

# Easterly WWTP

## Sinking Feeling – Finding and Fixing Leaking Plant Conduits and Air Piping



OWEA State Conference

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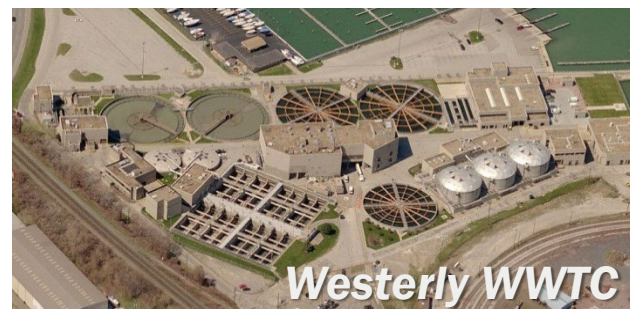
# Presentation Outline

1. NEORSD Overview
2. Project Background
3. Aeration System Air Leaks and Repairs
4. Final Settling Tank Return Activated Sludge (RAS) Pipe Leaks and Repairs
5. Main Drainage Conduit Cleaning, Leaks and Repairs
6. Future Repairs and Investigations

# Northeast Ohio Regional Sewer District

*Southerly WWTC*

- Who we are...
  - Regional wastewater utility created in 1972 by court order
  - Separate and distinct from the City of Cleveland and Cuyahoga County
- What we do...
  - Servicing all or part of 62 member communities
  - 1 million customers
  - 90+ billion gallons wastewater treated each year

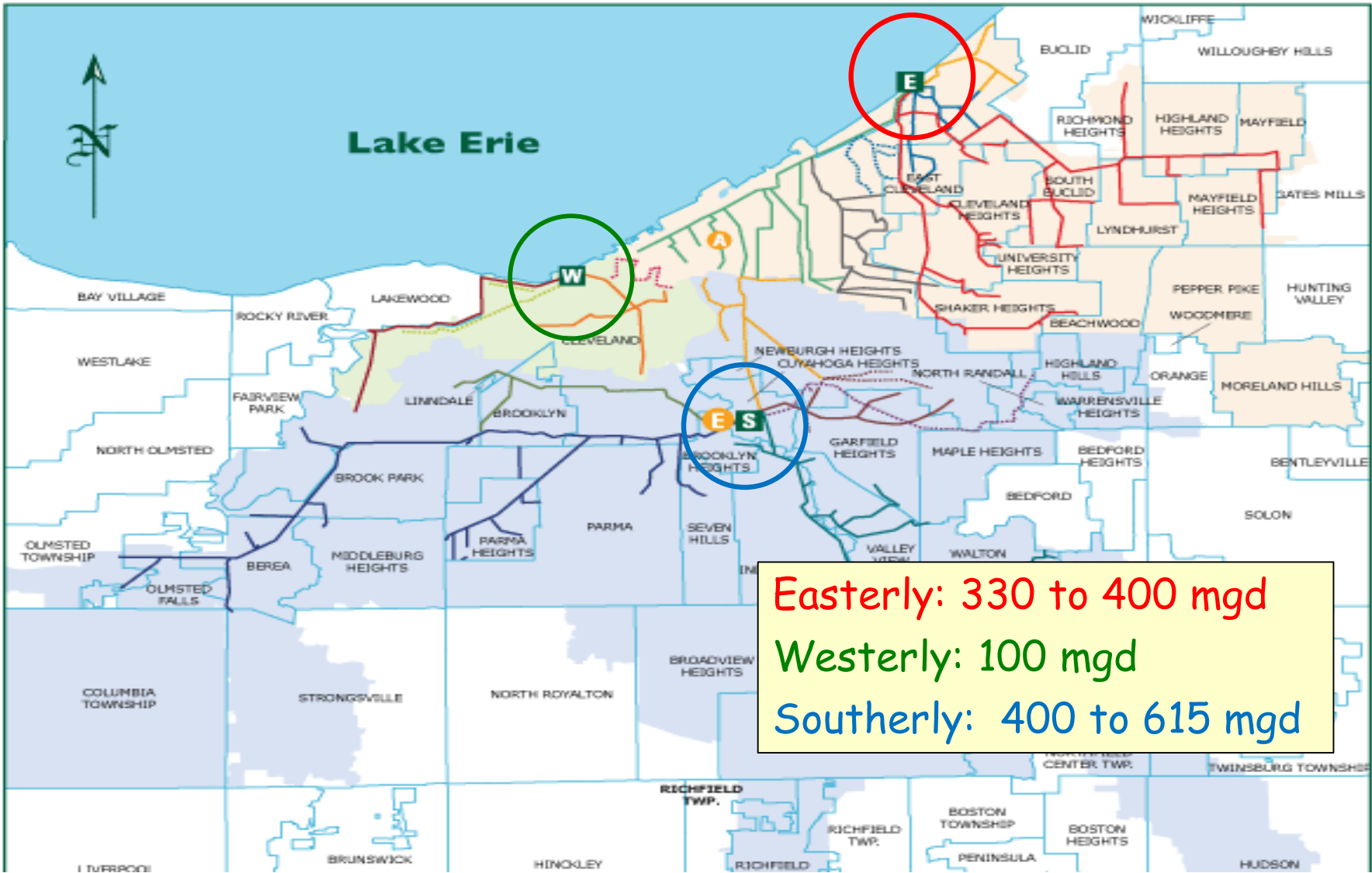


# Background

- NEORSD signed a Consent Decree in 2011 to provide Wet Weather Treatment at three WWTPs
- \$3 Billion dollar program - Project Clean Lake
  - Collection System Projects
  - Tunnel Storage Projects
  - Chemically Enhanced–High-Rate Treatment (CEHRT)
  - Expand biological capacity of Southerly and Easterly WWTPs.



# Easterly and Southerly Treatment Capacity

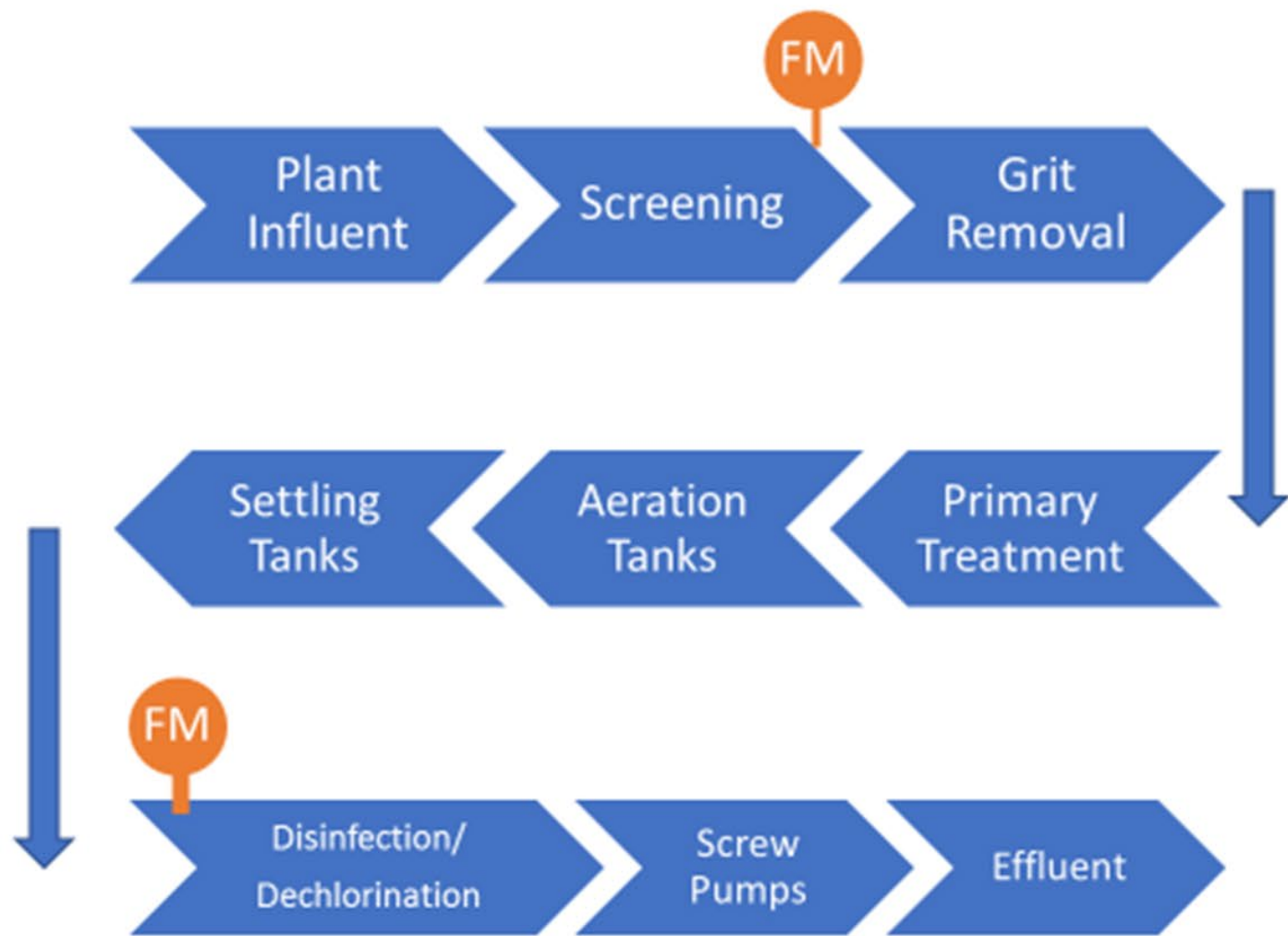


# NEORSD Easterly WWTP Overview

- Activated Sludge Treatment Facility constructed in 1930's
- Serves 333,000 residents of Cleveland, OH and Suburbs
- Three influent interceptors: Easterly, Heights-Hilltop and Collinwood
- ADF = 85 MGD; MDF = 400 MGD
- Receives combined wastewater from 3 large interceptors
- Wet Weather Flow: >1,000 MGD

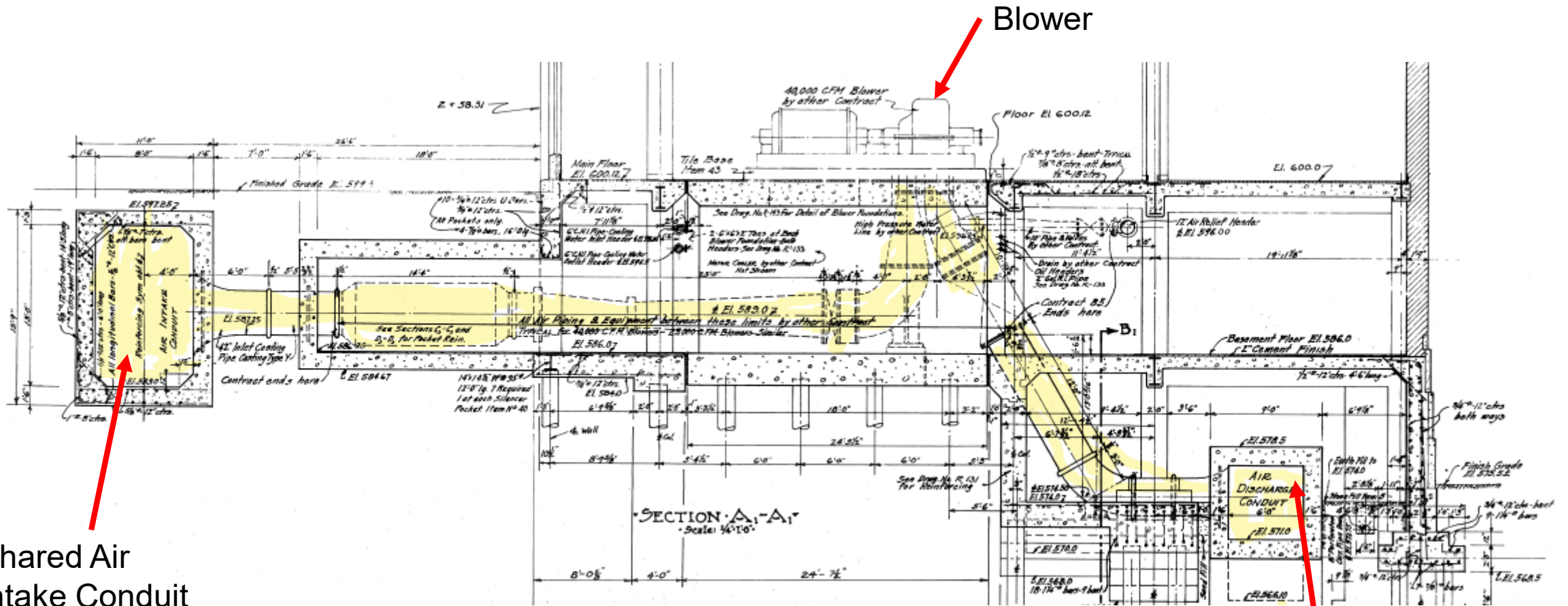


# Plant Process Flow Diagram



# Aeration System Air Leaks and Repairs

## Aeration Blower Piping Overview



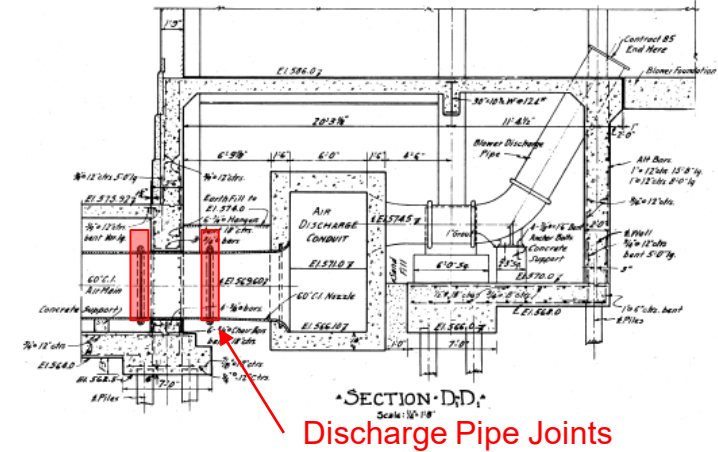
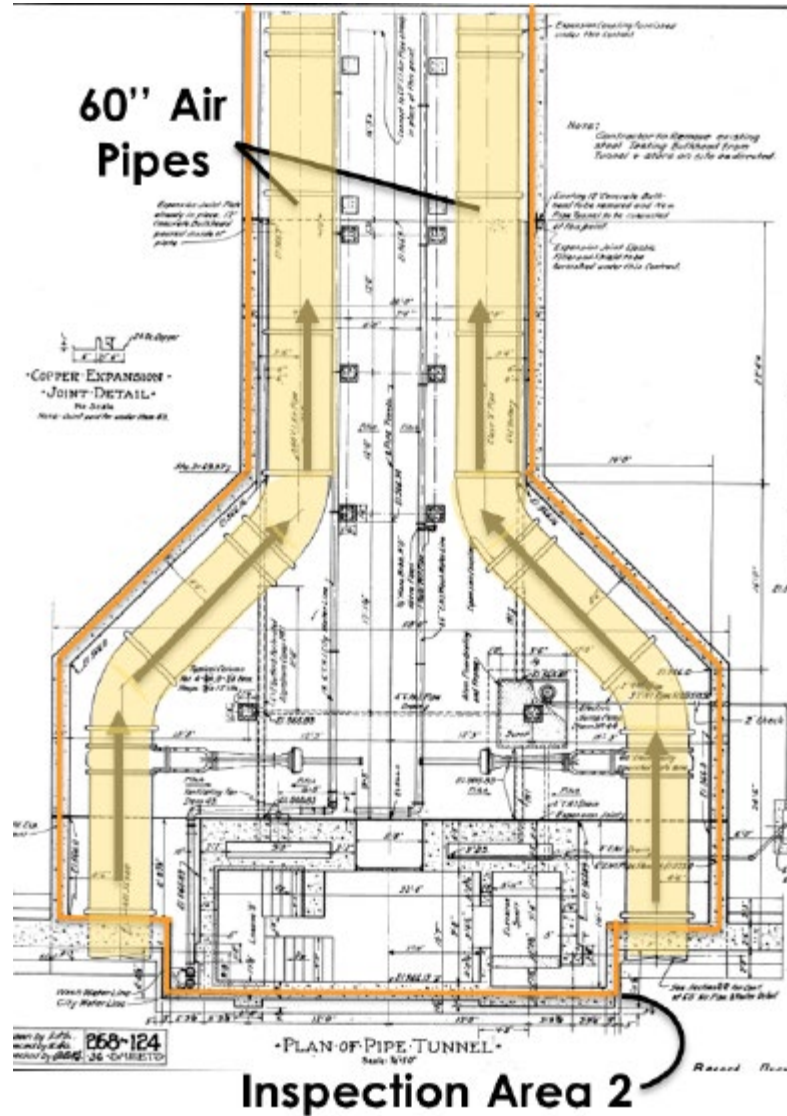
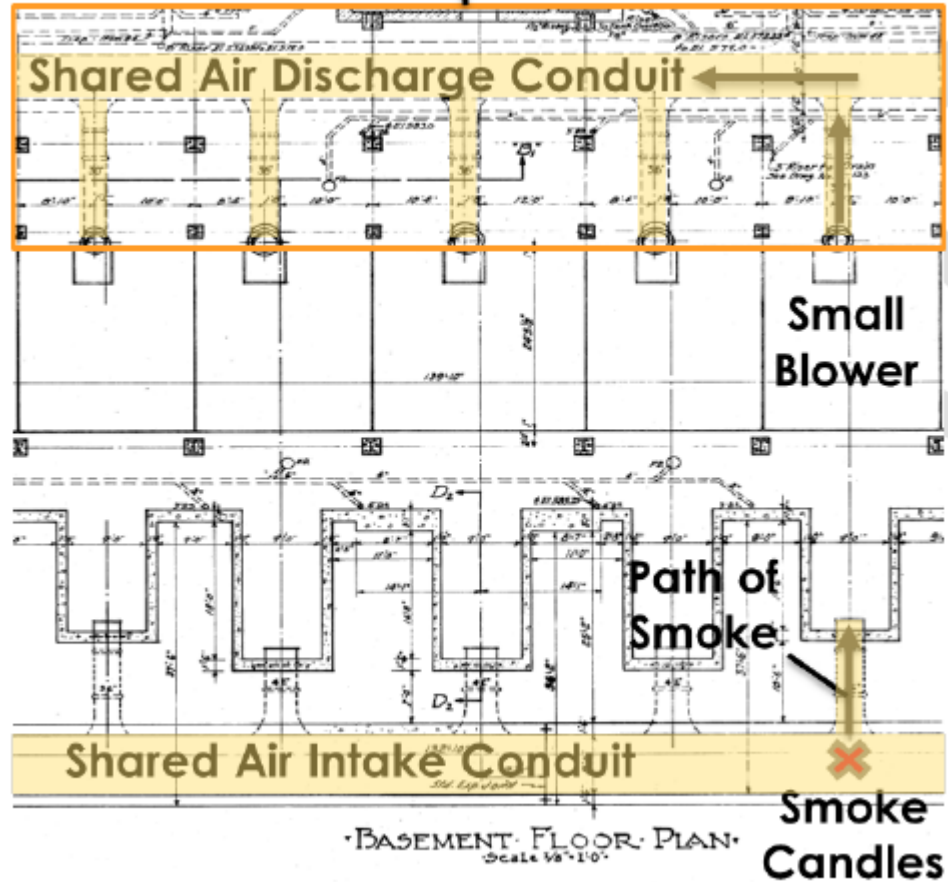
Shared Air Intake Conduit

Shared Air Discharge Conduit



# Aeration Blower Piping Overview

Inspection Area 1



Smoke Candles

# Blower Piping and Conduit Leak Testing



Expansion Joints Inside Discharge Conduit

## Leak Test Results:

Visual inspection was more beneficial than smoke test in determining the source of the leaks. System was shut down and the discharge conduit was accessed. Leaks were at the shared air discharge conduit concrete expansion joints and in the 60" pipe joints.

Air Intake Conduit

# Final Settling Tank RAS Piping Leaks and Repairs

**1991, FST 7 & 8:** 16" RAS pipe break repaired

**March 2016, FST 10:**

16" RAS pipe break repaired under ESSl Project Change Order. Open cut excavation and removal replacement of broken pipe and backfilled. \$215,000

**August 2017, FST 7:**

16" RAS pipe break repaired with an internal fiberglass lining. \$16,500

**2018, FST 11 & FST 12:**

Leaks determined to be present

# Secondary Treatment Site Plan



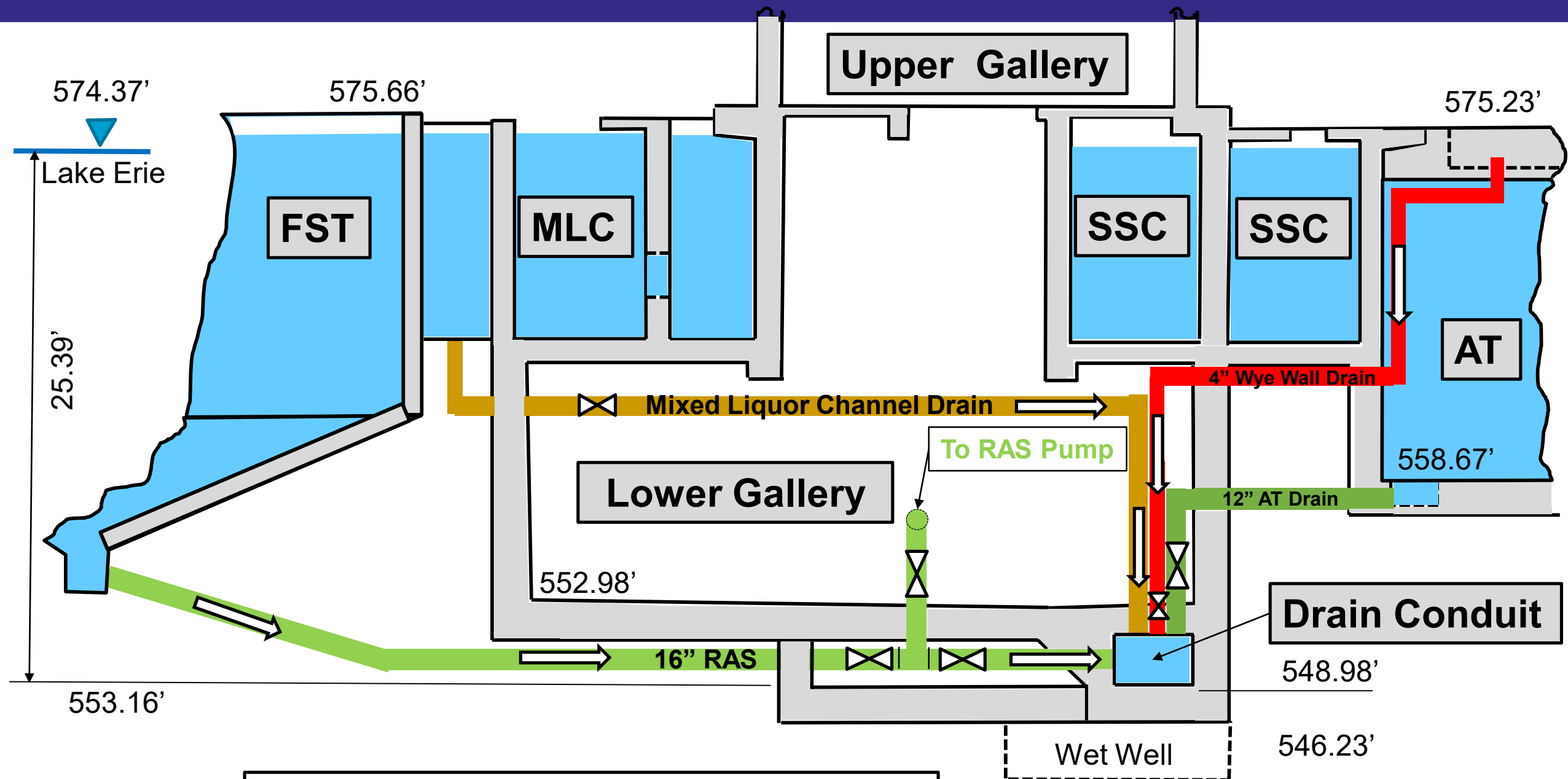
 Sinkhole Locations

7

10

11

12



**Section Thru Gallery Looking West**

# Final Settling Tank 10



2014: Sinkhole Observed



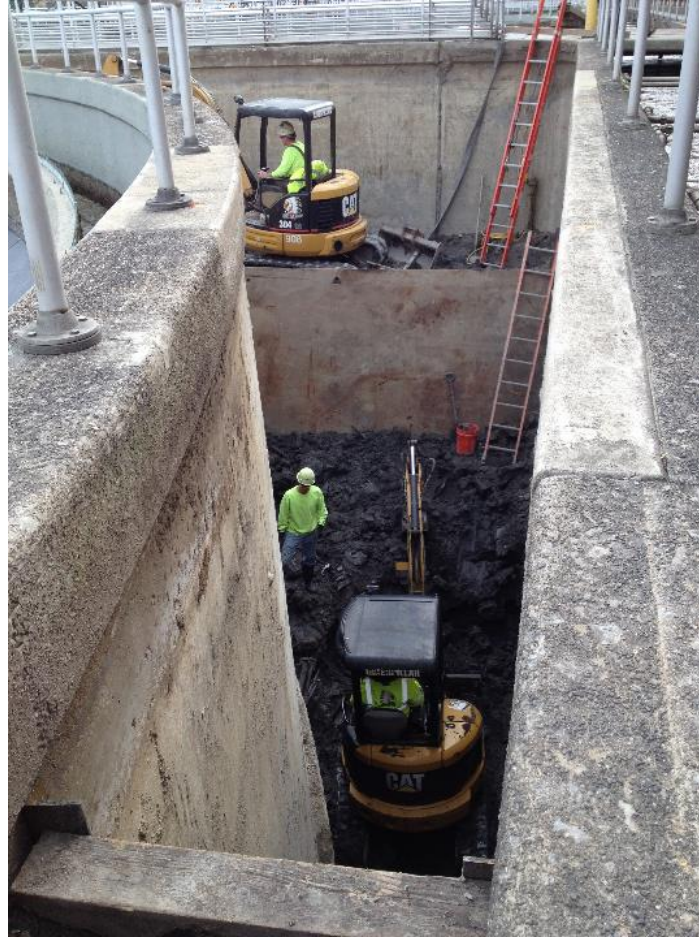
## Final Settling Tank 10

March 2016: 16" RAS  
pipe video from Gallery  
side determined pipe  
displacement.

**Video** of Displacement



# Final Settling Tank 10



March 2016: 16" RAS pipe break repaired under ESS I Project Change Order. Open cut excavation and removal replacement of broken pipe and backfilled with sand.



# Final Settling Tank 10



March 2016

# Final Settling Tank 7



January 2017: Sinkhole Observed



# Final Settling Tank 7



August 2017:

- 16" RAS Pipe video from tank side determined pipe displacement
- Pipe break repaired with internal fiberglass pipe repair
- Sinkhole backfilled with sand

# Final Settling Tank 7



**Sinkhole Reappears  
in February 2018  
(6 months after  
backfilling with  
sand)**





Empty / Dry

02/22/2018

## Final Settling Tank 7

Sinkholes are observed to fill and empty with the water level in the drainage conduit

This was the confirmation that the sinkholes were a result of the flow of water in and out of the drain conduit leak



Full / Wet

02/26/2018



**FST 11:** Sinkhole appears in 2018



February 2018, Sinkhole Reappears  
(23 months after backfilling repair with  
sand)

# Final Settling Tank 12



- Water level drop tests were conducted on all 20 FST Tanks looking for leaks. FST 11 & 12 were found to have leaks
- Dye Testing was conducted to determine the source of leak into Drain Conduit

# Final Settling Tank 12



Jetting and cleaning of FST 11 & 12 was required to perform video inspection





Build up Inside of Pipe FST 12



Variety of Jet Heads Utilized



Push Camera and live portable monitor, Push Camera wrapped with flotation noodles and water bottles



Remote Control Camera

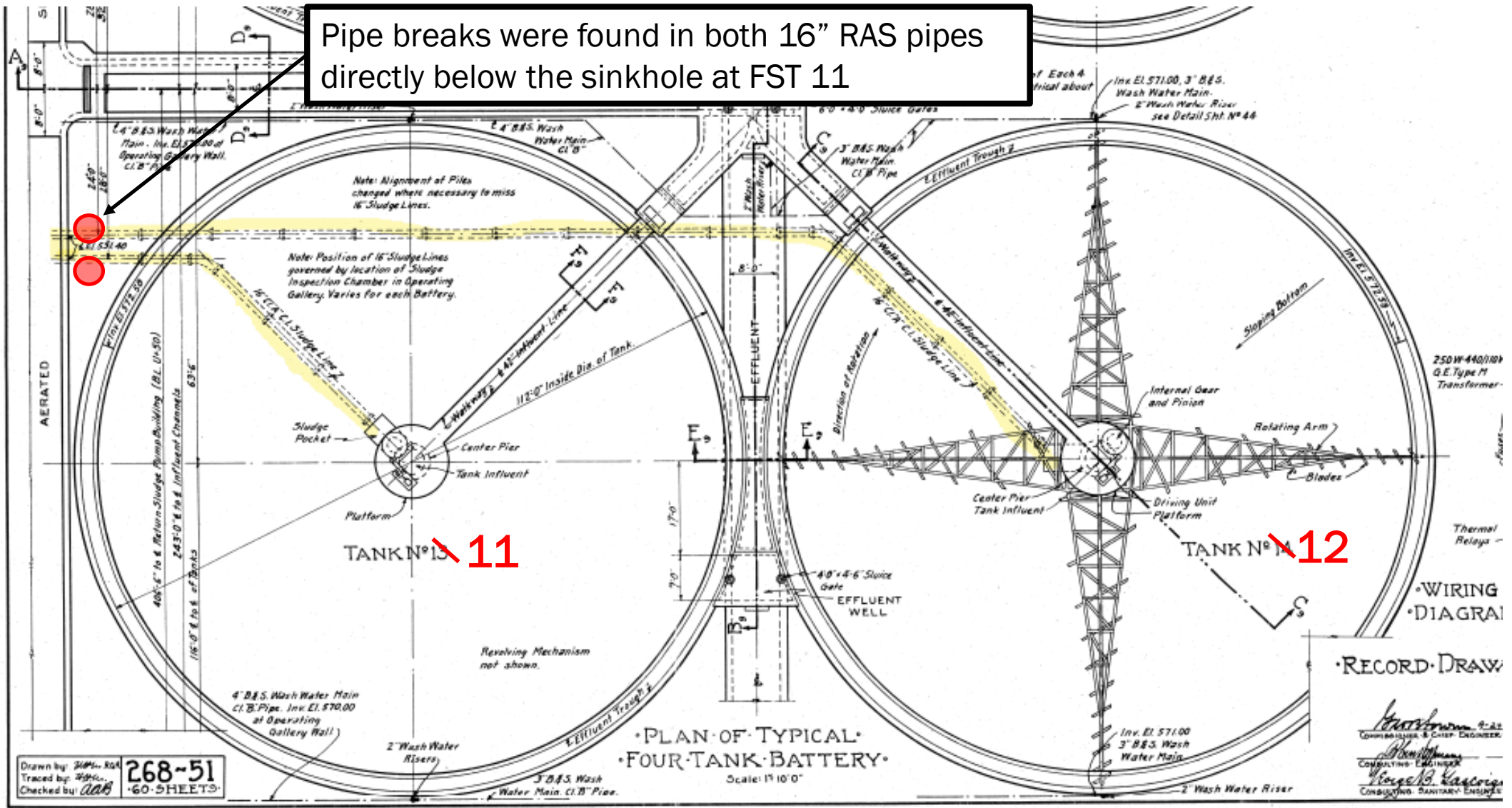


16" RAS piping in the Gallery was removed for remote camera access



Pipe breaks were found directly below the sinkhole at FST 11

Pipe breaks were found in both 16" RAS pipes directly below the sinkhole at FST 11



**Final Settling Tank 11 and 12**

# Main Drainage Conduit Cleaning



Jet Truck and Vac Truck

# Main Drainage Conduit Cleaning



Vac Truck Suction Piping



Grit Pad used for disposal of Vac Truck Contents

# Main Drainage Conduit Cleaning



3" Hydraulic Submersible Pump and Diesel Power Pack  
(2 pumps were utilized in the Wet Well)



# Main Drainage Conduit Cleaning





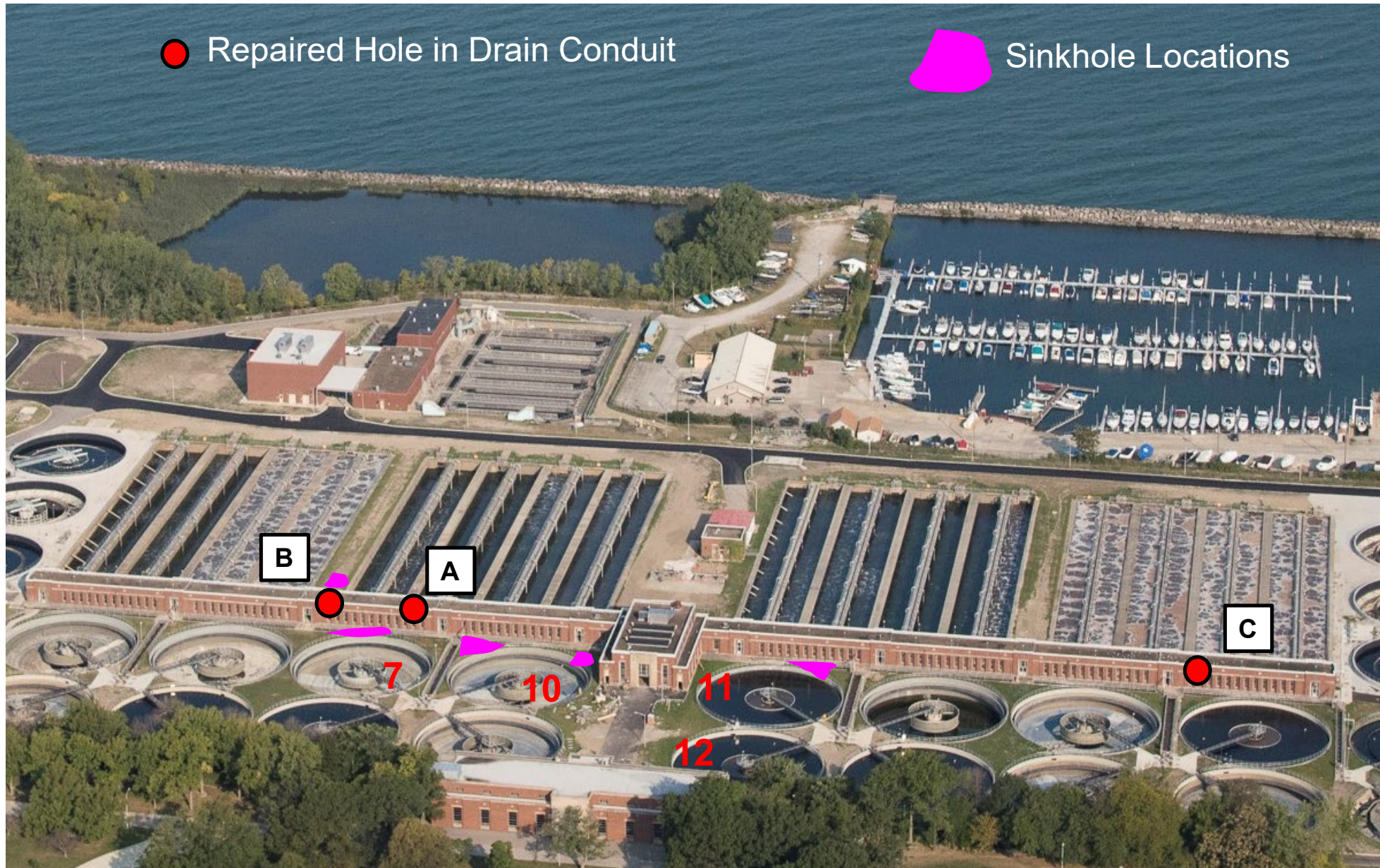


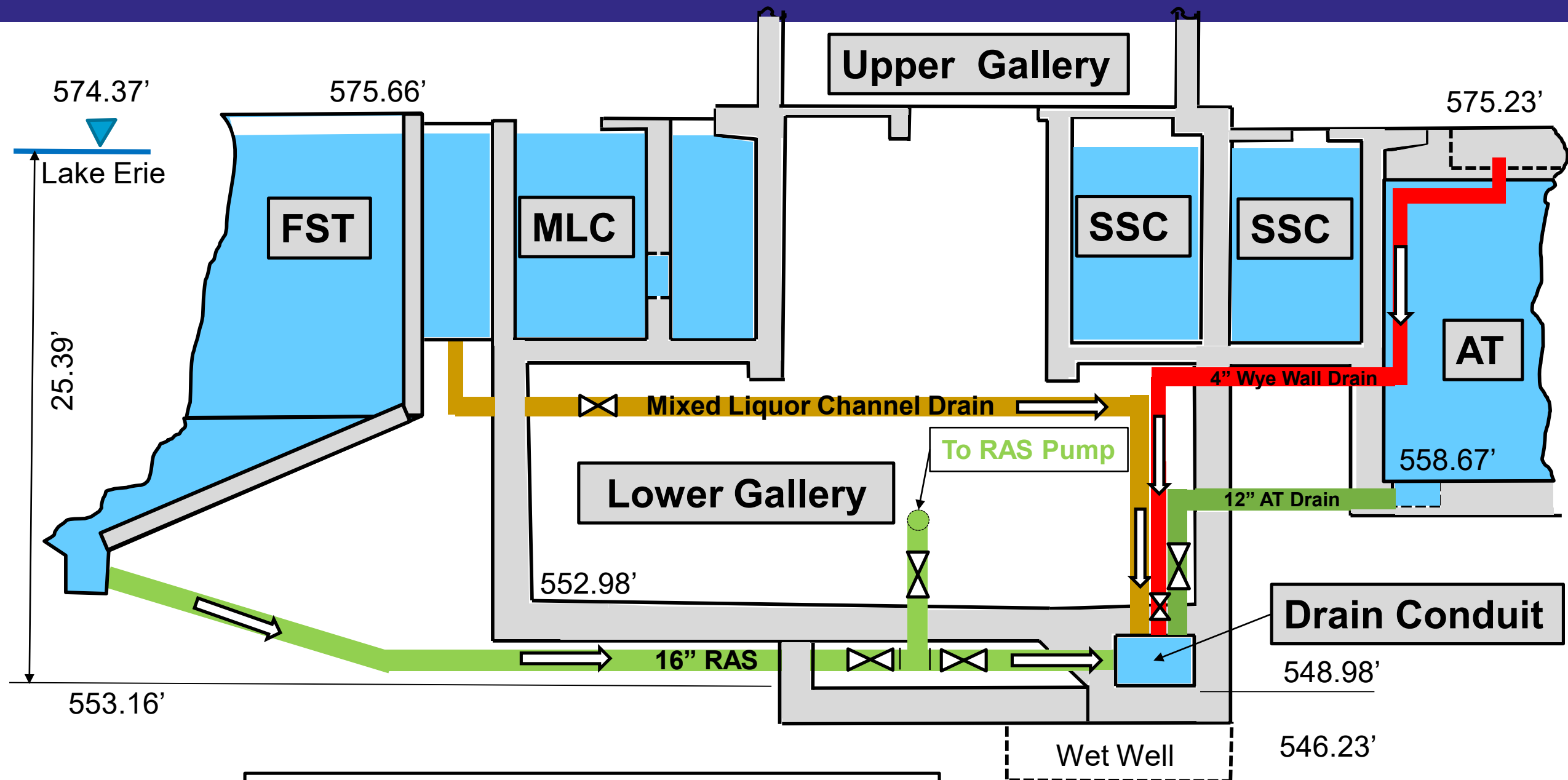
**East Conduit Cleaning**  
**Video**

# Main Drainage Conduit Leaks & Repairs

● Repaired Hole in Drain Conduit

▲ Sinkhole Locations

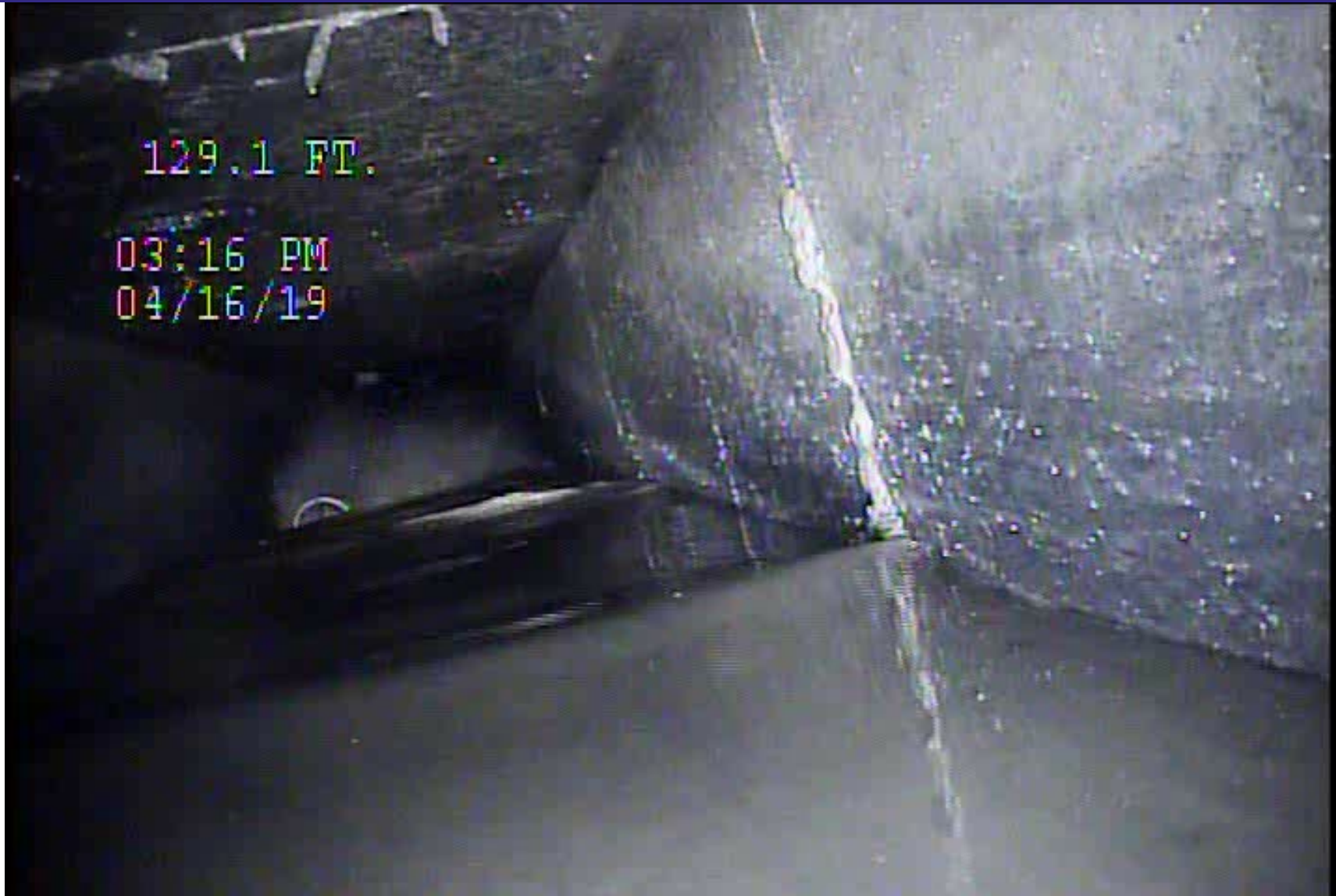




**Section Thru Gallery Looking West**



**West Conduit  
South Wall  
Location A  
Leak**



**West Conduit South Wall Location A Leak**  
**Video**



**West Conduit North Wall Opposite  
Location A Leak**



Drain Conduit



Drain Conduit Access MH



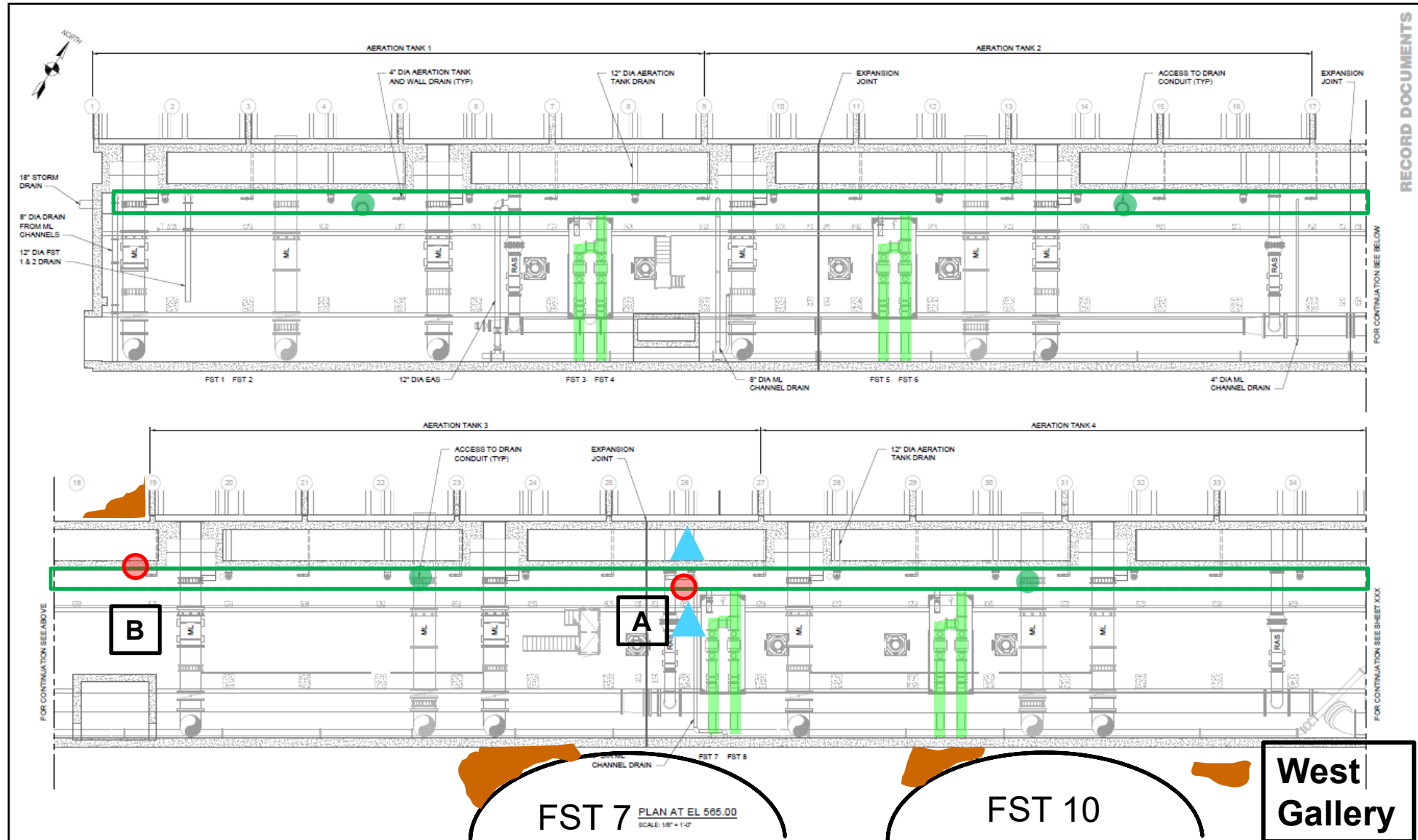
Sinkholes



Repaired Hole in Drain Conduit

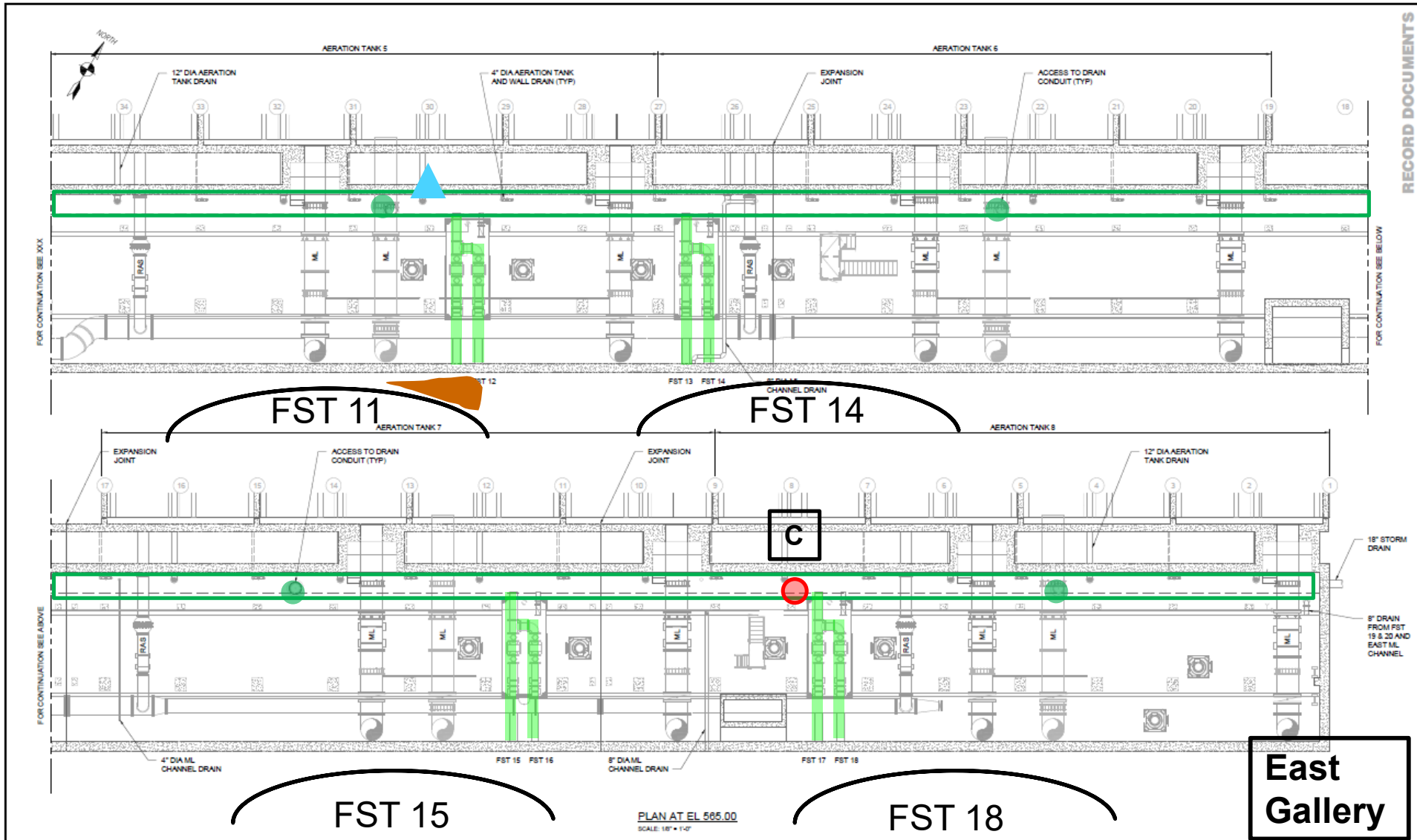


Exposed Pile Anchor



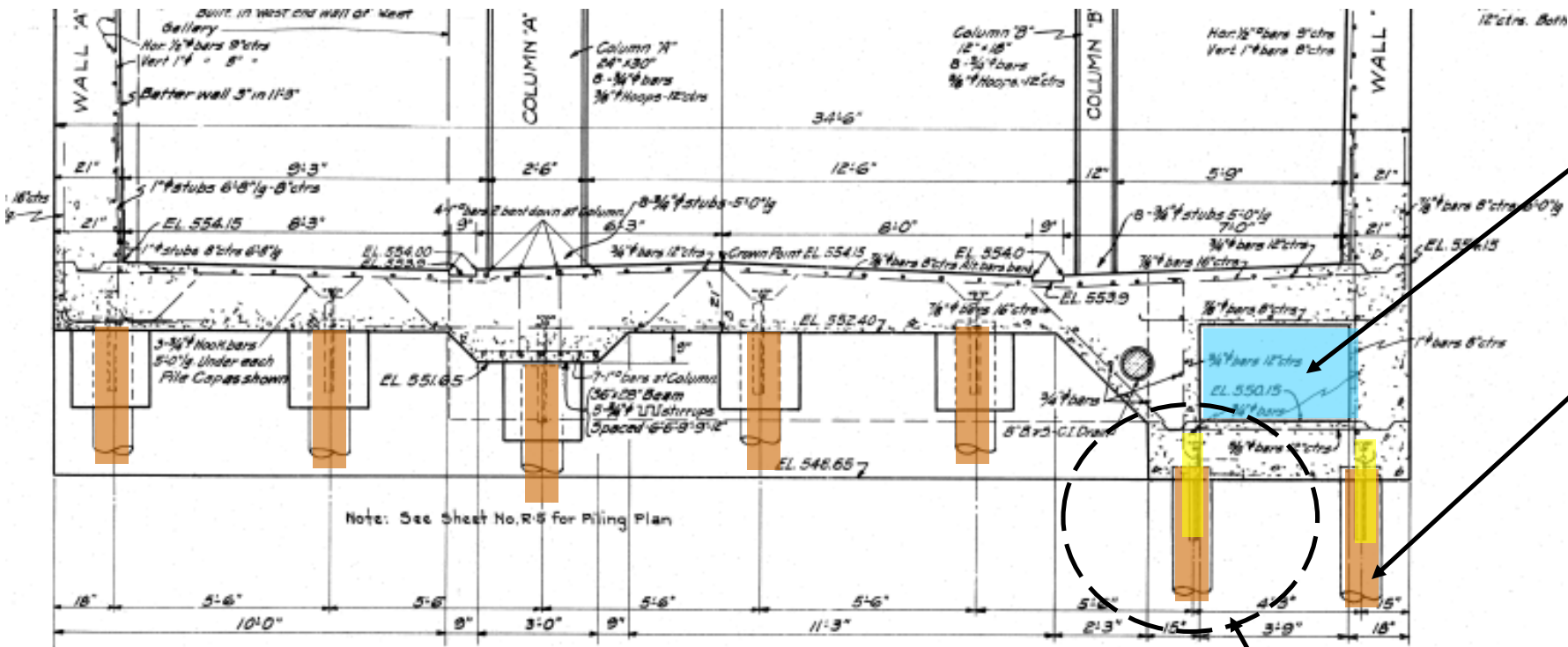
# Main Drainage Conduit Cleaning, Leaks & Repairs

- Drain Conduit
- Drain Conduit Access MH
- Sinkholes
- Repaired Hole in Drain Conduit
- Exposed Pile Anchor



# Main Drainage Conduit Cleaning, Leaks & Repairs



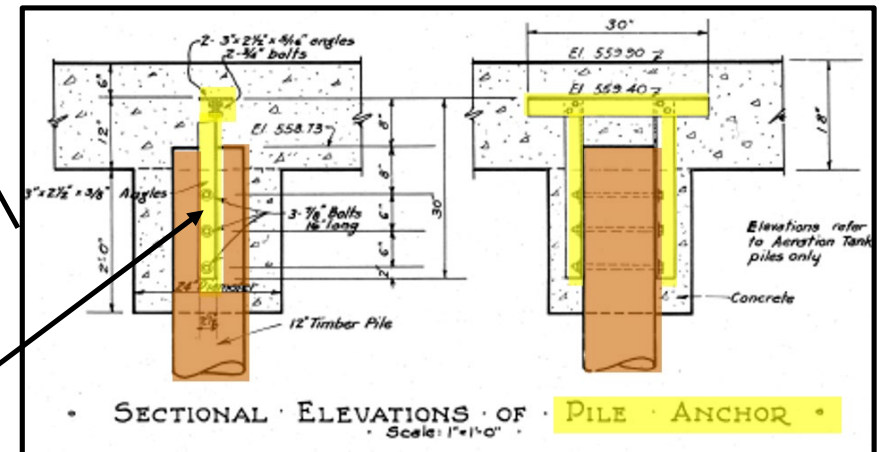


**Drain Conduit:**  
 2.5' high x 3.75' wide x  
 475' long each wing

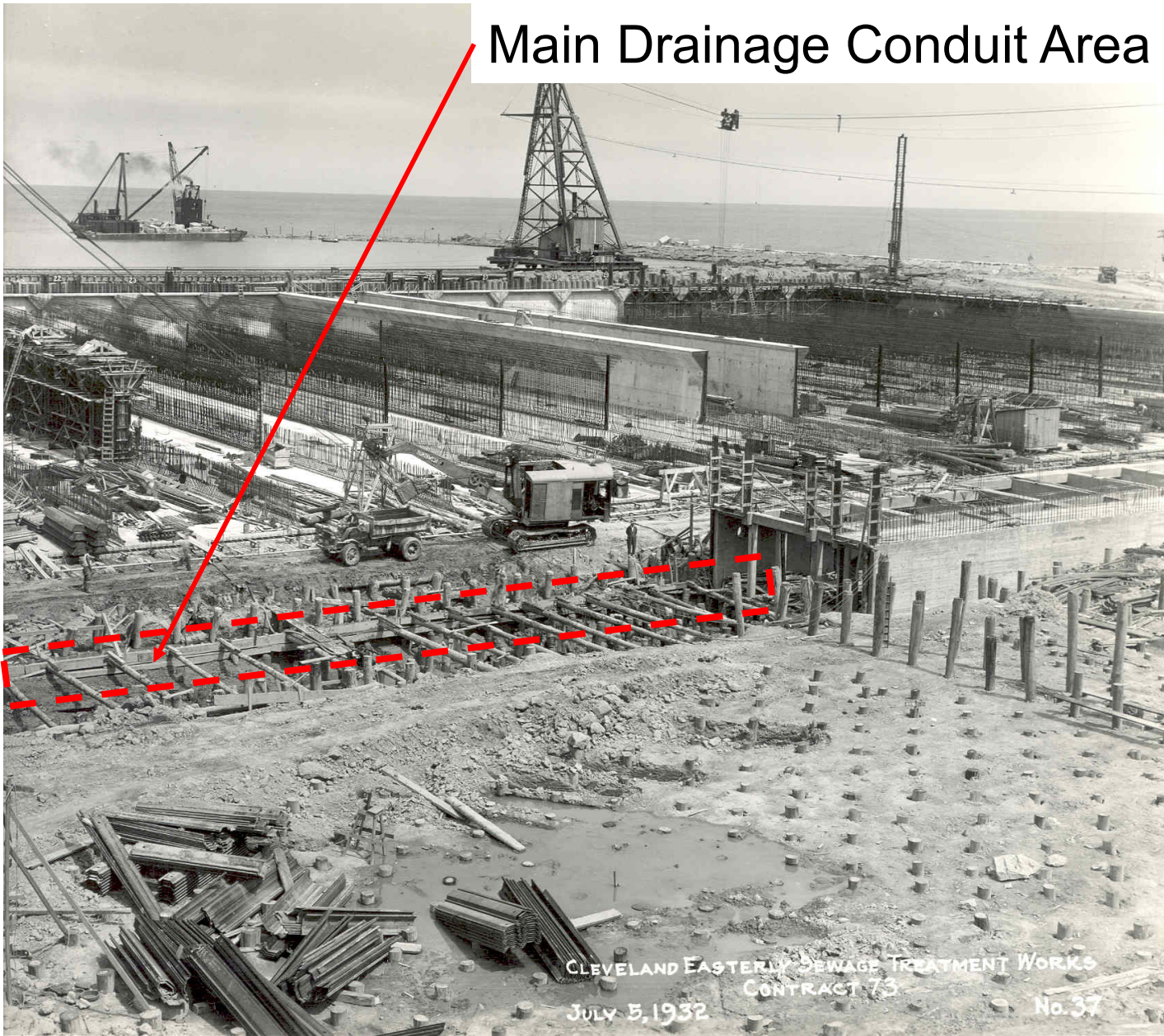
12" Timber Pile

Section thru Pipe Gallery

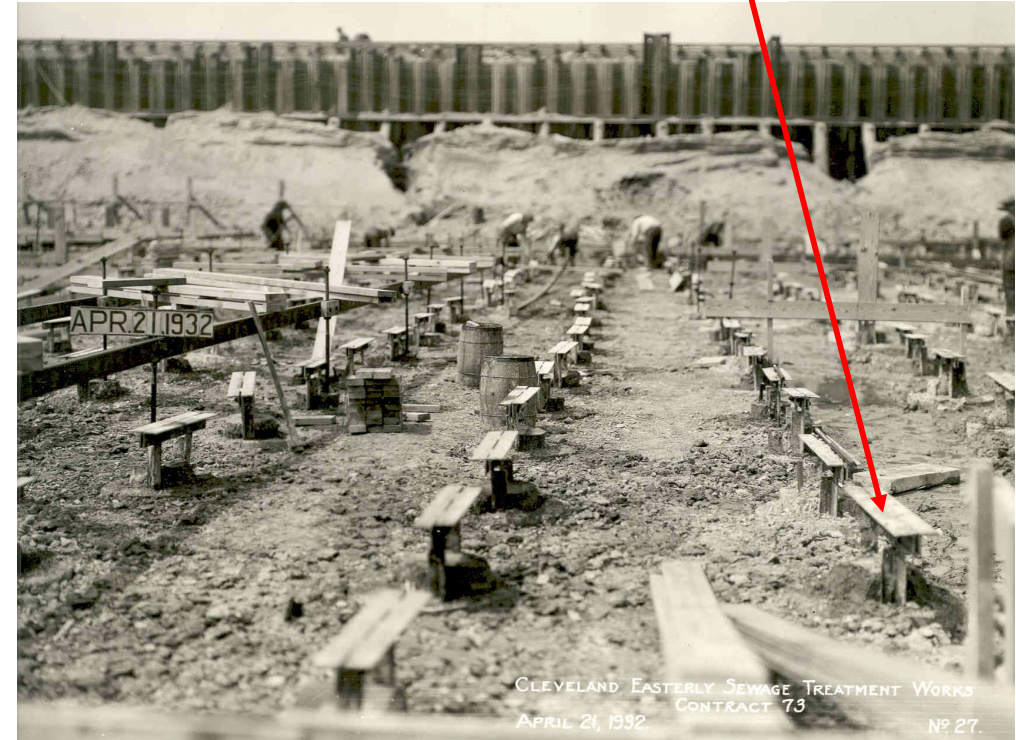
3" x 2 1/2" x 3/8" Angle Iron  
 Pile Anchor Straps



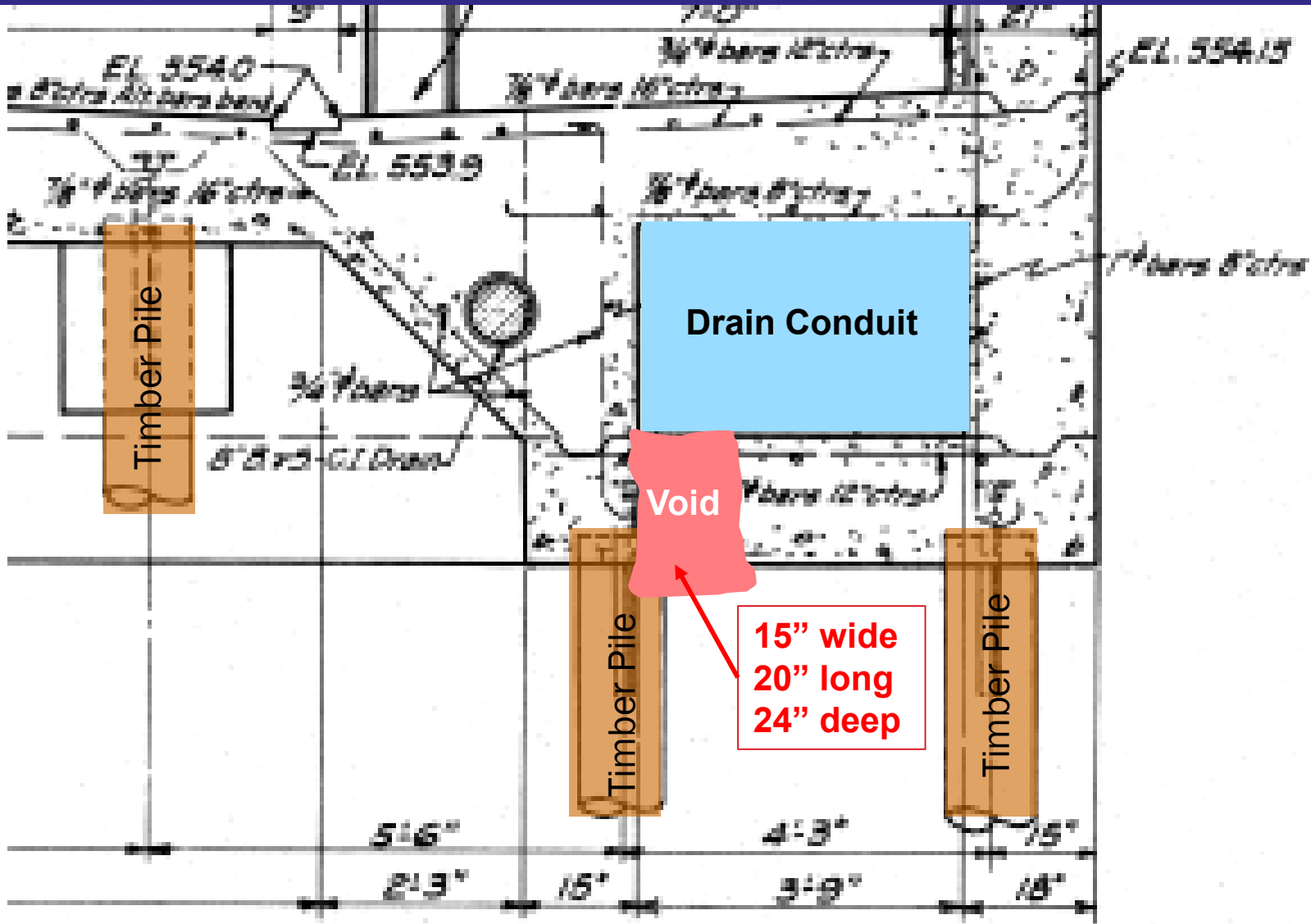
Main Drainage Conduit Area



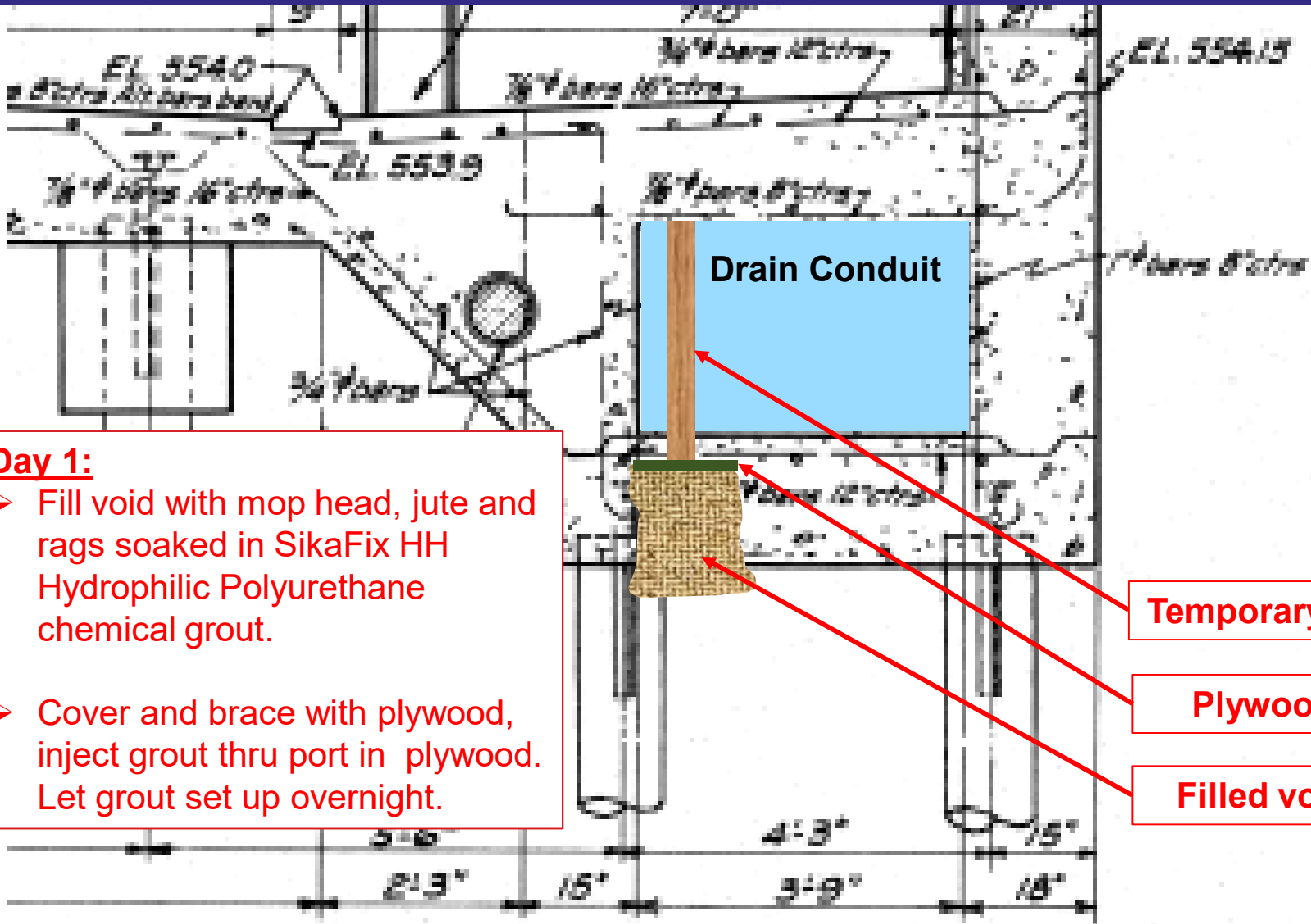
Wood Pile Anchor Straps



## 1932 Construction



**West Drain Conduit  
Location A: Hole in Drain Conduit**



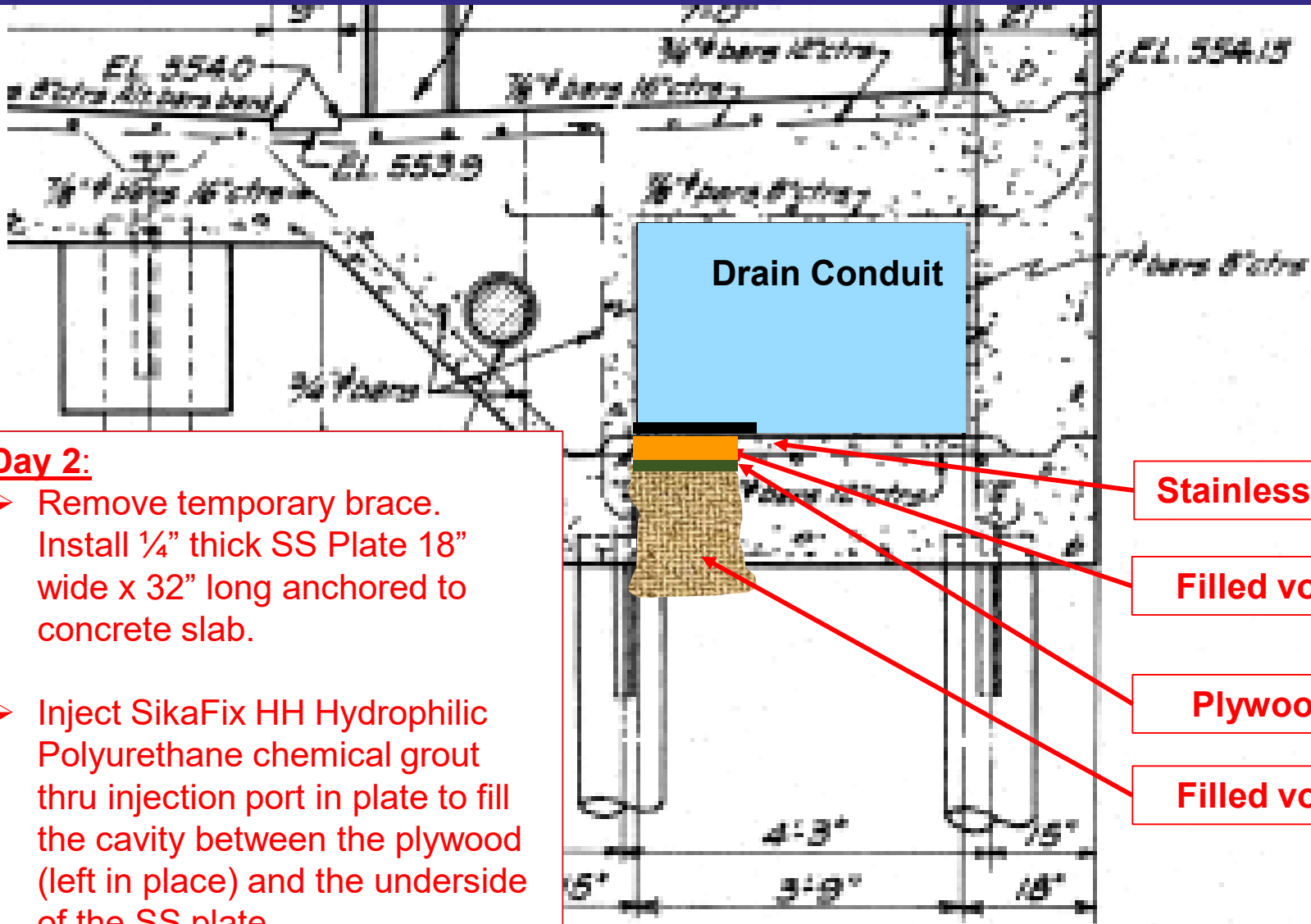
- Day 1:**
- Fill void with mop head, jute and rags soaked in SikaFix HH Hydrophilic Polyurethane chemical grout.
  - Cover and brace with plywood, inject grout thru port in plywood. Let grout set up overnight.

Temporary Brace

Plywood

Filled void

## West Drain Conduit Location A: Hole in Drain Conduit Repair



**Day 2:**

- Remove temporary brace. Install ¼" thick SS Plate 18" wide x 32" long anchored to concrete slab.
- Inject SikaFix HH Hydrophilic Polyurethane chemical grout thru injection port in plate to fill the cavity between the plywood (left in place) and the underside of the SS plate.

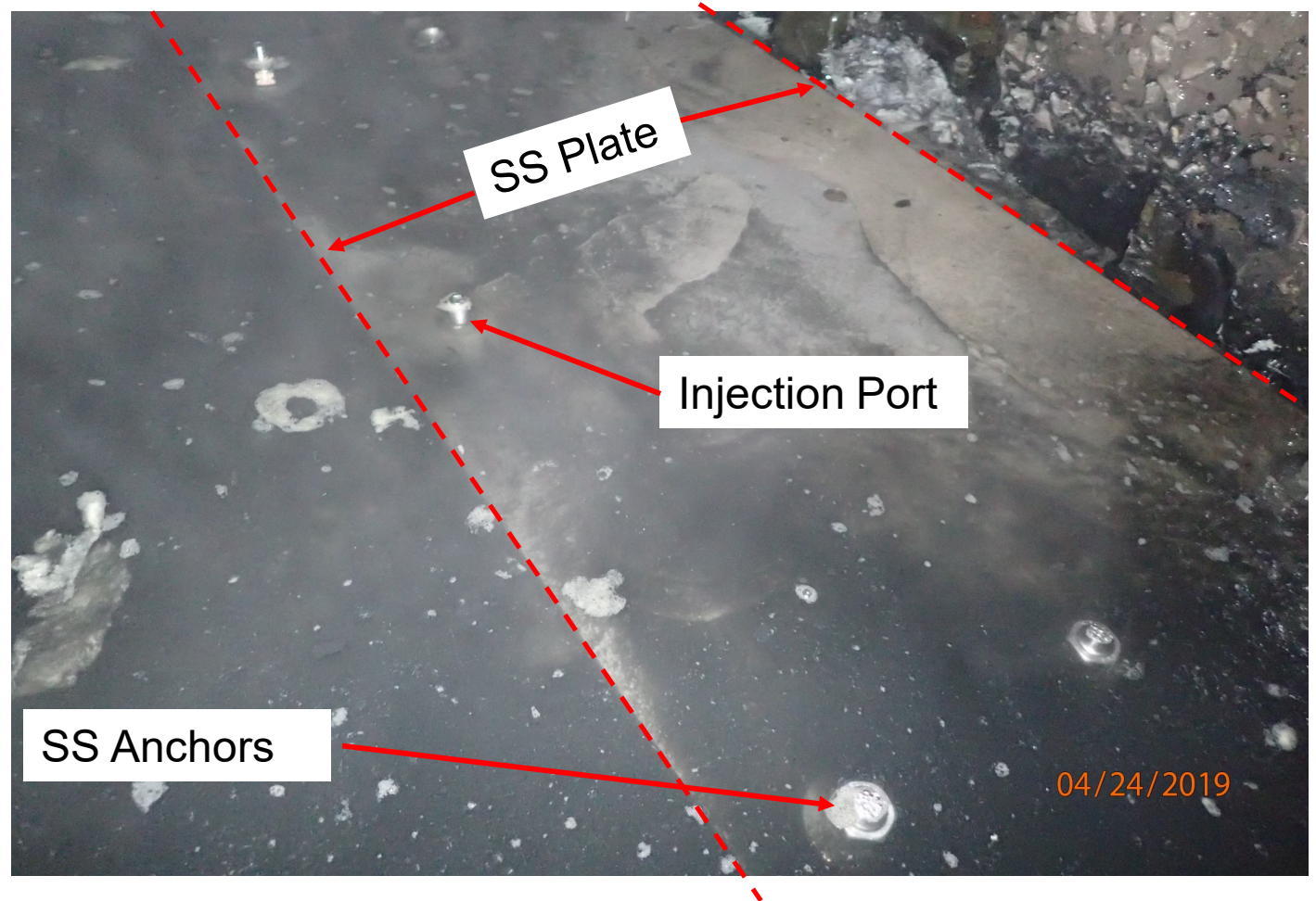
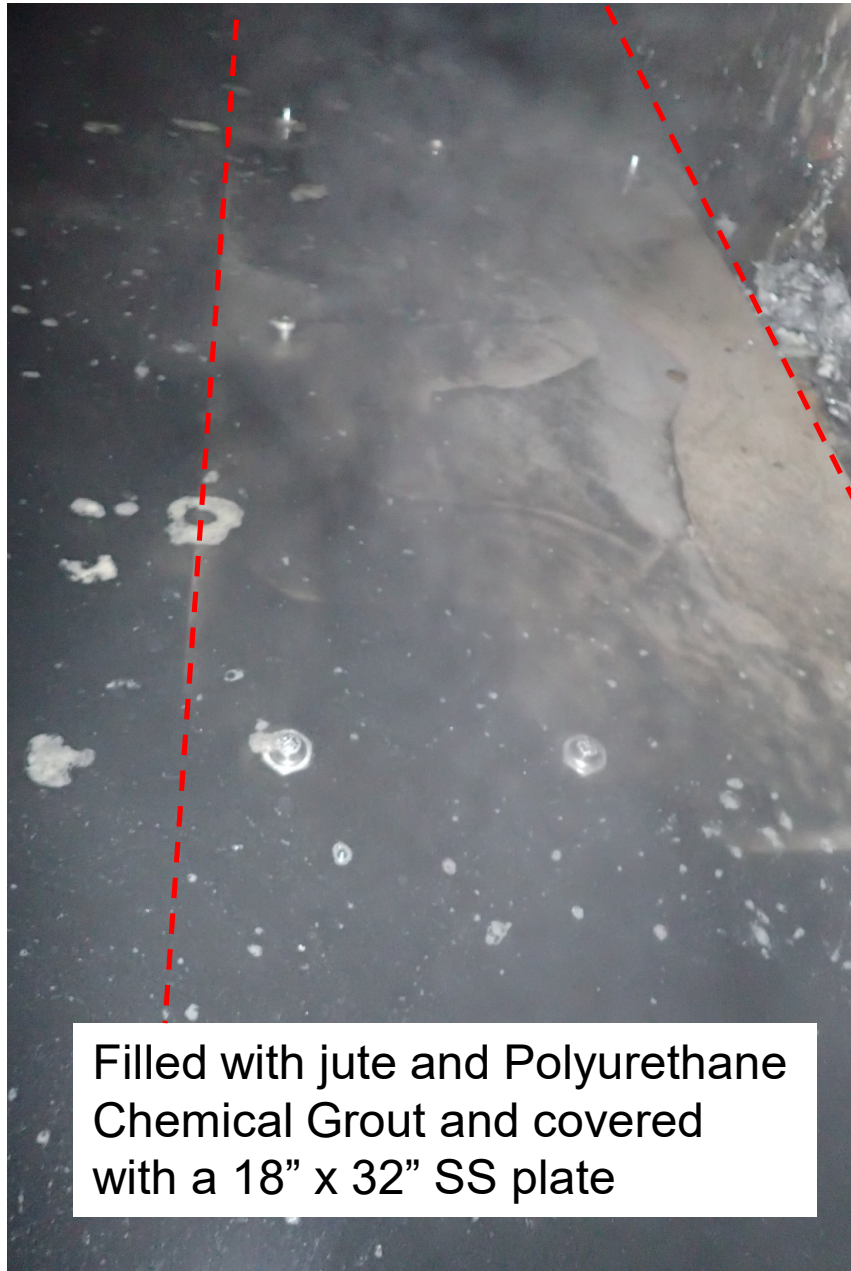
Stainless Steel Plate

Filled void

Plywood

Filled void

**West Drain Conduit  
Location A: Hole in Drain Conduit Repair**

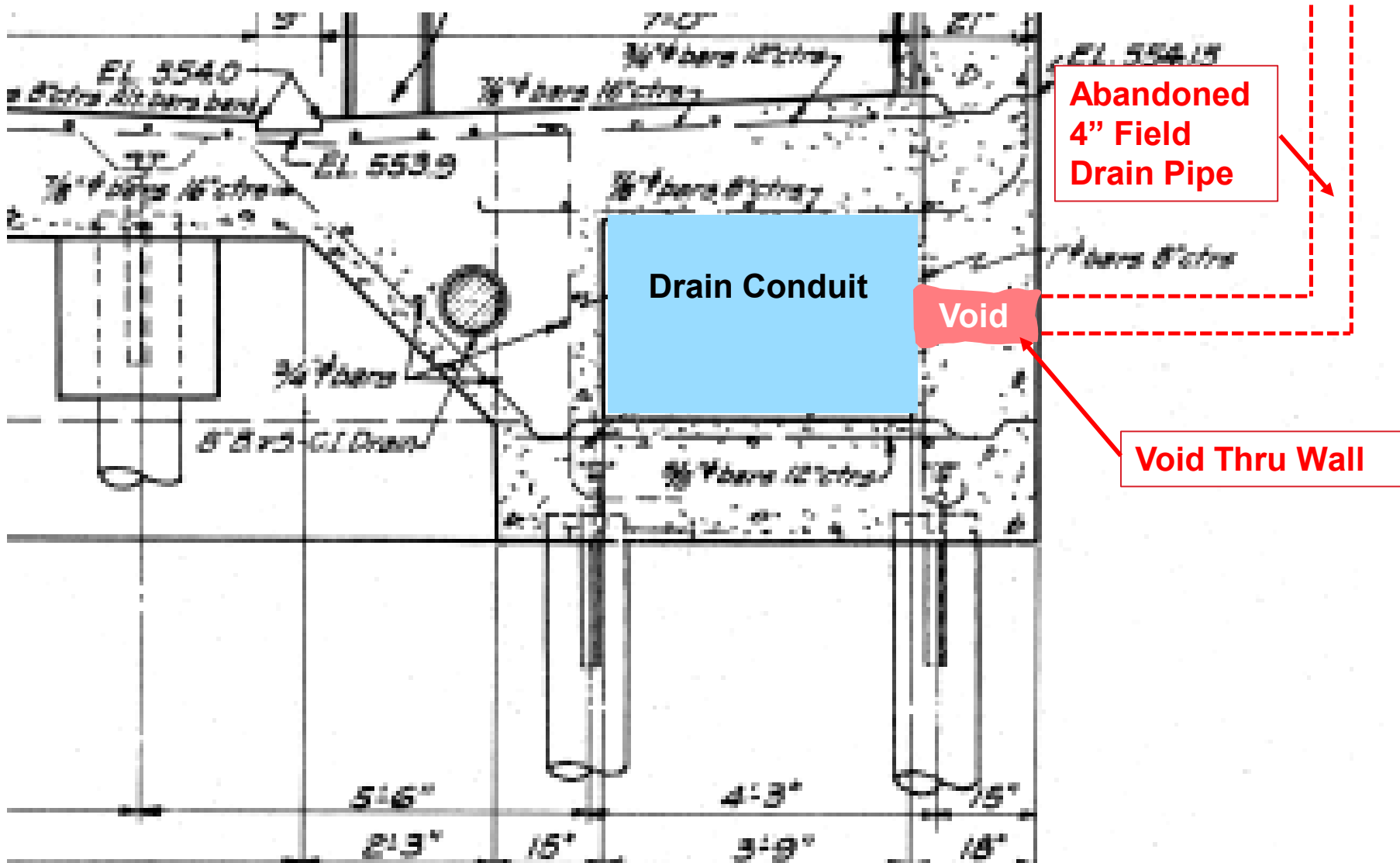


## West Drain Conduit Location A: Hole in Drain Conduit Repair

**Abandoned 4”  
diameter Field  
Drain Pipe  
Opening in  
North Wall of  
West Conduit  
Only a Minor  
Leak Observed  
at this Location**

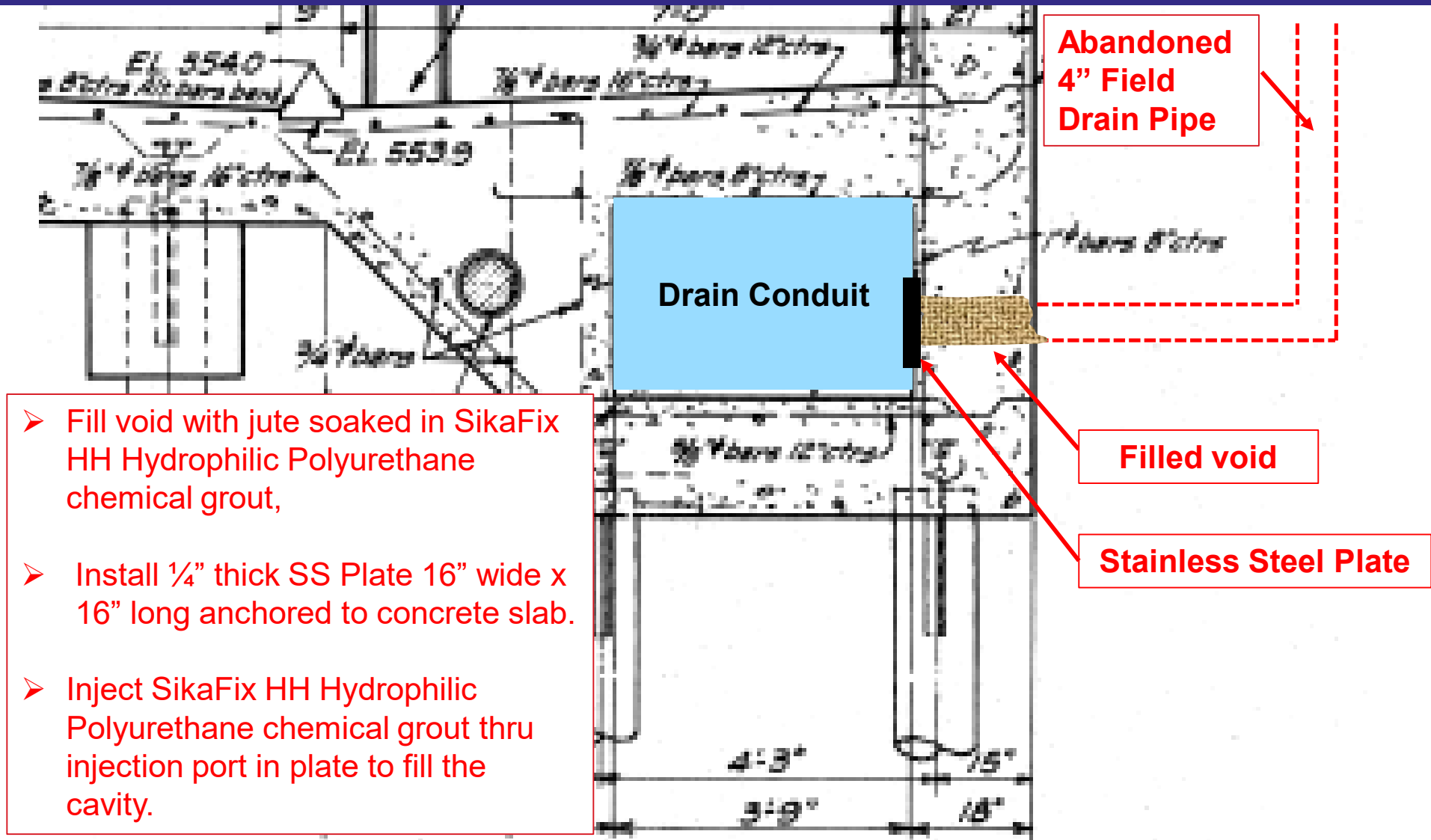


**West Drain Conduit  
Location B Hole in Drain Conduit**



**West Drain Conduit**  
**Location B: Hole in Drain Conduit Repair**

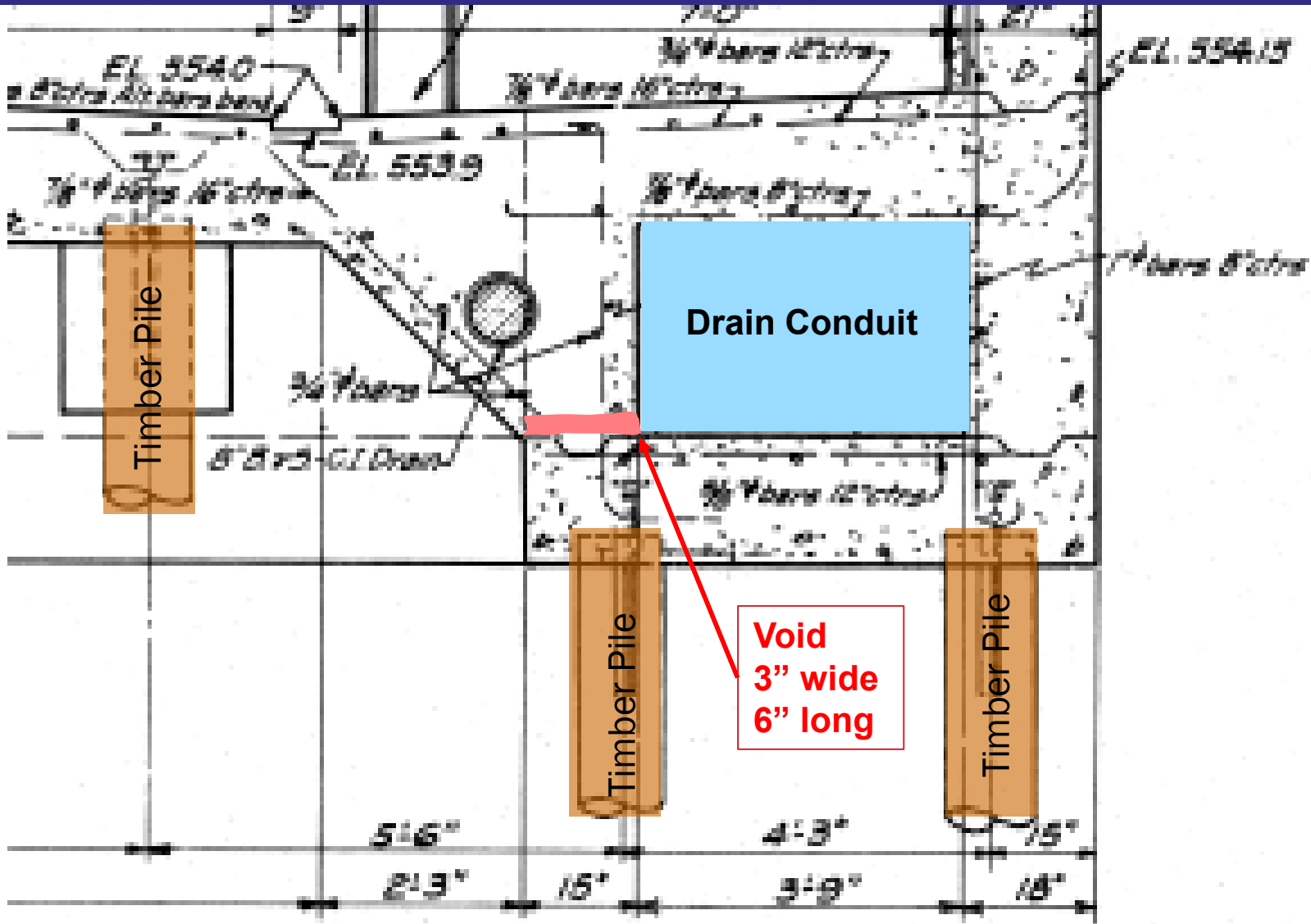




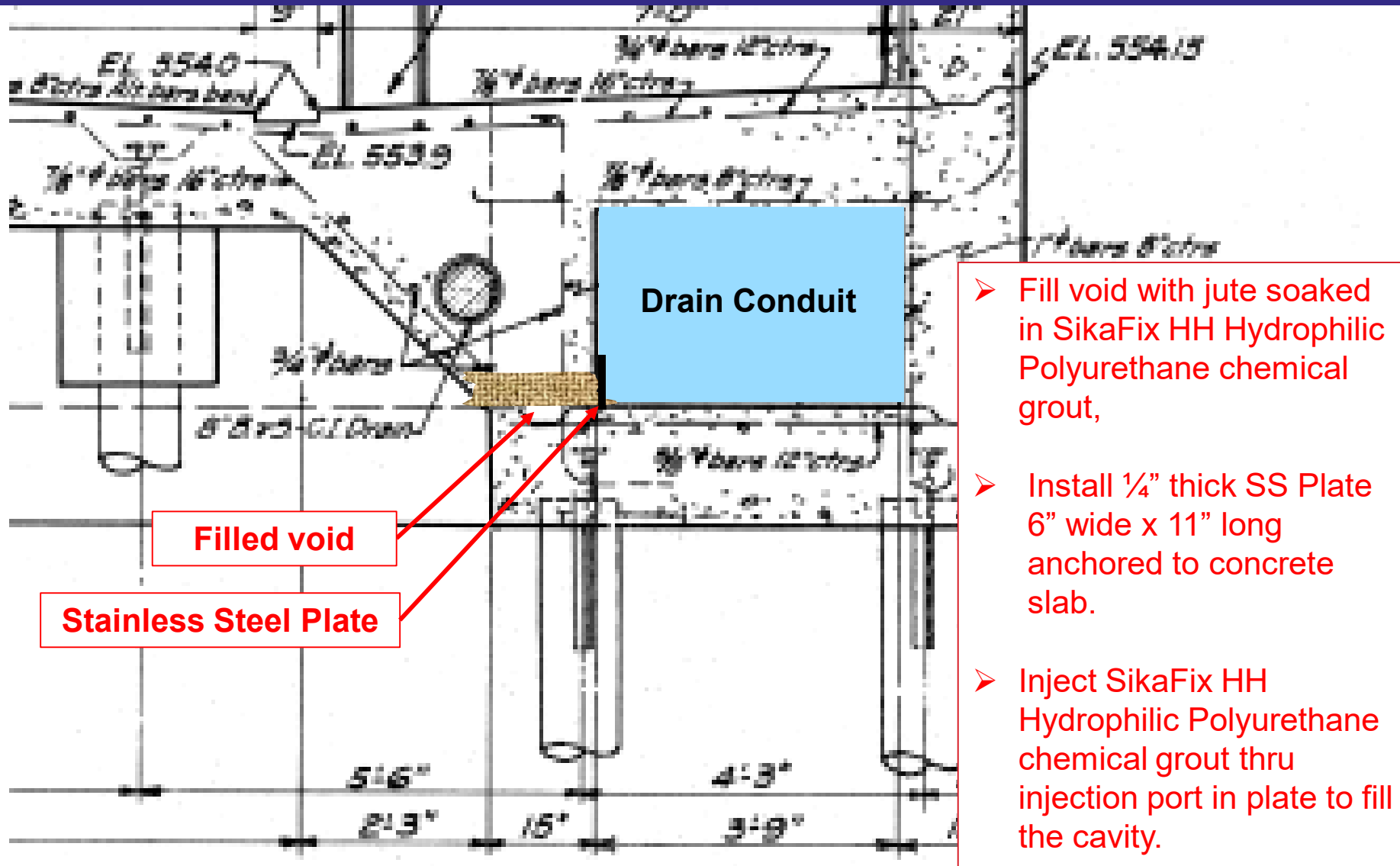
## West Drain Conduit Location B: Hole in Drain Conduit Repair



**East Conduit Location C Leak**



**East Drain Conduit  
Location C: Hole in Drain Conduit**



**East Drain Conduit  
Location C: Hole in Drain Conduit**



# Main Drainage Conduit Repair Materials



Polyurethane  
Chemical  
Grout

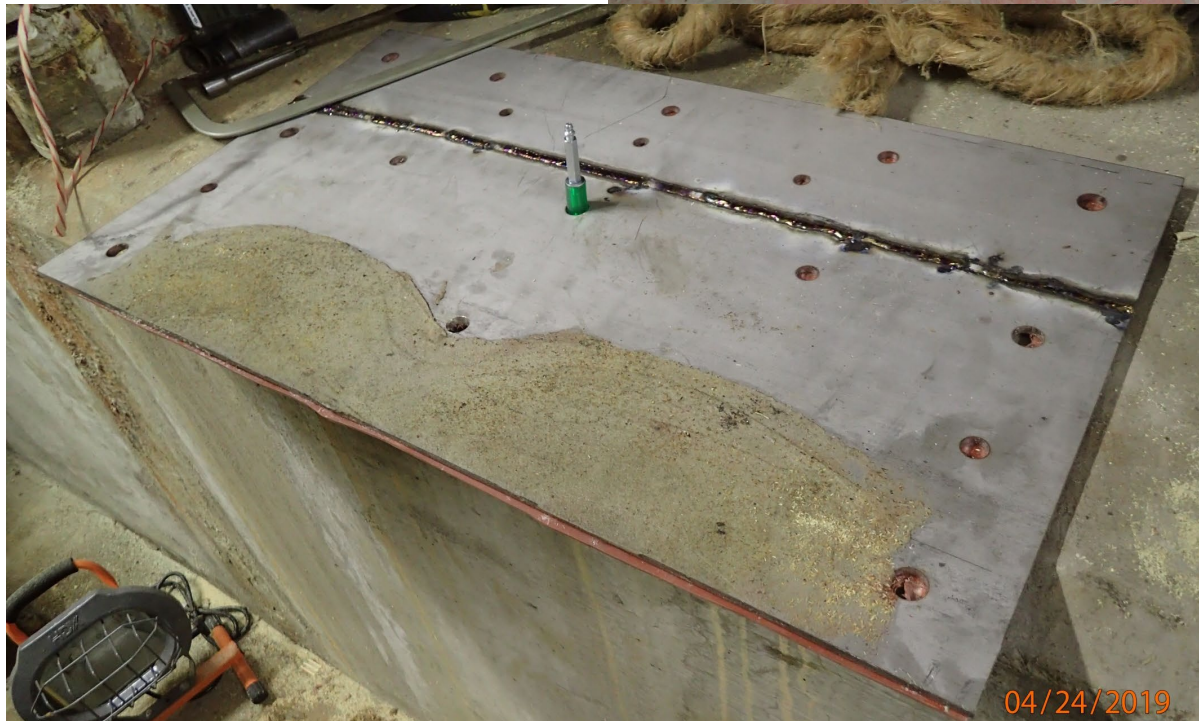


Jute  
Backing



# Main Drainage Conduit Repair Materials

Fabricated Bent and Flat  
 $\frac{1}{4}$ ' Thick SS Plates



Epoxy Paste Adhesive



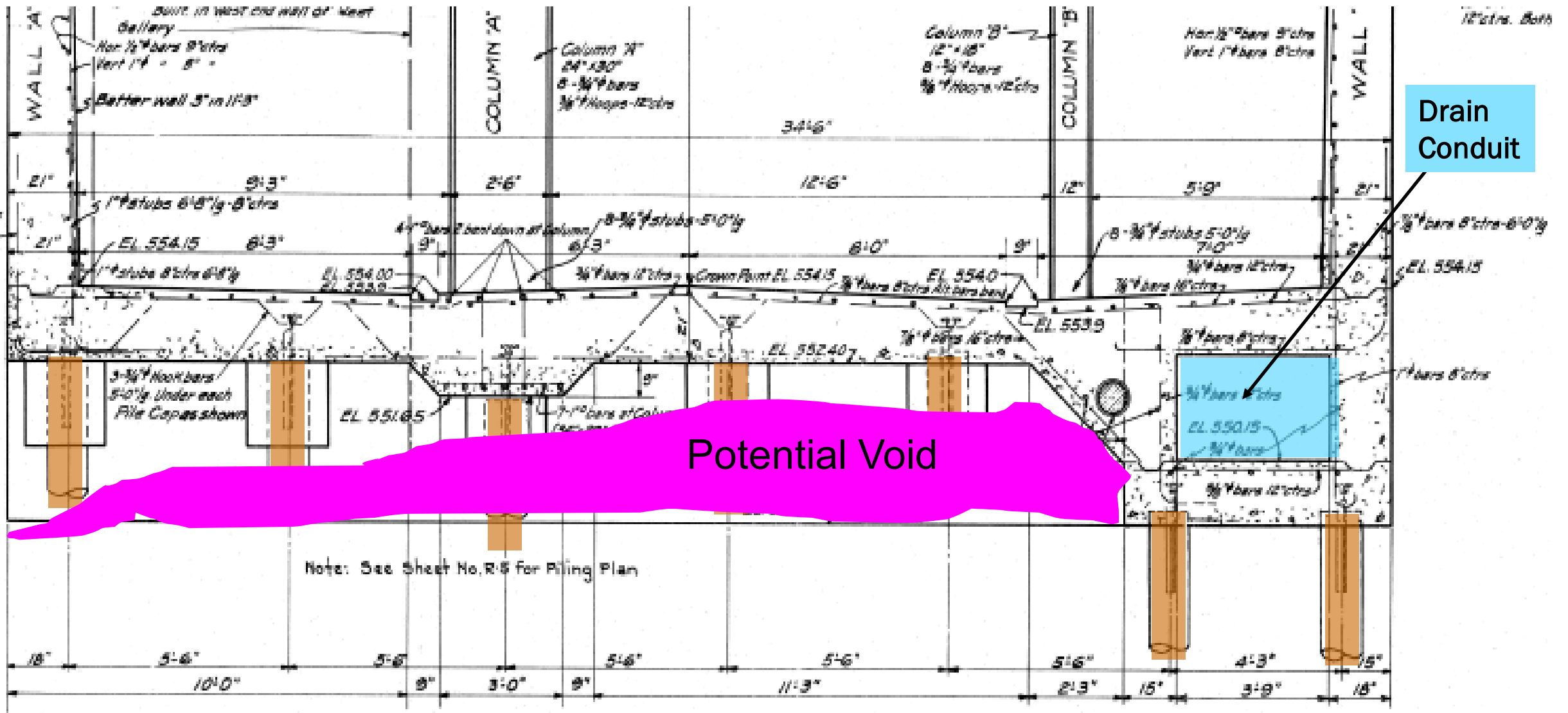
62 Valves Required Lock-Out

# Future Repairs and Investigations

- Final Settling Tanks 11 & 12 RAS Piping Breaks:  
Currently determining if pipes can be repaired by an internal repair method. This would be the most cost effective means to repair. If an internal repair cannot be performed then the area would need to be excavated and a portion of the pipe removed and replaced.
- Currently evaluating options to located suspected voids beneath the Drainage Conduit and Gallery bottom slab to determine the extend of voids created by the flow of water in and out of the large hole in the bottom of the Drainage Conduit in the West Gallery at repair location A.

Multichannel Analyses of Surface Waves (MASW) may be the best method due to the configuration of equipment and sumps within the Galleries.

Depending on the results of the non destructive testing voids, if determined to be present and large enough may be pressure grouted.



Section thru Pipe Gallery



# Questions ?



**West Conduit Cleaning**



**West Conduit Cleaning**



**West Conduit Cleaning**



**East Conduit Cleaning**



**East Conduit Cleaning**



**West Conduit South Wall Location A Leak**



**West Conduit South Wall Location A Leak**  
**Video**



manhole3W-AMH VAULT0E-1

4/17/2019

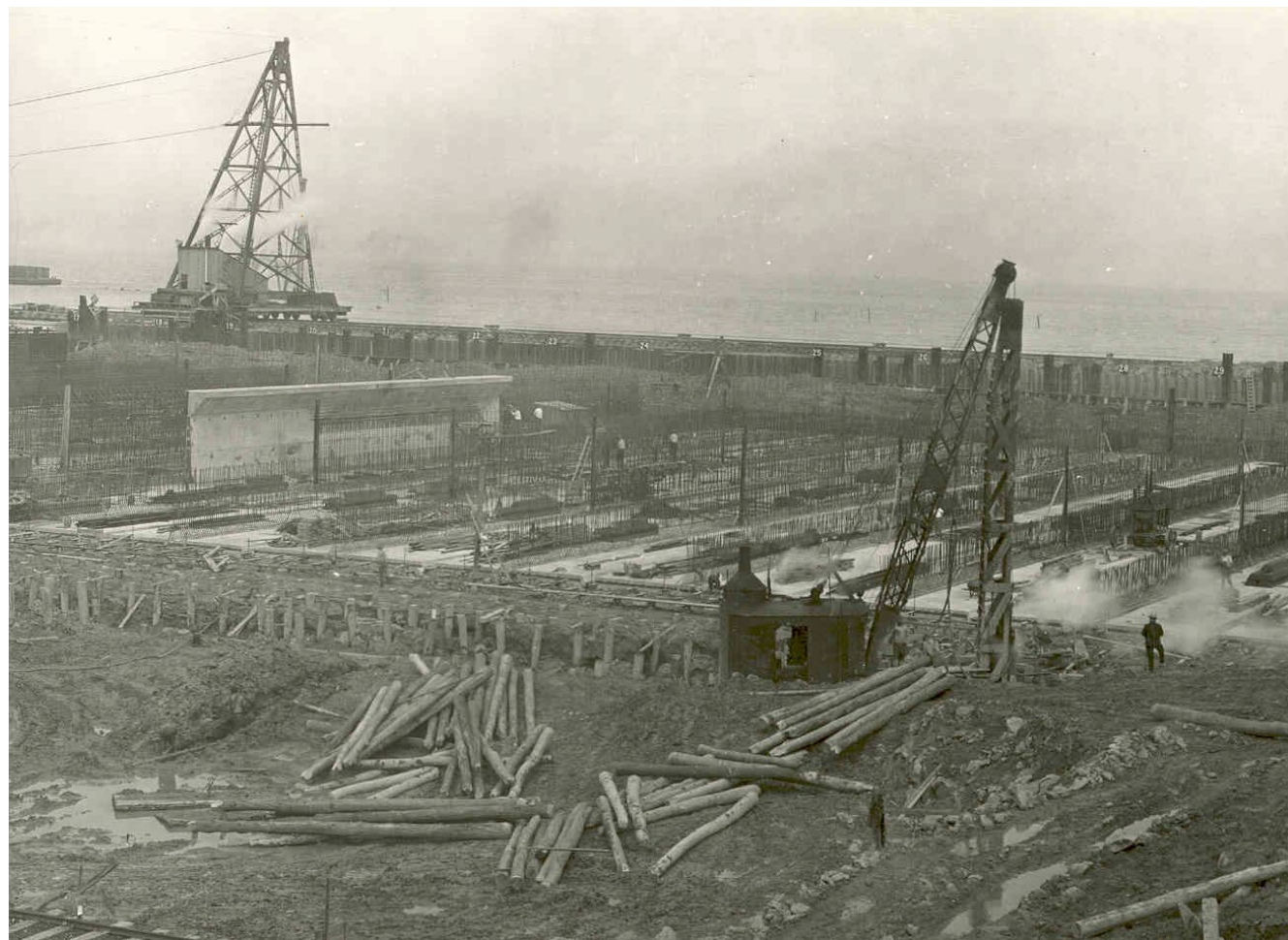
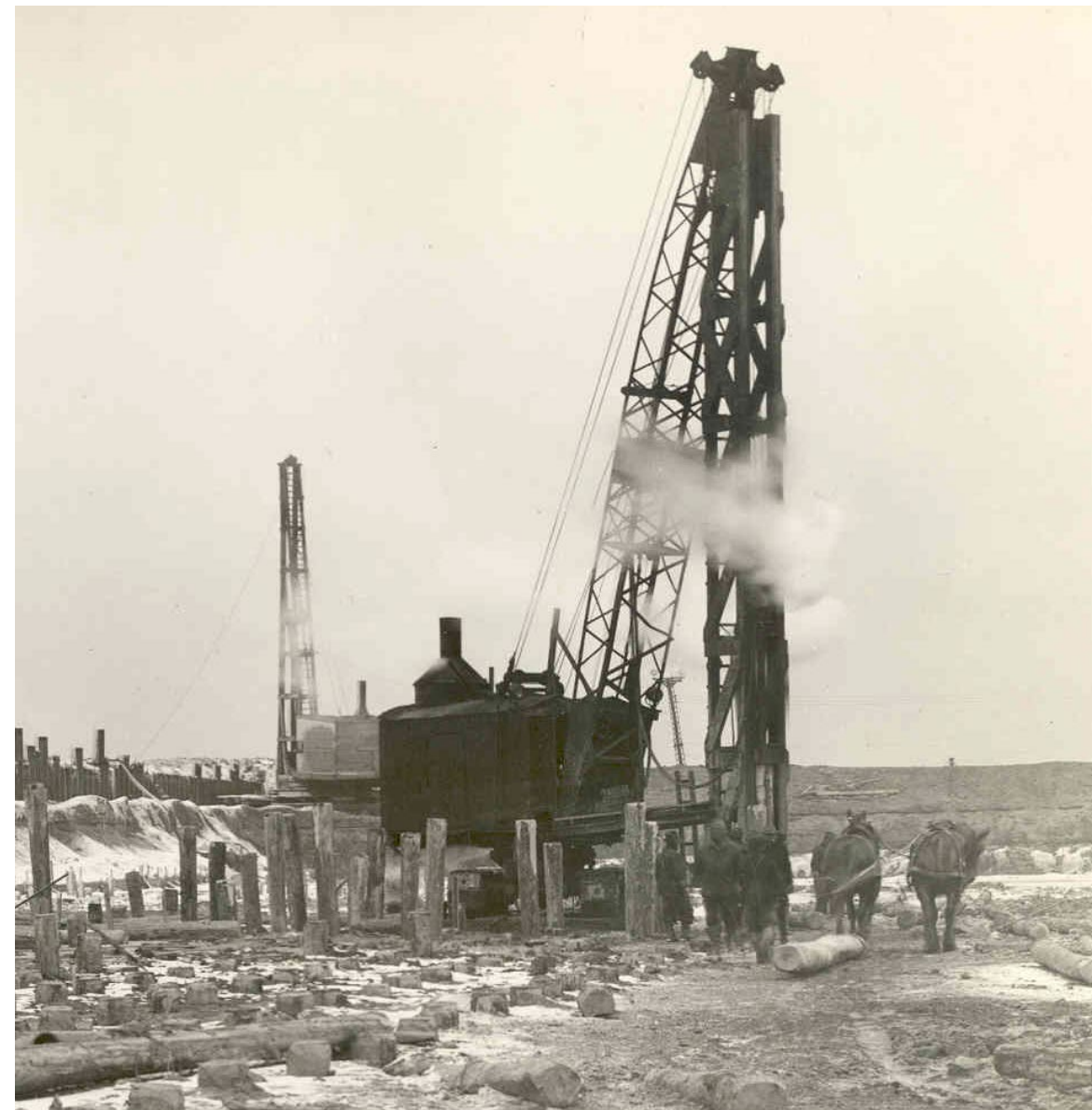
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Timber Pile  
Anchor Straps

**West Conduit  
South Wall  
Location A  
Leak**

152.1 ft.





**1932 Construction**



**East Conduit Location C Leak**  
**Video**

South wall repair.  
Filled with jute and  
Polyurethane  
Chemical Grout and  
covered with a  
6" x 11" SS plate  
(not installed yet in  
this photo)



**East Conduit Location C Repair**



**East Conduit Object North Wall  
(Pile Anchor Straps?)**