

# **MINT FARM WATER TREATMENT PLANT**

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## **TREATMENT TECHNOLOGIES EVALUATION FOR SILICA REMOVAL**

**JUNE 22, 2017**

# Dissolved Oxygen Project Status

Step	Status	Completion Date
Project Report	Done	December - 2016
Permits & Cultural Review	Done	March - 2017
Bid Advertisement	In Progress	June - 2017
DOH Approval	Pending	June - 2017
Contract Award	Tentative	Late July – 2017
Construction Complete*	Planned	December – 2017
Incremental DO Increases	Planned	Jan thru Sept – 2018

*\* Must be coordinated with Hillcrest Pump Station Project*

# Technologies for Silica Removal

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**Treatment Goal: 20-25 ppm silica concentration in finished water**

**Total Plant Capacity: 17.4 MGD**

**Volume Treated: 12 MGD to 17.4 MGD; treat portion required to meet goal**

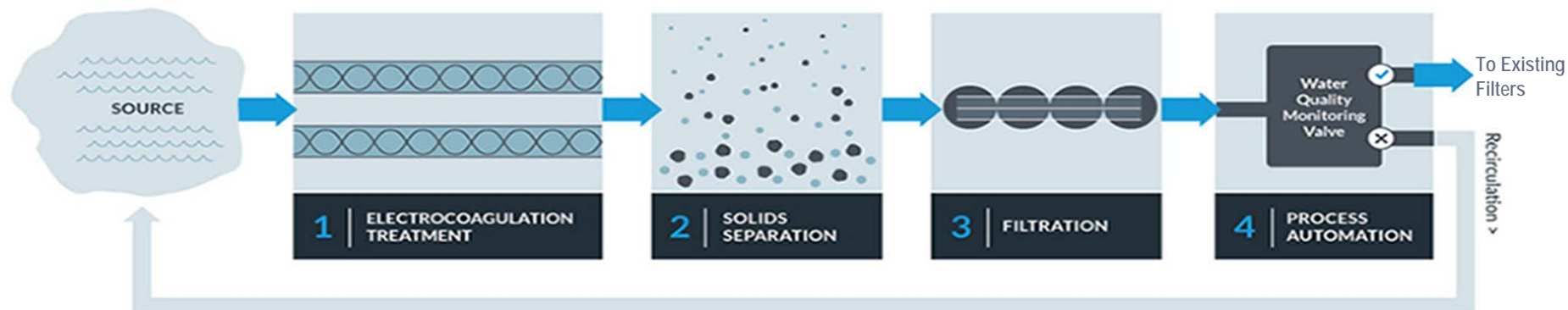
## **Short Listed Alternatives:**

- **Electrocoagulation**
- **Precipitation**
- **Reverse Osmosis**

## **Eliminated from Consideration:**

- ~~**Lime Softening**~~
- ~~**Ion Exchange**~~
- ~~**Activated Alumina**~~

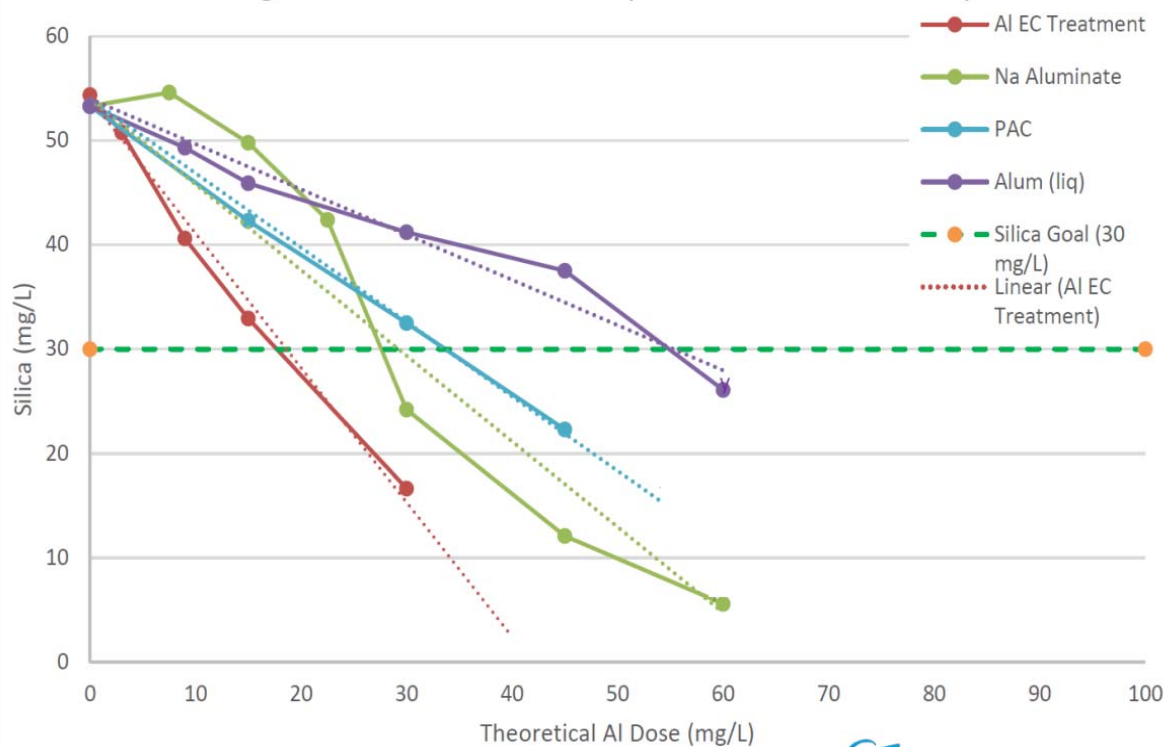
# Silica Removal by Electrocoagulation



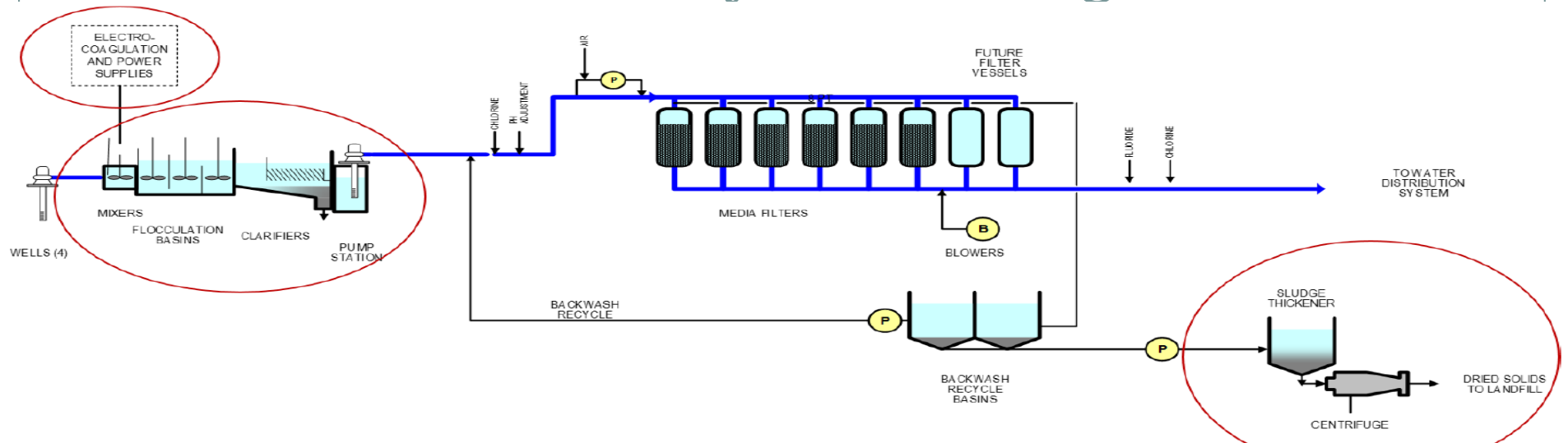
**WAVEIONICS™**

Electrocoagulation Enhanced Filtration System

Longview - Silica Reduction by Al EC and Al Chemistry

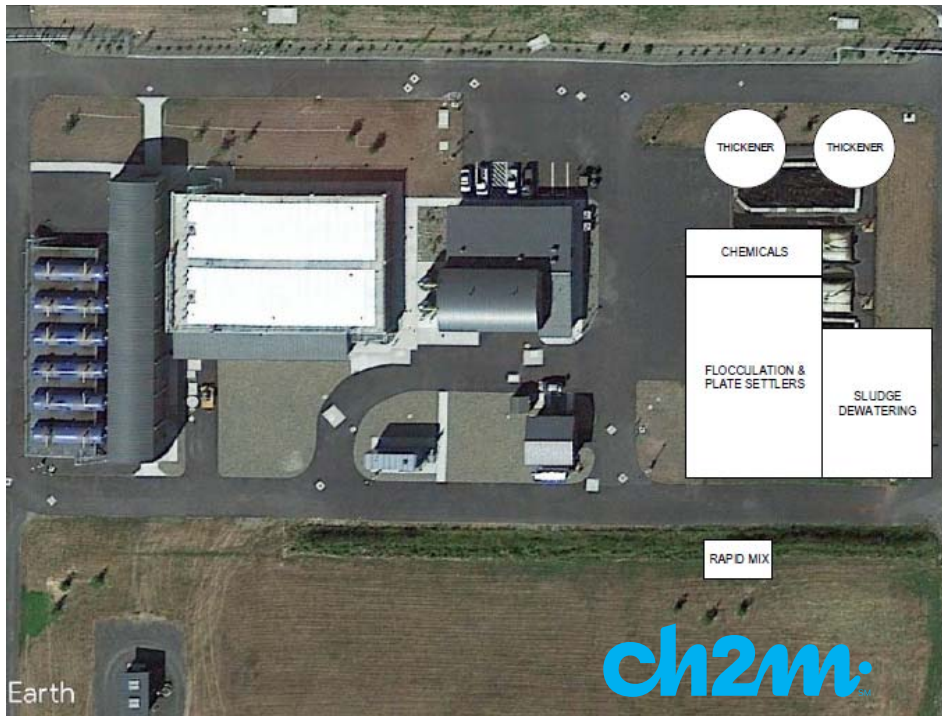
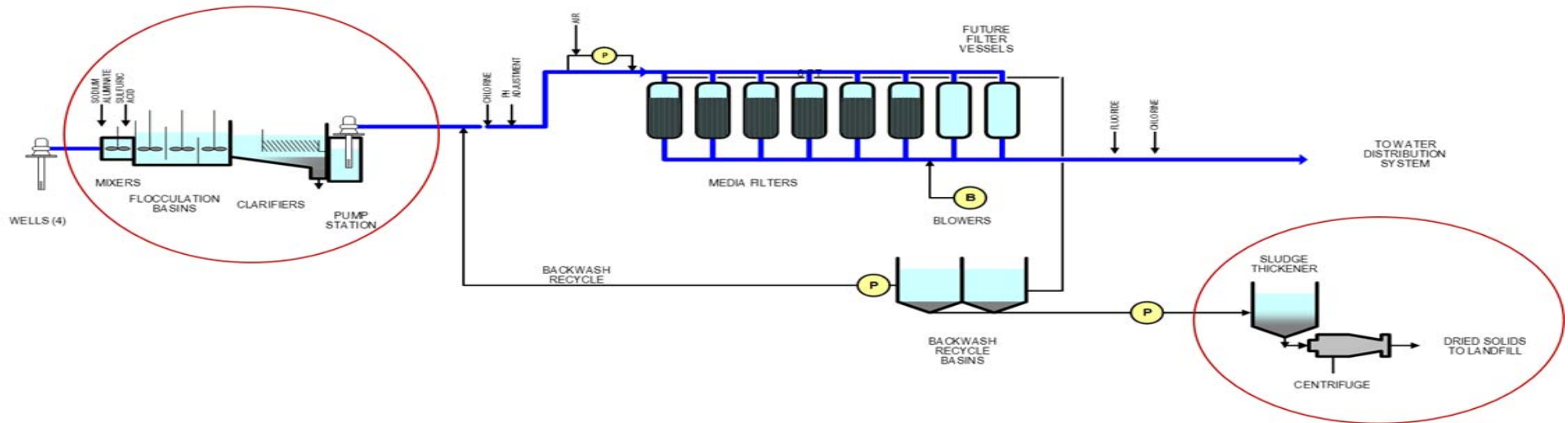


# Silica Removal by Electrocoagulation



- New EC building
  - 12 megacells
  - 12 power supplies
- 2 treatment trains
  - Rapid mix → floc basin → clarifiers
- In-plant pump station
- Sludge dewatering
  - Dry solids to landfill

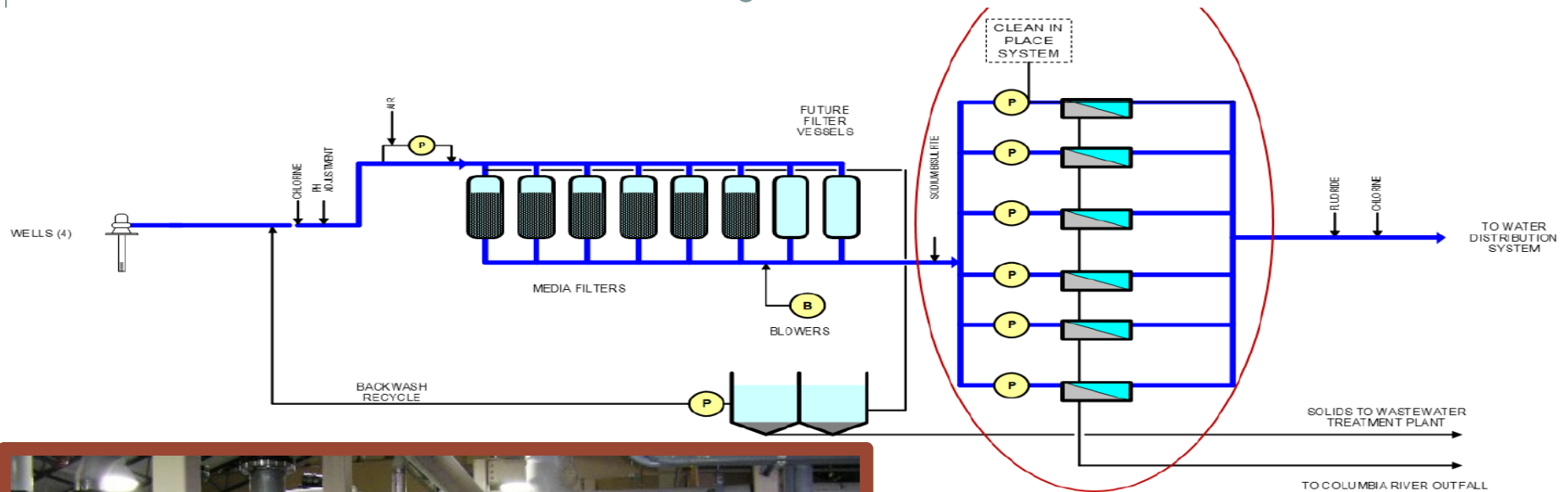
# Silica Removal by Precipitation



- New chem feed building
  - Sodium Aluminate (precipitate silica)
  - Sulfuric Acid (reduce pH)
- 2 treatment trains
  - Rapid mix → floc basin → clarifiers
- In-plant pump station
- Sludge dewatering
  - Dry solids to landfill



# Silica Removal by Reverse Osmosis



- New building for RO membranes
- Treat 75%, blend 25%
- No secondary pumping
- Sodium bisulfite for dechlorination
- Columbia River outfall for liquid waste

# Finished Water Quality Summary

(mg/L)	Existing	EC	Precip	RO (75:25)
Dissolved Solids	223	223	333	55.8
Aluminum	0.0028	0.11	0.24	0.0
Calcium	30.4	23	24	7.8
Magnesium	8.8	5.2	7.4	2.2
Iron	0.01	0.01	0.01	0.01
Manganese	0.004	0.004	0.004	0.0
Silica	54.4	19.9	12	14.5
Sodium	14.4	14.4	54	4.5
Hardness	108	108	108	27
Alkalinity	102	102	136	25.5



	Electrocoagulation	Precipitation	Reverse Osmosis
Capital Cost	\$27.7 M	\$19.9 M	\$28.2 M
O&M Cost	\$0.9 M/year	\$1.3 M/year	\$1.5 M/year
20-Yr Cost	\$65.0 M	\$64.6 M	\$81.3 M
Cost/ERU	<b>\$12.32/month</b>	<b>\$12.23/month</b>	<b>\$15.41/month</b>
Pros	<ul style="list-style-type: none"> <li>☺ Cutting edge</li> <li>☺ Alternative to bulk chemical storage &amp; feed</li> </ul>	<ul style="list-style-type: none"> <li>☺ Proven technology</li> <li>☺ Quicker to implement</li> </ul>	<ul style="list-style-type: none"> <li>☺ Removes Ca, Mg, H<sub>2</sub>S, Organic N</li> <li>☺ Closest resemblance to Fishers Lane treated water</li> </ul>
Cons	<ul style="list-style-type: none"> <li>● Not NSF certified</li> <li>● Typical Use &lt; 1 MGD; scaled up system not yet proven</li> <li>● Frequent anode cell replacement</li> <li>● Won't remove Ca, Mg</li> <li>● Double pumping</li> </ul>	<ul style="list-style-type: none"> <li>● Higher chemical use</li> <li>● Won't remove Ca, Mg</li> <li>● Double pumping</li> </ul>	<ul style="list-style-type: none"> <li>● 5-yr membrane life</li> <li>● 30% waste stream</li> <li>● Disposal of residuals</li> <li>● Removes good stuff!</li> </ul>

# Alternatives Evaluation Process

## Water Quality

- Silica reduction
- Hardness reduction
- Other benefit (or detriment)

35%

## Economic

- Capital Cost
- O&M Cost
- Rate impacts

27%

## Environmental

- Chemical use
- Resource waste
- Waste streams and solids handling

8%

## Technical

- Safety
- Operability
- Distribution system impacts
- Expandability

30%

# Implementation Schedule

#	Task	Months to Complete	Complete
0	Decision	1	Aug-2017
1	Hire Consultant	3	Oct-2017
2	Pilot Testing	2	Dec-2017
3	Project Report	2	Feb-2018
4	DOH Approval	6-12	Feb-2019
5	Final Design	6	Aug-2018
6	Permitting	3	Nov-2018
7	Site Preload	9-12	May-2019
8	Construction	12	May-2020
9	Implementation	6	Dec-2020

# Discussion

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- **Provide direction to staff regarding silica removal options (BHWSD concurrence needed):**
  - Discontinue further action - do not remove silica
  - Schedule joint meeting with BHWSD board
  - Proof one or more alternatives
    - ✦ Pilot test at larger scale
    - ✦ Pipe loop test to determine distribution system impacts
    - ✦ Optional qualitative testing
  - Select treatment alternative and begin design/construction
    - ✦ Minimum 1-month pilot test required for DOH approval
  - Solicit customer opinions
    - ✦ Telephone survey
    - ✦ Ballot measure
  - Other