Coal Pile Runoff Treatments for ELG Compliance

Presented by:
Max Swoboda, Project Solutions – Coal Ash Ponds
September 18, 2019

TRANSFORMING WATER. ENRICHING LIFE.

About the Presenter

Max Swoboda

Project Solutions – Coal Ash Ponds

- 25+ years of experience providing technical and water treatment solutions to power plants
- Has developed water solutions for many industries including ultrapure water production in fossil and nuclear facilities
- At Evoqua, focuses on the wastewater needs of coal-fired plants needing to stay in compliance with CCR and ELG regulations
- Bachelor of Science in Civil Engineering from the Virginia Military Institute

Agenda

Coal Pile Runoff Treatment for ELG Compliance

- Treatment background
- Regulations
- Design considerations
- Temporary Solution
- Conventional Solution

Evoqua's Reach in CCR

Presents

- Over 70 MGD of installed treatment
- 25 Sites under contract
- Multiyear projects
- 250-12,000 gpm

Solutions

- Clarification
- Filtration
- Reverse Osmosis
- Metals Removal
- Groundwater treatment
- Biological and non-biological selenium treatment

Coal Pile Runoff

It is what you think it is,

Rain falls on a coal pile, runs down the slope by gravity and creates run off water.

Source: Mark Schleifstein, NOLA.com | The Times-Picayun

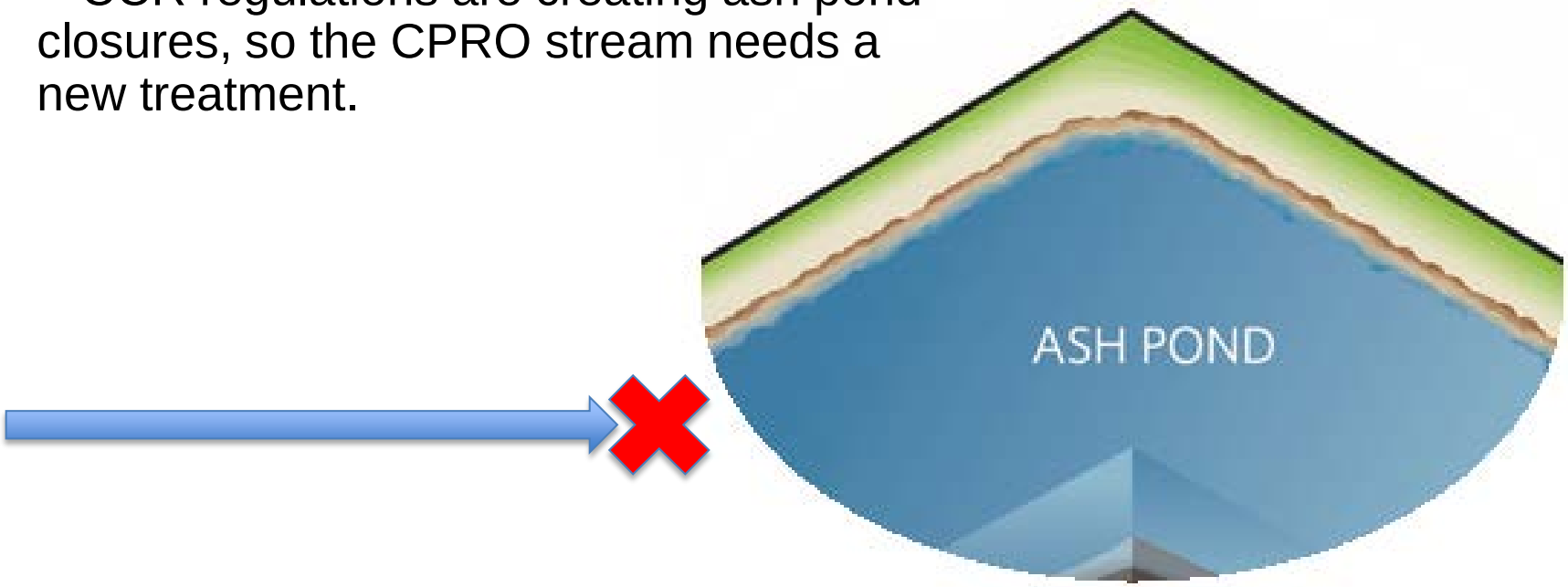
Coal Pile Runoff

Particles of fine coal get picked up and transported with the water.

Source: Mark Schleifstein, NOLA.com | The Times-Picayun

Coal Pile Runoff

- At many plants the coal pile runoff historically flowed to the ash pond for treatment.
- CCR regulations are creating ash pond closures, so the CPRO stream needs a new treatment.



Regulations for Coal Pile Runoff (CCR Rule)

The CCR rule regulates the disposal of coal combustion residuals and sets the minimum criteria for existing and new CCR landfills and surface impoundments, design and operating criteria, groundwater monitoring and corrective action, closure requirements and post closure care, and recordkeeping, notification, and internet posting requirements.

The rule requires any existing unlined CCR surface impoundment that is contaminating groundwater above a regulated constituent's groundwater protection standard to stop receiving CCR and either retrofit or close, except in limited circumstances.

Thus the CCR Rule indirectly addresses CPRO when there is no ash pond to receive it

Regulations for Coal Pile Runoff (ELG Rule)

§ 425.15 (a) Page 67896 (11) & (12)

- (a) 1982 NSPS. Any new source as of November 19, 1982, subject to paragraph (a) of this section, must achieve the following new source performance standards, in addition to the limitations in § 423.13 of this part, established on November 3, 2015.
- (1) pH. The pH of all discharges, except once through cooling water, shall be within the range of 6.0–9.0.
- (11) Coal pile runoff. Subject to the provisions of paragraph (a)(12) of this section, the quantity or quality of pollutants or pollutant parameters discharged in coal pile runoff shall not exceed the standards specified below:

  TSS not to exceed 50 mg/l

- (12) Coal pile runoff. Any untreated overflow from facilities designed, constructed, and operated to treat the coal pile runoff which results from a 10 year, 24 hour rainfall event shall not be subject to the standards in paragraph (a)(11) of this section.

ELG Regulations for Coal Pile Runoff

(12) 10 Year Rainfall, 24 hour

- So I only need to worry about that once every 10 years, right?
- There is no law of averages, an event can occur at anytime – coin flip example
- A 10 Year Rainfall event has a 10% likelihood of occurring within any given year.
- X-year rainfall or flood is a statistical term that suggest the probability that an event will occur in a given year.
- It is not the expected maximum rainfall event over the course of a 10 year period.

- Consider playing Roulette, there are 38 slots on the normal American wheel.
- Each number therefore has a 2.6% chance of winning.
- When you see a number hit back to back that is like two 38 year storms in a row

Regulations for Coal Pile Runoff (ELG Rule)

§ 423.13 Page 67894-67896

Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT).

- Coal pile runoff is not mentioned in this section. It speaks directly to (g)FGD, (h) fly ash transport water, (i) flue gas mercury control, (j) gasification, (k) bottom ash transport water, (l) combustion residual leachate.
- (n) In the event that waste streams from various sources are combined for treatment or discharge, the quantity of each pollutant or pollutant property controlled in paragraphs (a) through (m) of this section attributable to each controlled waste source shall not exceed the specified limitation for that waste source.
- *Whenever _____ water is used in any other plant process or is sent to a treatment system at the plant (except when it is used in the FGD scrubber), the resulting effluent must comply with the discharge limitation in this paragraph.*

Regulations for Coal Pile Runoff (ELG Rule)

Fifth Circuit Ruling – April 12, 2019

Best Available Technology economically achievable (BAT).

- Remanded the rule to EPA for reconsideration of the BAT for legacy wastewater
- Ruling was for legacy wastewater specifically combustion residual leachate
- Coal pile runoff is not specifically mentioned in ruling
- Final ELG Rule is expected December 2019

Treatment Design Considerations

- Volume
- Water quality
- Solids Loading
- Permitted discharge requirements

Random Coal Pile Volume

Areas

- Coal pile size is 27.6 acres
- Runoff pond is 5.3 pond
- Ratio is about 5x, thus 1” of rain is 4.5-6” in the pond.

Random Coal Pile Volume

Rain fall data (24 hour duration)

- 1 year storm (100%) – 2.61”
- 2 year storm (50%) – 3.15”
- 5 year storm (20%) – 3.91”
- 10 year storm (10%) – 4.51”
- 25 year storm (4%) – 5.33”

- Average Annual – 40.1”

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

Random Coal Pile Volume

How many gallons in 24 hours?

- One Year storm = 1,956,100 gallons
- Ten year storm = 3,384,000 gallons
- EPA/TVA expected direct runoff rate 73%

- Collection pond level change in 24 hours is 9”-20”

Random Coal Pile Volume

What flow rate?

- One Year storm = 1,360 gpm
- Ten year storm = 2,350 gpm
- EPA/TVA expected direct runoff rate 73%
- Design at 1,000 to 2,000 gpm would cover the worst case

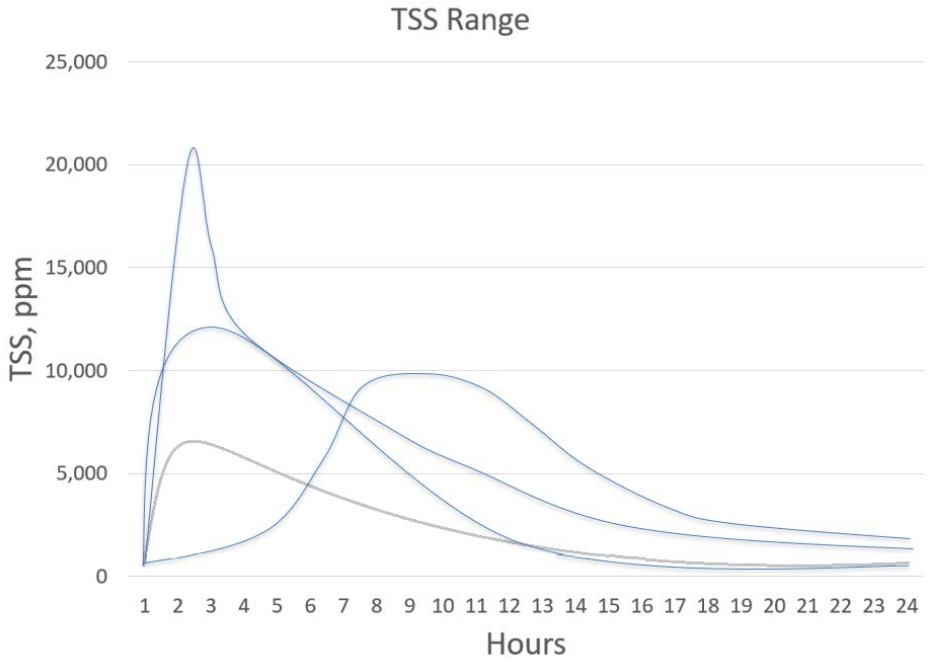
- A smaller system could be made by managing the pond level

Random Coal Pile Water Quality

What Design TSS?

- Data suggest a wide range, start gathering samples!

- 20-20,000 ppm TSS could be expected, 400 ppm average
- Rainfall will set the curve peak and duration based on storm strength



*Hypothetical data

Random Coal Pile Water Quality

Effects of Coal Type on Runoff Characteristic

	IL Basin	PRB	Appalachian
Type	Bituminous	Sub-bituminous	Bituminous
Iron	1,000-1,500	2-10	2-10
pH	Low 1.5-4	High 7-8	Low 4-6
Ions	Cl, Hg, Fe, Cr, S	Cu	As, Cr, Cu, Hg, Se

Random Coal Pile Solids Loading

Expected TSS - Annual

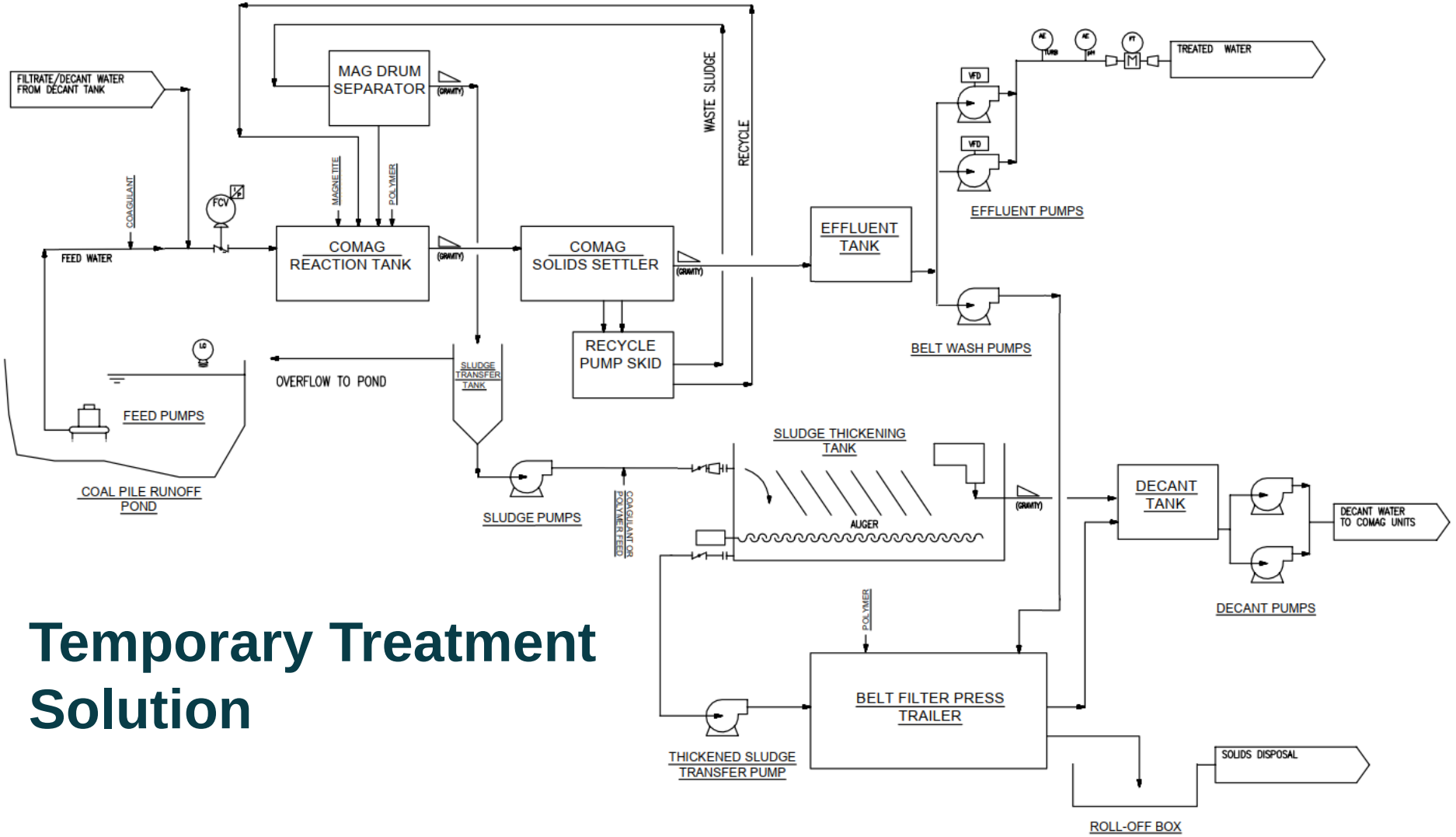
- Average Precipitation 40.1” per year
- Annual volume of 360,000,000 of runoff
- Assume average TSS translates to x tons of runoff solids
  - 360 ppm = 540 tons
  - 600 ppm = 900 tons
  - 1,200 ppm = 1,800 tons
- Avoid disposal cost by placing the solids back on the coal pile
- The returned solids are de minumis amounts in relation to the coal pile
- ILB coal solids would contain iron floc solids

Treatment Design Considerations

Treatment targets

- TSS not to exceed 50 mg/l
- pH 6 – 9
- Oil and Grease 10 ppm

Temporary Treatment Solution



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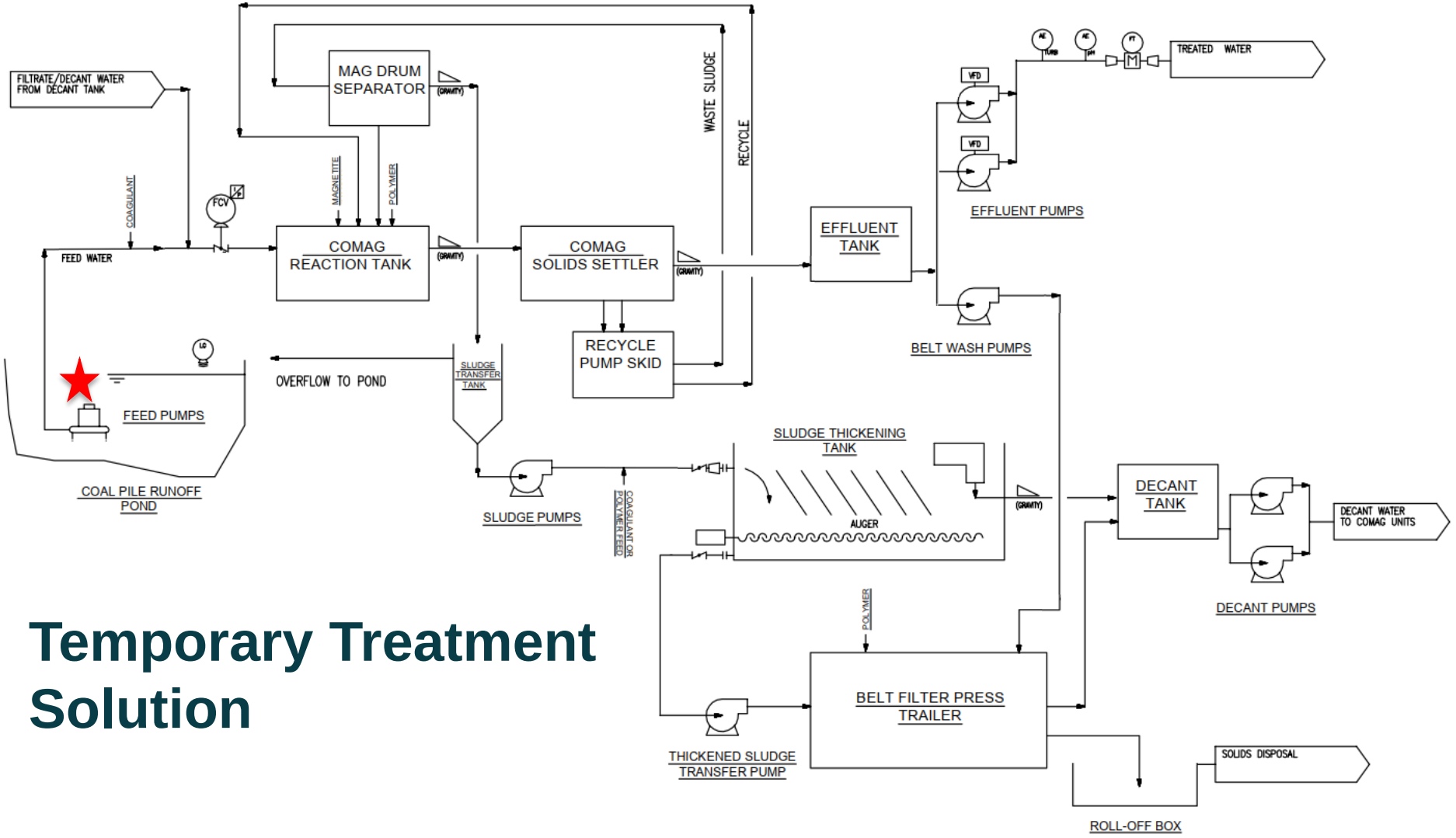

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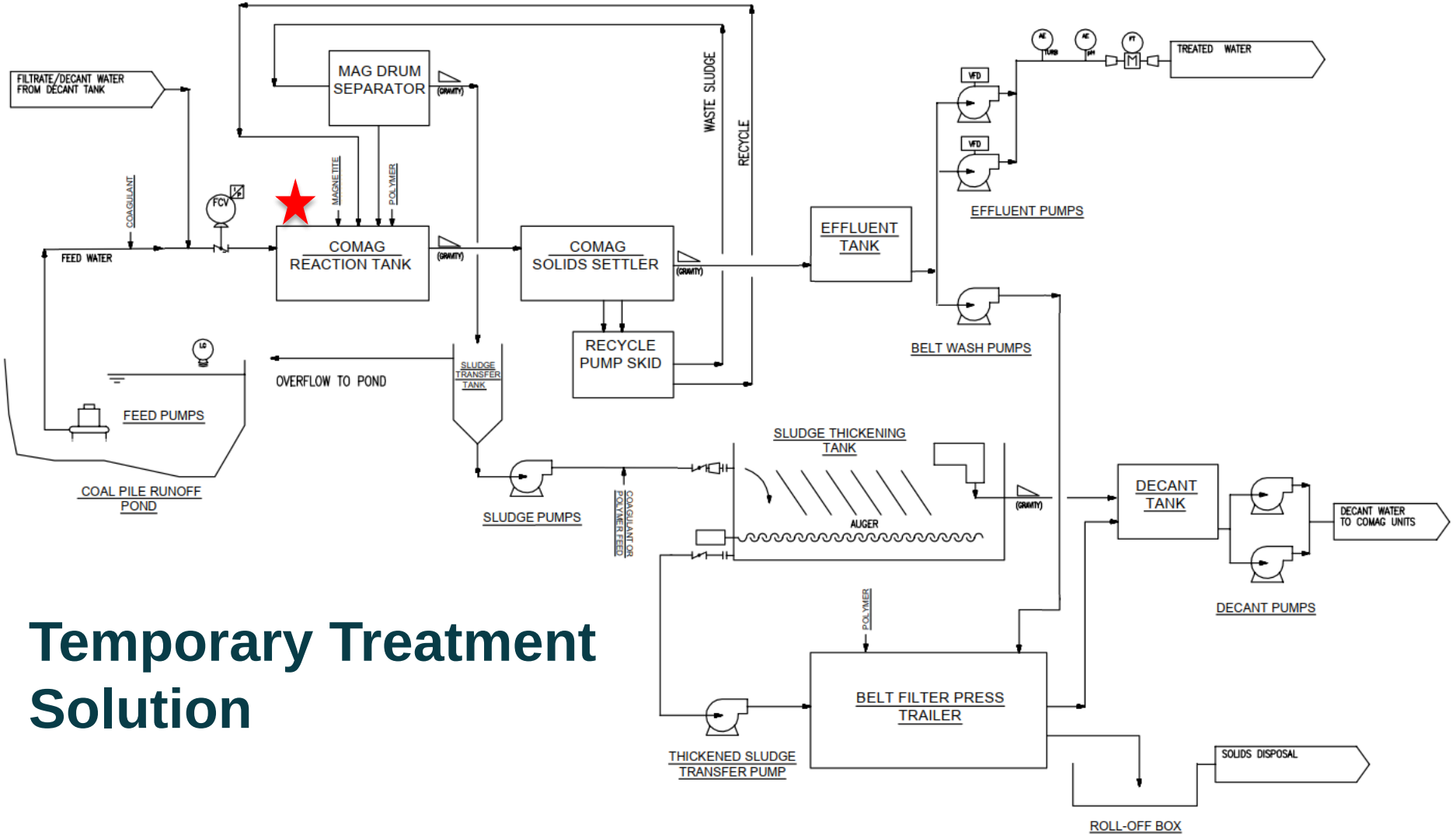
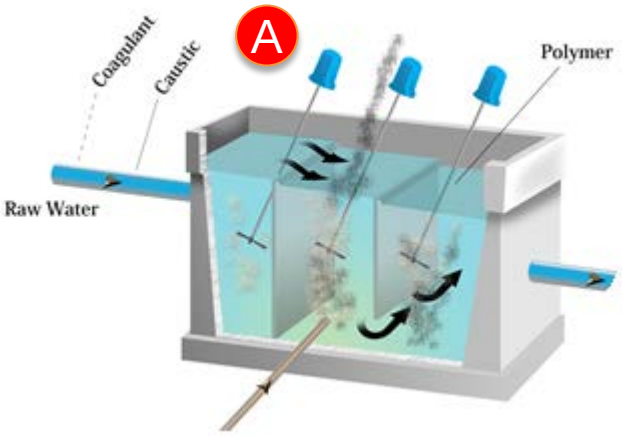


CoMag® Ballasted Flocculation

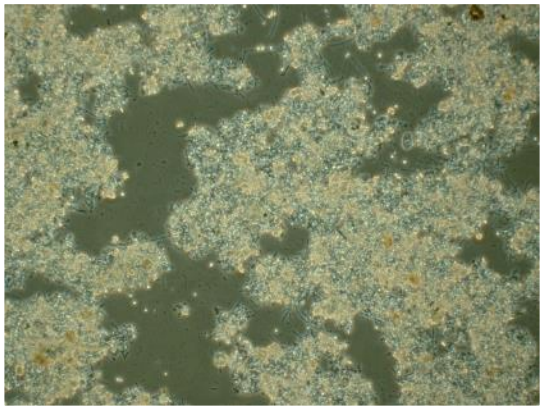


Ballasted Flocculation: A Simple, Reliable and Robust Process

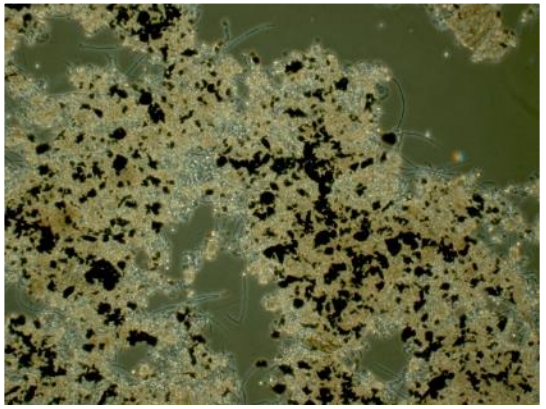
Ballasted Floc

- Magnetite injected into the floc
- Floc becomes impregnated with magnetite
- Specific gravity of the floc rises sharply
- Floc settles faster and more reliably
- Enables higher surface overflow rates (SORs = gpm/ft^2)
- Enables greater treatment capacity in smaller clarifiers

Lower capital and operating costs

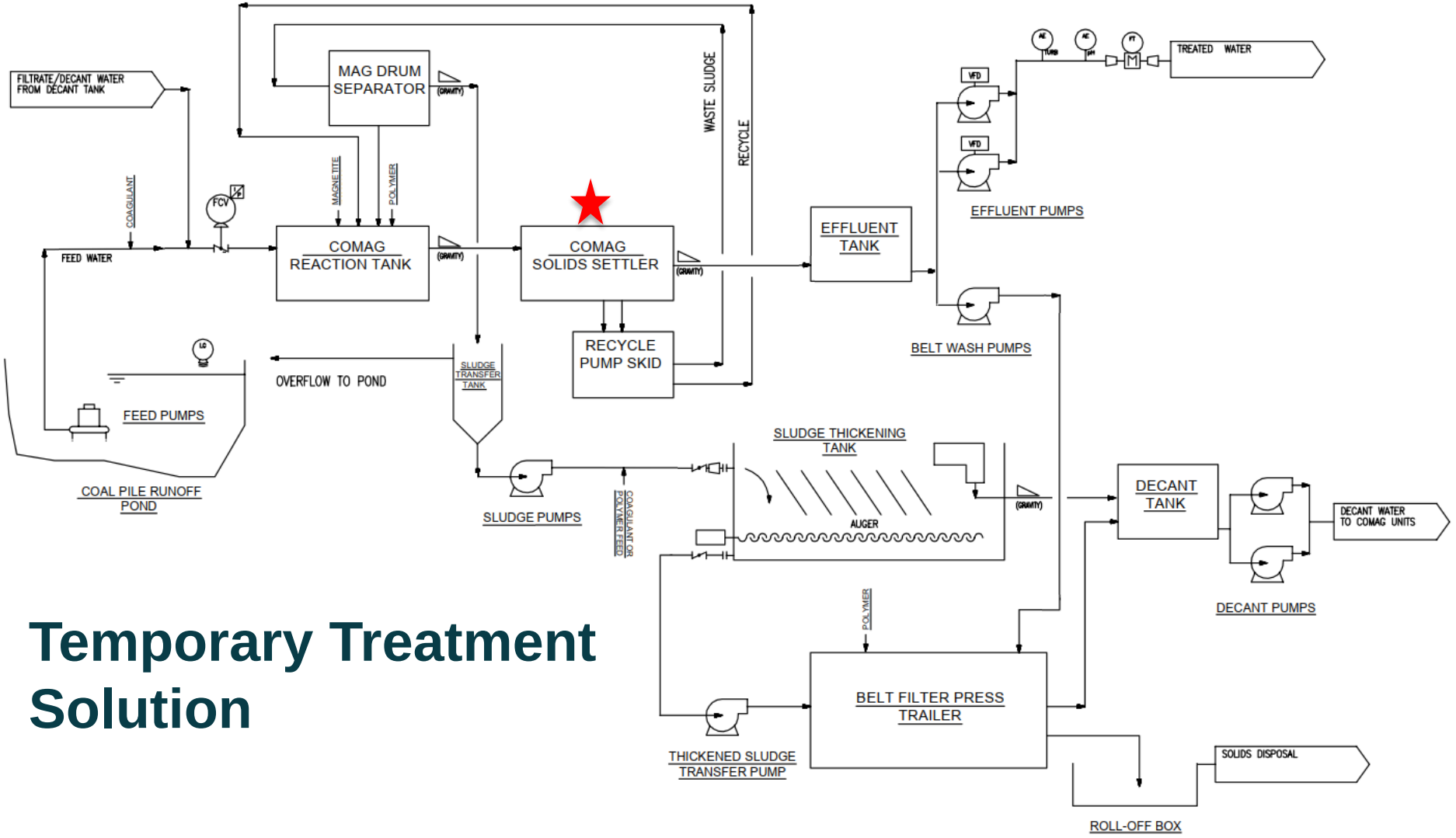


Floc without ballast settles slowly

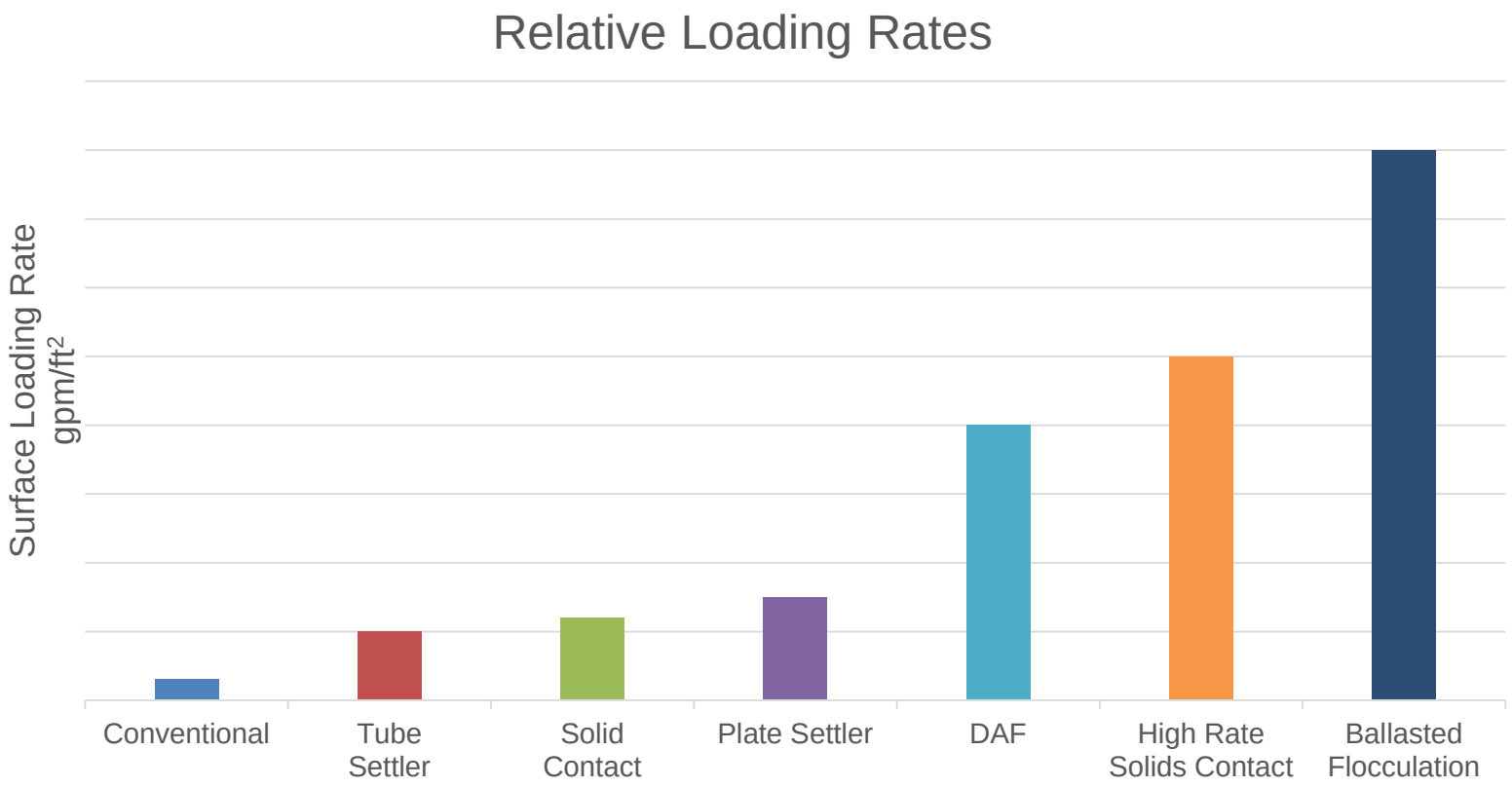


Ballasted floc settles rapidly & reliably

Temporary Treatment Solution

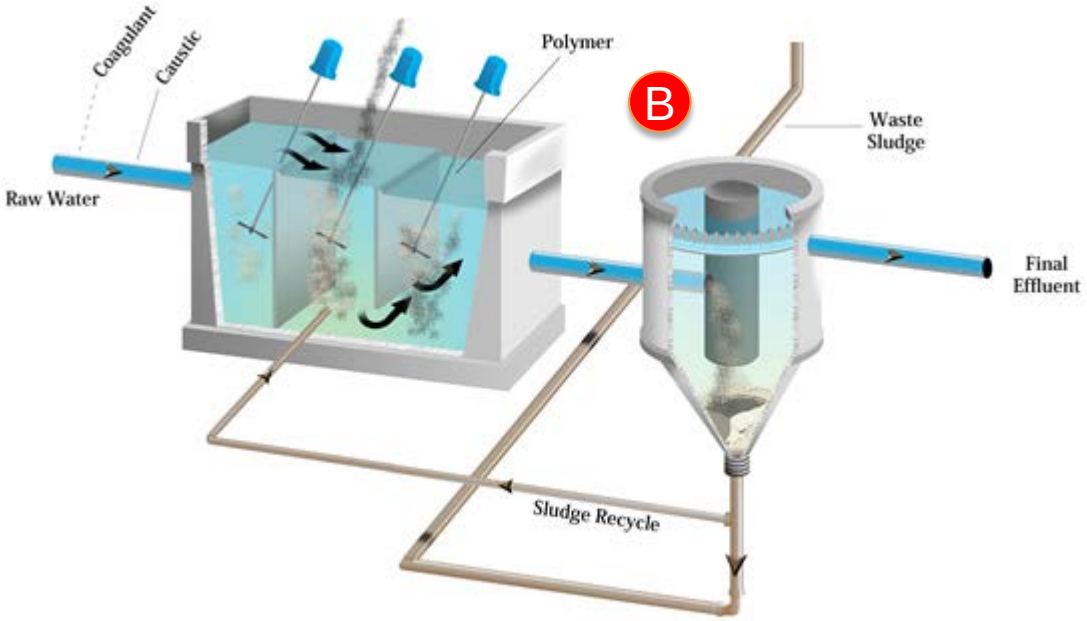


Clarification Technologies



Higher Loading Rate = More Capacity for a Given Footprint

CoMag® Ballasted Flocculation



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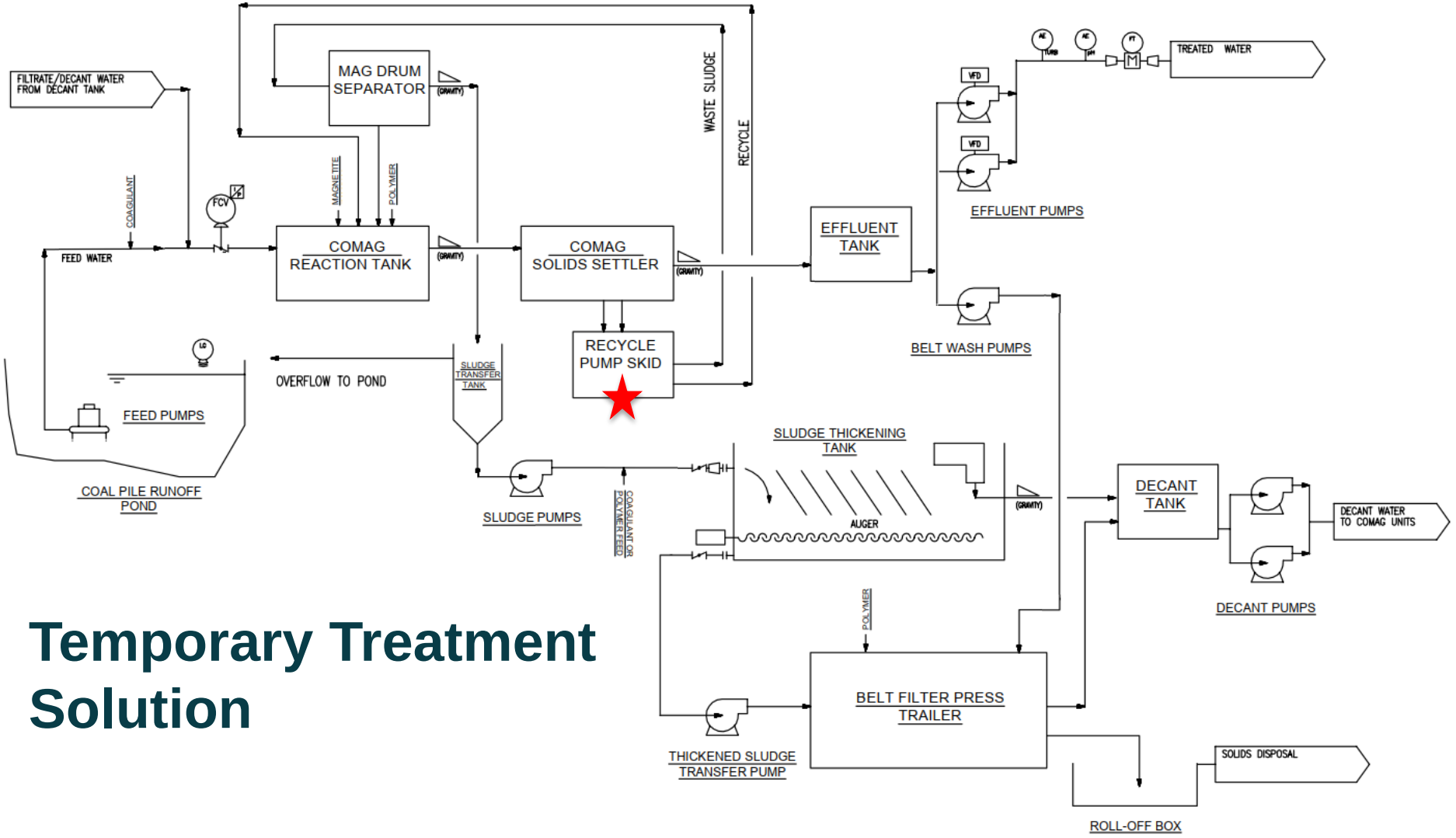

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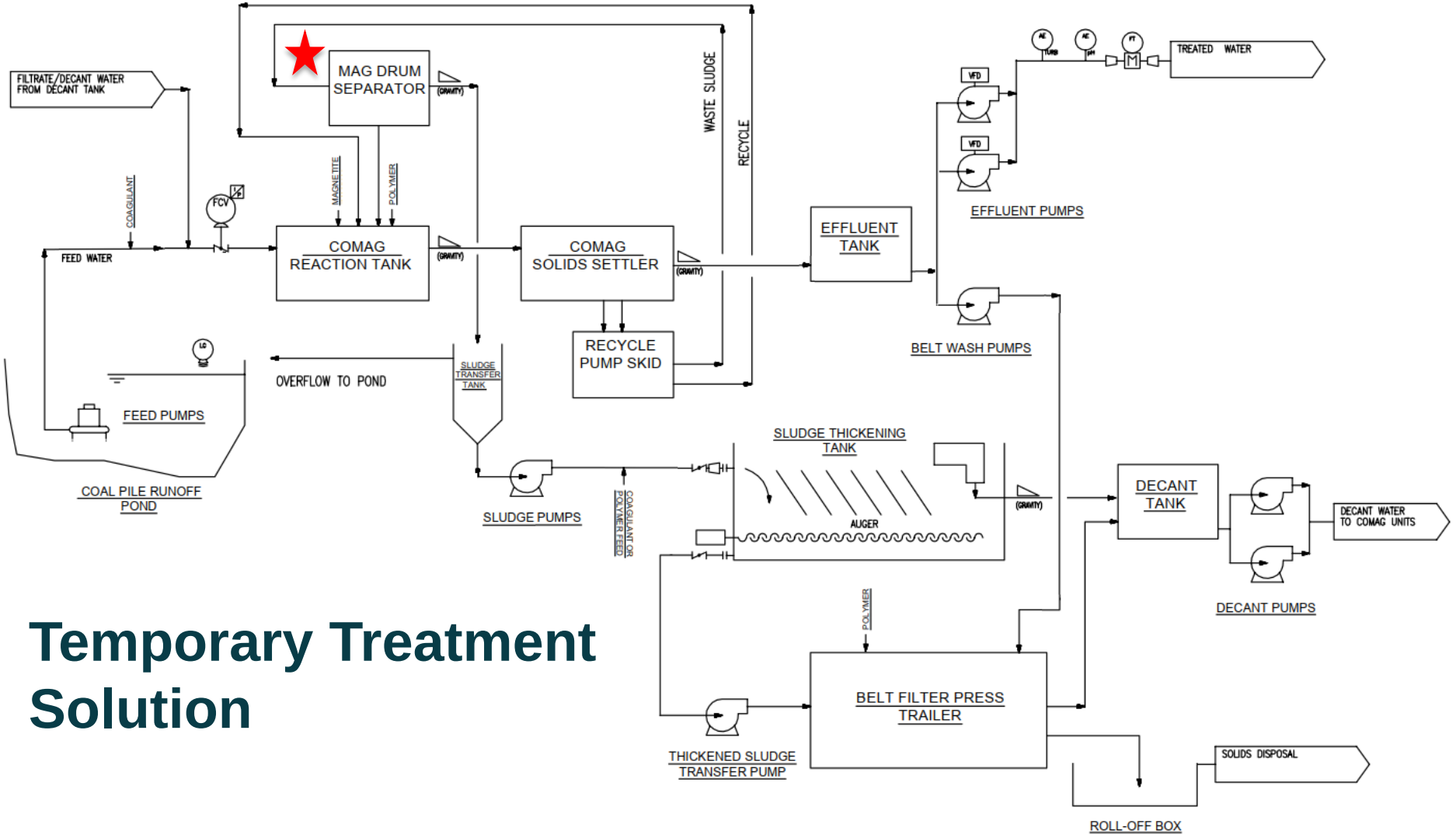

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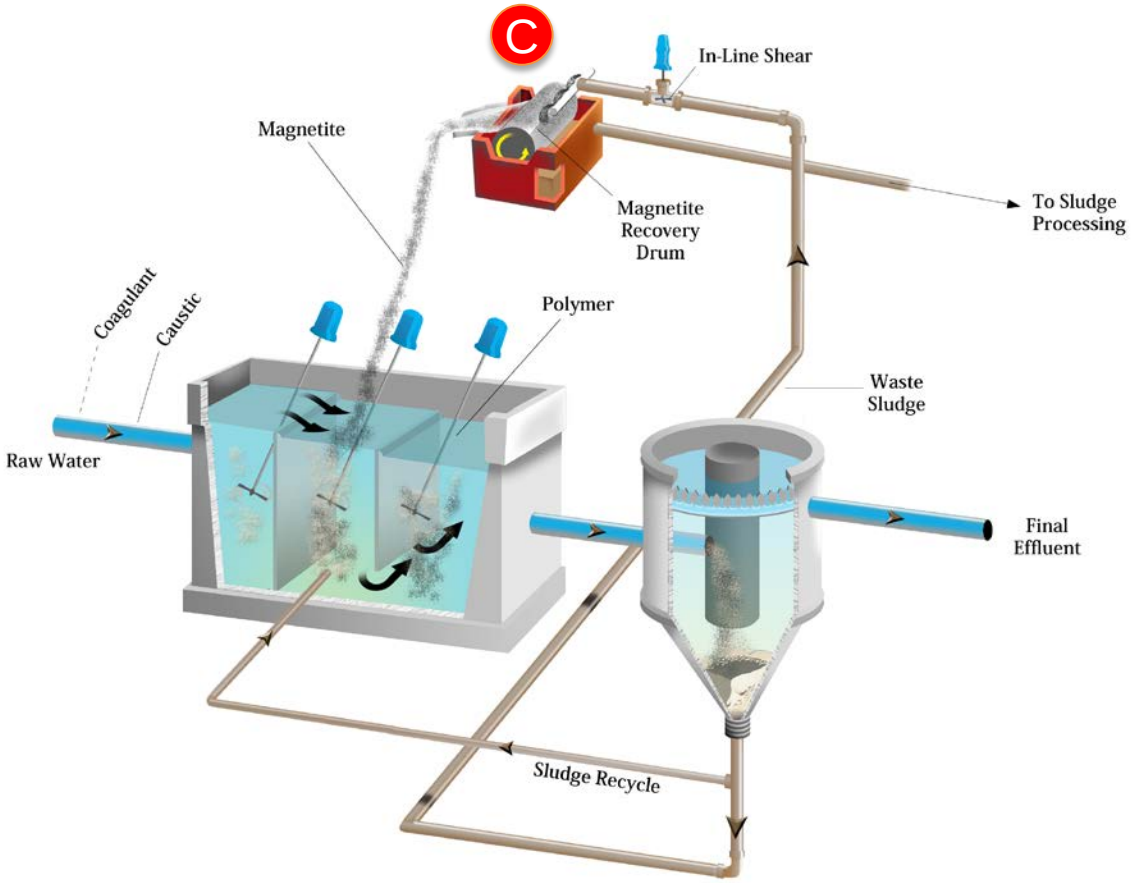

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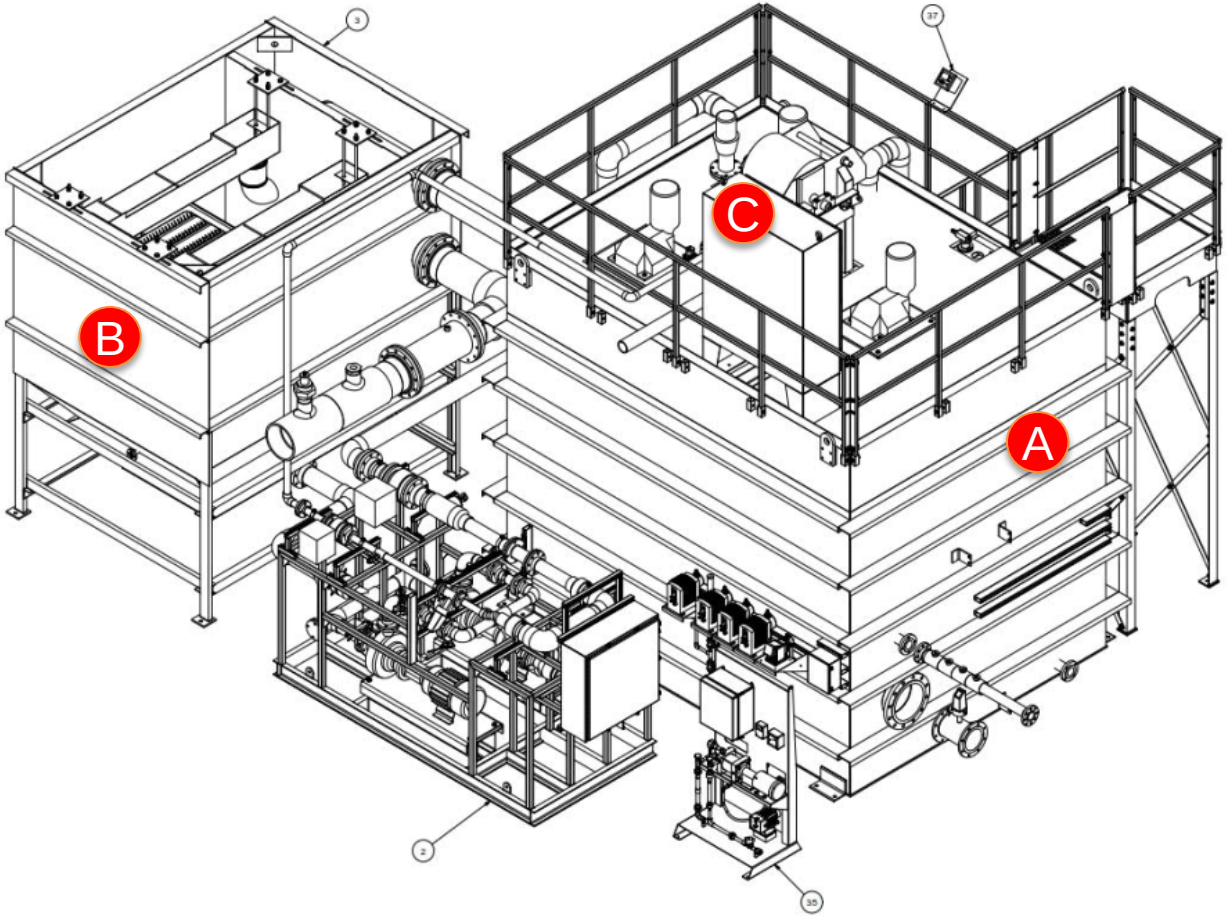

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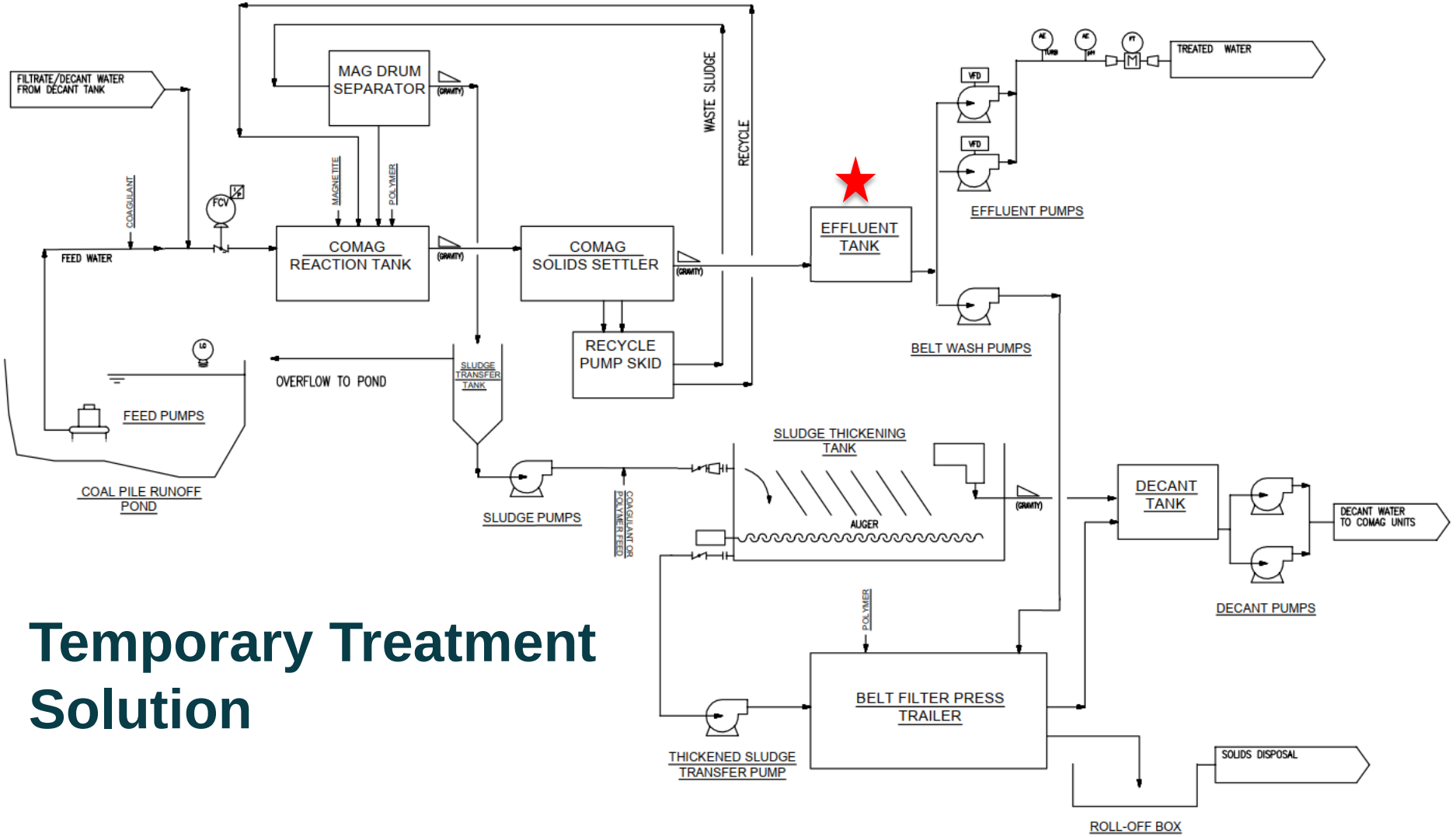

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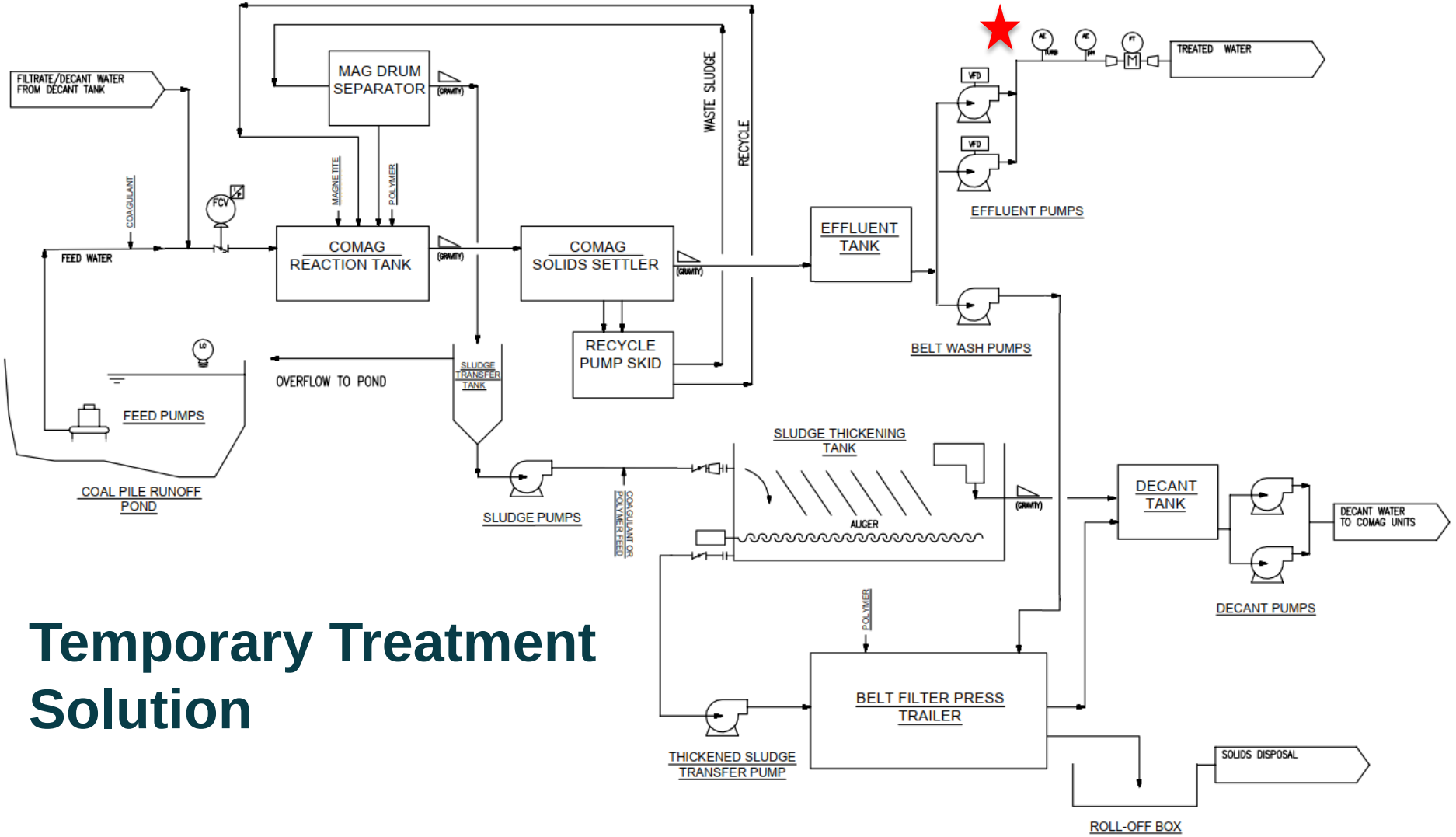

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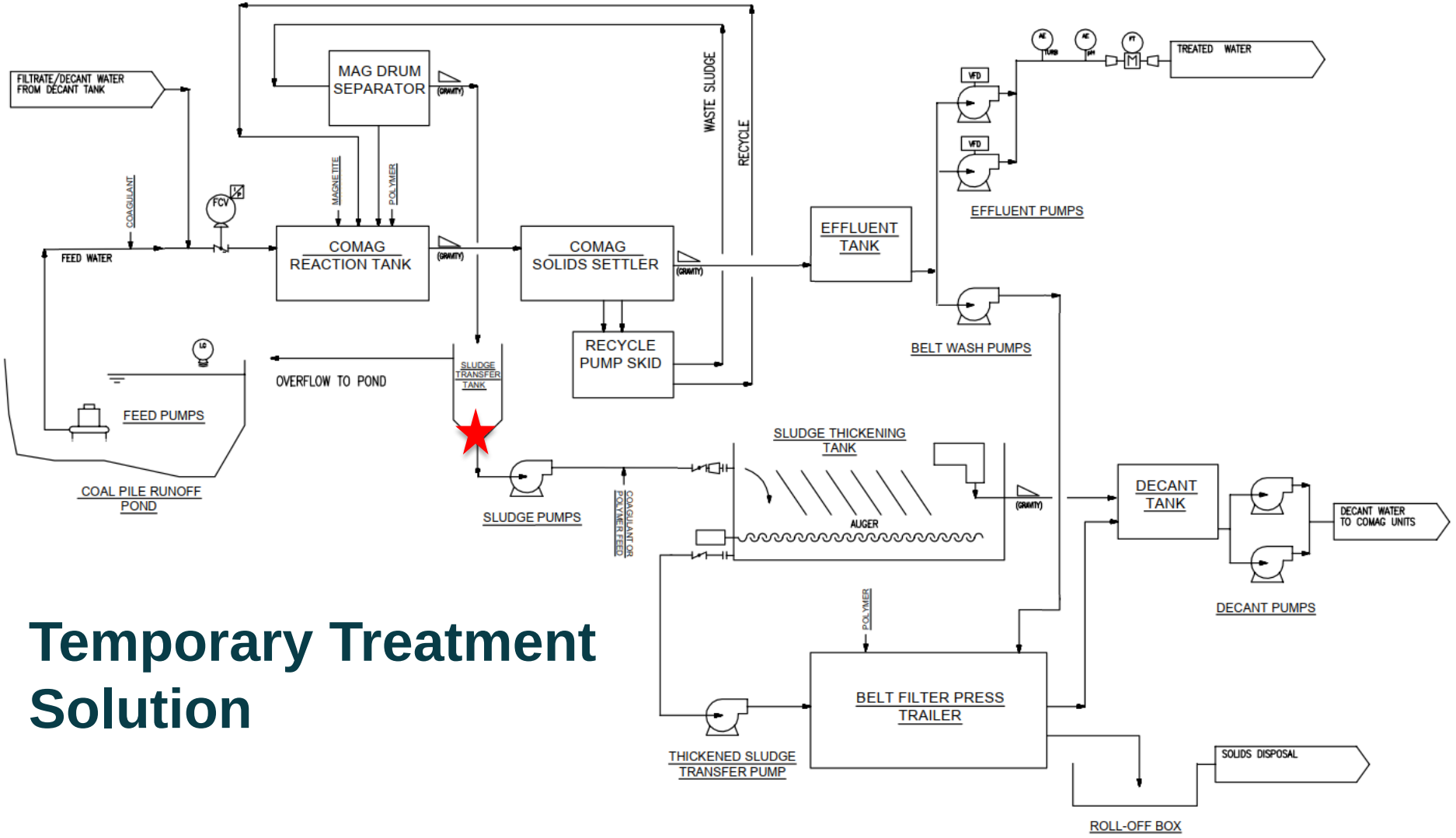

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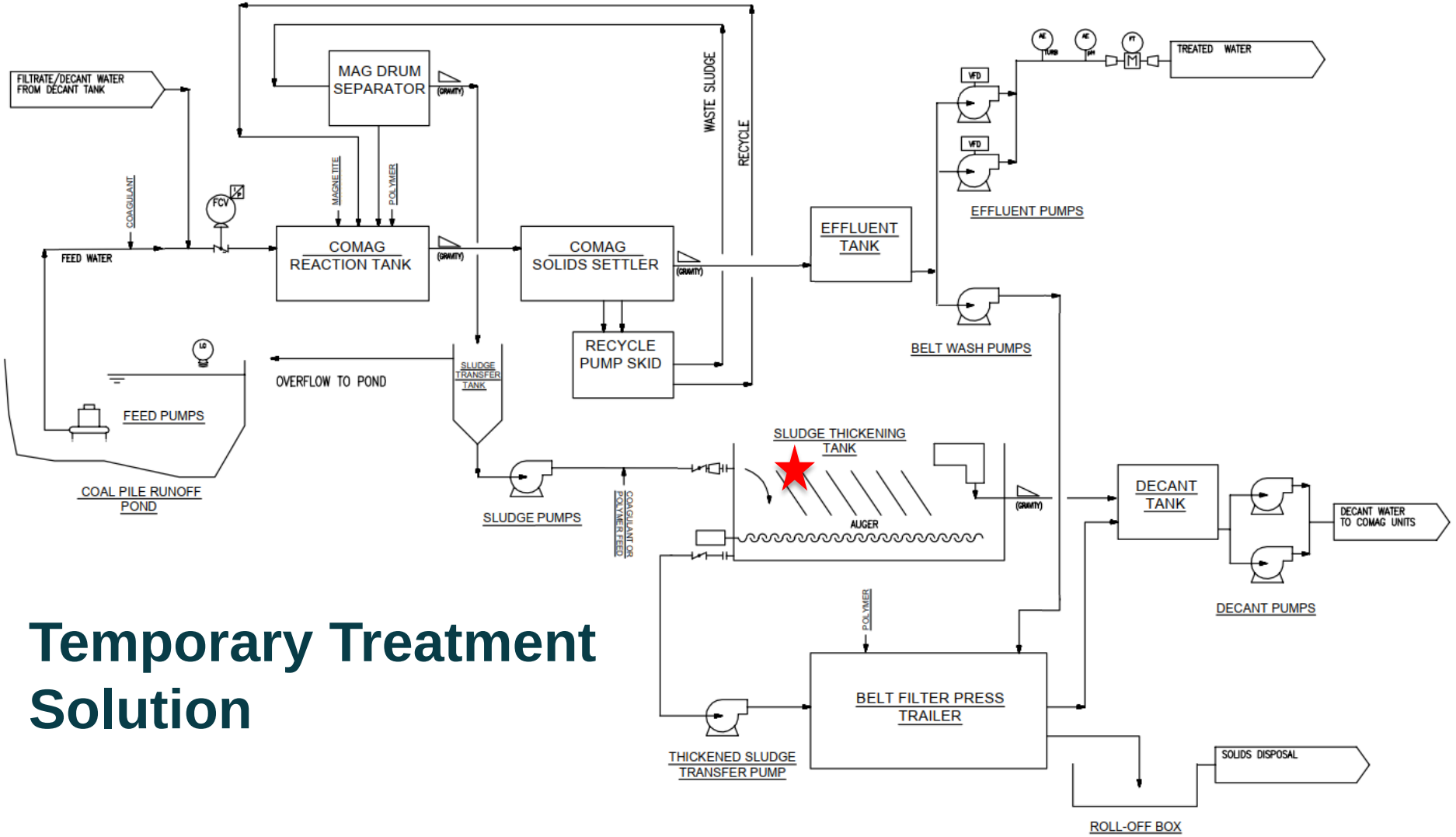

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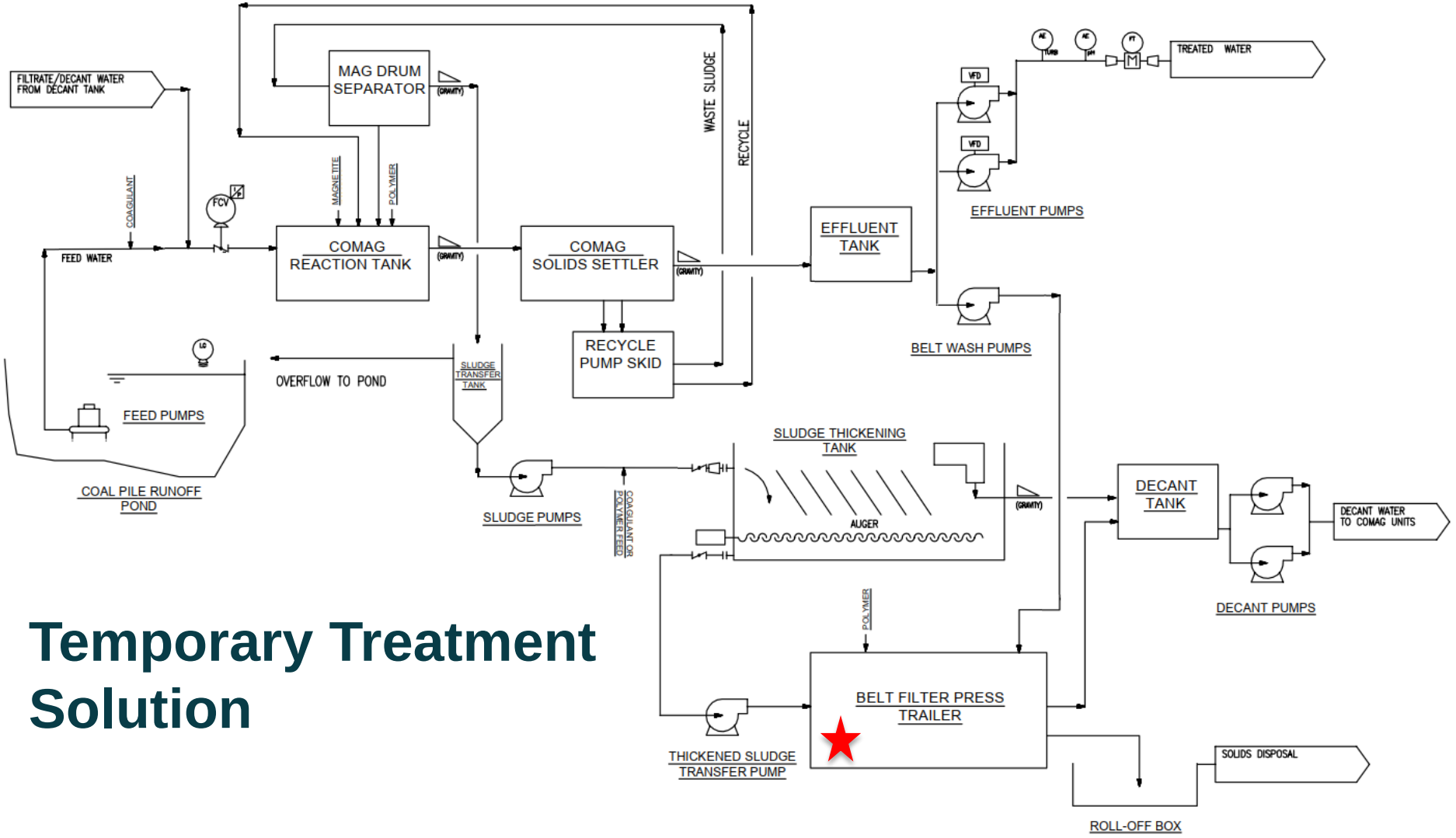

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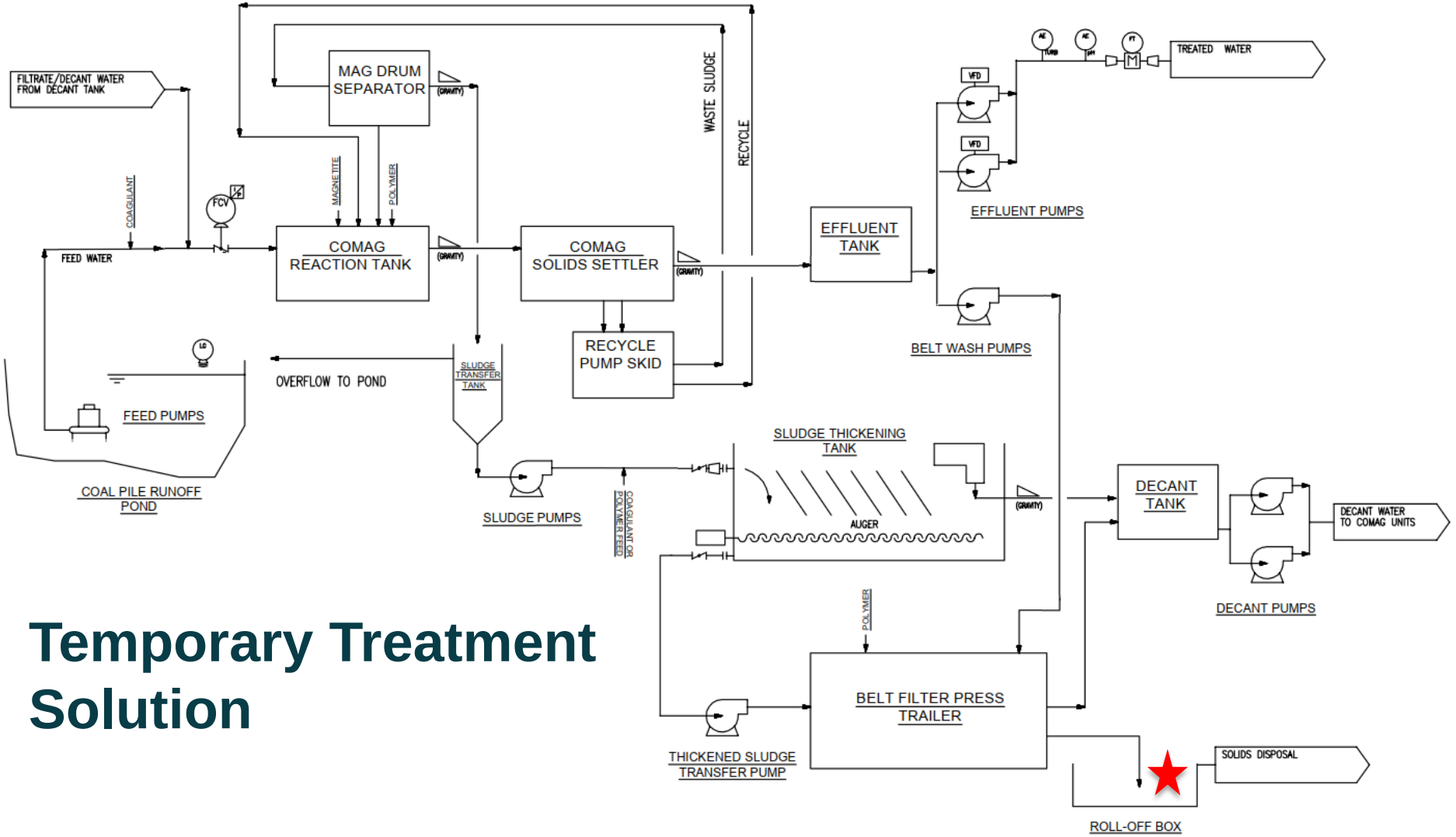

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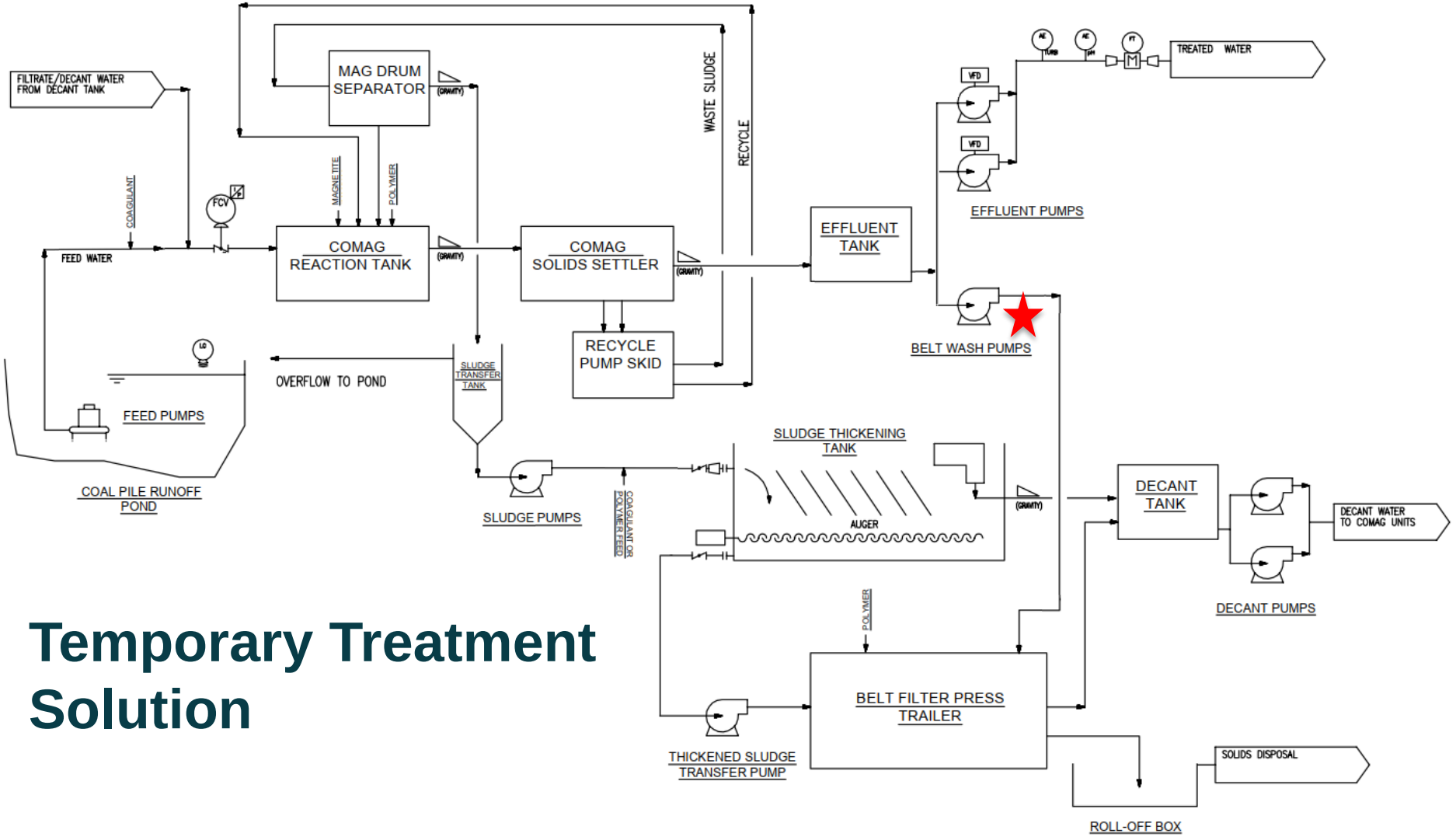

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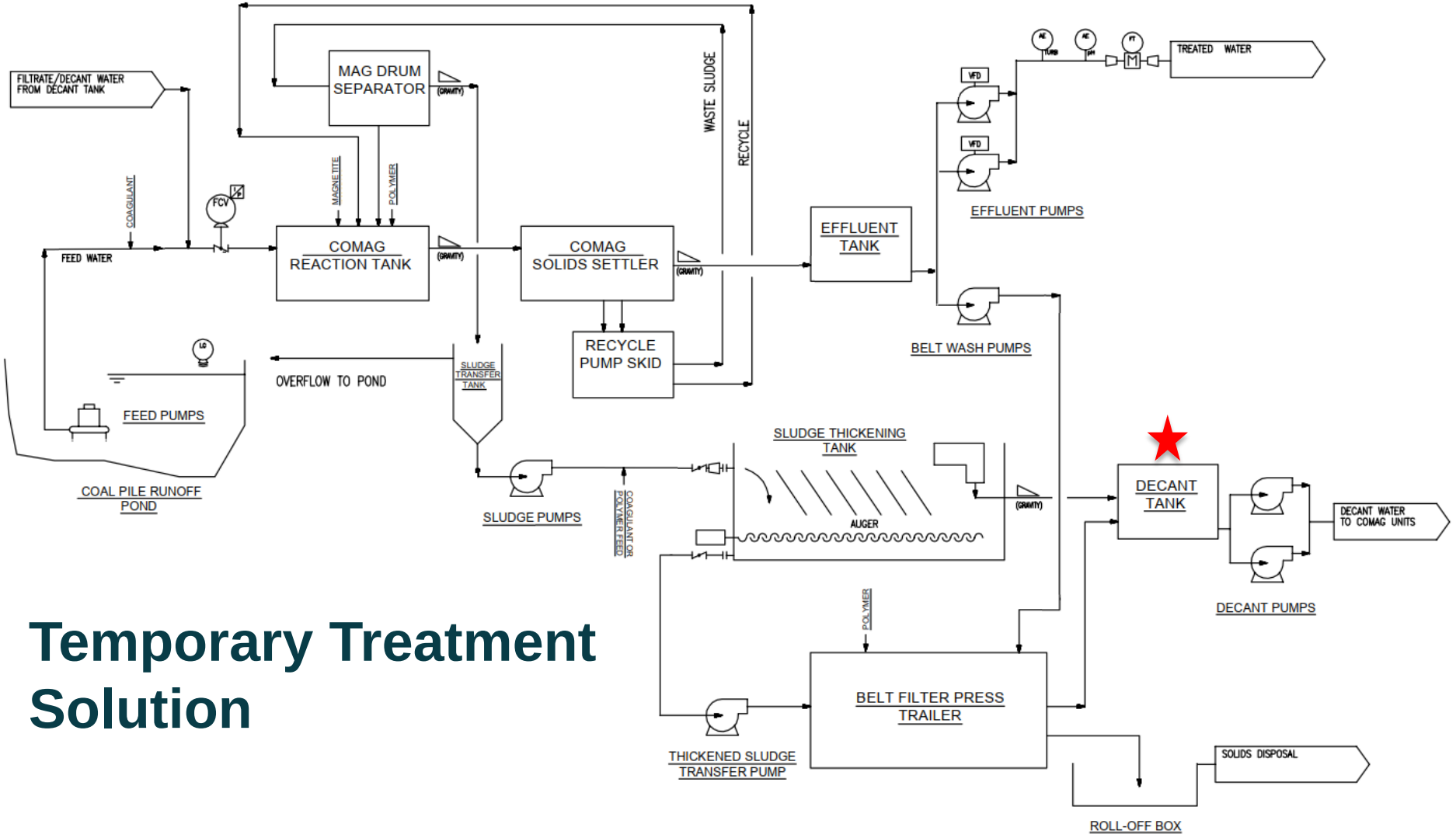

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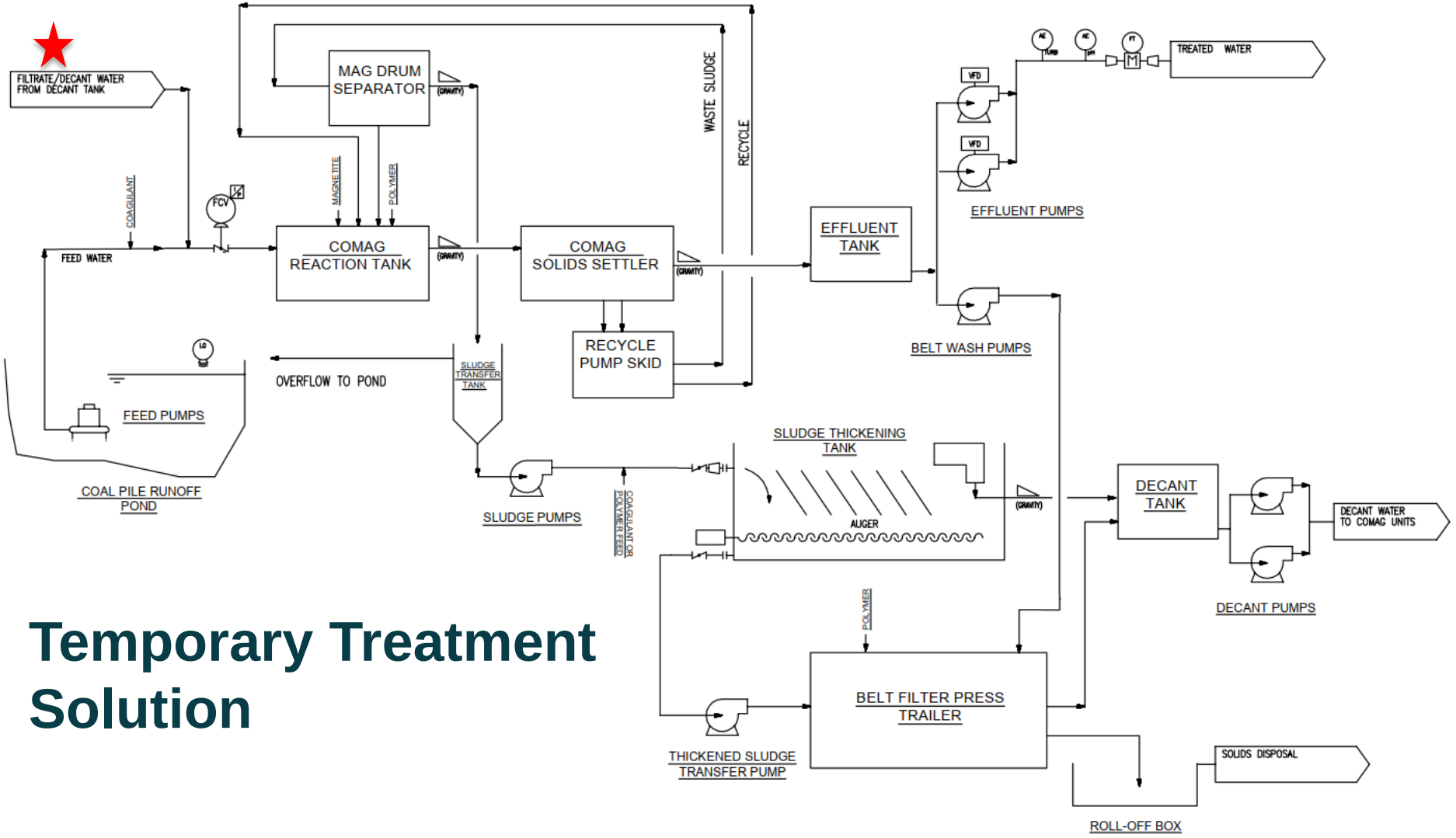
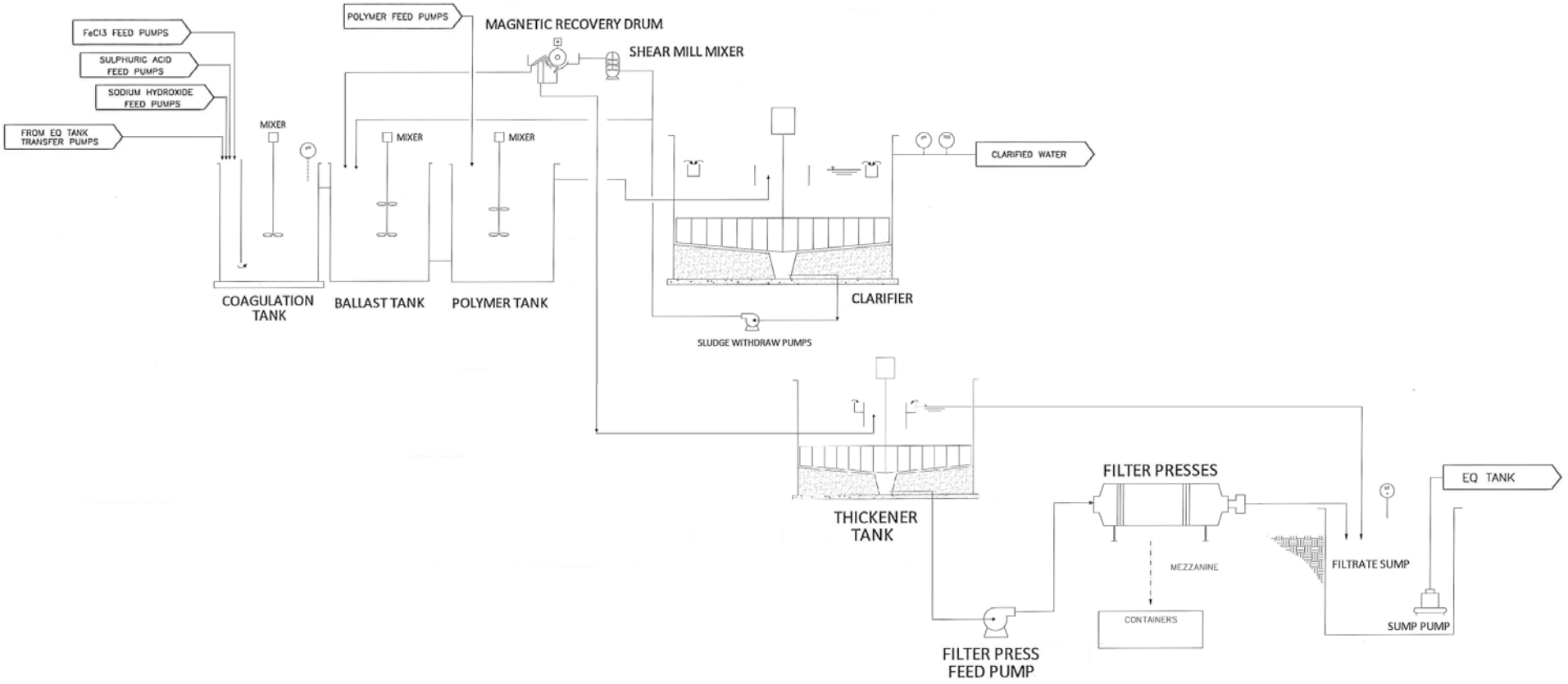


Treated Water Quality

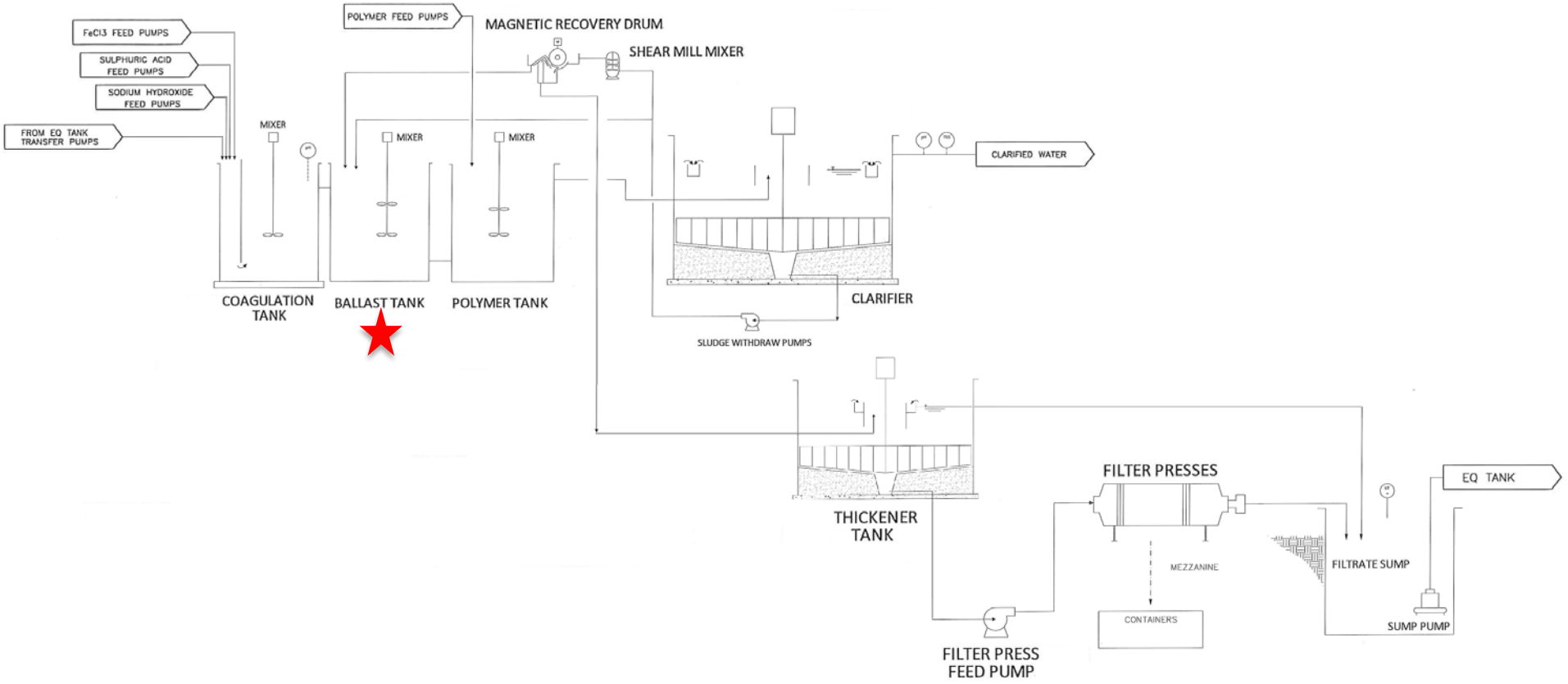
Coal Pile Runoff Effluent	
Constituent	**Daily Maximum**
pH	6.0-9.0
TSS	50.0 ppm
Oil & Grease	10.0 ppm

Conversion from Temporary to Permeant Design

Process the same, size and shape change



Process the same, size and shape change



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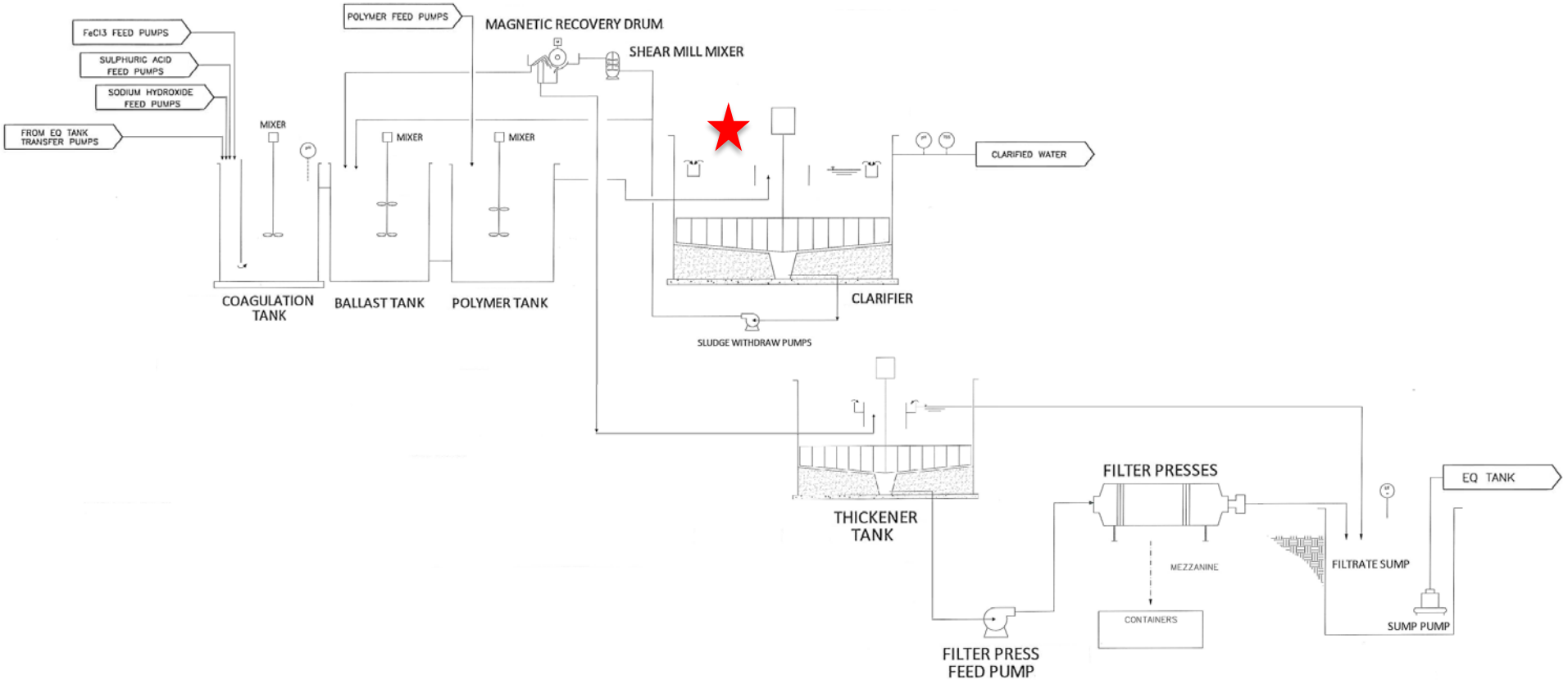
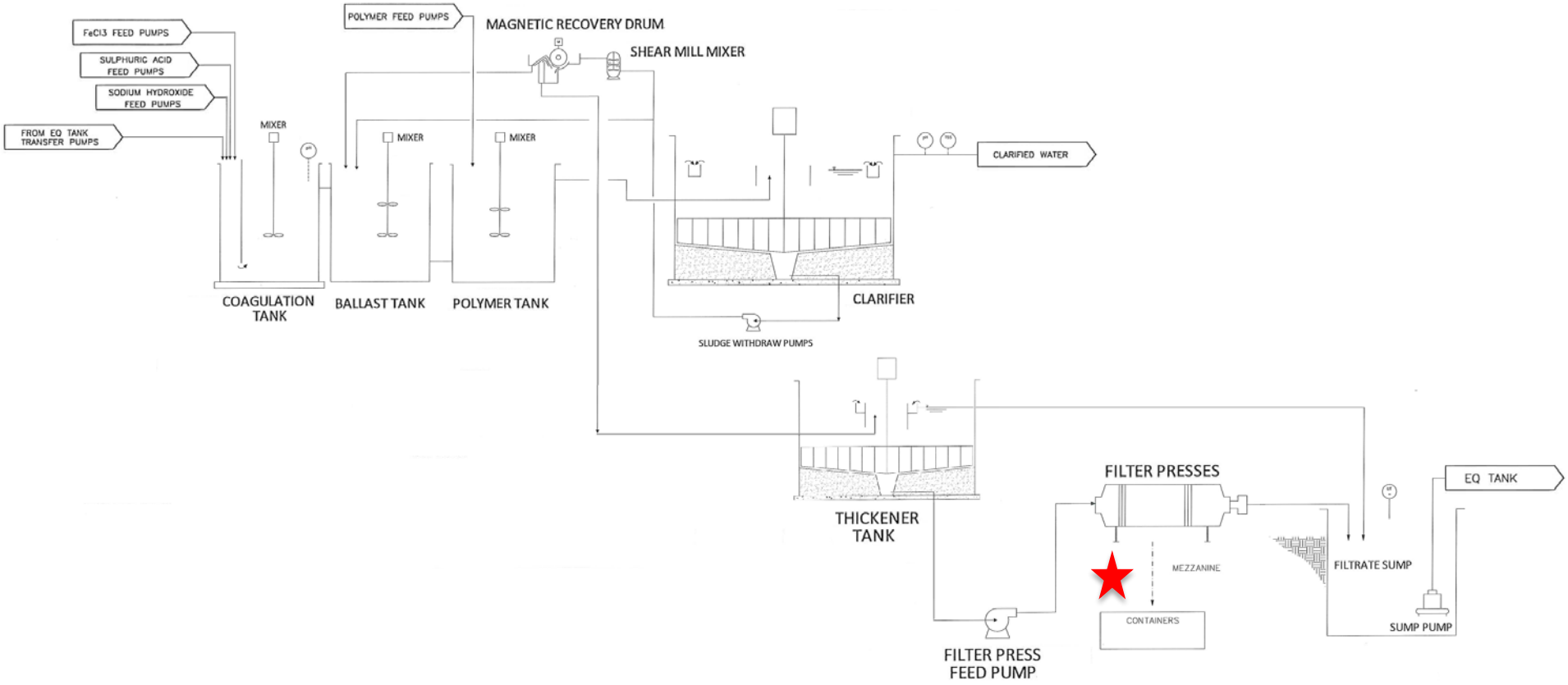


Conventional Design Circular CoMag

- Size not restricted by DOT highway regulations
- Substantially higher flowrate per train
- Rake vs. Vibrator
- Lower cost of operation

Process the same, size and shape change

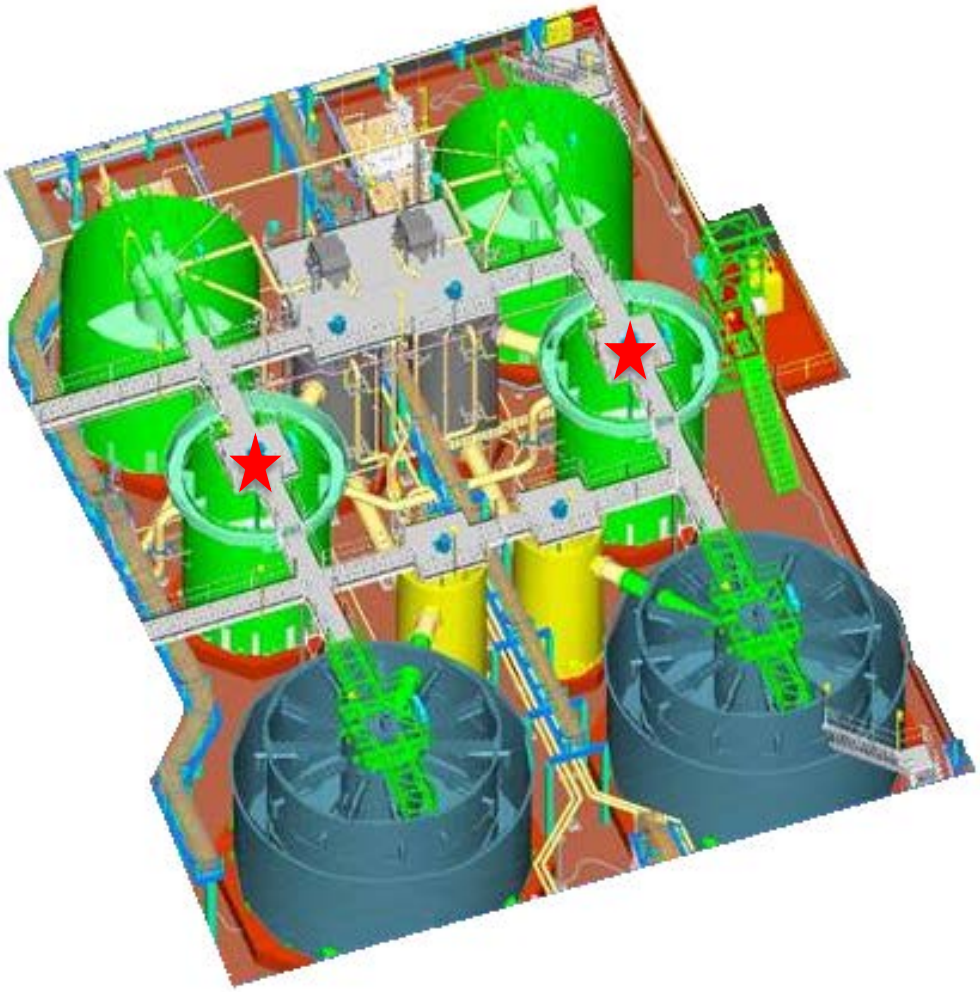


Conventional Design
Plate and Frame Filter Press

- Size not restricted by DOT highway regulations
- Plate and frame filter press operation vs. belt press
- Mezzanine installation
- Lower Operational Cost

System Overview

- 1,200-4,000 gpm per train
- 1,000 ppm TSS Average
- 2,000-10,000 ppm TSS Spikes
- 28’ Diameter Clarifier
- Dewatering to 40-60% solids



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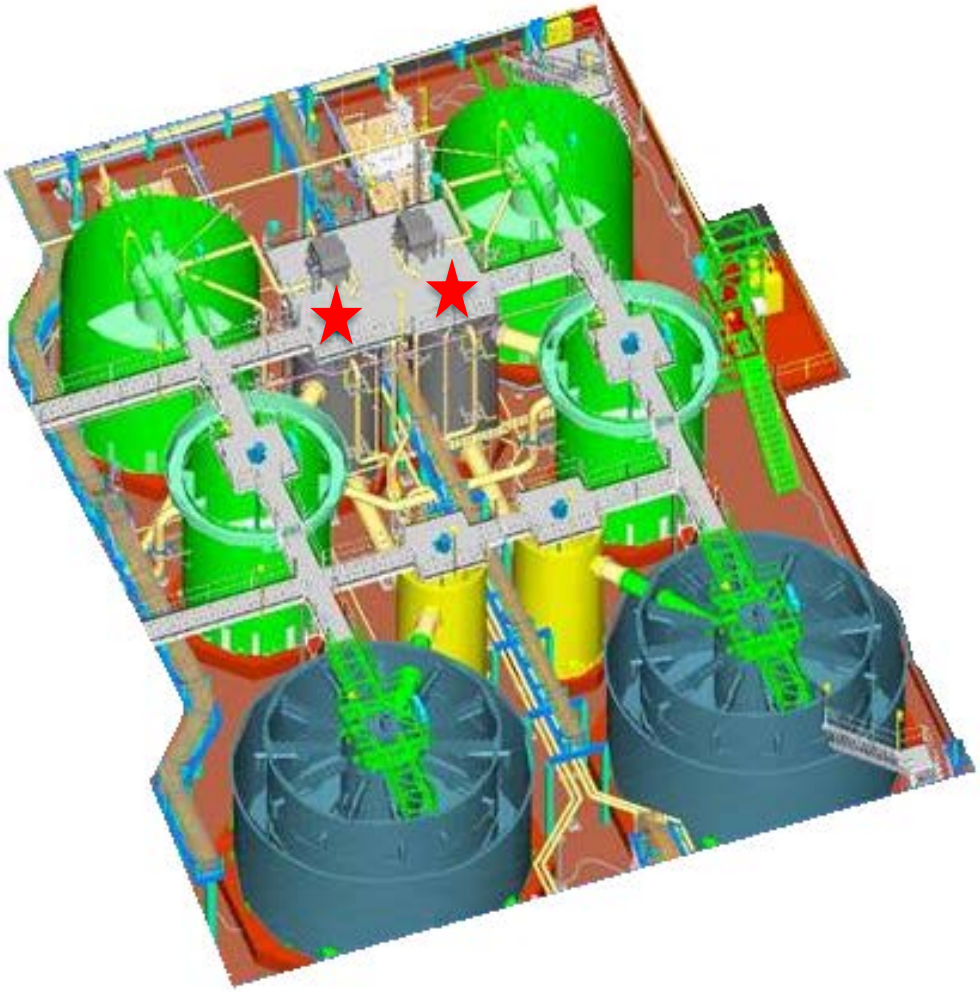

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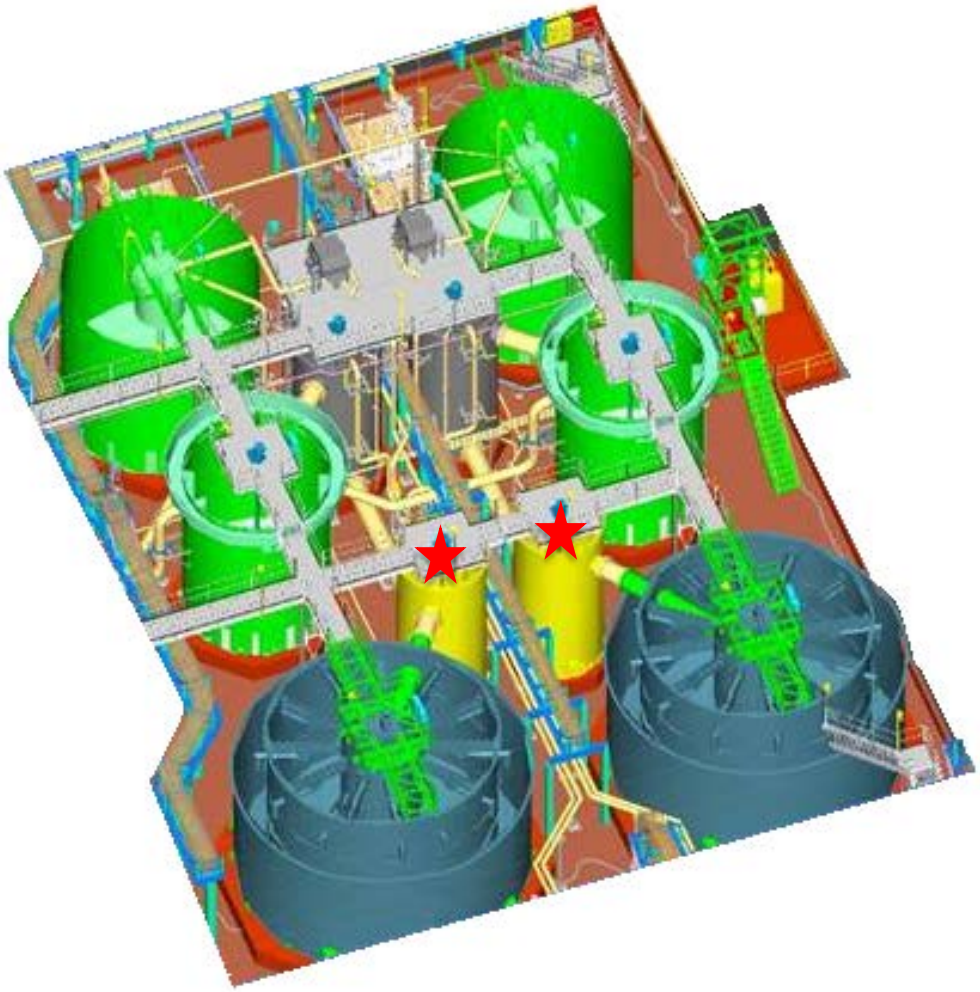

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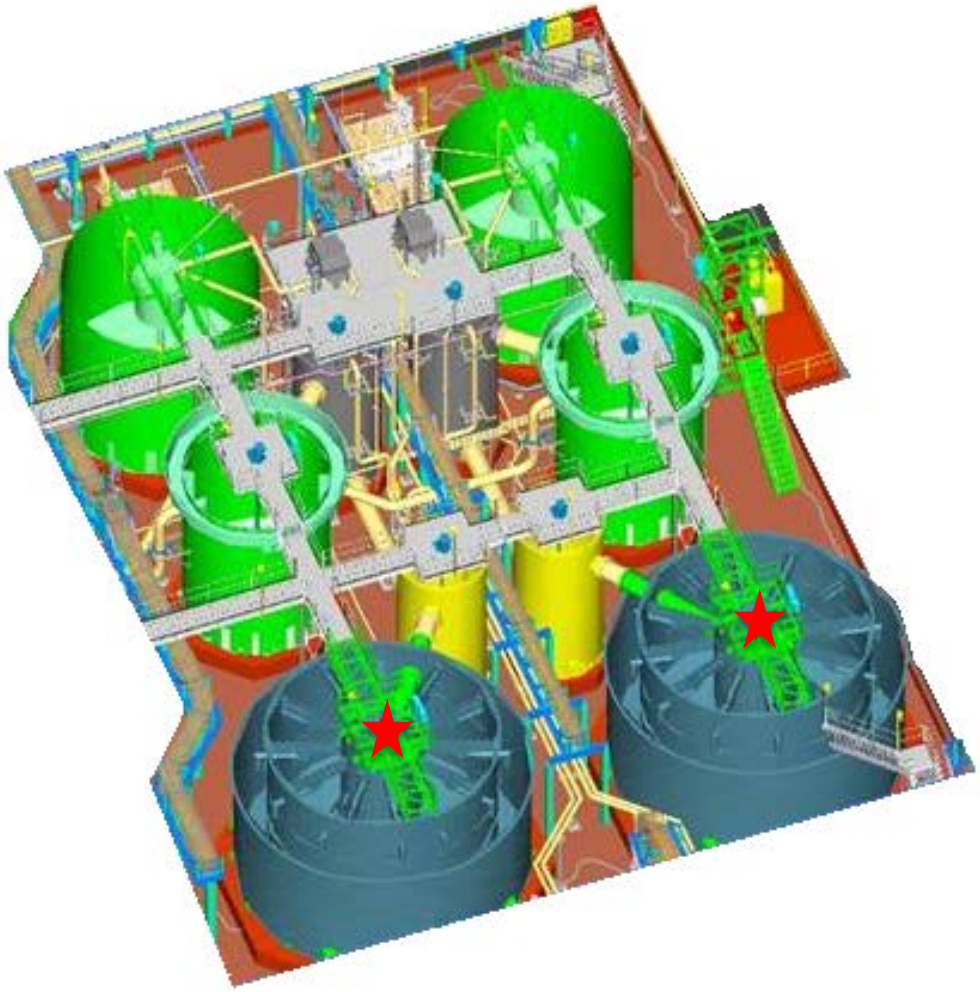

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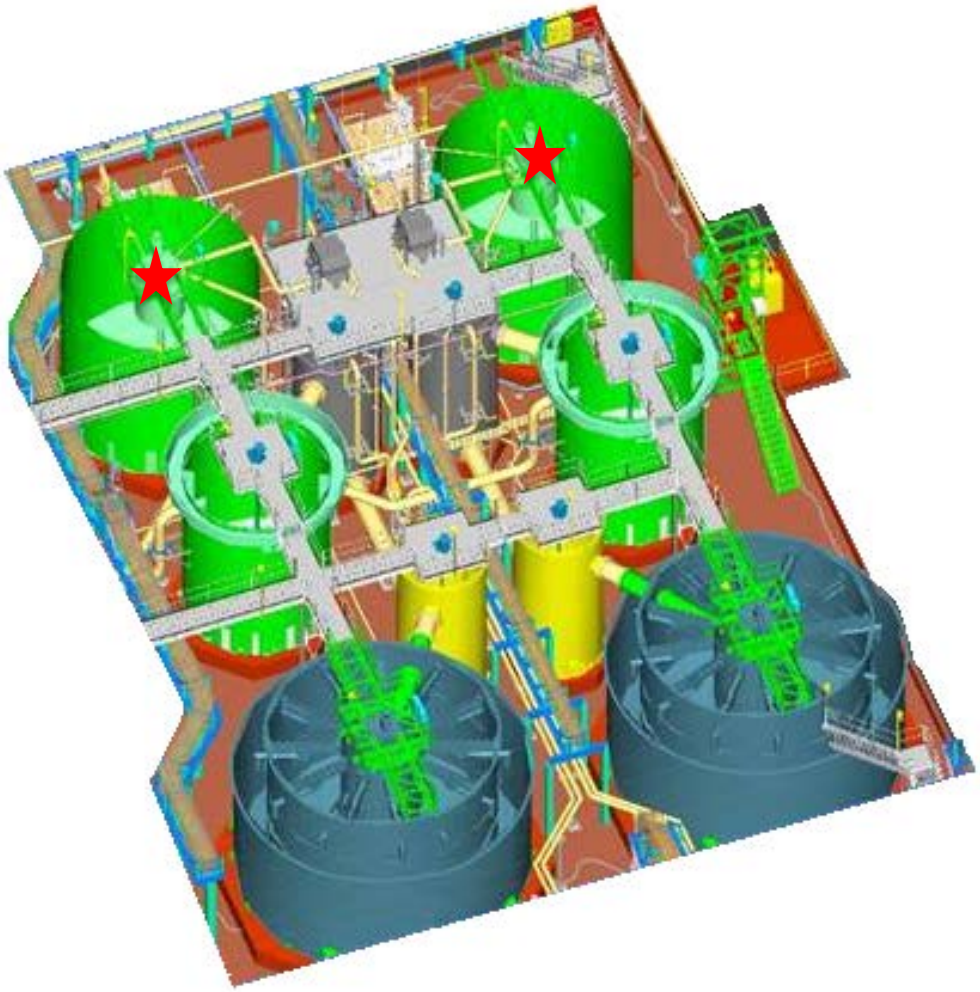
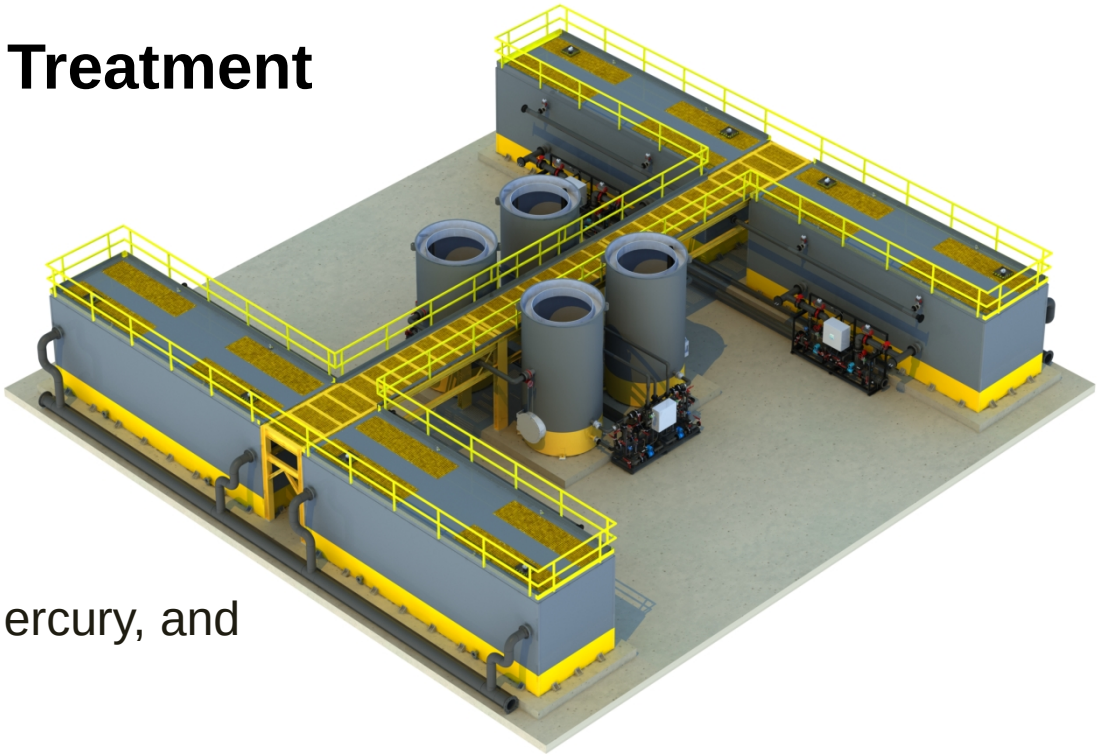


SeHawk System

- **Biological Selenium Treatment**
  - Small footprint
  - Pre-fabricated
  - Modular and scalable



  - Microbiological process
  - Reduced retention time
  - Treats Selenium, Arsenic, Mercury, and Nitrate

Summary

- Analytical data collection
- Timing – ELG Rule Watch
- Plan of attack – Engineering
- Identify key assets
- Execution with trusted partners

For More Information

Visit:

http://www.evoqua.com/en/brands/IPS/Pages/ELG-and-CCR-Solutions-for-Coal-Fired-Plants.aspx

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