Options and Evaluations for Silica Removal City of Longview Water Supply System

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AGENDA

- ✓ History of Changing a Water Supply Source
  - ✓ Surface Water to Groundwater – 12 MGD
- ✓ Impacts to the Community
- ✓ Planning for the Next Future
- ✓ Silica Treatment Options

Why Change the Water Supply ?

Circa 2009/10

- ✓ Summer water demand exceeded plant capacity
- ✓ Increased supply needed for future growth
- ✓ Cowlitz River sediment was increasing and problematic
- ✓ USACE Retention Structure began overflowing in 2006
- ✓ By 2008, Cowlitz reached sediment level predicted for 2039
- ✓ Vintage Fishers Lane WTP was failing
- ✓ Non-compliant intake structure needed regulatory upgrade

Fishers Lane
Water Treatment Plant

Deteriorated plant:

- ✓ Constructed 1946; 60+ years old
- ✓ Failing concrete basins
- ✓ Multiple catastropohic filter failures
- ✓ Substantial repair / replacement needed

Spalling of Water Holding Structures

Ice formed outside Water Holding Structures (from leaks)

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Intake issues

- ✓ In danger of running dry
- ✓ Frequent dredging required
- ✓ Did not meet fish code
- ✓ Pacific Smelt listed threatened (2010)
- ✓ Rigorous permitting process ahead

Cowlitz River Intake at Fishers Ln.

Supply Change

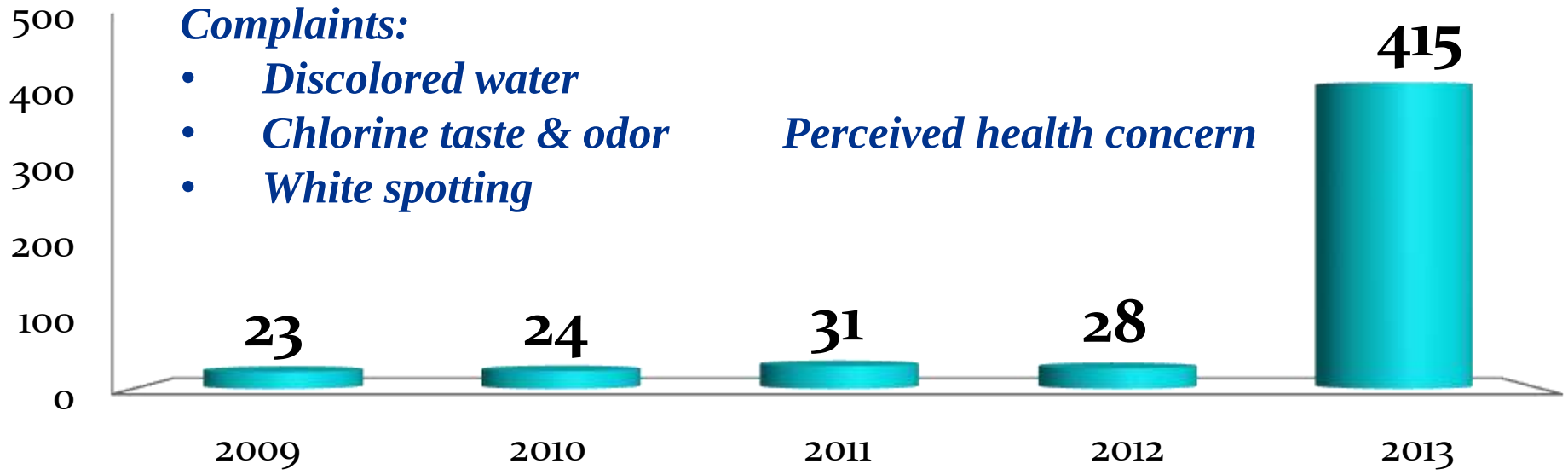
January 31, 2013

Water Quality Complaints

- ✓ Complaints began 3 mo. after start-up
- ✓ Zero CL2 in areas of cast iron mains

Immediate City response:

- Spot flush → Area flush
- Coliform testing (no “hits”)
- WQ testing (SMCL’s exceeded)
- Emergency declaration



Water Quality Complaints

THE DAILY NEWS

Longview's Tap Water Residue is Here to Stay

facebook

Citizens Against
Longview's New Water Supply
1,644 likes

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Discolored Water Photos from Facebook Page

- Threats of class action lawsuits
- Fears of falling real estate values

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Changes in pipe scale due to source water switch

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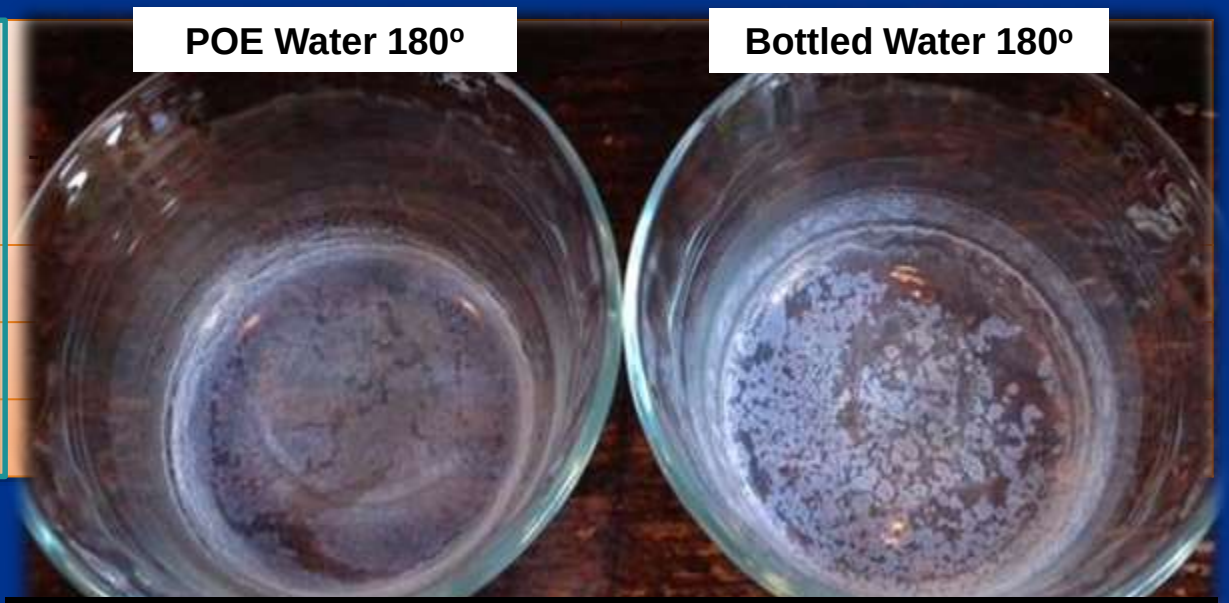
NOW –
What is that Stuff in the Water?

- ✓ What is causing the white spotting?
  - ✓ Hardness?
  - ✓ Silica?
  - ✓ Other evaporative solids?

	Silica (mg/L SiO_2)
Surface Water	24
Ground Water	50-60
Bottled Water	85



Silica Evaporation Trials – Groundwater vs Bottled

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Conclusion - Silica

- ✓ Primary cause of spotting is naturally occurring silica
  - Appears to etch surfaces if allowed to evaporate
- ✓ Aesthetic issue not experienced equally; varies with:
  - Type and age of glassware or surface
  - Amount of hand washing and hand drying
  - Dishwasher use, settings, detergents and rinse aids
  - Evaporation plus heat is most problematic
- ✓ Softening not likely to make significant improvement
- ✓ Silica removal very complex and expensive

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Activities Since 2014

- ✓ 2014 – 2015 Community Developed Options Plan
  - ✓ Survey Results Satisfaction Rating
    - ✓ Longview --- 4.3 out of a possible 10
    - ✓ BHWSD --- 4.9 out of a possible 10

- ✓ 2016 - 2017 Assessed Opportunity for Ranney Collector Wells along Cowlitz River (return to original source)

- ✓ 2017 - 2018 Determine Options for Silica Removal and implement Dissolved Oxygen treatment

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Water Characterization
Mint Farm Raw Water

Total Metals Analysis		
Barium	µg/L	13.6
Boron	µg/L	<100 U
Calcium	µg/L	33,000
Iron	µg/L	957
Magnesium	µg/L	9,140
Manganese	µg/L	630
Potassium	µg/L	3,960
Silica	µg/L	56,900
Sodium	µg/L	11,700
Strontium	µg/L	93.2
Hardness, Ca	mg/L as $CaCO_3$	82.4
Hardness, Mg	mg/L as $CaCO_3$	37.6
Hardness, total	mg/L as $CaCO_3$	120

General Chemistry Analysis		
Alkalinity, total	mg/L as $CaCO_3$	47.3
Alkalinity, bicarbonate	mg/L as $CaCO_3$	<5.00 U
pH	Units	7.45
Turbidity	NTU	3.78
Conductivity	µS/cm	296
Total Dissolved Solids	mg/L	211
Ammonia	mg/L-N	0.16
Nitrate	mg/L-N	<0.010 U
Nitrite	mg/L-N	<0.010 U
TKN	mg/L-N	0.52
Chloride	mg/L	28.4
Sulfate	mg/L	1.08
Fluoride	mg/L	<0.20 U
TOC	mg/L	1.52
Reactive Silica	mg/L	59.0

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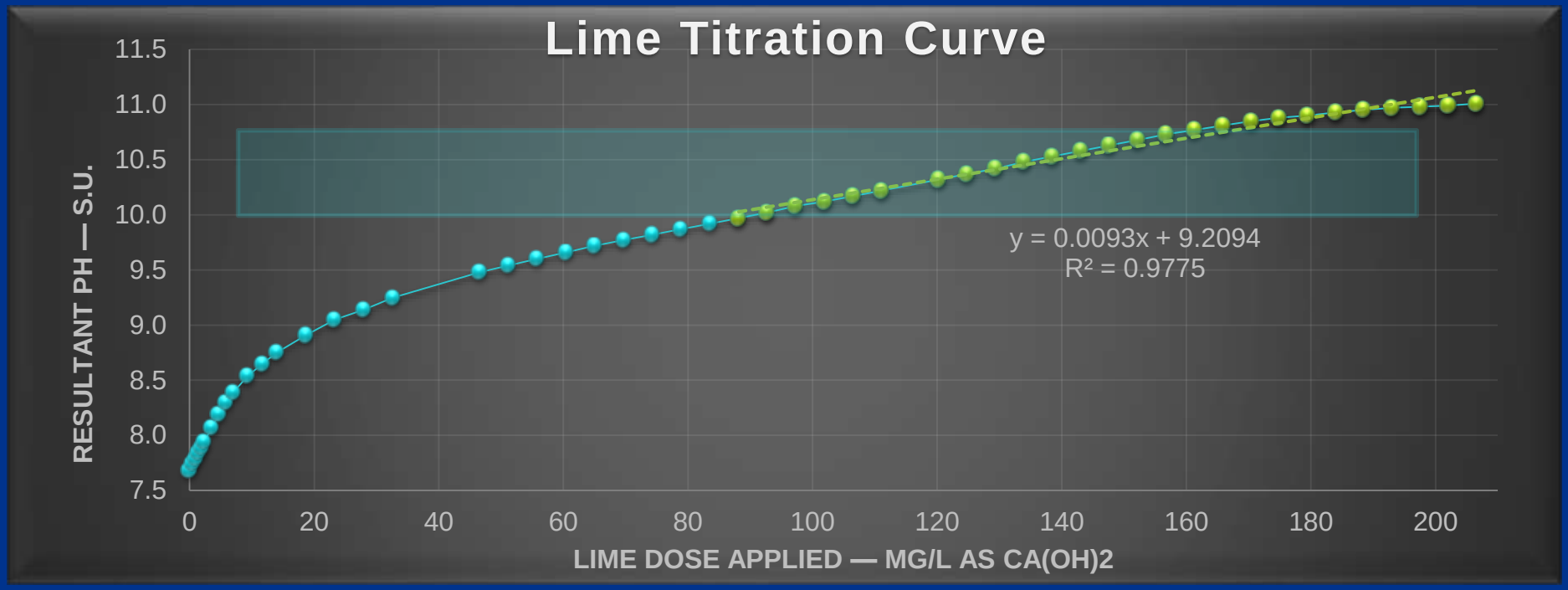
Silica Removal Options Evaluated

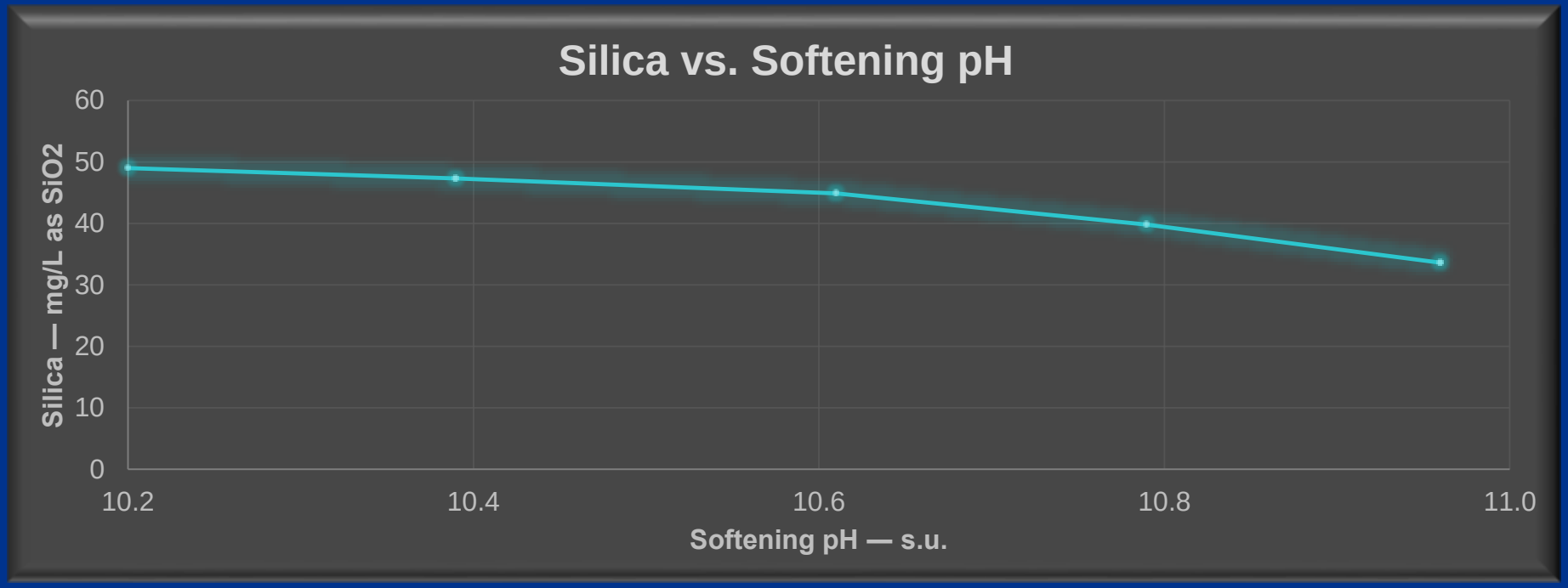
- ✓ Lime Softening
- ✓ Sodium Aluminate
- ✓ Reverse Osmosis
- ✓ Electrocoagulation

Lime Softening
(to increase pH)

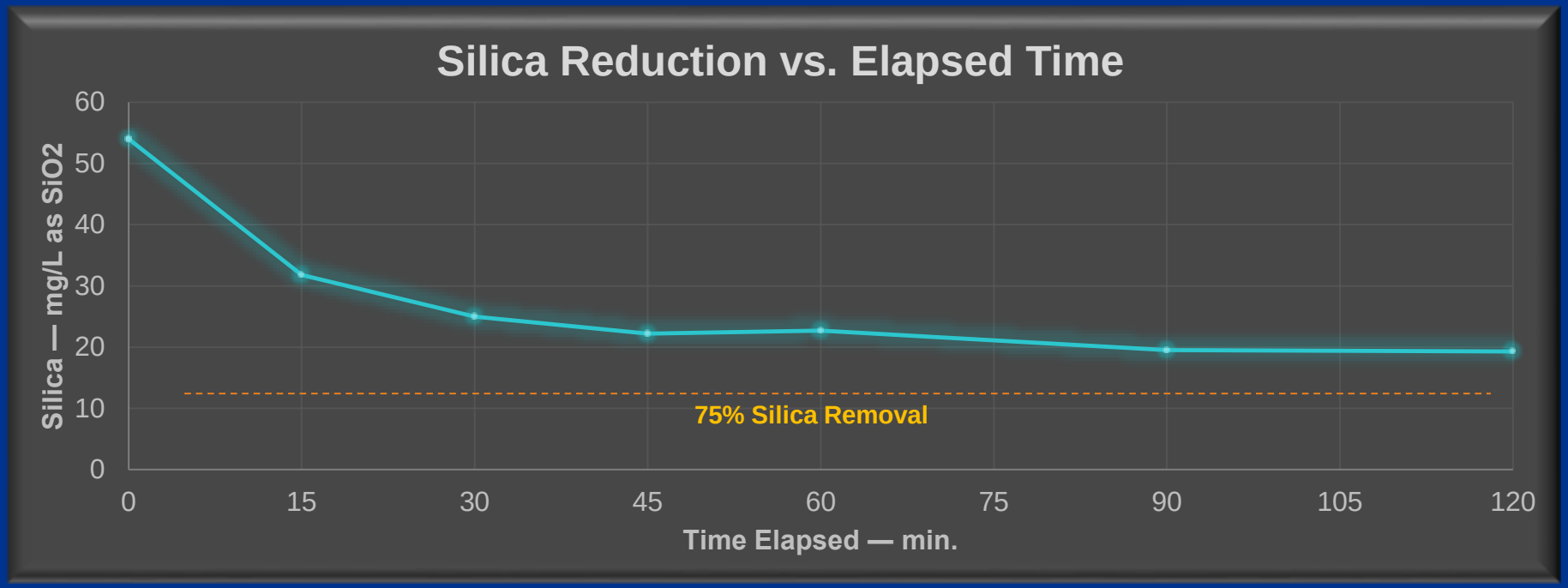


75 mg/L CO_2 needed for recarbonation to pH 7.8
Final Hardness 82 mg/L as CaCO3

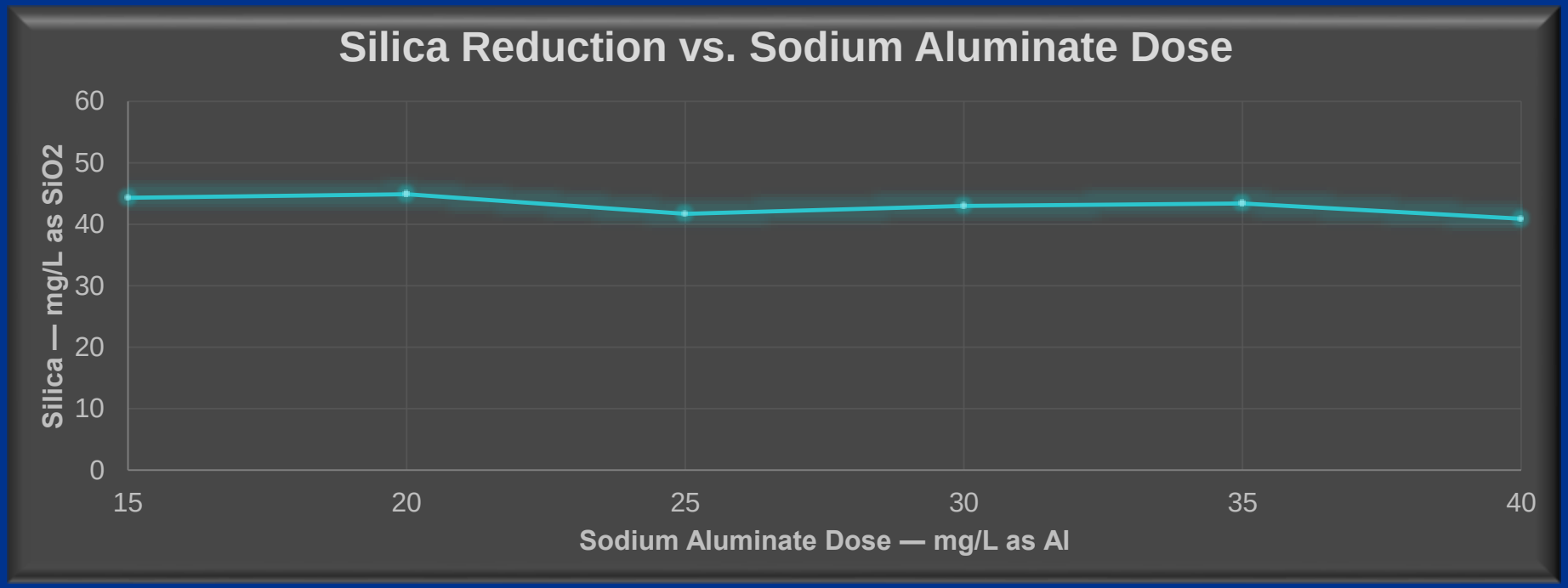
Silica Removal with Lime Softening Only
(No Magnesium Chloride Addition)



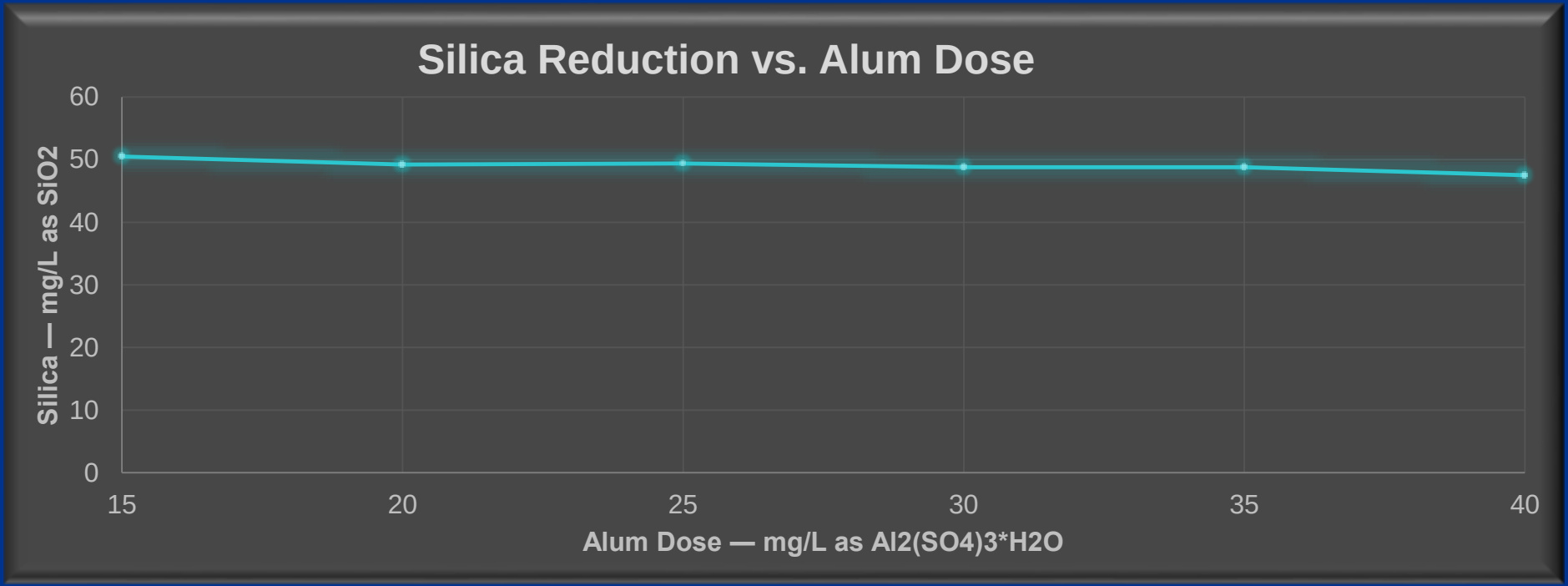
Reaction Time for Silica Reduction
(Lime Softening at pH 11 & Magnesium Chloride at 50mg/L)



Sodium Aluminate without pH Adjustment

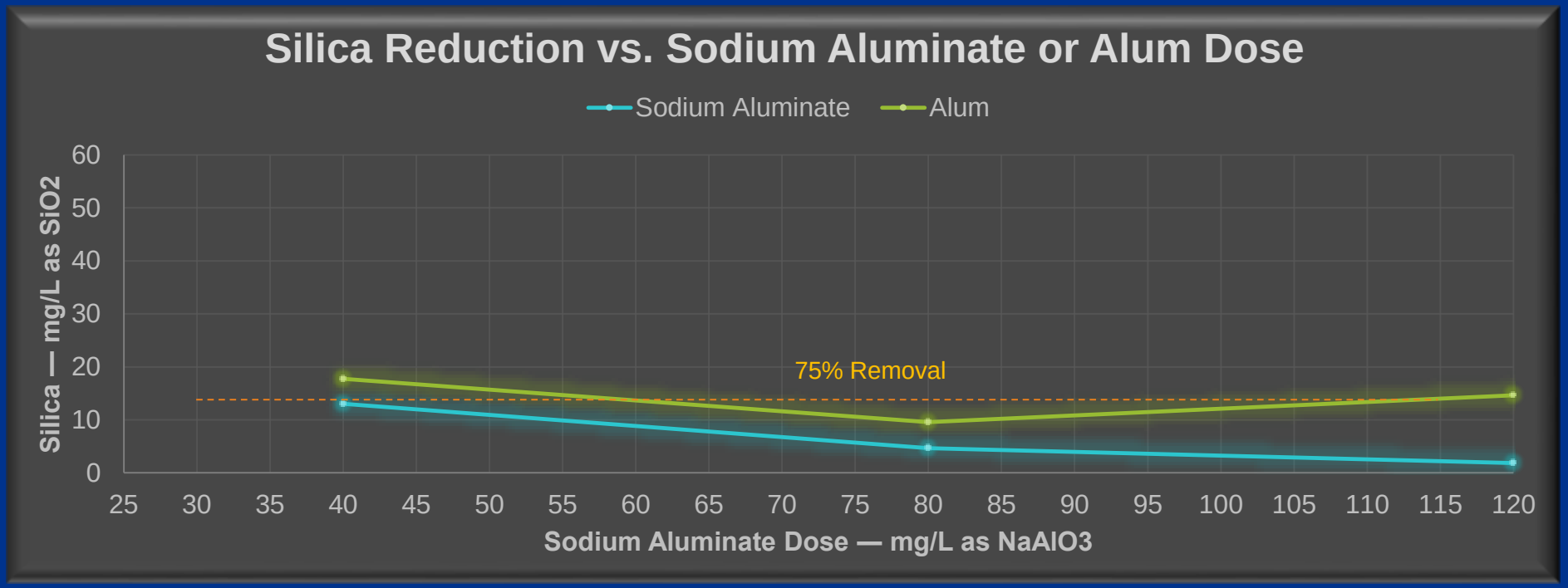


Alum without pH Adjustment



Sodium Aluminate or Alum Dose

pH Maintained between 8.0 and 8.2



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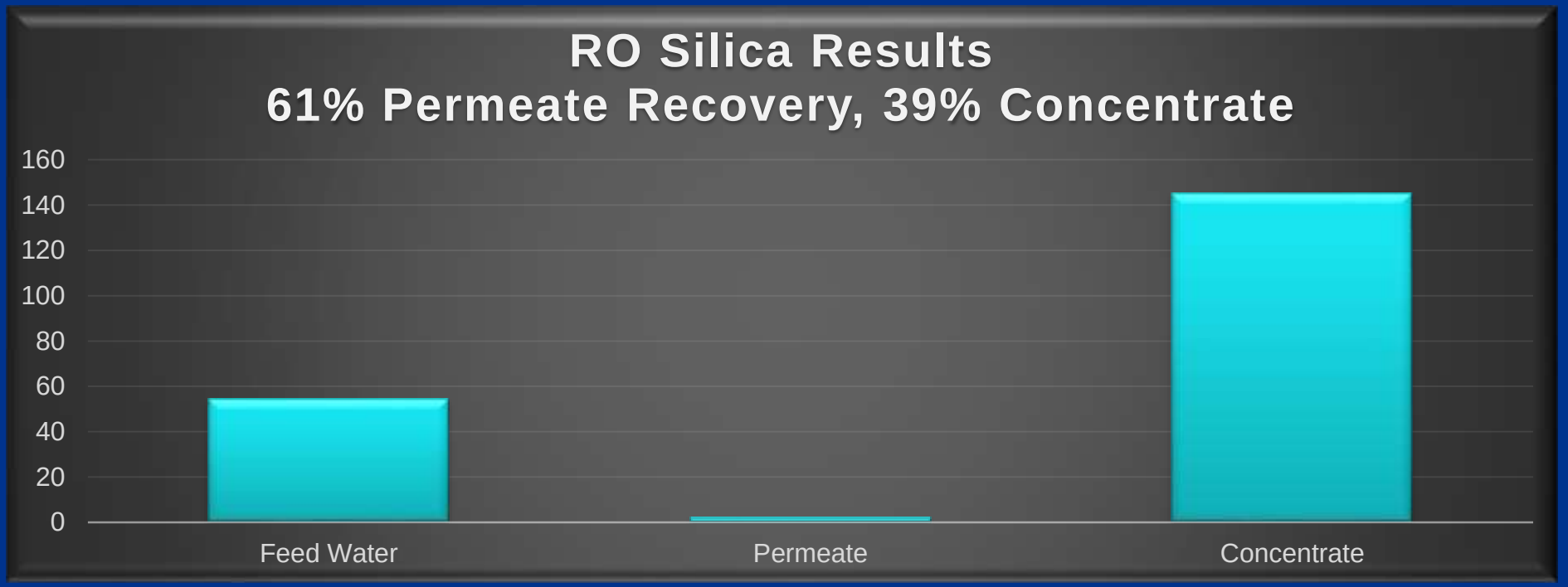
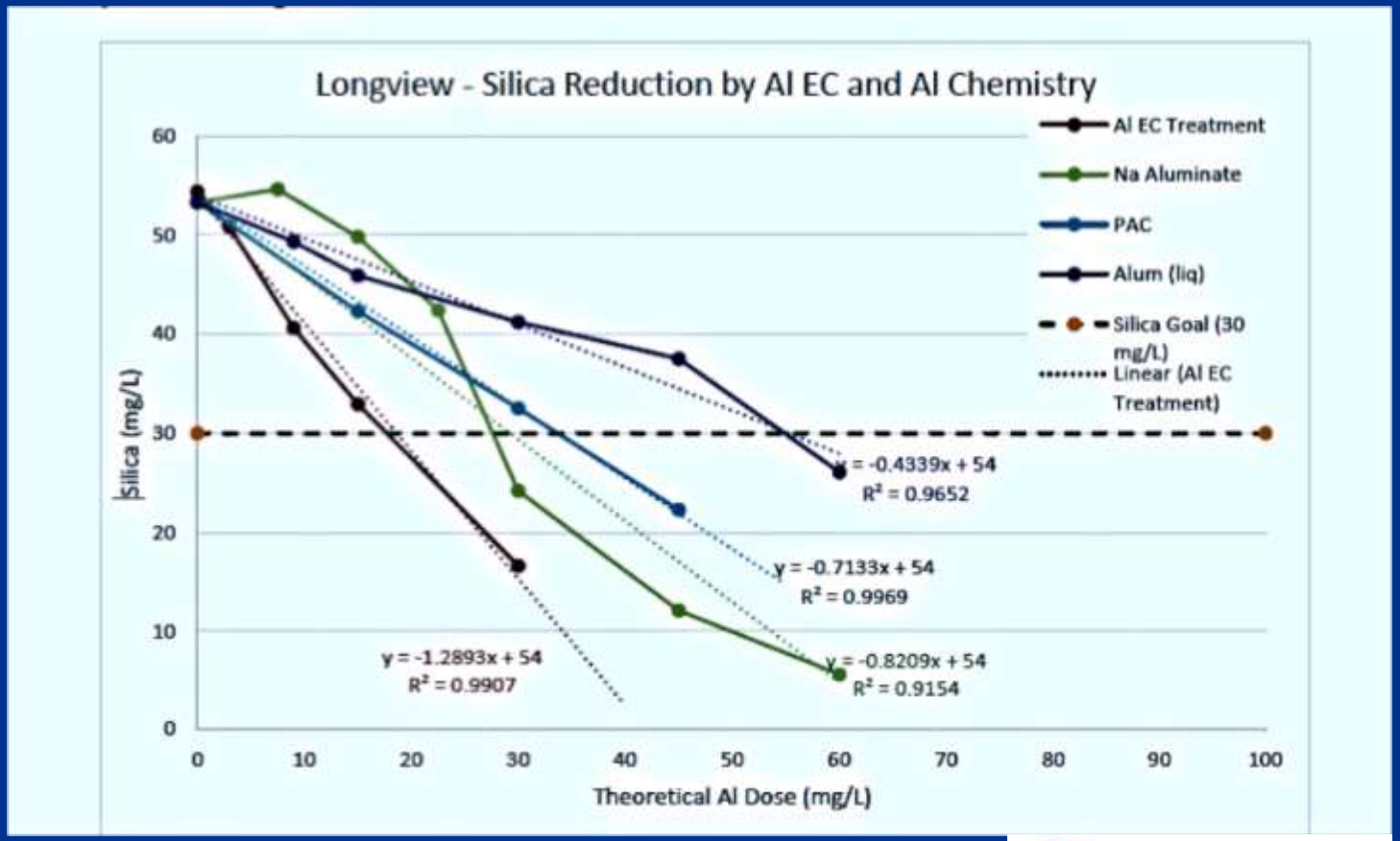
RO Removal of Silica

Would allow 20% to 25% Blend of Feed Water with Permeate



Electrocoagulation Results

(Al to $Al(SO_4)_3*H_2O$ multiplier is 13.8)



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Capital and O&M Costs
12 MGD

	RO	Lime	NaAl	EC+Al
Power	$328,500	$15,549	$5,037	$76,650
Labor	$80,000	$80,000	$80,000	$80,000
Chem & Consumables	$11,103	$417,341	$341,275	$3,960,980
R.O. Replacement	$440,000			
O&M	$859,603	$512,890	$426,312	$4,117,630
Capital	$29,500,000	$8,900,000	$8,300,000	$10,100,000
pmt 4%	$2,170,661	$654,877	$610,728	$743,175
$/ERU/MO	**$9.02**	**$3.48**	**$3.09**	**$14.47**

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City's Current Choices:

- ✓ Implement Dissolved Oxygen Treatment
- ✓ Review Need for Silica Removal at a Later Date

PRESENTATION END