Page WWTP Tertiary Treatment Phosphorus Reduction

Spokane River Forum
April 22, 2025

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SOUTH FORK
EST 1965
★ COEUR D'ALENE RIVER ★
SEWER DISTRICT

Outline

- Overview of South Fork CDA River Sewer District
- The Problem
- The Solution
- Implementation

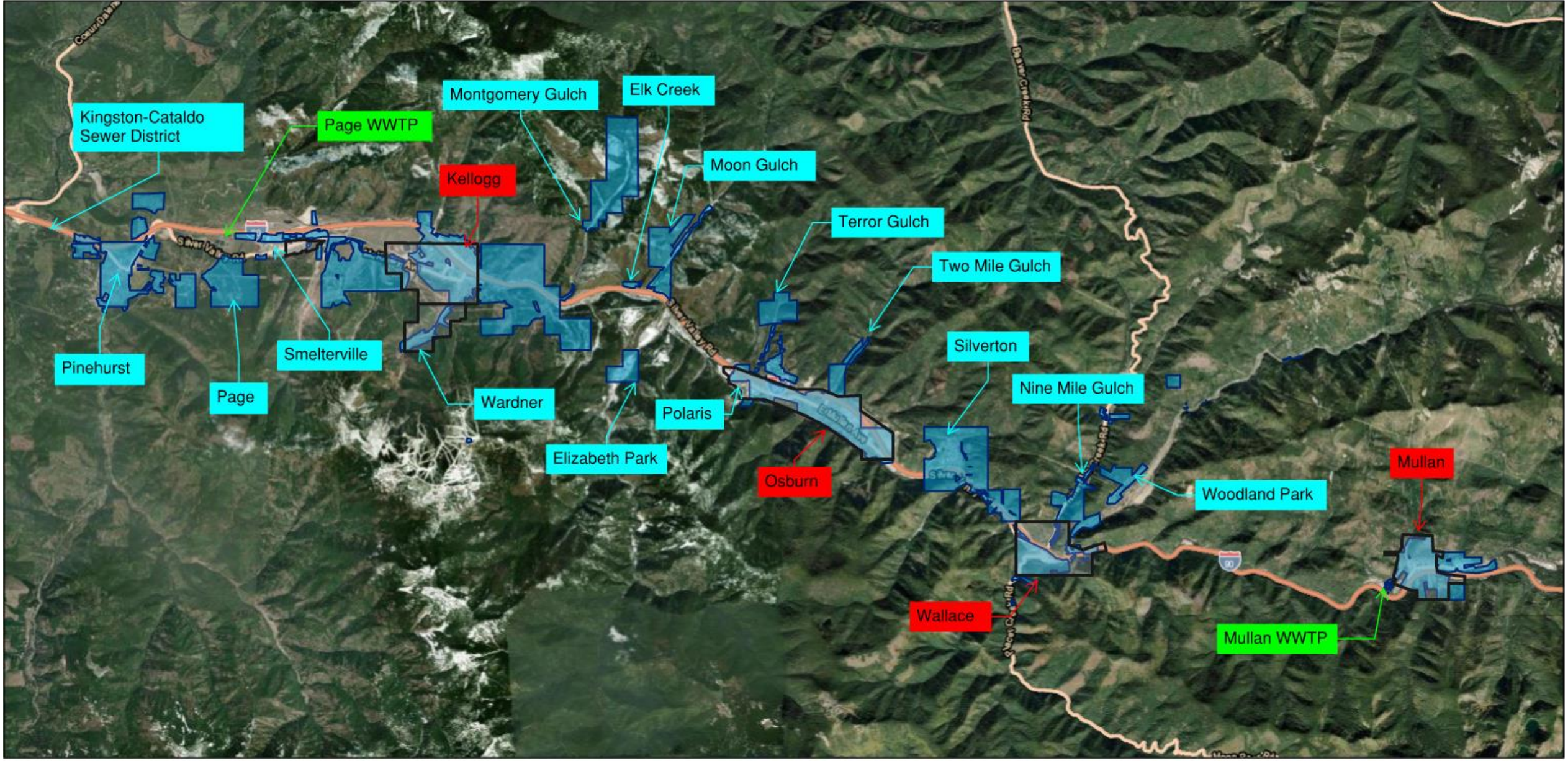
SOUTH FORK

EST 1965

★ COEUR D'ALENE RIVER ★

SEWER DISTRICT

- Sewer District established 1965
- Serve 22 separate towns and communities
- Service population 7,055
- 57 miles of pipe (18 miles of interceptor)
- 1,200 manholes
- 7 lift stations
- 2 wastewater treatment plants



2/19/2025, 8:10:49 AM

1:144,448

0 1 2 4 mi

0 1.75 3.5 7 km

World Transportation

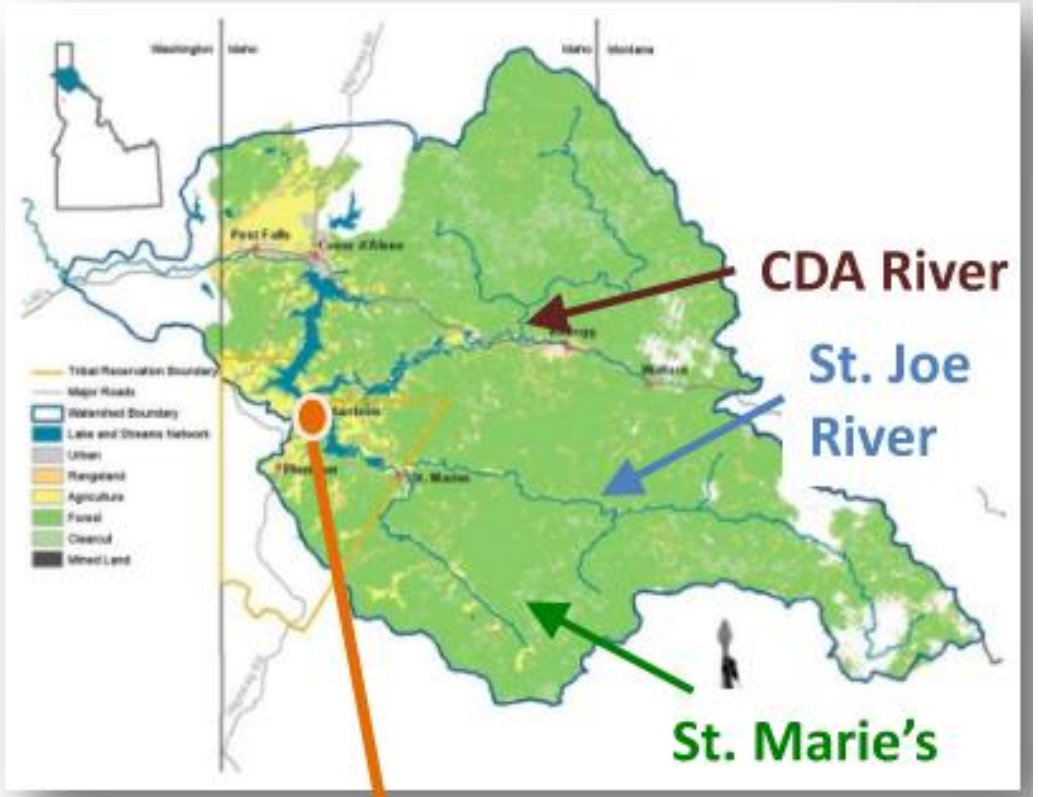
City Boundaries (1965)

Boundary with Annexations (Post-Formation)

Esri, HERE, Earthstar Geographics

The Problem…

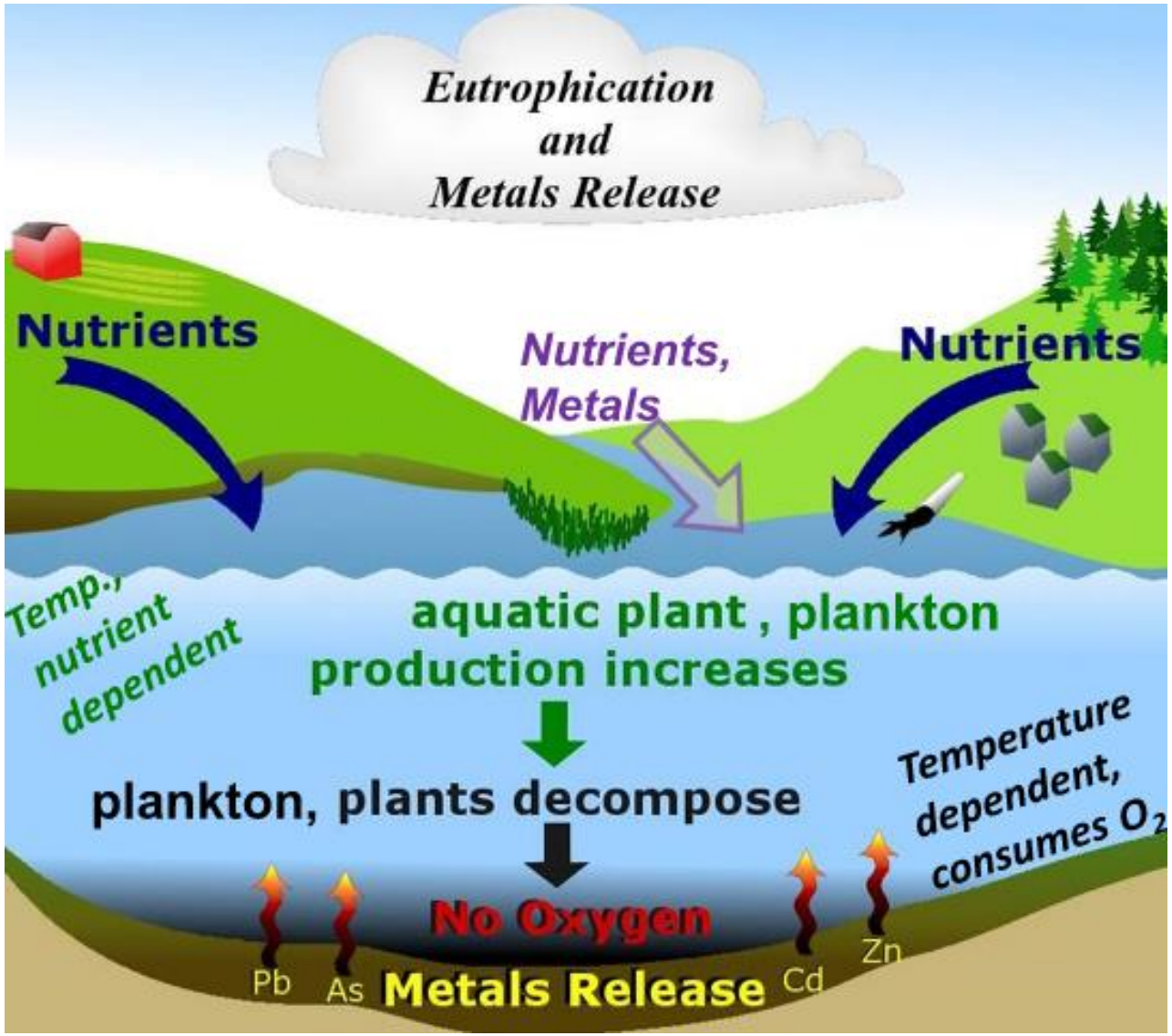
- 75 million metric tons of lead, cadmium, zinc and arsenic deposited in lake bottom
- Logging, farming, construction contribute sediment and nutrients (nitrogen & phosphorus)



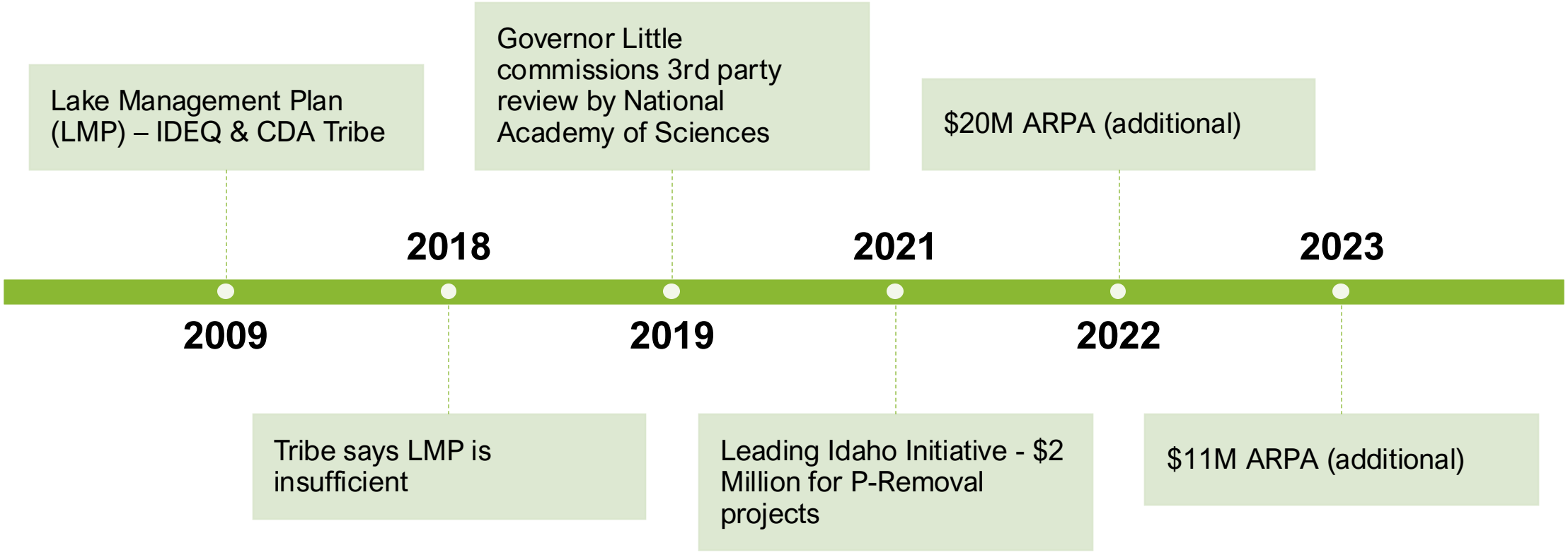
Lake acts as a sink for metals and nutrients

Lake Metabolism:
Nutrients, Carbon, Oxygen

- Nutrients (N, P) = Plant growth
- Plants decompose = Reduced oxygen
- No oxygen (hypoxia) = Metals release
- Higher metals = reduced lake productivity
- Tipping point when lake becomes eutrophic

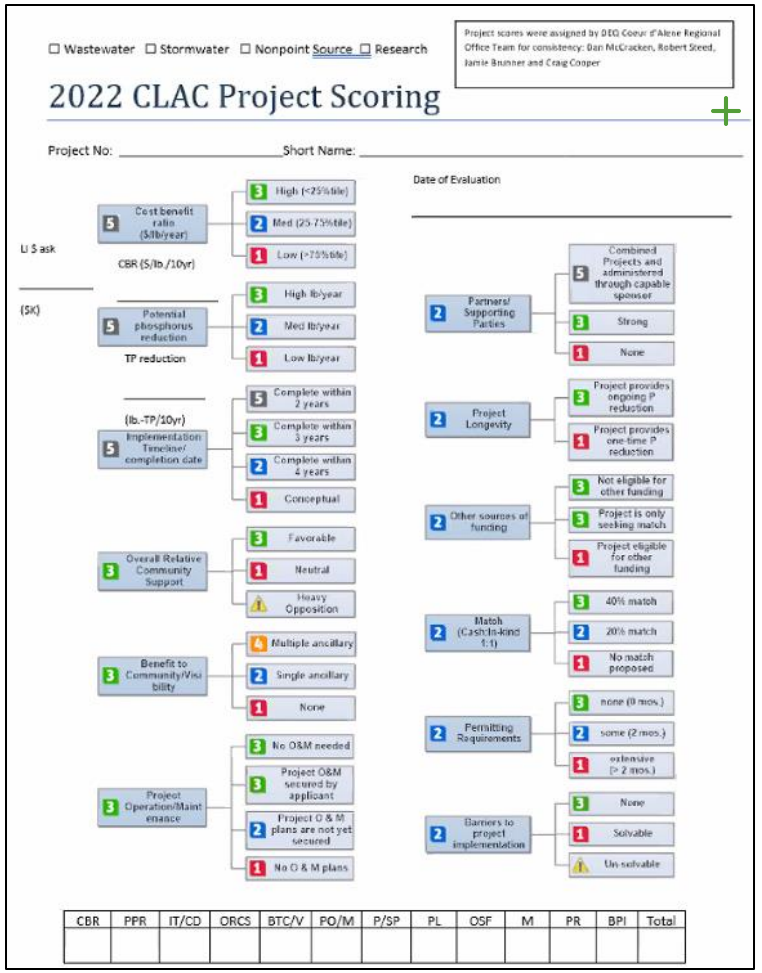


Coeur d'Alene Lake Advisory Committee



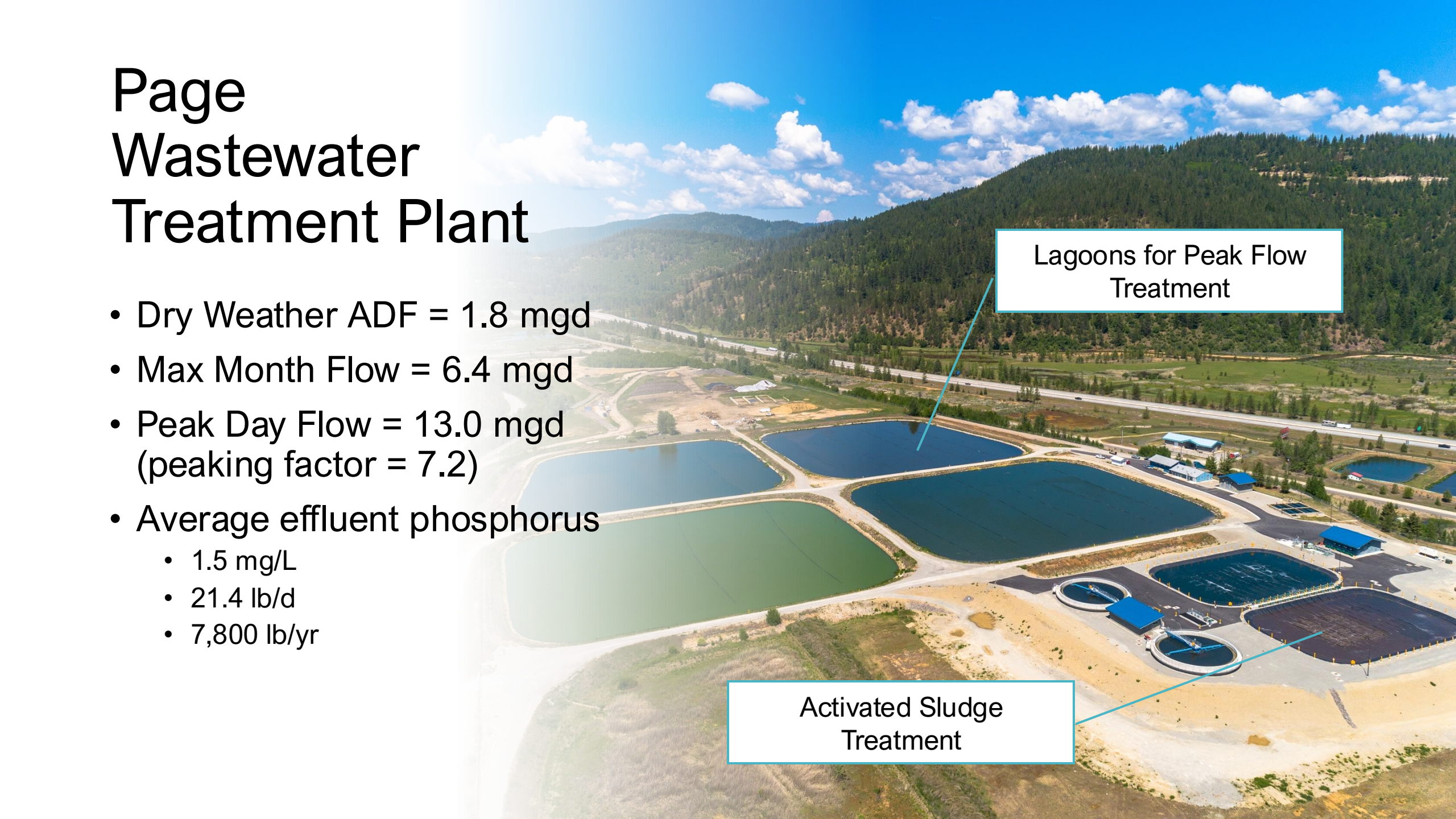
Call for Phosphorus Reduction Projects

- Page WWTP Tertiary Treatment
  - 65% of total phosphorus from point source discharges
  - 8-10% of total phosphorus load from CDA River
  - Tertiary treatment estimated to reduce P load by up to 7,015 lb/year (90% Removal)
  - Estimated project cost $17M



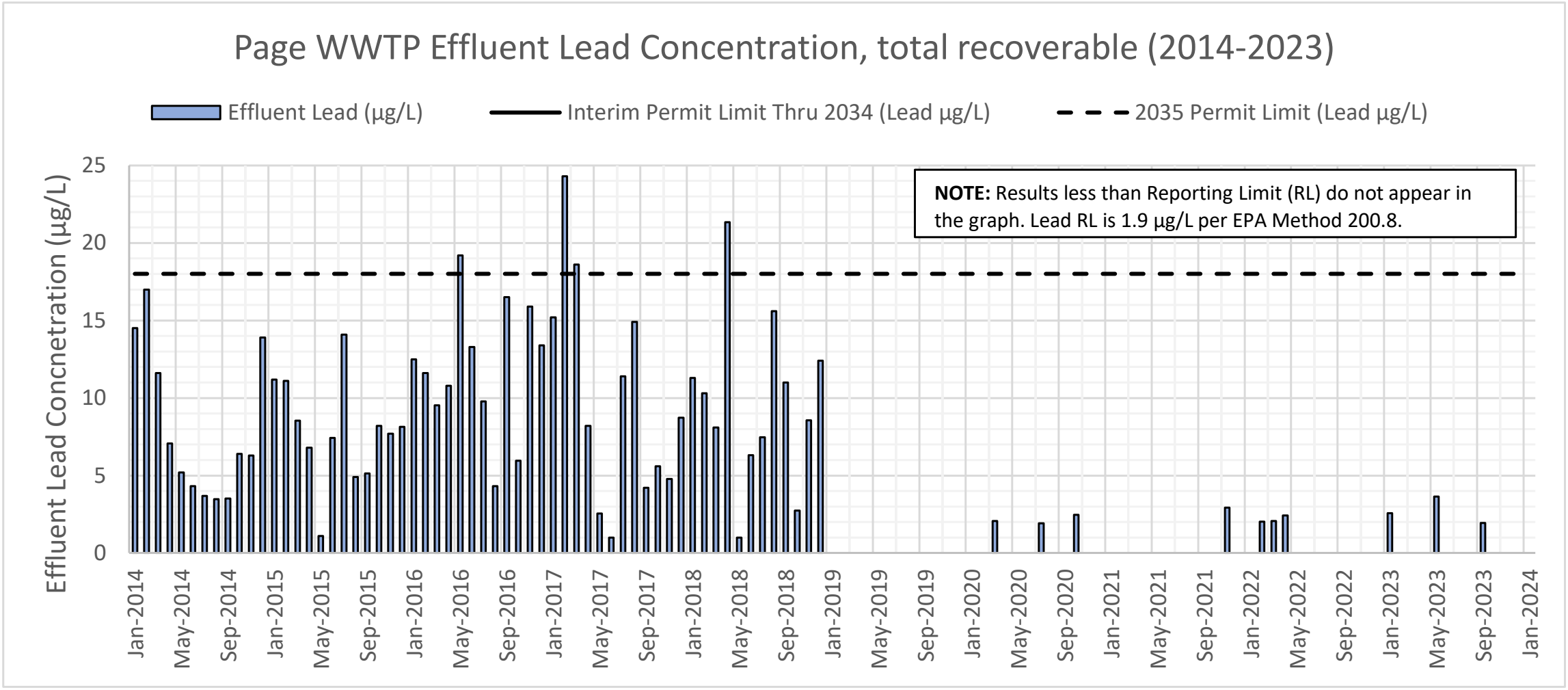
Page Wastewater Treatment Plant

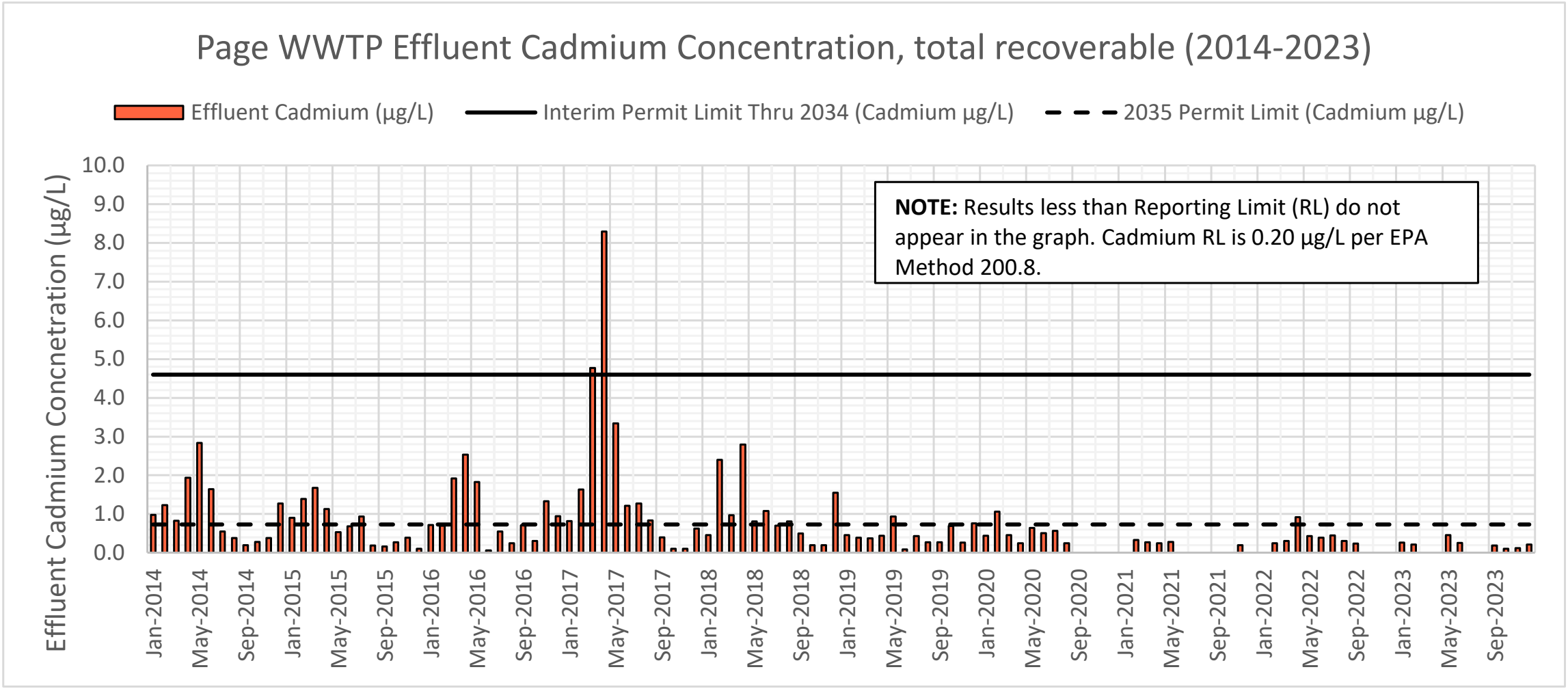
- Dry Weather ADF = 1.8 mgd
- Max Month Flow = 6.4 mgd
- Peak Day Flow = 13.0 mgd (peaking factor = 7.2)
- Average effluent phosphorus
  - 1.5 mg/L
  - 21.4 lb/d
  - 7,800 lb/yr



Problem #2: Metals Limits

Final Numeric Effluent Limits – Water Quality-Based – Effective January 1, 2035							
Cadmium *Effective* ***January 1, 2035***	µg/L	**0.73**	—	**1.7**	Effluent	1/month	24-hour composite
	lb/day	**0.026**	—	**0.060**			
Lead *Effective* ***January 1, 2035***	µg/L	**18**	—	**39**	Effluent	1/month	24-hour composite
	lb/day	**0.65**	—	**1.4**			
Zinc *Effective* ***January 1, 2035***	µg/L	**107**	—	**168**	Effluent	1/month	24-hour composite
	lb/day	**3.8**	—	**6.0**			


Page WWTP Effluent Lead Concentration, total recoverable (2014-2023)
Effluent Lead (µg/L)
Interim Permit Limit Thru 2034 (Lead µg/L)
2035 Permit Limit (Lead µg/L)
NOTE: Results less than Reporting Limit (RL) do not appear in the graph. Lead RL is 1.9 µg/L per EPA Method 200.8.
Effluent Lead Concnetration (µg/L)
0
5
10
15
20
25
Jan-2014
May-2014
Sep-2014
Jan-2015
May-2015
Sep-2015
Jan-2016
May-2016
Sep-2016
Jan-2017
May-2017
Sep-2017
Jan-2018
May-2018
Sep-2018
Jan-2019
May-2019
Sep-2019
Jan-2020
May-2020
Sep-2020
Jan-2021
May-2021
Sep-2021
Jan-2022
May-2022
Sep-2022
Jan-2023
May-2023
Sep-2023
Jan-2024


Page WWTP Effluent Cadmium Concentration, total recoverable (2014-2023)
Effluent Cadmium (µg/L)
Interim Permit Limit Thru 2034 (Cadmium µg/L)
2035 Permit Limit (Cadmium µg/L)
Effluent Cadmium Concnetration (µg/L)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
NOTE: Results less than Reporting Limit (RL) do not appear in the graph. Cadmium RL is 0.20 µg/L per EPA Method 200.8.
Jan-2014
May-2014
Sep-2014
Jan-2015
May-2015
Sep-2015
Jan-2016
May-2016
Sep-2016
Jan-2017
May-2017
Sep-2017
Jan-2018
May-2018
Sep-2018
Jan-2019
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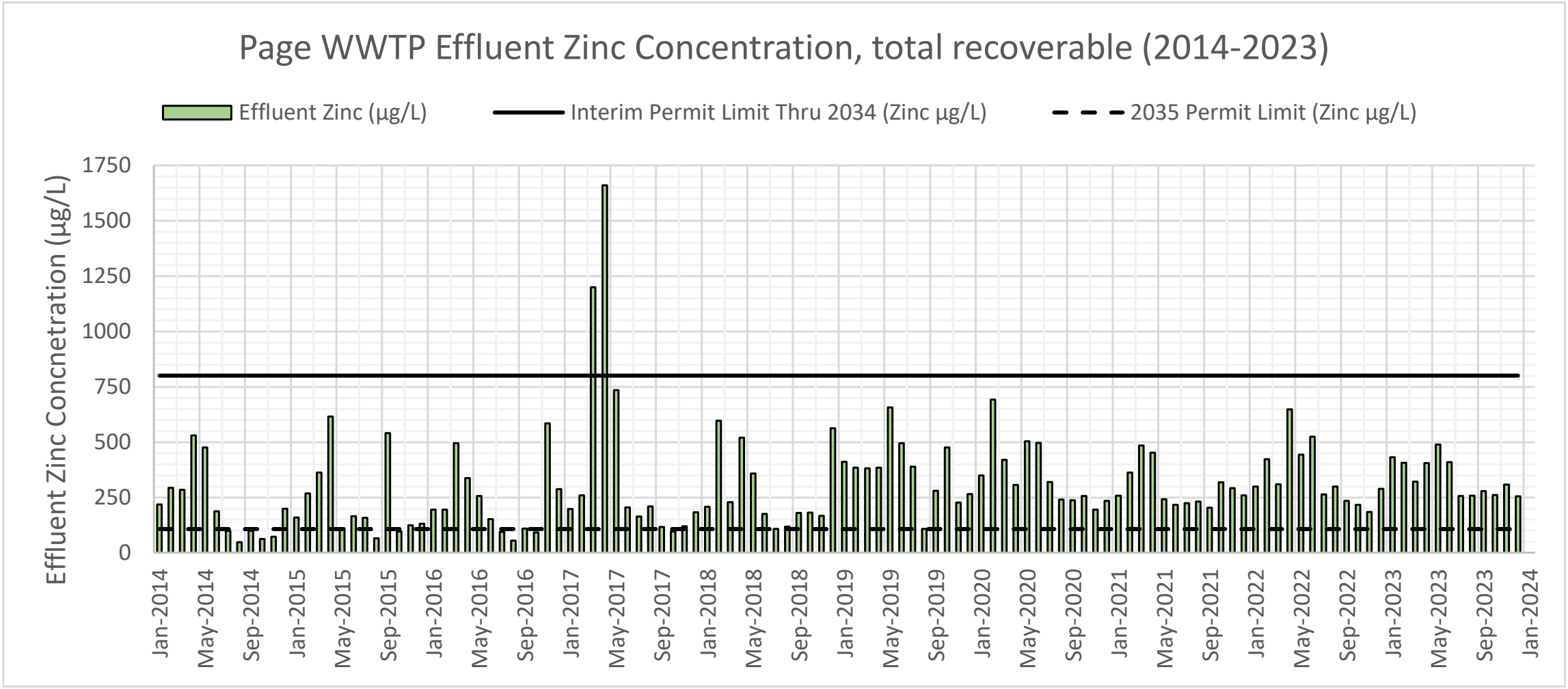
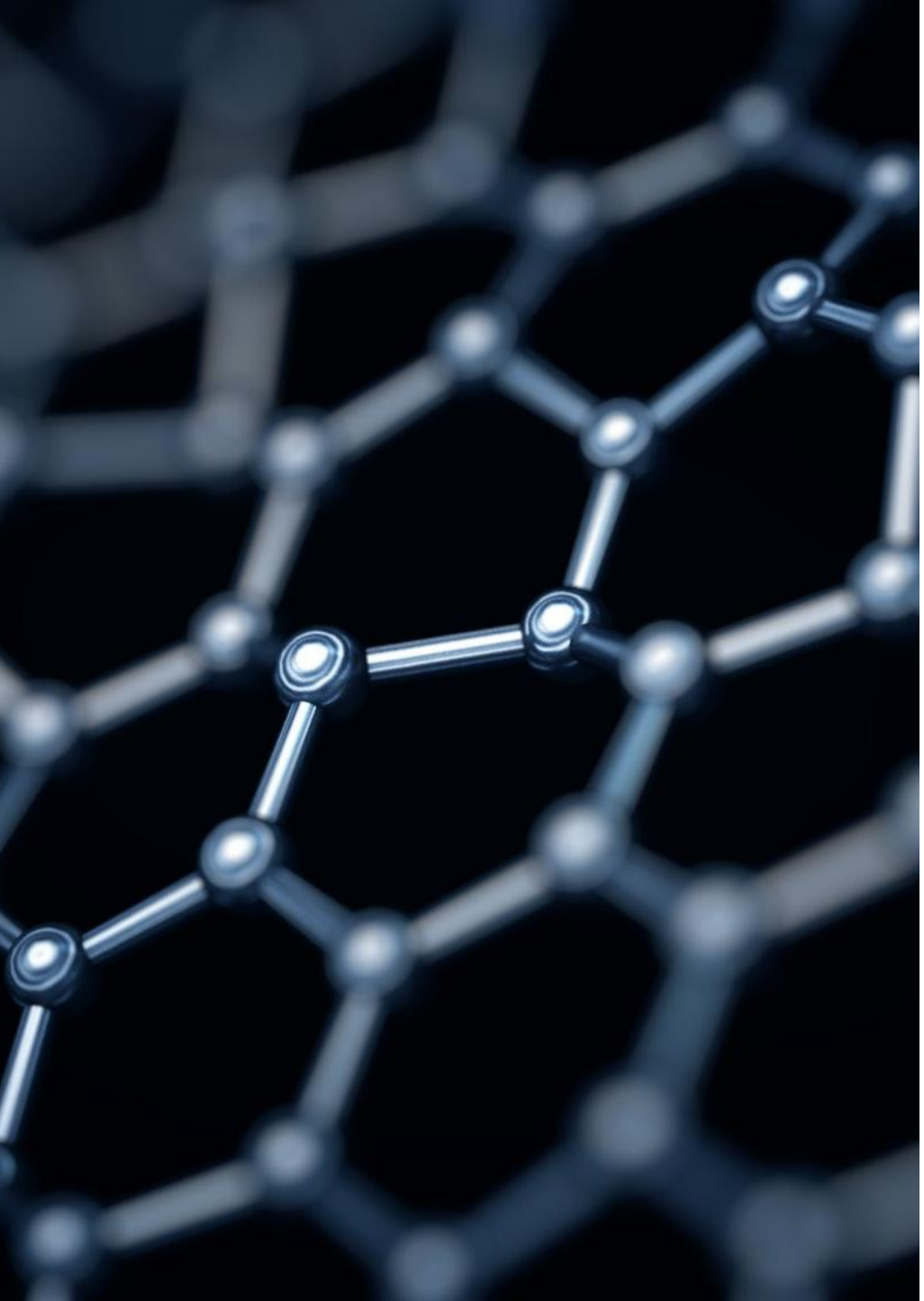
Jan-2023
May-2023
Sep-2023


Page WWTP Effluent Zinc Concentration, total recoverable (2014-2023)
Effluent Zinc (µg/L)
Interim Permit Limit Thru 2034 (Zinc µg/L)
2035 Permit Limit (Zinc µg/L)
Effluent Zinc Concnetration (µg/L)
1750
1500
1250
1000
750
500
250
0
Jan-2014
May-2014
Sep-2014
Jan-2015
May-2015
Sep-2015
Jan-2016
May-2016
Sep-2016
Jan-2017
May-2017
Sep-2017
Jan-2018
May-2018
Sep-2018
Jan-2019
May-2019
Sep-2019
Jan-2020
May-2020
Sep-2020
Jan-2021
May-2021
Sep-2021
Jan-2022
May-2022
Sep-2022
Jan-2023
May-2023
Sep-2023
Jan-2024



Project Goals

Phosphorus Reduction (voluntary)

Maximize phosphorus removed per dollar spent

Target 80-90% P removal

Future permitting to be determined – ideally seasonal average ppd

Improved heavy metals treatment

Leverage P-removal process for future metals compliance

Minimize operational complexity O&M costs

Small operations staff

Keep rates low

All ARPA funding **must** be spent by Dec. 31, 2026

Design Criteria

- ADF 2.4 mgd
- Peak 3.2 mgd
- Q>3.2 mgd secondary treatment only

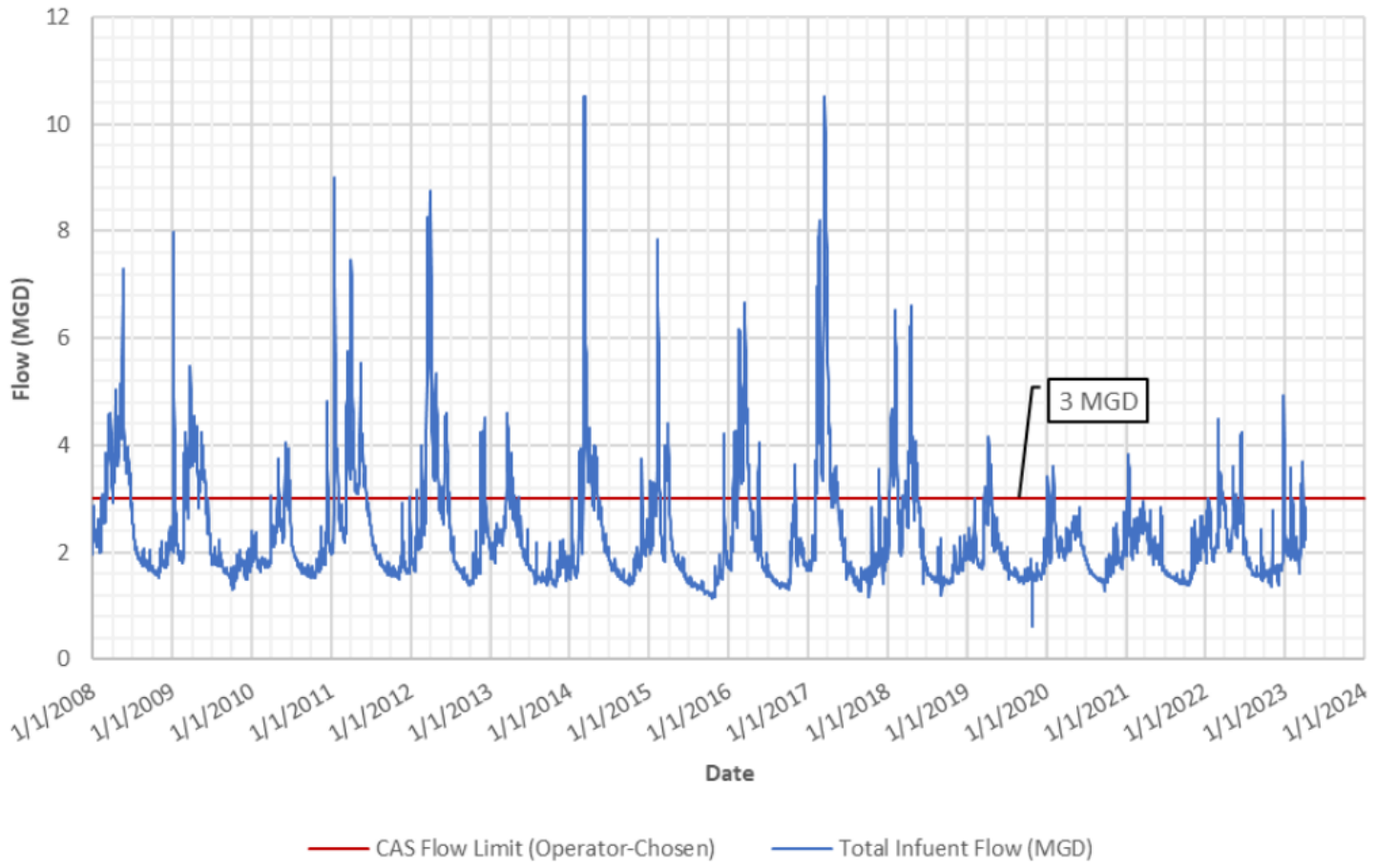


Figure 1 Influent Flow Relative to the AS Capacity

Universe of Treatment Technologies

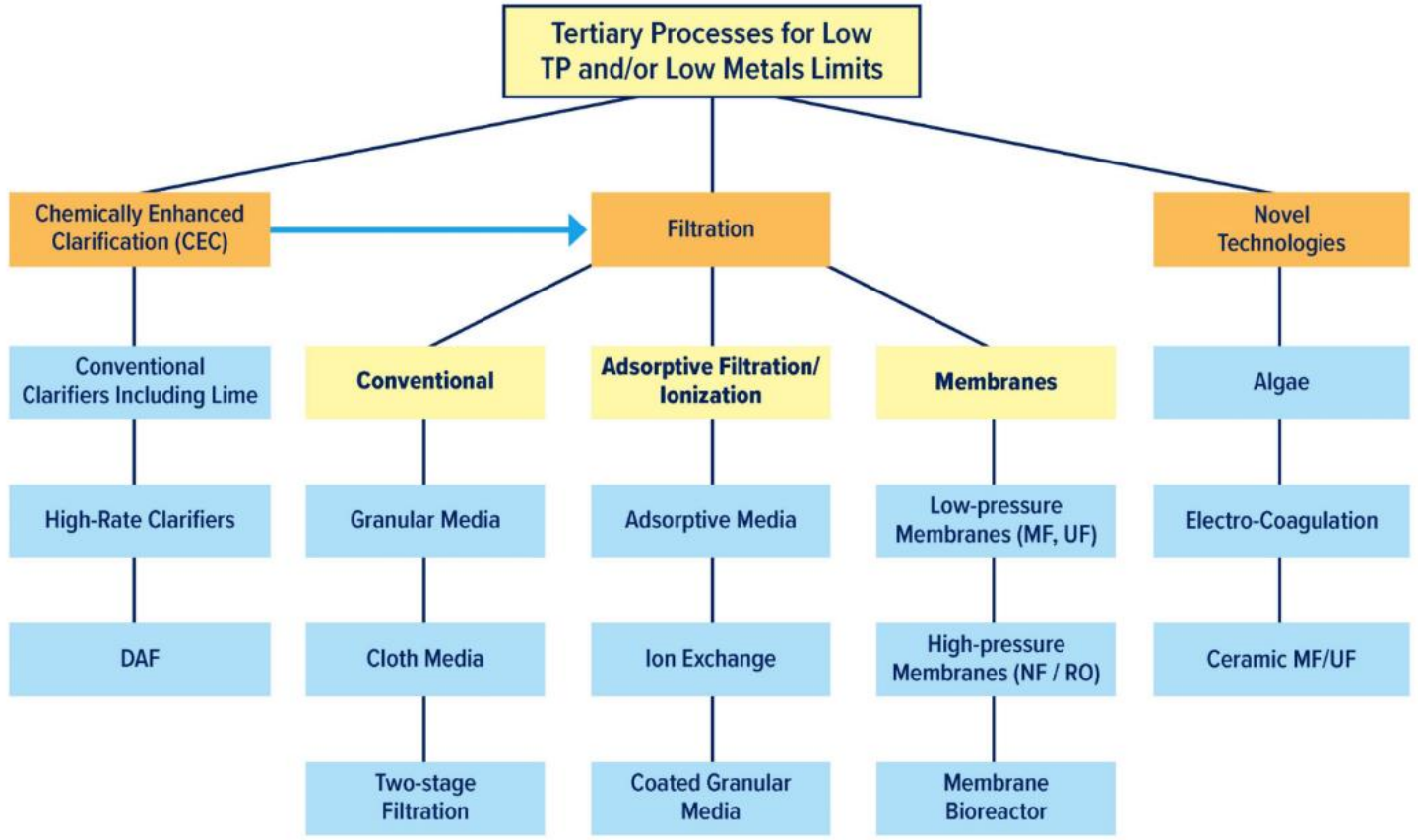
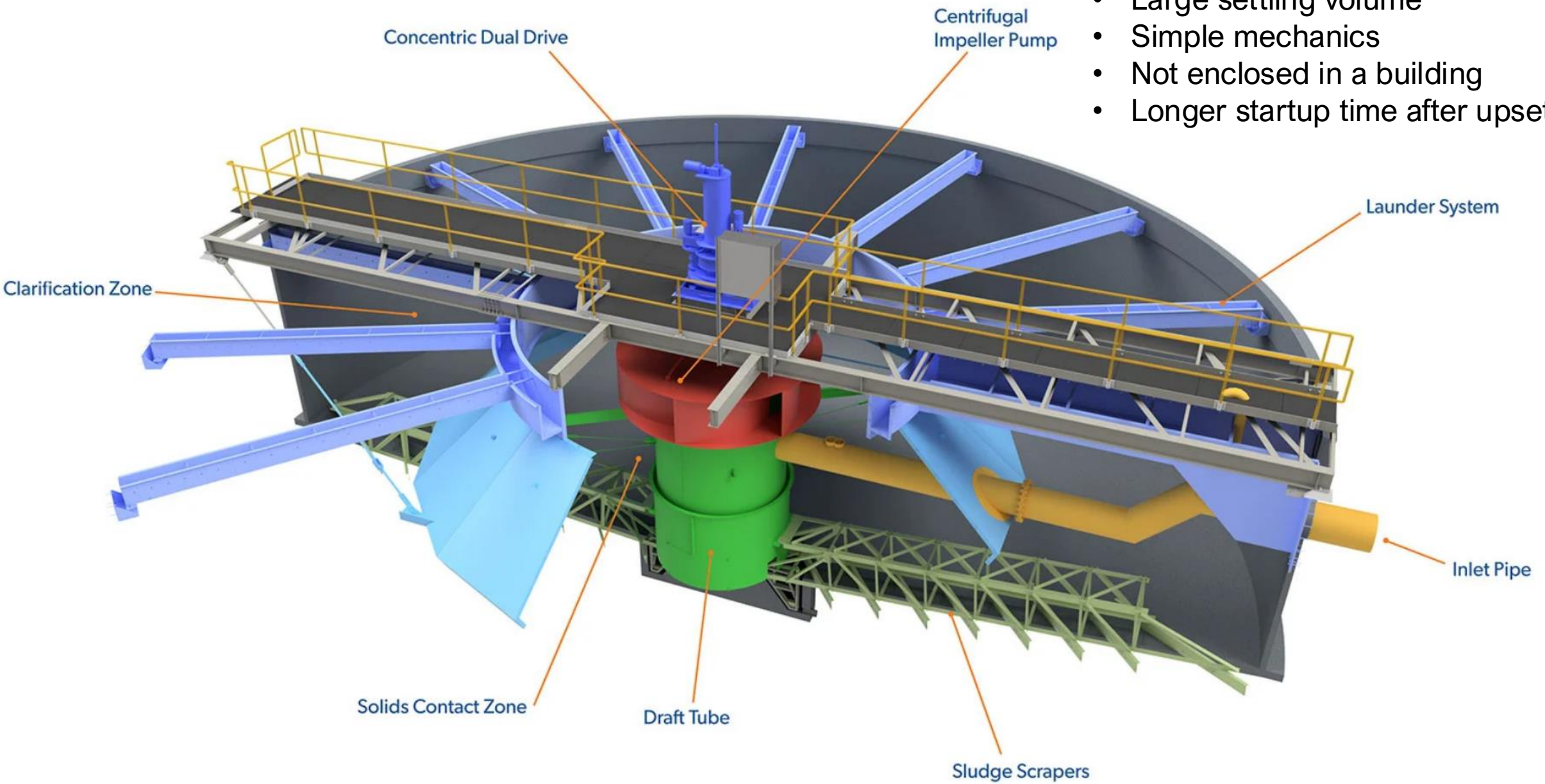


Figure 8 Tertiary Phosphorus and/or Metal Removal Processes

Solids CONTACT CLARIFIER™

- Large footprint
- Large settling volume
- Simple mechanics
- Not enclosed in a building
- Longer startup time after upset



Solids Contact Clarifier

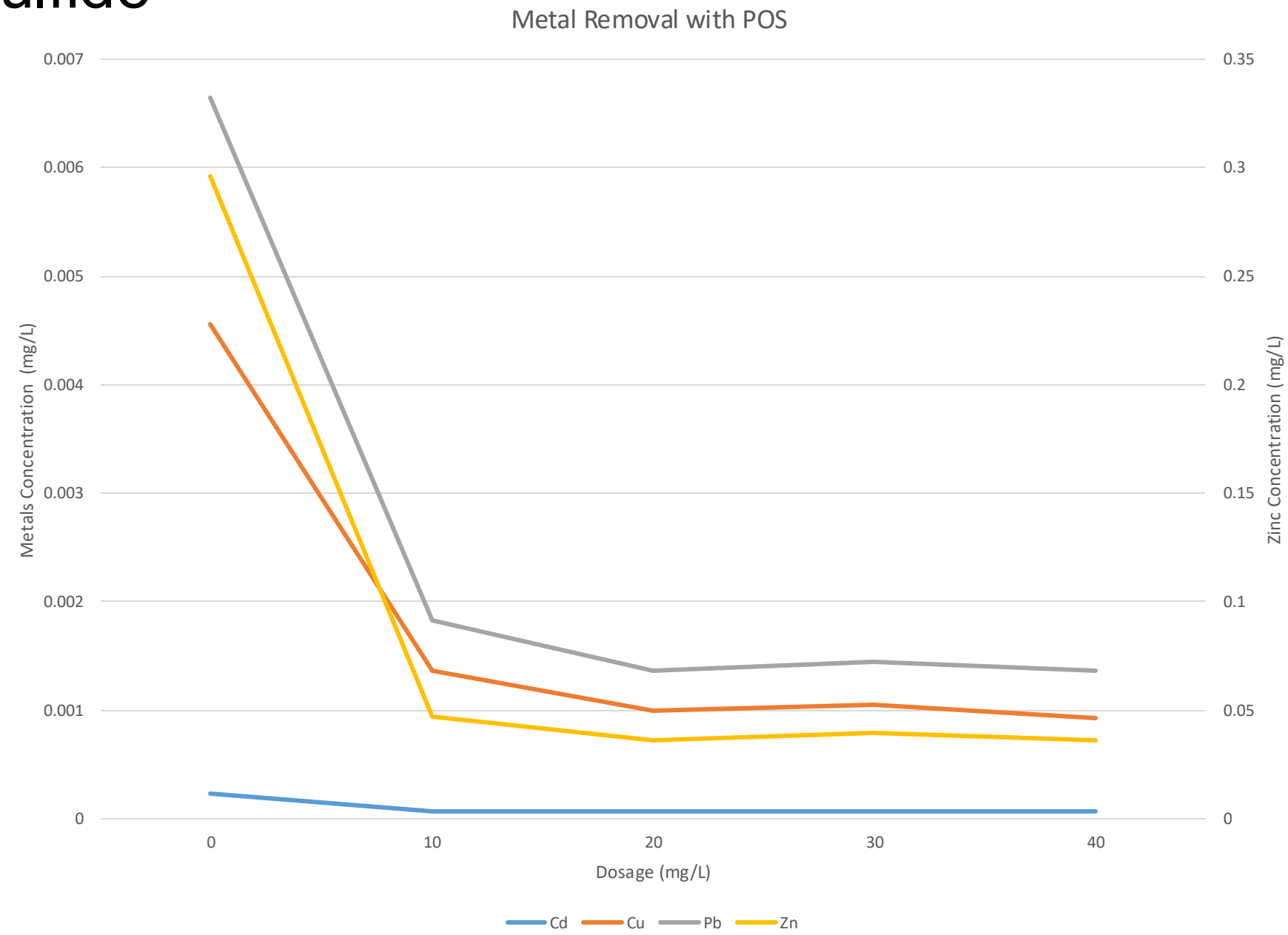
Hayden Area Regional Sewer Board

Jar Testing


Pipette tips
Pipettenspitzen
Puntas de pipeta
1-5ml
KIMTECH
B-KER
B-KER

TP Removal - Alum

Polyorgano Sulfide



Pilot Testing

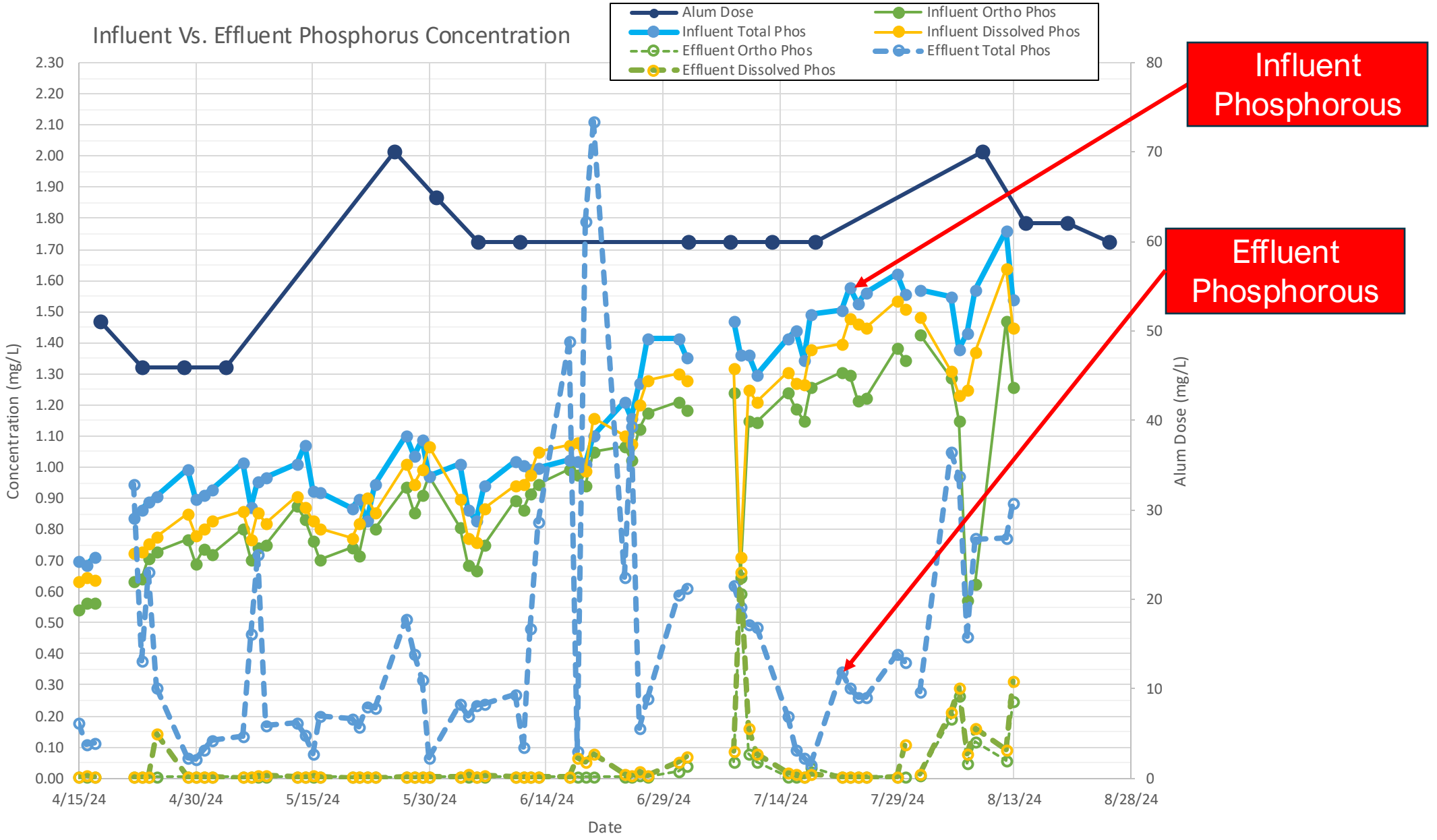
Pilot Study Objectives

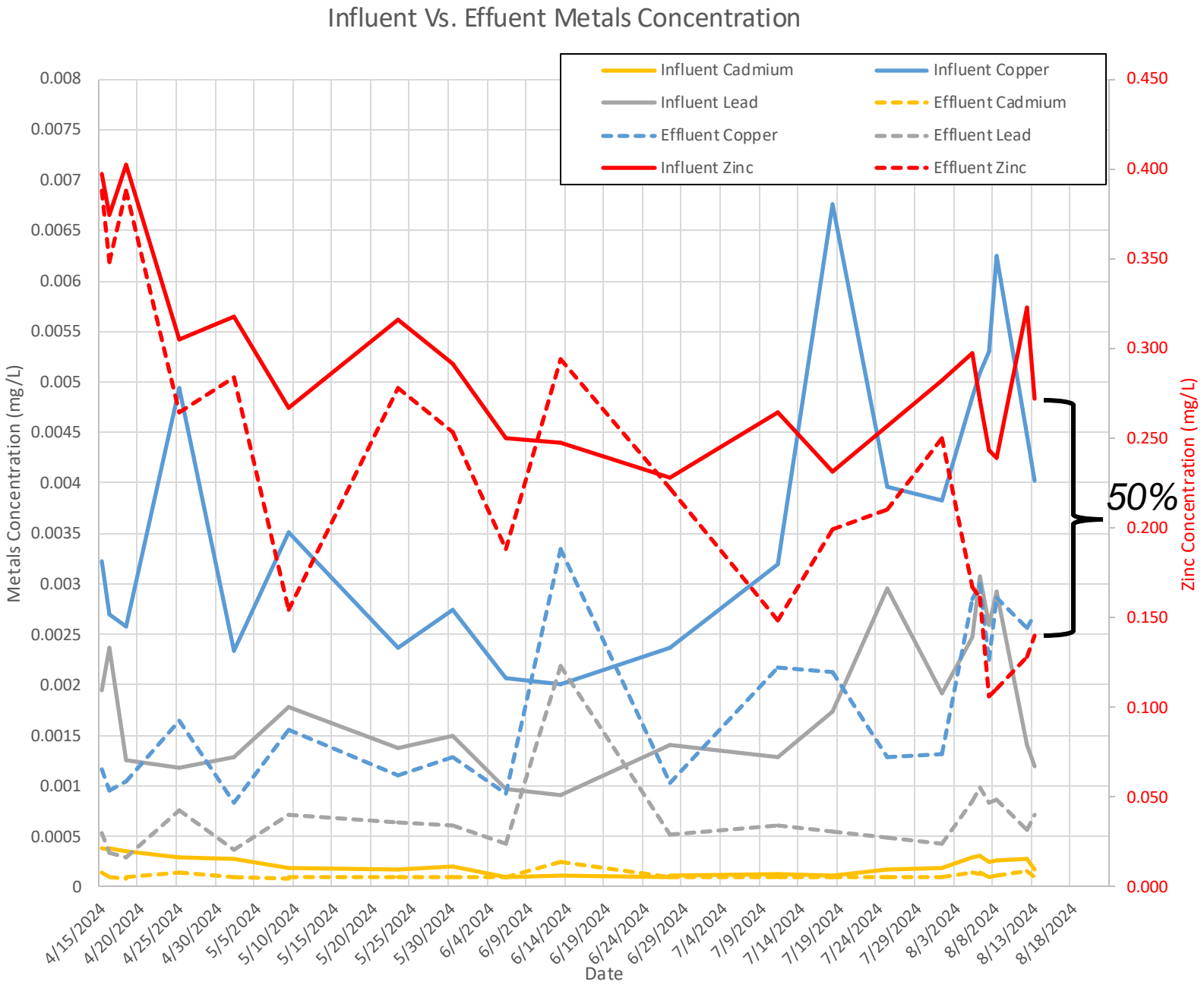
- Demonstrate phosphorus removal performance of a SCC treatment and provide data to full scale SCC bidders to facilitate their provision of a performance guarantee. Target – 0.15 mg/l P
- Collect data to optimize chemical usage
- Investigate metals removal from the SCC process


KECKLEY
SOLIDS SAMPLING


NaOH
Alum
Polymer&
POS

Pilot Results




Influent Vs. Effuent Metals Concentration
Influent Cadmium
Influent Copper
Influent Lead
Effluent Cadmium
Effluent Copper
Effluent Lead
Influent Zinc
Effluent Zinc
Metals Concentration (mg/L)
Zinc Concentration (mg/L)
0.008
0.0075
0.007
0.0065
0.006
0.0055
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
50%
4/15/2024
4/20/2024
4/25/2024
4/30/2024
5/5/2024
5/10/2024
5/15/2024
5/20/2024
5/25/2024
5/30/2024
6/4/2024
6/9/2024
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6/29/2024
7/4/2024
7/9/2024
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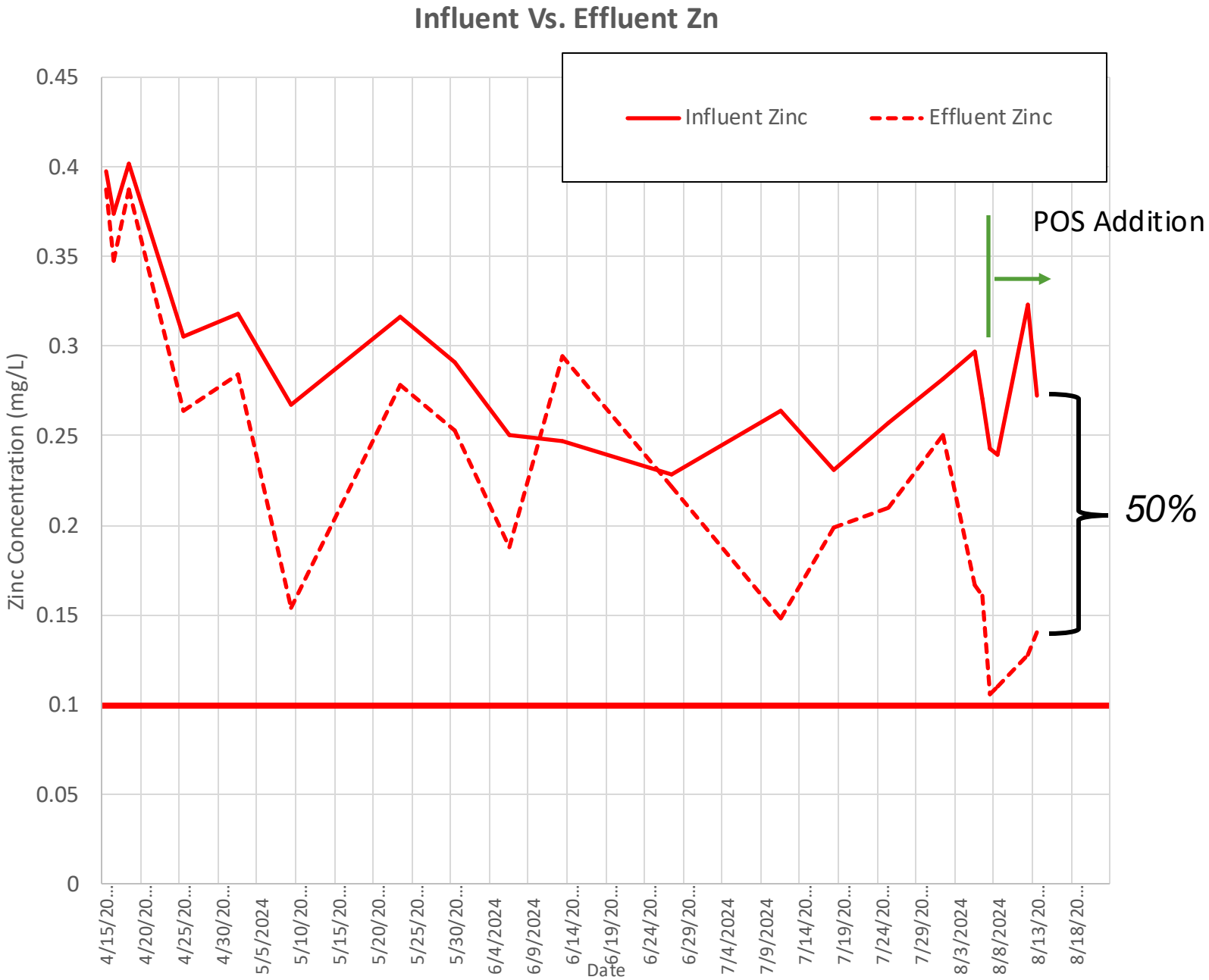
8/3/2024
8/8/2024
8/13/2024
8/18/2024
Date


Influent Vs. Effluent Zn
Influent Zinc
Effluent Zinc
POS Addition
50%
Zinc Concentration (mg/L)
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
4/15/20...
4/20/20...
4/25/20...
4/30/20...
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5/10/20...
5/15/20...
5/20/20...
5/25/20...
5/30/20...
6/4/2024
6/9/2024
6/14/20...
6/19/20...
6/24/20...
6/29/20...
7/4/2024
7/9/2024
7/14/20...
7/19/20...
7/24/20...
7/29/20...
8/3/2024
8/8/2024
8/13/20...
8/18/20...
Date

Sludge Handling

Sludge Dewatering

Sludge Dewatering

Geotube Dewaterability Testing

Implementation

Pre-Procurement

October 2024: Geotechnical Improvements (Big Sky Const.)

October 2024: Pre-engineered Metal Building (Ginno/ PBS)

December 2024: Solids Contact Clarifier (WesTech)


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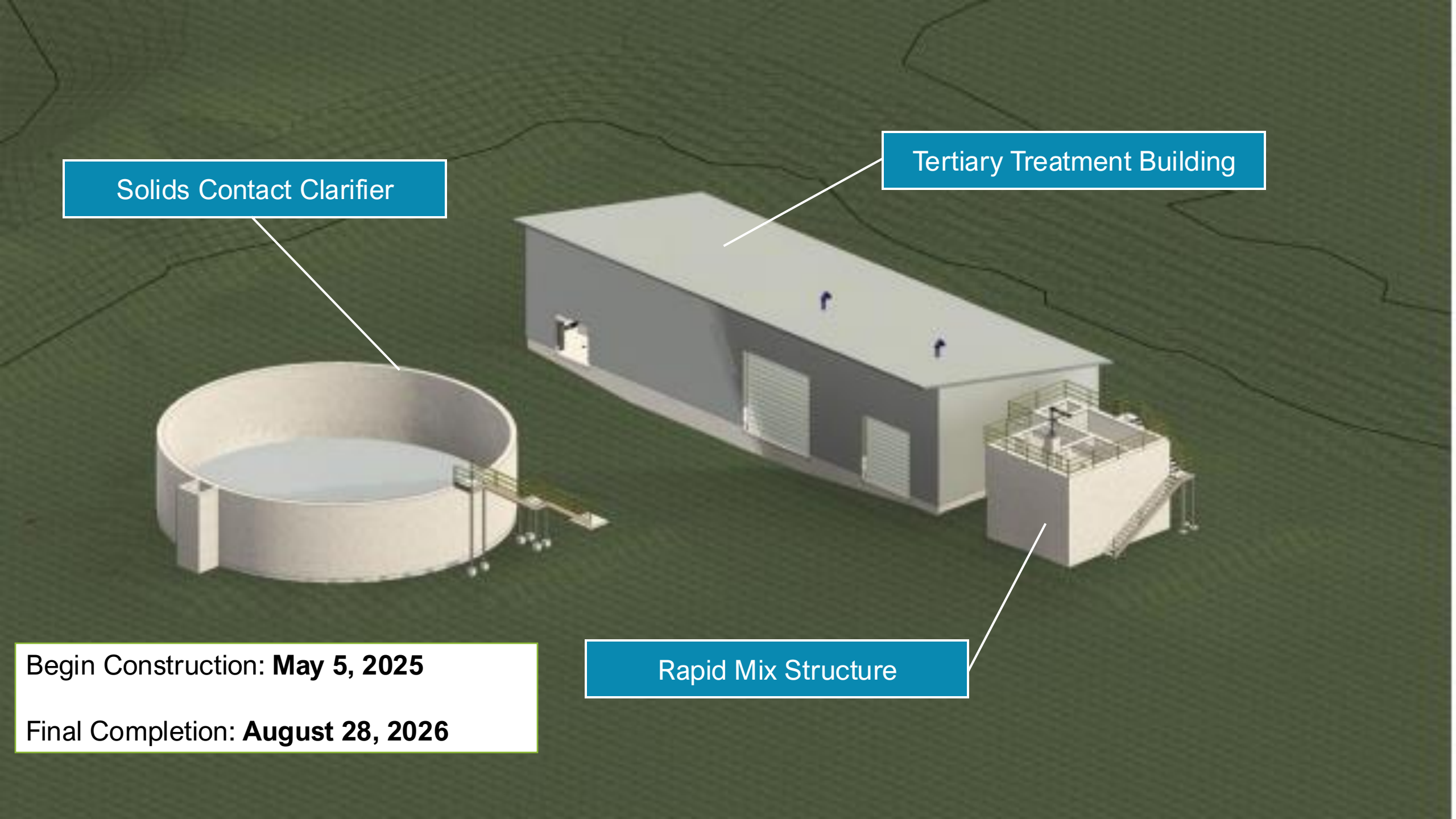
October 2024



Begin Construction: **May 5, 2025**

Final Completion: **August 28, 2026**

Project Budget

Phosphorus Reduction Grant:
$17M

Davis-Bacon Wage Compliance:
$1.2M

Smelterville Annexation:
$3.2M

Total Project:
$21.4M

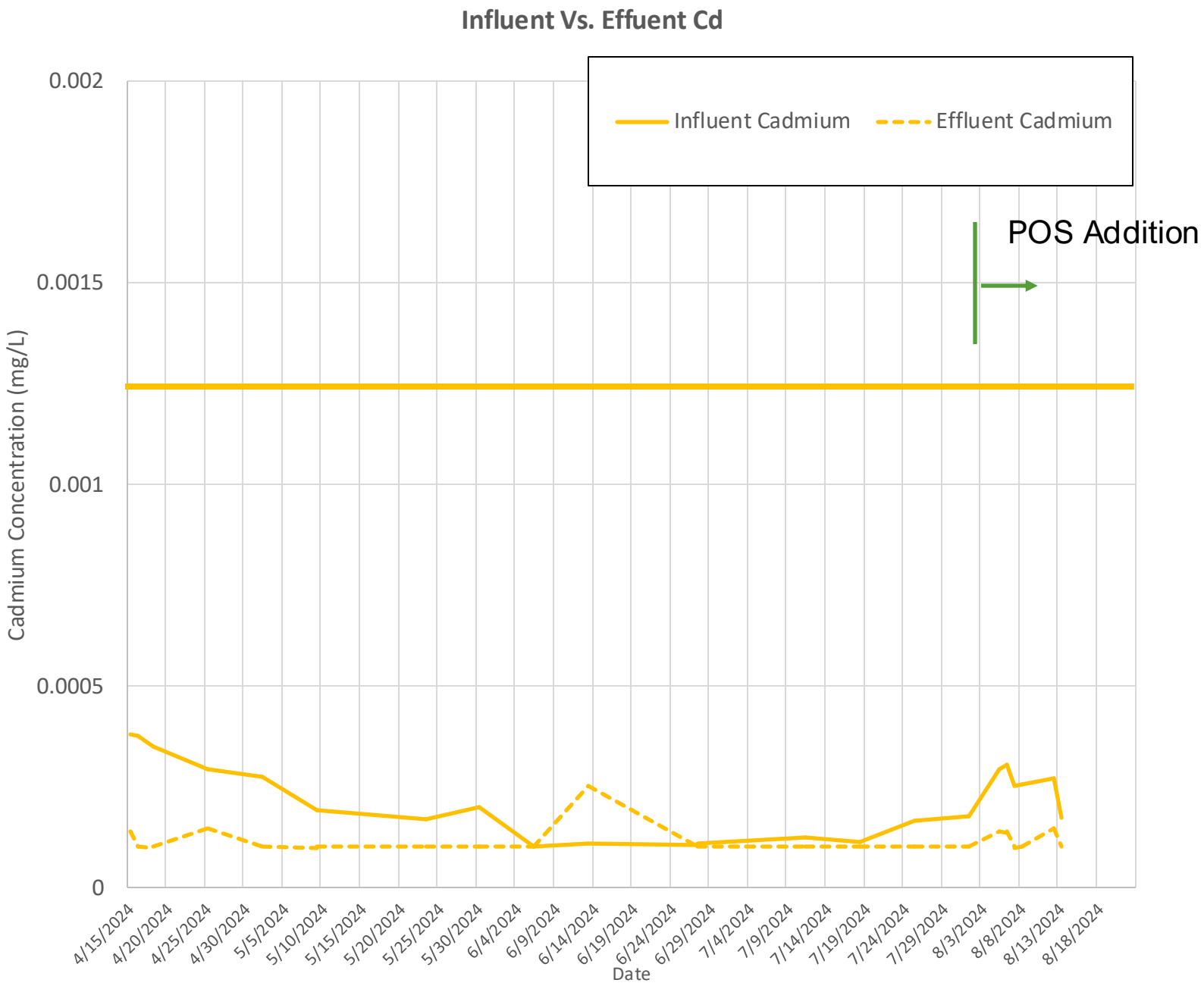

Questions

Preferred Alternatives

- **BPR Conversion** – Not practical due to retrofit challenges and need for carbon supplementation
- **Conventional Clarification**
  - Solids Contact Clarifiers
  - Lamella Plate/ Tube Settlers
- **High-Rate Clarification**
  - Dense Sludge
  - Ballasted Flocculation
- **Filtration**
  - Cloth or screen disk filters
  - Continuous backwash upflow filters

Chemical Precipitation

- Metal coagulant (aluminum or iron based) forms hydroxide sludge
- Hydroxide sludge adsorbs soluble phosphorus creating a particle that can settle or be filtered


Influent Vs. Effuent Cd
Influent Cadmium
Effluent Cadmium
POS Addition
Cadmium Concentration (mg/L)
0.002
0.0015
0.001
0.0005
0
4/15/2024
4/20/2024
4/25/2024
4/30/2024
5/5/2024
5/10/2024
5/15/2024
5/20/2024
5/25/2024
5/30/2024
6/4/2024
6/9/2024
6/14/2024
6/19/2024
6/24/2024
6/29/2024
7/4/2024
7/9/2024
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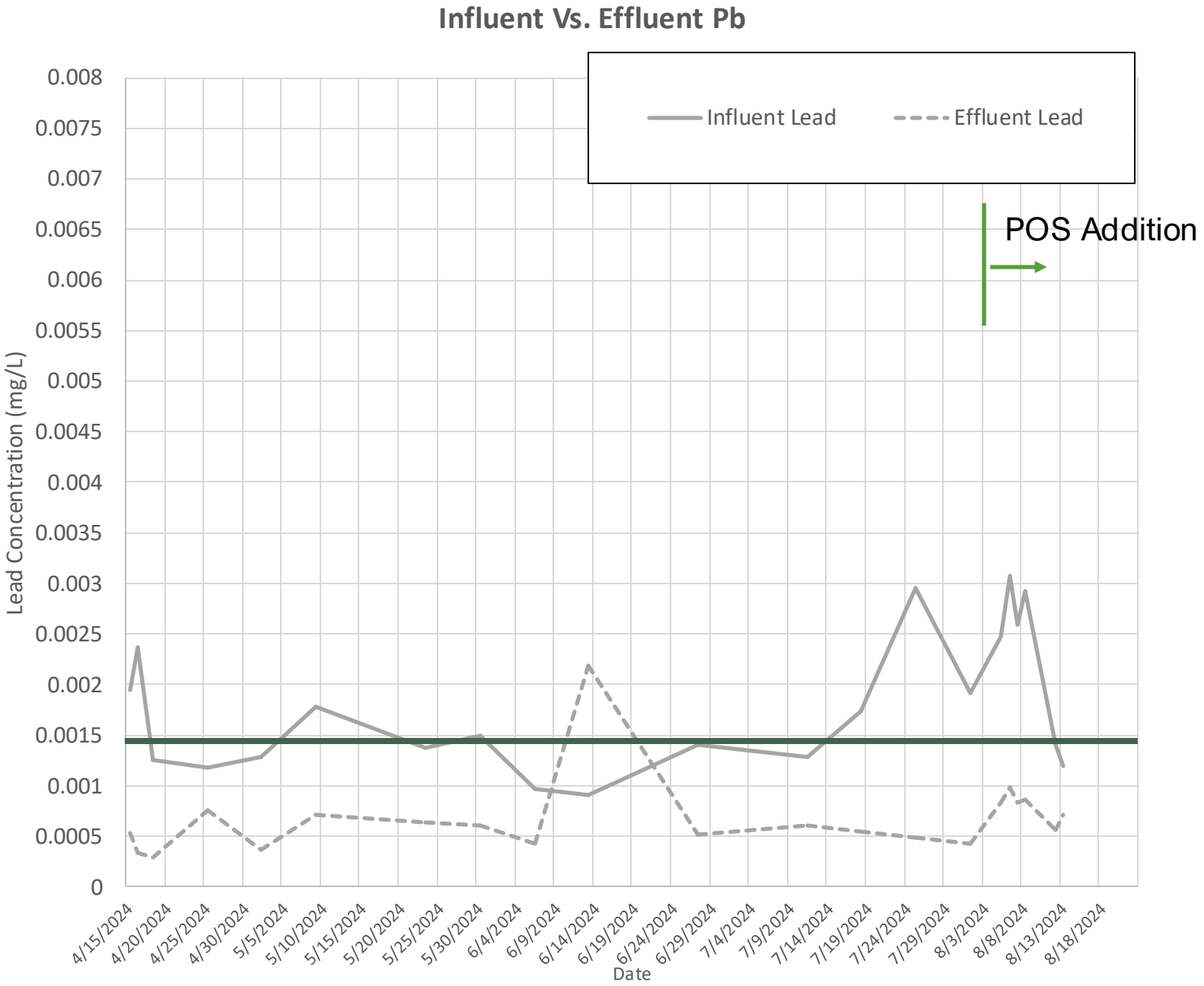
8/3/2024
8/8/2024
8/13/2024
8/18/2024
Date


Influent Vs. Effluent Pb
Influent Lead
Effluent Lead
POS Addition
Lead Concentration (mg/L)
0.008
0.0075
0.007
0.0065
0.006
0.0055
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
4/15/2024
4/20/2024
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6/9/2024
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Date