REPAIR OR REPLACE: Approaches to Renewing Secondary Clarifiers

Practical Considerations and Creative Solutions

Presented by Erik Osborn, PE & Sean Tarbox, PE

Woodard & Curran

Learning Goals

- **Drivers for clarifier upgrades**
- **Under-slab piping rehab**
- **Mechanism materials & coatings**
- **Concrete repair and coatings**

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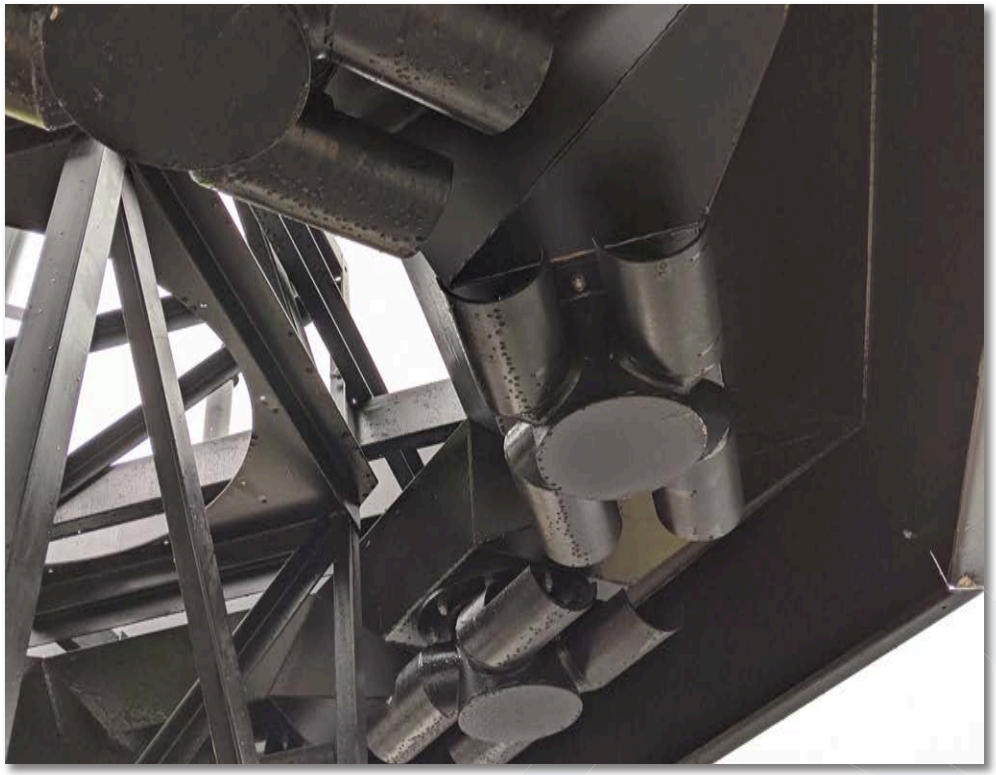
Drivers for Secondary Clarifier Upgrades

- Asset Condition
- Process Performance
  - CSO abatement
  - phosphorous removal
  - consider operational changes first

Process Performance Upgrades

- Full radius scum trough, Monmouth IL



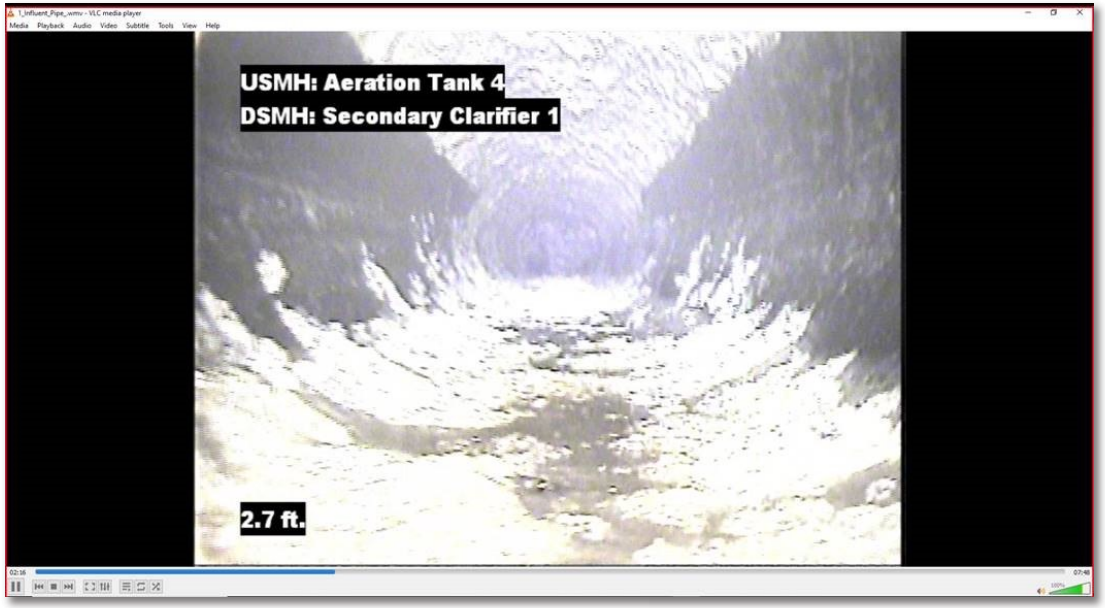
- LA EDI, Windsor Locks, CT

Under-Slab Pipes

- Invisible, but important
- Signs of failure:
  - Unbalanced gravity hydraulics
  - Reduced RAS capacity
- Confirm using
  - Hydraulic modeling
  - CCTV
  - Visual inspection
- Rehab methods
  - Dig & replace
  - Rehab in place
  - Replace in slab
  - Replace at mid-depth

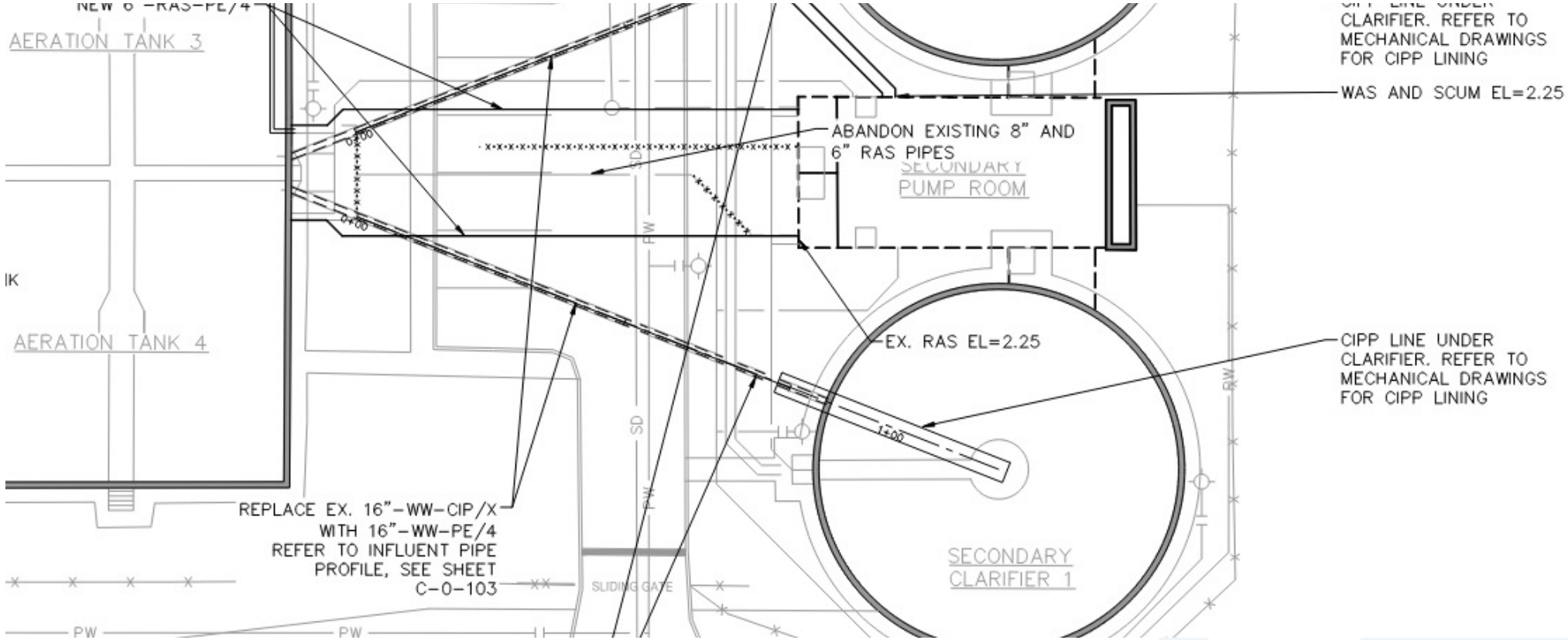
Under-Slab Pipes: Condition Assessment

- CCTV of clarifier influent pipe



- RAS pipe seen through inspection port

Under-Slab Pipes: Rehab Methods



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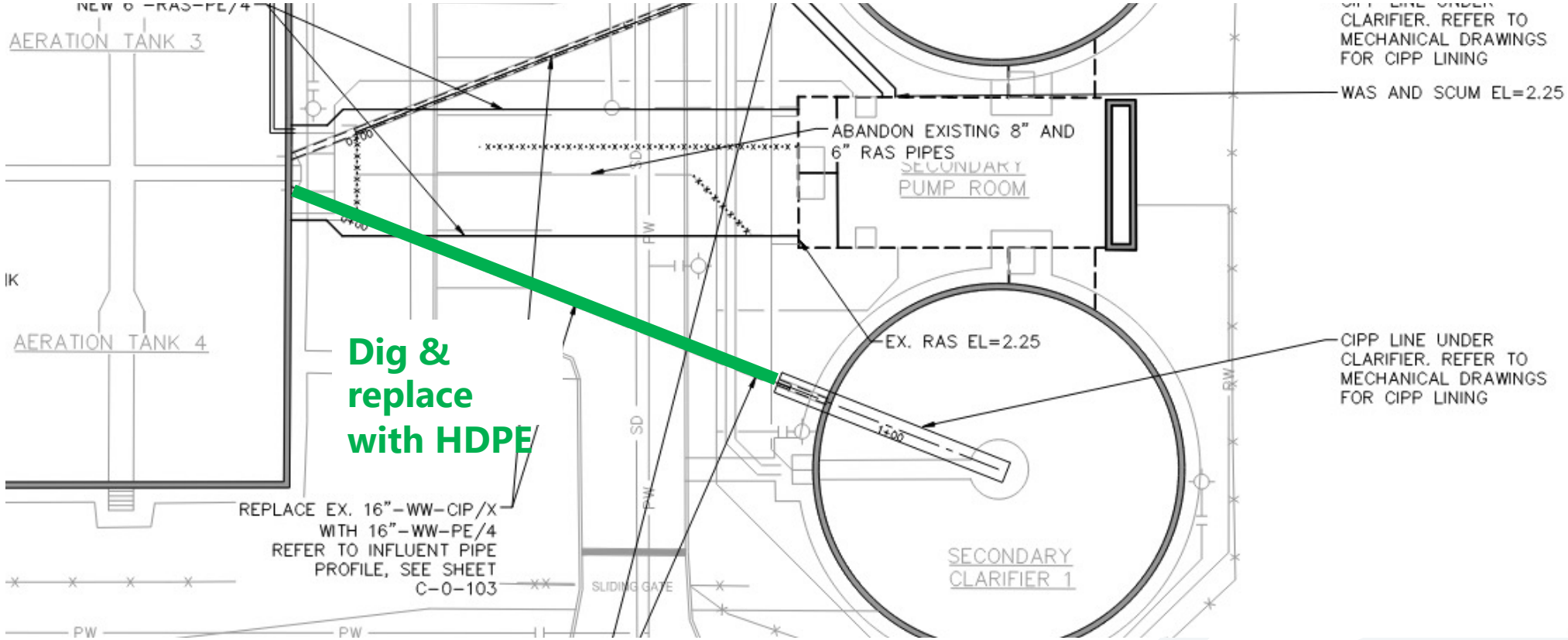

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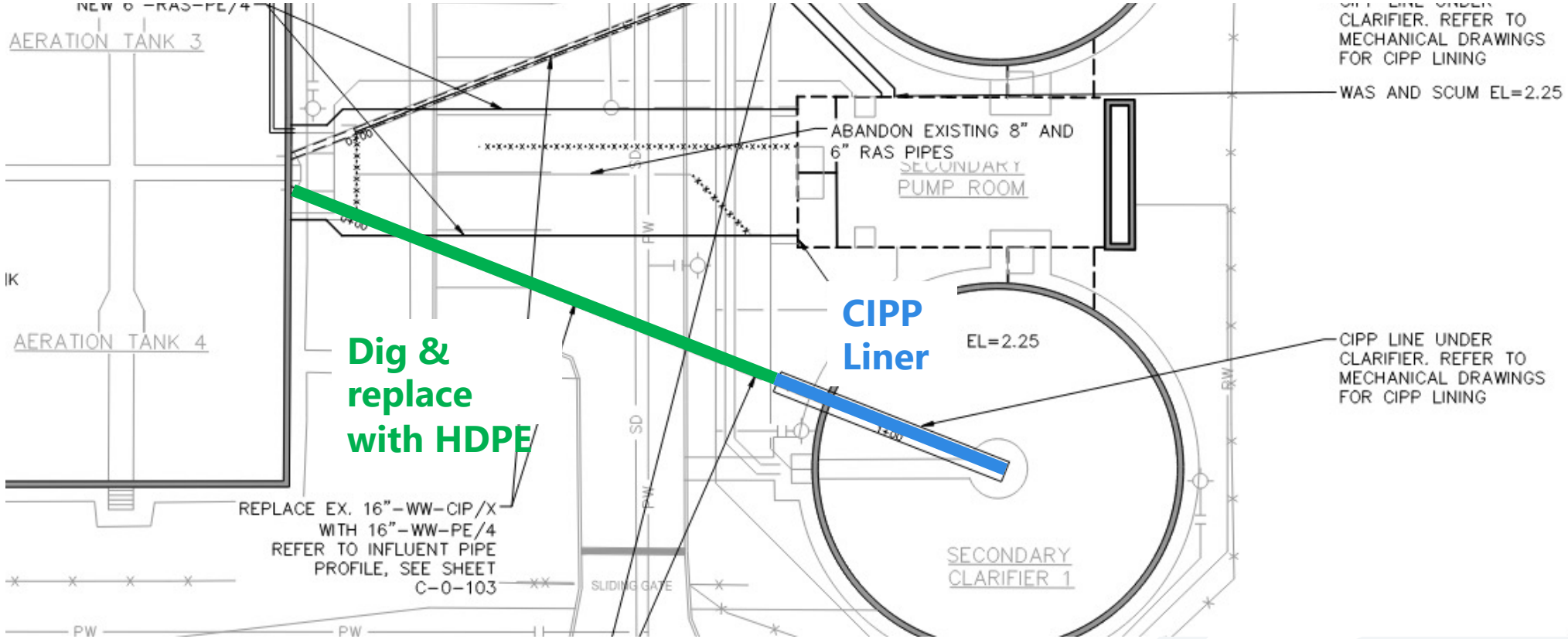

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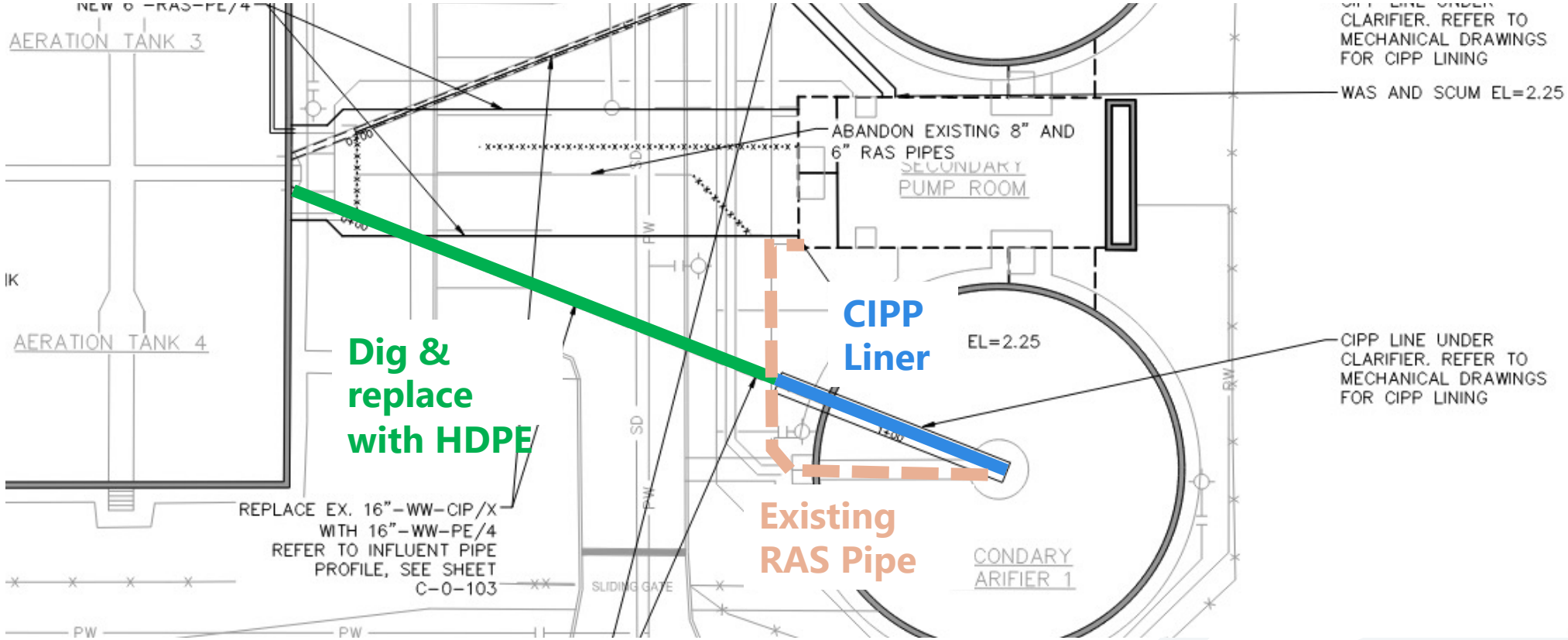

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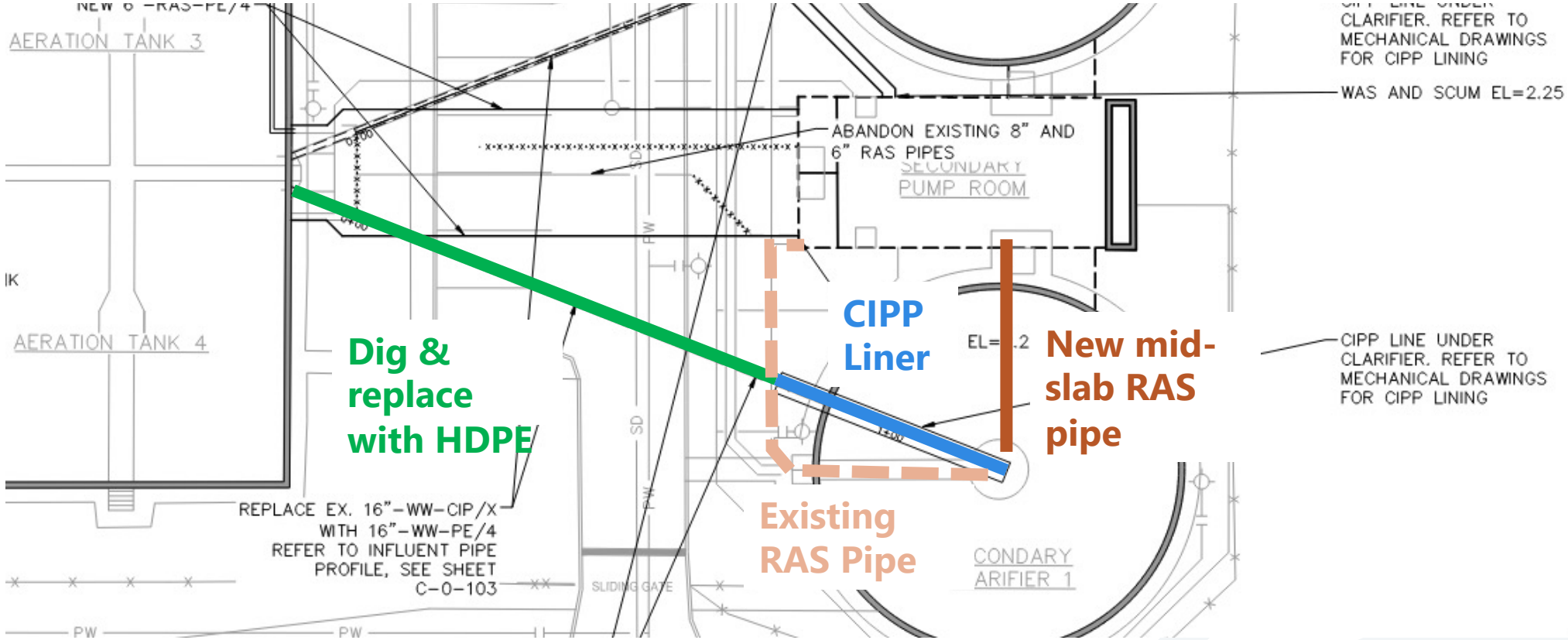
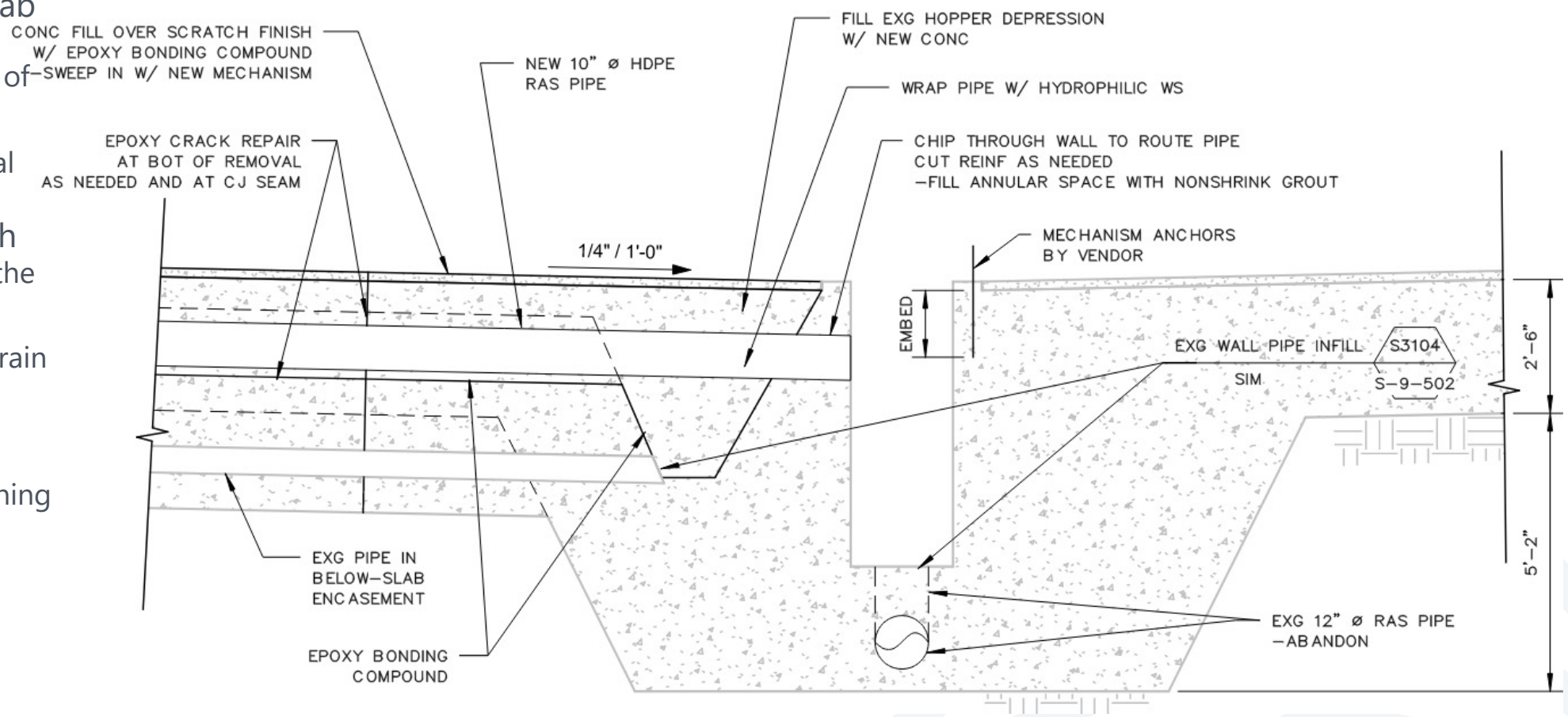


Mid-Slab RAS Pipe

- Versus cutting through entire slab
  - Less work
  - Reduced risk of groundwater intrusion
  - Less structural impact
- Versus mid-depth
  - Less steel in the tank
  - Ability to completely drain
- Versus rehab in place
  - Bends complicate lining
  - Wanted to change alignment



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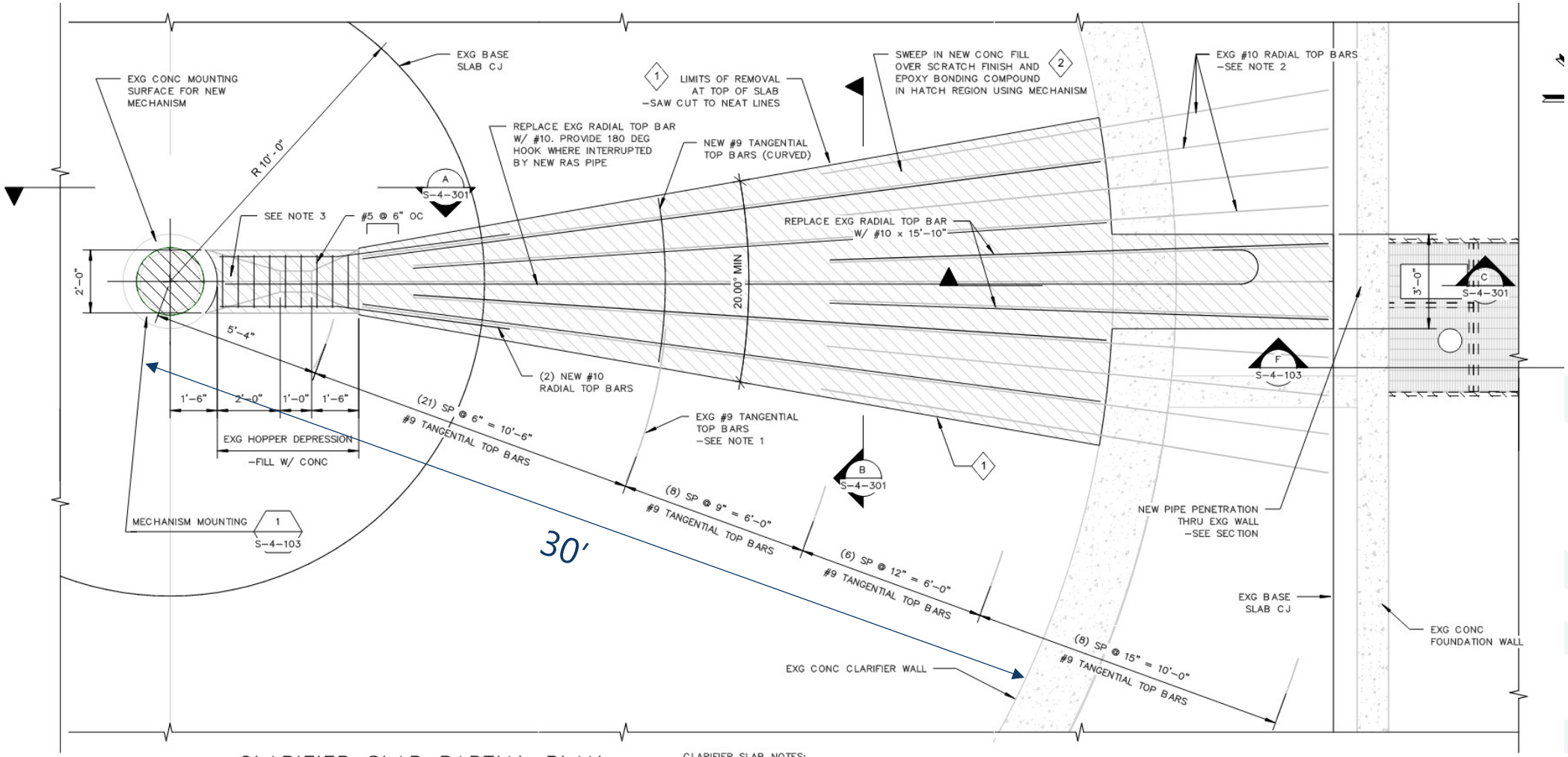

CLARIFIER SLAB PARTIAL PLAN

SCALE: 3/8" = 1'-0"

CLARIFIER SLAB NOTES:

1. EXG TANGENTIAL TOP BARS REQUIRED TO BE CUT FOR INSTALLATION OF NEW RAS PIPE SHALL BE TRIMMED, CLEANED AND SPLICED TO NEW BAR. OTHER TANGENTIAL TOP BARS MAY BE CLEANED AND INCORPORATED TO NEW WORK AS APPROVED BY ENGINEER WHERE CONDITION WARRANTS.

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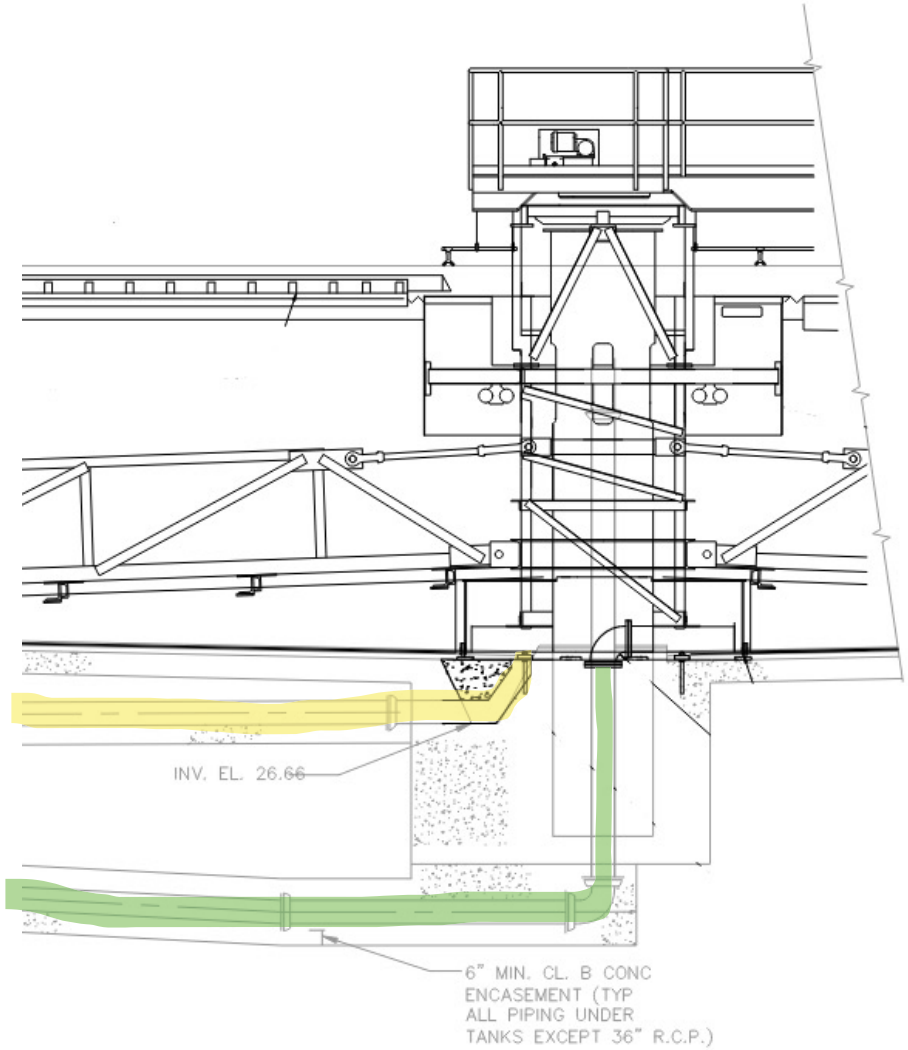
Mid-Slab Pipes: Conversion from an EQ Tank

Mid-Depth Influent Pipe

- Allows flexibility with alignment
- Cost effective
- Saves time during construction

Conversion of peripheral to center feed, Monmouth IL.

Increasing RAS capacity



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Mechanism

- Materials
  - Stainless steel is a 50% cost adder
    - Good idea for wear parts like beaches
  - Galvanized steel: not recommended
    - Mechanism to right installed 2014, photo 2021
  - Painted steel most typical
- Anticipated life & things to watch for
  - LAWPCA & Lowell mechanisms were 30+ years old!
  - Coatings are a maintenance item

Mechanism – Painting (Lifespan and Costs)

- Typical System
  - Abrasive Blast Surface Preparation (SSPC-SP 10 Near White Metal Blast)
  - Zinc Rich Primer
  - Epoxy Mid-Coat
  - Epoxy Finish Coat if covered or submerged
  - Urethane Finish Coat if exposed to UV
- 15 to 20-year Lifespan
- Typical Costs
  - $45,000 - $95,000 depending on size (60'-90' diameter range)

Mechanism – Painting (Considerations)

- Color selection
  - Consider availability
  - Suggest contrasting colors between coats
- Protecting adjacent surfaces from overspray
- Temperature and Humidity Controls
  - Tenting, heating, dehumidification maybe required

Mechanism – Painting (Schedule)

Typical Coating Schedule per Coat:

- 1 day per Rake Arm x2
- 1 day for Center Columns & Feed Well
- 1 day for Walkways

Average Duration offline:

- 3 coats x 4 days = 12 days
- 1 day to mobilize and clean tank
- Manufacturer's curing period – typically 7 days
  - Coordinate w/ operations to keep clarifiers offline
- Total 20 working days

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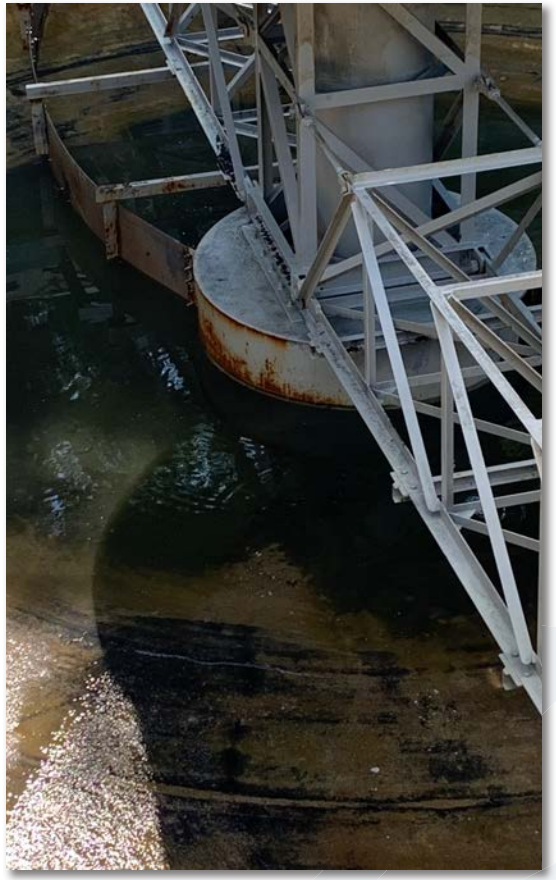
Mechanism – Painting (Inspection)

- Third Party Inspection
- Typically $1,000 – $1,500 per day
- Surface Blast Profile
- Dry Film Thickness (DFT)
- Pin Hole, Holiday, or Discontinuity Testing
- Schedule
  - Minimum: Random Threat
  - Good: Surface Preparation & Final Coat ($2k-$3k)
  - Better: Surface Preparation and each coat ($4k-$6k)
  - Best: Full Time ($12k-$18k)

Field touch up of factory primed & painted mechanism

Mechanism – Other Considerations

- Cleaning prior to contractors working
- Groundwater/rain removal
- Unit price line items for metal repair
- Removing, storing, protecting handrails, grating, piping, conduit, etc.
- Confined space considerations
  - Large enough to enter
  - Limited entry or exit (one ladder)
  - Not designed for occupancy
  - Permit Required:
    - Hazardous atmosphere
    - Potential to engulf
    - Floors that slope downward and taper to smaller area
    - Unguarded machinery



Mechanism – Other Considerations

- Center Column Attachment
  - Anchor rods at base
  - Cage to center bearing
- Rake Arm Scrapers
  - Stainless or bronze components fair well
  - Carbon steel mounts do not
- Neoprene/rubber seals

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Misc Metals/FRP – Weirs & Baffles

Anticipated life & things to watch for:

- Sealant behind weirs
- Aluminum weirs
  - Localized pitting
- FRP weirs & baffles
  - Delamination

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- Conduits
- Pipe Hangers & unistrut
- Railing Heights / Fall Hazards
  - 42" tall "guards"
  - At any 30" drop
- Davit Mounts
  - Confined space retrieval
- Coordination with dome tension rings

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Misc Metals/FRP – PRVs

- Pressure Relief Valves
  - Clean
  - Check seals

Concrete

Anticipated life & things to watch for

- Concrete structures typically designed for 50-year life span
- Trouble areas
  - Base slab grout
  - Construction joints
  - Launders – especially if covered
  - Exposed aggregates

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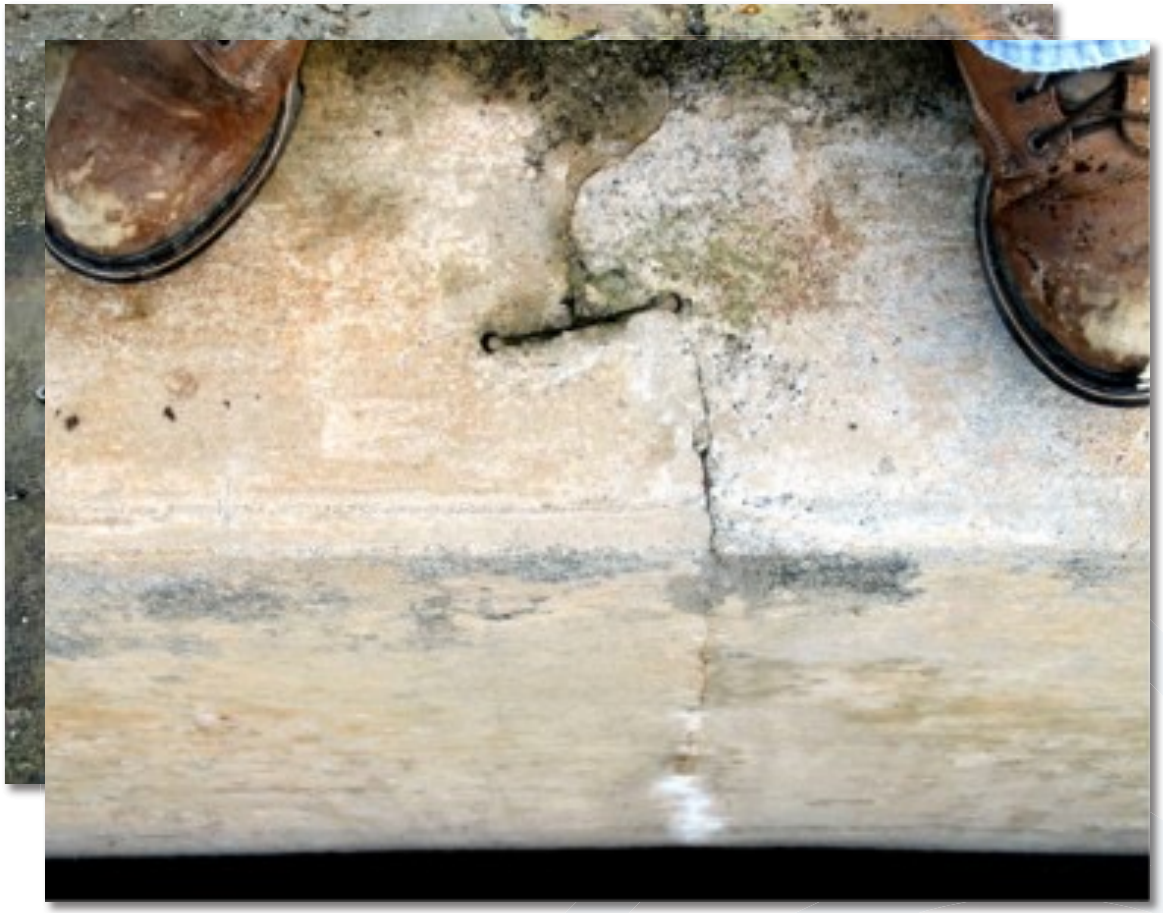

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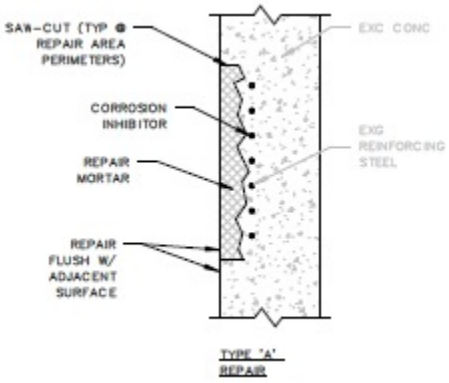
Concrete – Repairs

Typical Repairs

- Shallow & Deep Spall Repair
  - ~$65-$125/SF
- Crack Injection
  - ~$115-$135/SF
- Route and Seal crack sealing
  - ~$20-$20/SF



Concrete – Coatings

- Typical System
  - Surface preparation
  - Cementitious Product
  - Epoxy Coating
- Schedule considerations
  - Surface preparation to proper pH
  - Curing of Cementitious filler
  - Coating cure time
  - Inspections
- Typical Costs
  - $65-$75 / square foot

Questions?

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