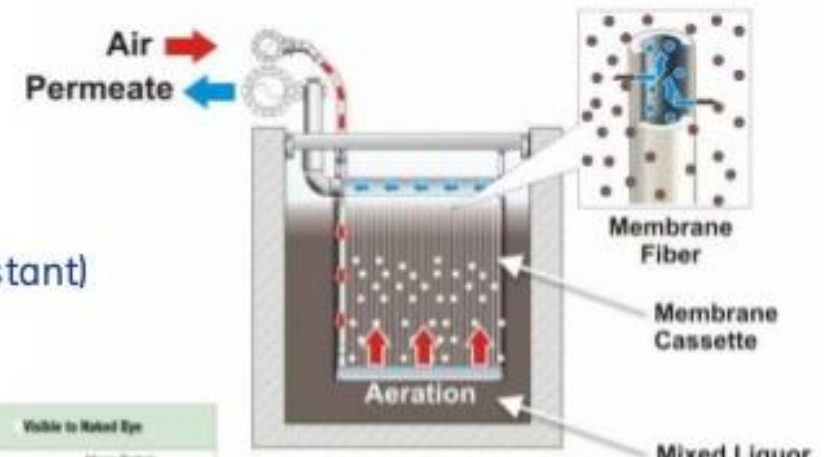
4. Synthesize Information Through a Case Study of the Village of Galena MBR Design Build Project

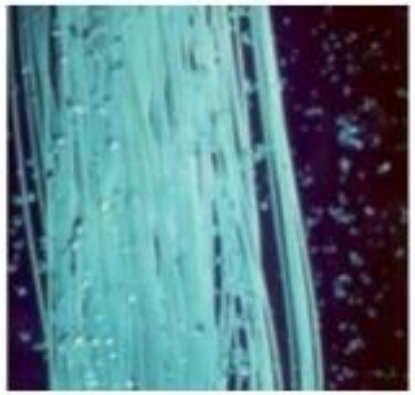
Zeeweed MBR Process Example

4. Synthesize Information Through a Case Study of the Village of Galena MBR Design Build Project

ZeeWeed MBR Technology

- Immersed
- Hollow fiber
- Outside-in
- Ultrafiltration (UF)
- PVDF (chlorine and oxidant-resistant) polymer





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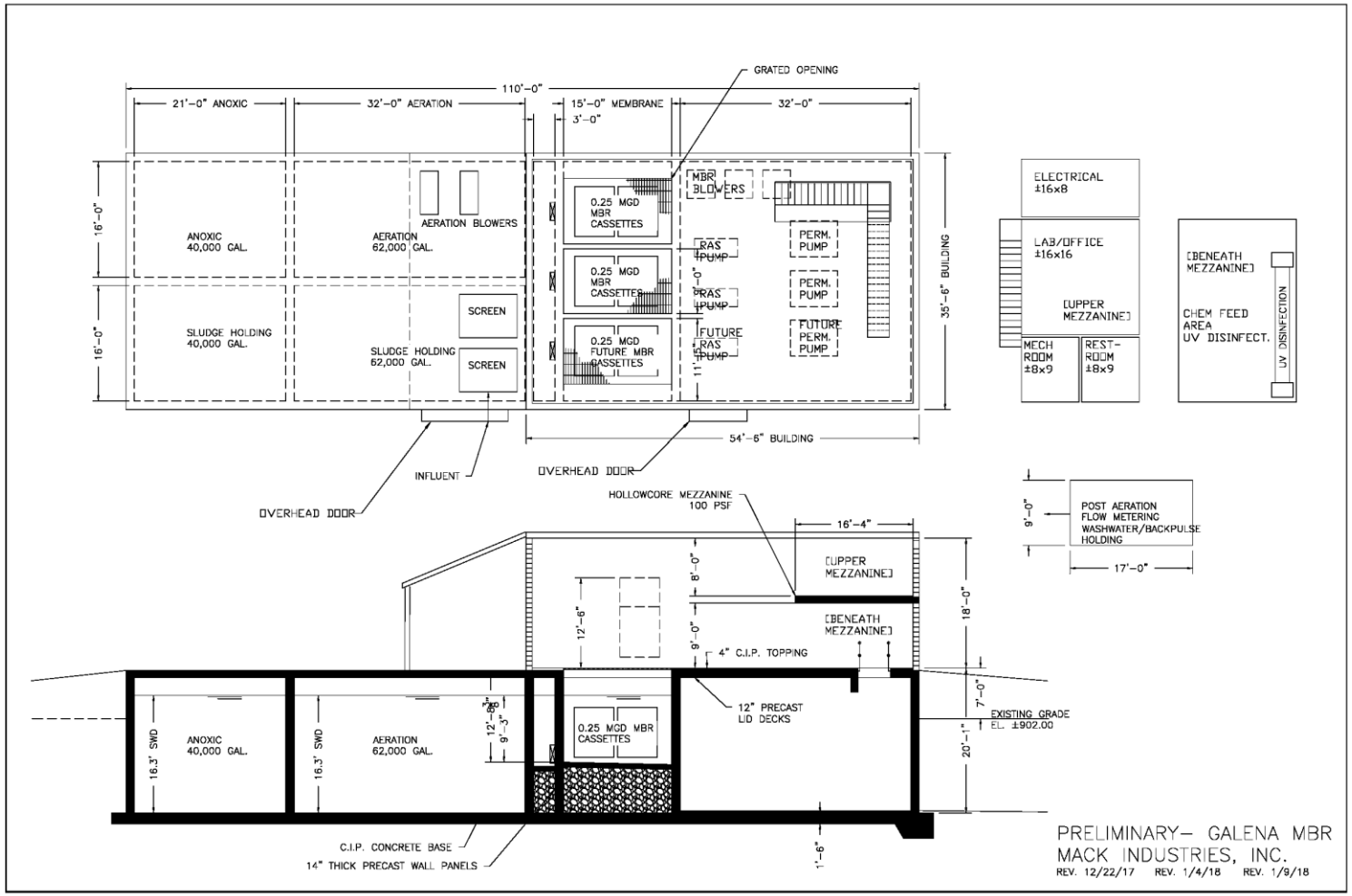
Village of Galena, Ohio WWTP

4. Synthesize Information Through a Case Study of the Village of Galena MBR Design Build Project

Proposed Process Layout



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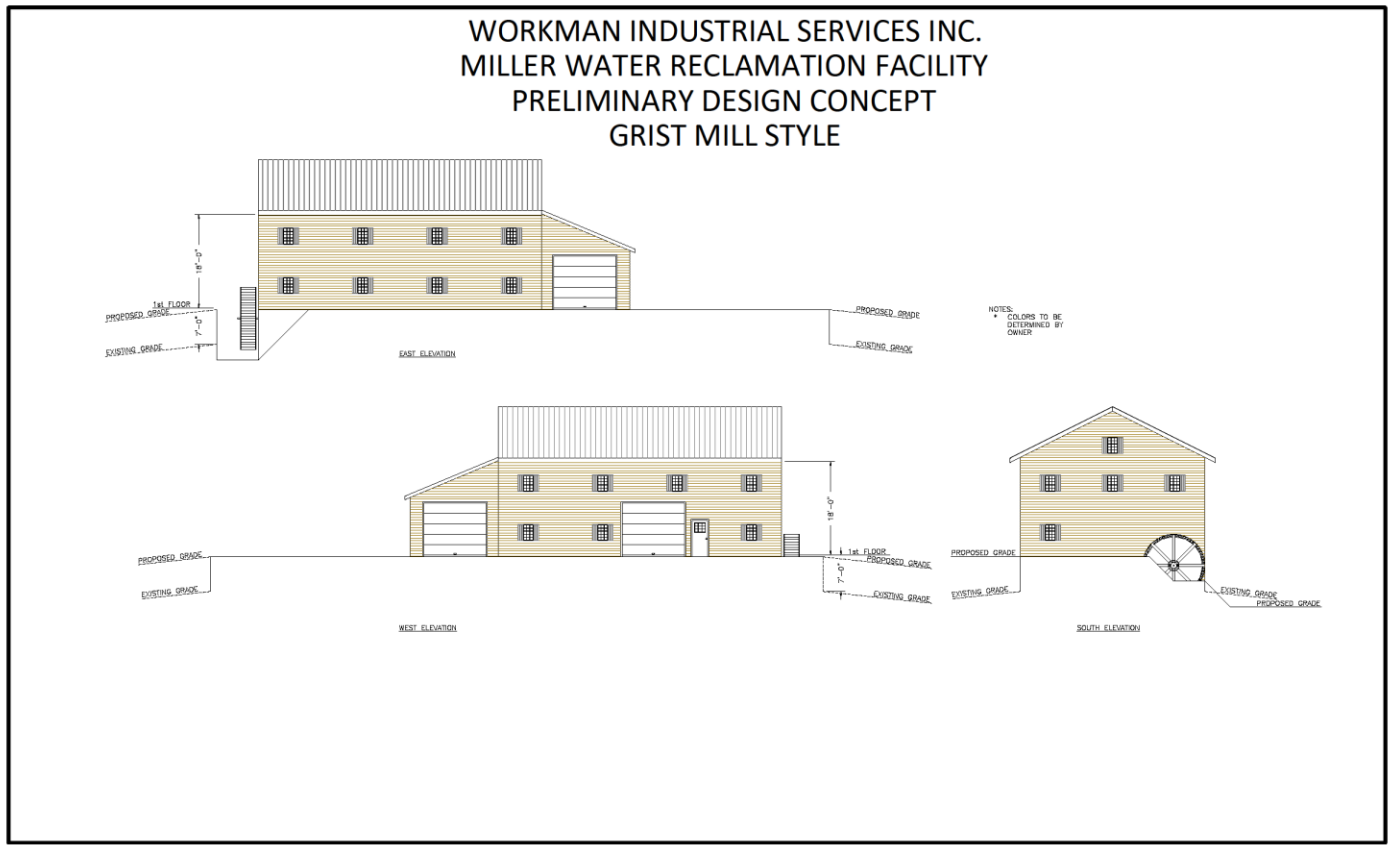
Proposed Elevations



4. Synthesize Information Through a Case Study of the Village of Galena MBR Design Build Project

Proposed Building

4. Synthesize Information Through a Case Study of the Village of Galena MBR Design Build Project

Presentation Learning Objectives

- Gain Knowledge of Membrane Bioreactor Technology for WWTP's

✓Become Familiar with California Title 22 Reuse Standards

✓Understand the Design Build Process for WWTP's in Ohio

✓Synthesize Information Through a Case Study of the Galena Project

✓Learn About MBR Application at the Galena, Ohio WWTP

We are Finished!

Questions About MBR or DB??

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